

**FLORA OF INDIA**  
**VOLUME 23**

**LORANTHACEAE - DAPHNIPHYLLACEAE**

Editors

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**FLORA OF INDIA**  
**VOLUME 23**  
**LORANTHACEAE-DAPHNIPHYLLACEAE**

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## ABBREVIATIONS OF LANGUAGES

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



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# LORANTHACEAE

(K. Rajasekaran)

Shrubs, hemiparasitic on trees or rarely parasitic on roots, sometimes dioecious; indumentum of candelabra, abietiform, stellate, conchiform or anvil hairs, malpighian hairs, usually represented by one type or occasionally more than one type. Leaves opposite or whorled, rarely alternate or both, simple, entire, exstipulate, curvipinnately, rectipinnately or rarely palmatipinnately nerved, petiolate or sessile. Inflorescences axillary or terminal, rarely ramiflorous, cymose, umbellate, glomerate, as simple or compound dichasium, or often spikes, centripetal or centrifugal pseudoracemes; flowers solitary, paired or 3 together in axils of bracts, bisexual or unisexual, actinomorphic or zygomorphic, 4 - 6-merous. Calyx (calyculus) absent or forming a reduced epigynous rim, rarely 4 - 6-toothed. Corolla choripetalous or sympetalous, valvate, 3 - 6-merous; petals 3 - 6 (rarely absent), free or connate into a tube; lobes acute or obtuse, often coiled and interlocked at anthesis. Stamens 3 - 6, opposite and inserted on petals or at their base; filaments flat, terete or subterete; anthers basifixed or occasionally dorsifixed, multilocellate or quadrilocellate, sometimes unilocellate or transversely locellate, dehiscent longitudinally or by terminal pores or transverse slits; connective prolonged into a sterile apex. Disc present or absent. Ovary inferior, unilocular, glabrous or hairy, occasionally rugose or muricate; style 1, simple (or absent); stigma capitate, conical, lobed or papillate; ovule solitary on basal placenta. Fruit a pseudocarp, berry, drupe or samaroid, glabrous or hairy, rugose, tubercled or pitted; seed 1, often sticky, without testa; endosperm copious, succulent or sometimes absent, with or without horns, mamillate or non-mamillate; embryo linear, small, straight, 0.3 - 1.2 times the length of the endosperm; cotyledons sometimes 3 - 6 or absent.

Pantropical, mostly in Southern Hemisphere, extending to temperate zones, ca 68 genera and ca 900 species; 8 genera and 49 species in India.

*Note.* The anatomical and palynological characters given for the species are from the author's papers published in J. Swamy Bot. Club, Vol. 24: pages 43 - 56. 2007, unless otherwise stated.

*Literature.* BARLOW, B. A. (1997). Loranthaceae in Flora Malesiana 13: 209 - 401. DANSER, B. H. (1929). On the taxonomy and the nomenclature of the Loranthaceae of Asia and Australia. Bull. Jard. Bot. Buitenzorg, Ser. III, 10: 291 - 373. DIXIT, S. N. (1962). Rank of the subfamilies of Lorantheoideae and Viscoideae. Bull. Bot. Surv. India 4: 49 - 55. JOHRI, B. M. & A. K. BHATNAGAR (1972). Loranthaceae - Botanical Monograph. CSIR, New Delhi. KUIJT, J. (2008). A note on stamen position and petal number in Loranthaceae. Blumea 55(1): 224 - 225. RAJASEKARAN, K. (1986 - 1987). Studies in Indian Loranthaceae I - VI. J. Swamy Bot. Club 3: 15 - 18, 85 - 90, 157 - 165; *ibid.* 4: 1 - 3; *ibid.* 24: 43 - 56. RAJASEKARAN, K. (2007). Studies in Indian Loranthaceae VIII. Inflorescence. J. Econ. Taxon. Bot. 31(1): 177 - 180.

## KEY TO THE GENERA

- 1 a. Corolla choripetalous; petals free completely or almost to the base, but sometimes pseudo-sympetalous or sometimes coherent **4. Helixanthera**
- b. Corolla sympetalous; petals fused up to the middle or higher, sometimes with corolla-tube deeply split on one side **2**
- 2 a. Bracts conspicuous, ca 15 mm long, arranged in involucre of 3 - 4, enclosing 3 - 4 flowers **8. Tolypanthus**

- b. Bracts small or inconspicuous, 1 - 6 mm long, usually scale-like, 1 - 3 at base of ovary or forming a cup-like rim on rachis of inflorescence 3
- 3 a. Corolla 6-merous 4  
b. Corolla 5- or 4-merous 5
- 4 a. Inflorescence axis decussately flattened; flowers sessile, few in a capitulum, borne in hollows; peduncle subtended by 1 - 4 whorls of bracts; floral bracts and bracteoles longer than ovary, enclosing whole of calyculus; bracteoles free **2. Elytranthe**  
b. Inflorescence axis terete or quadrangular or triangular; flowers pedicelled, not borne in hollows; peduncles not subtended by whorl of bracts; floral bracts and bracteoles shorter than ovary, not enclosing the calyculus; bracteoles connate **5. Macrosolen**
- 5 a. Flowers in dichasial fascicles; flower buds lanceolate; corolla-lobes twisted and interlocked after anthesis; filaments coiled **3. Helicanthes**  
b. Flowers in centrifugal pseudoracemose or compound dichasium or simple dichasium or reduced dichasium; flower buds otherwise; corolla-lobes reflexed or obliquely erect after anthesis; filaments erect or recurved 6
- 6 a. Corolla 5-merous, slightly zygomorphic, not deeply split on one side **1. Dendrophthoe**  
b. Corolla mostly 4-merous, zygomorphic with a deep split on the inner side of the curved tube 7
- 7 a. Inflorescence usually 3 - 10-flowered simple raceme, rarely a reduced 2-flowered umbel; fruit pyriform, obovoid or clavate, distinctly stipitate, not woody **6. Scurrula**  
b. Inflorescence a few-flowered simple 2 - 5-rayed umbel; fruit urceolate or ellipsoid, not stipitate, warty **7. Taxillus**

### 1. *Dendrophthoe* Mart.

Shrubs, usually glabrous, rarely with malpighian hairs in juvenile parts. Leaves opposite, alternate or subopposite, petiolate or sessile, elliptic, ovate or falcate. Pseudoracemes axillary, centrifugal, 3 - 20-flowered, flower buds spatulate; pedicels short, bearing a single round bract below the ovary. Flowers ebracteolate, slightly zygomorphic, 5-merous, mostly glabrous. Calyculus-tube entire, truncate. Corolla-tube long, ventricose, curved, splitting on one side; lobes 5, unilaterally reflexed. Stamens 5, erect or recurved; filaments subterete; anthers oblong, isothecate or anisothecate, elevatilobate without sterile apex. Ovary oblong, bearing a conspicuous entire calyx-rim; style tetragonous; stigma capitate. Fruits pseudocarps, ellipsoid to ellipsoid-ovoid, with apical collar, smooth, glabrous. Endosperm linear-elliptic, horned, mamillate.

Tropical Africa, Asia and Australia, ca 30 species; 4 in India.

#### KEY TO THE SPECIES

- 1 a. Leaves both opposite and alternate 2  
b. Leaves opposite 3
- 2 a. Leaves undulate along margins; lateral nerves faint; racemes 2 - 8 cm long, 10 - 25-flowered **1. *D. falcata***  
b. Leaves entire along margins; lateral nerves prominent; racemes 0.7 - 2 cm long, 3 - 12-flowered **4. *D. pentandra***
- 3 a. Branching pseudo-dichotomous; leaves sessile or subsessile; flowers in peduncled umbellate cymes, 2.5 - 3 cm long; anthers isothecate with rounded sterile apex; endosperm hornless, mamillate **2. *D. memecylifolia***

- b. Branching lateral; leaves petiolate; flowers solitary or in very short peduncled cymes, 2 - 2.2 cm long; anthers anisothecate without sterile apex; endosperm with five distal incurved horns, not mamillate

**3. D. neelgherrensis**

**1. Dendrophthoe falcata** (L.f.) Blume in Schult.f., Syst. Veg. 7: 1730. 1830. *Loranthus falcatus* L.f., Sp. Pl. Suppl. 211. 1781. *L. longiflorus* Desr. in Lam., Encycl. 3: 598. 1789; Hook.f., Fl. Brit. India 5: 214. 1886. *Dendrophthoe longiflora* Tiegh. in Bull. Soc. Bot. France 42: 85 & 252. 1895.

Beng.: *Amguruj*, *Bajrangi*; Garo: *Tuthekmi*; Guj.: *Vando*; Hindi: *Bandha*; Kan.: *Bandanika*; Mal.: *Ilti*, *Ithi*, *Ithikanni*, *Ithiyalkanni*, *Utir*; Mar.: *Vanda*; Punj.: *Banda*; Sans.: *Vanda*; Tam.: *Plavithil*, *Pulluruvi*; Tel.: *Badanika*, *Bajinika*.

Shrubs, up to 2 m tall. Leaves alternate and opposite, linear-oblong to elliptic-oblong, elliptic-ovate or falcate, cordate-amplexicaule or cuneate at base, obtuse, subacute or sometimes rounded at apex, undulate along margins, 4 - 16 x (1.5 -) 2.5 - 9 cm, coriaceous, glabrous; lateral nerves 3 - 6 pairs; petioles 1 - 12 mm long or absent. Inflorescences axillary or supra-axillary, sometimes ramiflorous, centrifugal pseudoracemose, 2 - 8 cm long; peduncle solitary or few together, 10 - 25 (- 50)-flowered, 1 - 5 cm long; flower buds spatulate, white to pink or bright red with green clavate upper portion. Flowers secund, zygomorphic, 5.5 - 7 cm long, yellow-scarlet; pedicels 4 - 5 mm long; bracts broadly ovate, 1.5 - 2 x 0.8 - 1 mm. Calyculus-tube subtentire to denticulate, ca 1.2 cm long. Petals 5, united, 2.5 - 5 cm long, yellow-scarlet at base, green at apex; tube terete and ca 2 mm thick at base, ventricose and up to 4 mm across at middle, split more deeply on one side; lobes 5, linear-elliptic, shorter than tube, unilaterally reflexed, 9 - 12 mm long, ca 1 mm wide, orange or red outside and greenish yellow inside. Stamens 5; filaments adnate to corolla, bright red; anthers oblong or linear, 3 - 5 mm long, basifixed, Ovary oblong, 3 - 5 mm long; style exerted, green; stigma capitate, light reddish brown or dark red. Fruits ellipsoid-ovoid to oblong, with persistent apical calyculus-tube, 10 - 17 x 4 - 6 mm, smooth, glabrous, bright pink.

*Distrib.* India: Widespread throughout India, including Andaman & Nicobar Islands, up to 2500 m altitude. Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, Indo-china, Thailand, Malesia to tropical Australia.

*Uses.* Bark astringent, narcotic, used for wounds and menstrual troubles and also as a remedy for consumption, asthma and as a substitute for betel-nut; ashes of bark used to wash clothes; decoction given in swellings and juice poured in ears to reduce ear-aches. Wood is useful in tannery.

*Notes.* Wood with numerous pores, diffuse porous; pores very small; pittings scalariform; fibres thick-walled, narrow-lumened.

Pollen 3-lobed; P - 24 (26.6) 33  $\frac{1}{4}$   $\frac{1}{4}$   $\mu$ m; E - 50 (59.9) 61  $\mu$ m; P/E - 0.47  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m (Vasanthy, Inst. Franc. Pondicherry 1976).

Chromosome number: n = 9 (Kumar & Abraham, Proc. Indian Acad. Sci. 15 B: 253. 1942).

## KEY TO THE VARIETIES

- 1 a. Leaves linear, up to 2.5 cm wide **1.3. var. falcata**  
 b. Leaves broader, more than 2.5 cm wide 2
- 2 a. Pseudocarps ovoid, hard and rugose **1.2. var. coccinea**  
 b. Pseudocarps oblong and smooth 3
- 3 a. Leaves sessile or subsessile, amplexicaule at base; flowers glabrous throughout **1.1. var. amplexifolia**  
 b. Leaves petiolate, not amplexicaule at base; flowers covered with malpighian hairs when young **1.4. var. pubescens**

**1.1. var. amplexifolia** (DC.) Rajasek. in J. Econ. Taxon. Bot. 31: 182. 2007. *Loranthus amplexifolius* DC., Prodr. 4: 305. 1830. *L. longiflorus* var. *amplexifolia* (DC.) Thwaites, Enum. Pl. Zeyl. 134. 1864; Hook.f., Fl. Brit. India 5: 215. 1886.

This variety is more robust than var. *falcata*. The leaves are larger, sessile, orbicular to oblong, 10 - 18 cm across and cordate-amplexicaule at base. The flowers are longer, more than 6.5 cm long. The filaments are hairy. The endosperm bears glabrous horns, which do not fork.

*Fl. & Fr.* Nov. - April.

*Distrib.* India: Subtropical evergreen forests of Western Ghats, above 1200 m altitude, found on a variety of hosts. Maharashtra, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Note.* Chromosome number:  $n = 9$  (Bir, Gill & Bedi in Taxon 28: 402. 1979).

**1.2. var. coccinea** (Talbot) Santapau, Fl. Saurashtra 34. 1953; Bole & Pathak, Fl. Saurashtra 2: 257. 1988. *Loranthus longiflorus* var. *coccinea* Talbot, Forest Fl. Bombay & Sind 2: 412. 1911.

Branches stout, lenticellate. Leaves broadly ovate, shortly petiolate. Calyculus rugose outside; limb often 5-notched. Corolla-tube 4 - 5 cm long, bright scarlet red; lobes short, scarlet or greenish. Filaments scarlet. Fruits ovoid.

*Fl.* Feb. - July.

*Distrib.* India: Gujarat and Karnataka.

Endemic.

**1.3. var. falcata**

Characterised by long narrow linear leaves, with the calyx either glabrous or scurfy white tomentose.

*Fl. & Fr.* Almost throughout the year, mostly in Nov. - March.

*Distrib.* India: Subtropical forests, 400 - 1800 m. Throughout India.

Sri Lanka, Bangladesh, Myanmar, Indo-china, Thailand, throughout Malesia to N. Australia and Solomon Islands.

*Note.* Chromosome number:  $n = 9$  (Bir, Gill & Bedi in Taxon 28: 402. 1979).

**1.4. var. pubescens** (Hook.f.) V.Chandras. in A.N.Henry et al., Fl. Tamil Nadu, Ser. 1 Analysis 2: 215. 1987. *Loranthus longiflorus* var. *pubescens* Hook.f., Fl. Brit. India 5: 215. 1886.

This variety is characterised by the presence of short hairs on young flowers. The inflorescences are often terminal.

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

*Distrib.* India: Deciduous or semideciduous forests, from sea level to moderate altitudes, found on a variety of hosts. Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri lanka.

**2. Dendrophthoe memecylifolia** (Wight & Arn.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 310. 1929. *Loranthus memecylifolius* Wight & Arn., Prodr. Fl. Ind. Orient. 1: 383. 1834; Hook.f., Fl. Brit. India 5: 217. 1886.

Branches terete; branching lateral; lenticels circular with vertical slit. Leaves opposite, elliptic, ovate or oblong-elliptic, cuneate at base, obtuse or subacute at apex, 4.5 - 6 x 2 - 2.5 cm, coriaceous; lateral nerves 3 or 4 pairs; petioles 2.5 - 3 mm long. Inflorescences centrifugal pseudoracemose; peduncle solitary, 3 - 5-flowered, 5 - 10 mm long; flower buds clavate, conical with obtuse beaked apex, 1.5 - 2 cm long. Flowers 2.5 - 3 cm long; pedicels 2.5 - 3 mm long; bract ovate-cymbiform, encircling ovary, 2 - 2.5 x 1 - 1.2 mm. Calyculus-tube widening towards top, toothed or lobed. Petals 5, united; tube splitting equally on all sides up to two-third from top; lobes 5, linear-elliptic, 14 - 16 mm long. Stamens 5; filaments subterete, 4 - 5 mm long; anthers linear, 3 - 3.5 mm long. Ovary oblong, smooth, 2.5 - 3 mm long; style tetragonous; stigma clavate. Fruits ellipsoid, 9 - 10 x 5 - 6 mm, glabrous, smooth; calyculus persistent, almost as broad as the fruits with uneven rim.

*Fl. & Fr.* Feb. - June.

*Distrib.* India: Subtropical and temperate forests of Western Ghats, particularly in shola forests, above 1200 m altitude, found on a variety of hosts. Karnataka, Kerala and Tamil Nadu. Endemic.

*Notes.* Vessels with scalariform circular-ovate pits; fibres thick-walled, narrow-lumened.

Pollen grains 3-lobed; P - 29 (33.2) 37  $\mu\text{m}$ ; E - 52 (56.5) 62  $\mu\text{m}$ . P/E - 0.59  $\mu\text{m}$ ; ex. 2  $\mu\text{m}$ ; col. 1  $\mu\text{m}$ .

**3. Dendrophthoe neelgherrensis** (Wight & Arn.) Tiegh. in Bull. Soc. Bot. France 42: 252. 1895. *Loranthus neelgherrensis* Wight & Arn., Prodr. Fl. Ind. Orient. 1: 382. 1834; Hook.f., Fl. Brit. India 5: 216. 1886.

Branches terete, knotty at nodes; branching pseudo-dichotomous, sometimes terminal branching in whorls of 3. Leaves opposite, sessile, elliptic-ovate, obtuse, acute or cuneate at base, undulate along margins, 5 - 12 x 2 - 4 cm, crustaceous; lateral nerves 2 or 3 pairs. Inflorescences axillary, ramiflorous, centrifugal pseudo-racemose; peduncles 2 or 3 in each axil, 3 - 5-flowered, 3 - 10 mm long. Flowers actinomorphic, ca 2 cm long; pedicels 1.7 - 2 mm long; bracts ovate-cymbiform, encircling ovary, 1 - 1.5 x 0.7 - 0.9 mm. Calyculus-tube cupular, usually toothed, ca 0.6 mm long. Petals 5, united; tube slightly gibbous at base, equally split nearly up

to middle, 8 - 15 mm long, dark red or dull white; lobes 5, linear-elliptic, ca 6 x 1 mm. Stamens 5; filaments 4 - 5 mm long, all dark red or greenish white; anthers linear-oblong, 2.5 - 3 mm long, broader than filaments, reddish or yellowish. Ovary asymmetric, 2 - 2.5 mm long; style terete or tetragonous; stigma obovoid, lobed, ca 1 mm long. Fruits obovoid, smooth, glabrous, with persistent margined calyculus-tube, 9 - 10 x 5.5 - 6 mm.

*Fl. & Fr.* Sept. - Dec. (or sometimes throughout the year).

*Distrib.* India: Along the fringes of Shola forests at 1500 - 2000 m altitudes, on a variety of hosts. Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Notes.* Wood reddish brown; pores very small, diffuse porous, vessel pitting scalariform, parenchyma paratracheal; rays short, broad, evenly spaced; fibres excessively thick-walled, narrow lumened.

Pollen 3-lobed, occasionally 4-lobed; P - 22 (26.4) 33  $\mu$ m; E - 45 (53.4) 59  $\mu$ m; P/E - 0.57  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m (Vasanthy, Inst. Franc. Pondicherry. 1976).

Chromosome number: n = 9 (Barlow & Wiens, Flinders Univ. S. Austr. Sch. Biol. Sci. Bedford Park, 1971).

**4. *Dendrophthoe pentandra* (L.) Miq., Fl. Ned. Ind. 1(1): 818. 1855; Barlow in Fl. Malesiana Ser. I, 13: 318. ff. 2, 21, 22c. 1997. *Loranthus pentandrus* L., Mant. Pl. 1: 63. 1767.**

Shrubs, up to 2 m high; young shoots puberulous; branches greyish. Leaves alternate to subopposite; elliptic to suborbicular or sometimes lanceolate, cuneate or attenuate at base, rounded or occasionally acute or acuminate at apex, 5 - 15 x 2.5 - 10 cm; stiffly coriaceous, glabrous, penninerved; lateral nerves 2 - 4 per side, more or less prominent above and beneath; petioles 5 - 20 mm long. Racemes at the nodes, solitary or 2 - 3-together, 3 - 12-flowered; rachis 0.7 - 2 cm long, greyish stellate-tomentellous; bracts broadly ovate, 1 - 1.5 mm long. Flowers: pedicels 1 - 3 mm long. Calyx ca 2.5 mm long; tube 0.5 - 1.5 mm long, 5-fid. Mature buds 1 - 2 cm long. Corolla orange, green or yellow, inflated and angular or winged in the lower part, narrowed to a neck, clavate and rounded at apex; tube in open flower 6 - 12 mm long, campanulate, with the lobes reflexed and often almost closing the neck. Filaments 3 - 5 mm long; anthers 2 - 5 mm long. Fruits 8 - 10 x 5 - 6 mm, red, pilosulous or glabrous.

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

*Distrib.* India: At low altitudes in humid forests. East India.

Myanmar, China, Thailand, Laos, Cambodia, Vietnam and Malesia.

#### EXCLUDED SPECIES

***Dendrophthoe sarcophylla* (Wall. ex Wight & Arn.) Danser in Bull. Jard. Bor. Buitenzorg, Ser. 3, 10: 311. 1929. *Loranthus sarcophyllus* Wall. [Cat. No. 6863. 1832, nom. nud.] ex Wight & Arn., Prodr. Fl. Ind. Orient. 384. 1834; Hook.f., Fl. Brit. India 5: 217. 1886.**

There is no specimen matching the description in any Indian herbarium. Probably this may be a form of *Dendrophthoe falcata*.



## 2. *Elytranthe* (Blume) Blume

Shrubs, glabrous throughout; young internodes winged or not. Leaves opposite, elliptic-ovate, curvipinnate, leathery. Inflorescence a capitulum; peduncle subtended by poorly developed bracts; inflorescence-axis decussately flattened; flower buds spatulate or clavate-conical; flowers inserted in hollows on short, stout rachis, subtended by one bract and 2 bracteoles, bisexual, actinomorphic, sympetalous, 6-merous; bracts and bracteoles free, large, enclosing ovary. Calyculus tubular, entire or toothed. Petals 6, united; tube with angular shoulders, narrow at base; lobes reflexed or coiled after anthesis. Stamens 6, erect or recurved; filaments subterete or trigonous, subulate; anthers isothecate, elevatilobate, multilocellate or 4-locellate with sterile apex. Ovary subglobose, smooth; style tetragonous; stigma subglobose. Fruits ellipsoid or ovoid, urceolate, smooth. Endosperm with thickened pads, horned, not mamillate.

Indo-Malesia: India, Sri Lanka, Thailand, Java, Sumatra and Borneo, ca 11 species; 5 in India.

### KEY TO THE SPECIES

- 1 a. Anther-thecae multilocellate 2
- b. Anther-thecae quadrilocellate 3
- 2 a. Young internodes not winged; peduncles 5 - 6 mm long; flower buds clavate-conical; flowers 1.5 - 2 cm long; calyculus distinctly toothed; corolla-lobes reflexed, less than 2 cm long; anther-thecae with 8 - 10 vertically elongated locelli; endosperm without distinct neck **2. *E. capitellata***
- b. Young internodes winged; peduncles 10 - 12 mm long; flower buds spatulate; flowers 4.5 - 5.5 cm long; calyculus entire with undulate margin; corolla-lobes reflexed and coiled, more than 3 cm long; anther-thecae with 16 - 20 circular locelli; endosperm with distinct neck **3. *E. parasitica***
- 3 a. Capitulum 2-flowered; peduncular bracts equal in size; corolla-tube tumid at base **1. *E. albida***
- b. Capitulum 3 - 6-flowered; peduncular bracts equal in size; corolla-tube not tumid at base 4
- 4 a. Leaves decurrent, crustaceous; peduncles subtended by 3 or 4 whorls of bracts; flower buds stout, 1.8 - 2.2 cm long; calyculus splitting unilaterally; corolla-lobes thick, broad; anthers broader than filaments, 1.2 - 2.5 mm long; endosperm horned **4. *E. pseudopsilantha***
- b. Leaves not decurrent, coriaceous; peduncles subtended by 1 or 2 whorls of bracts; flower buds slender, 2.5 - 3 cm long; calyculus entire; corolla-lobes thin, narrow; anthers as broad as filaments, 3 - 4 mm long; endosperm hornless **5. *E. psilantha***

**1. *Elytranthe albida*** (Blume) Blume, Syst. Veg. ed. 15 Bis [Roemer & Schultes] 7(2): 1730. 1830. *Loranthus albidus* Blume in Verh. Batav. Genootsch. Kunsten 9: 184. 1823 & Bijdr. Fl. Ned. Ind. 665. 1826; Hook.f., Fl. Brit. India 5: 222. 1886. *L. collettii* King ex Collett & Hemsl. in J. Linn. Soc. Bot. 28: 120. 1890. *Elytranthe collettii* (King ex Collett & Hemsl.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 313. 1929.

Stems up to 12 cm thick, widely branched; twigs terete or winged, glabrous; wings of successive internodes alternating with each other. Leaves opposite, oblong-ovate, orbicular-ovate to lanceolate, with thickened margins, cuneate to rounded at base, subacute to obtuse at apex, 10 - 15 x 5 - 8 cm, coriaceous; lateral nerves 15 - 18 pairs; petioles 3 - 4 cm long. Inflorescence axillary or in axils of old leaves; peduncle one in each axil, each 2 or 3 flowered, 1 - 1.5 cm long,

subtended by a pair of bracts; bracts unequal; larger bracts conical, acute, dorsally keeled, ca 2 x 4 mm; smaller bracts suborbicular, obtuse, not keeled; flower buds spatulate, crowded, subterete below, ribbed above, stout, 4 - 4.2 cm long. Flowers 5 - 6 cm long; bracteoles not seen. Calyculus campanulate, entire; tube 1 - 1.5 mm long; limb 1.5 - 3.5 mm high. Corolla red, 4.5 - 6 cm long; tube funnel-shaped with inflated base, obtusely 6-keeled, splitting equally up to one-third the length, 3 - 3.5 cm long, yellowish white with bluish dots; lobes 6, narrowly elliptic, reflexed or reflexed and coiled, sometime interlocked at anthesis, acute, 1.5 - 2.5 cm long, green at first, later violet and lastly red. Stamens 6, erect; filaments 8 - 10 mm long; anthers linear, slightly narrower than filament, 4-locular, introrse, 5 - 7 mm long. Ovary not seen. Fruits broadly ellipsoid, ca 3 mm long.

*Fl. & Fr.*: Nov. - Jan.

*Distrib.* India: Evergreen forests at about 1200 m altitude. Rare, found on *Quercus griffithii*. Arunachal Pradesh and Mizoram (at Champhai).

China, Myanmar, Thailand, Laos, Vietnam, Malaysia, Java, Sumatra and Borneo.

**2. Elytranthe capitellata** (Wight & Arn.) Engl. in Engl. & Prantl, Pflanzenfam. 3(1): 189. 1889. *Loranthus capitellatus* Wight & Arn., Prodr. Fl. Ind. Orient. 1: 382. 1834; Hook.f., Fl. Brit. India 5: 221. 1886. *Macrosolen capitellatus* (Wight & Arn.) Danser in Blumea 2: 36. 1936.

Twigs terete, not winged. Leaves opposite, elliptic-ovate to lanceolate, rounded or narrowed and shortly decurrent at base, recurved along margins, acute to subacute at apex, 5 - 7.5 x 2 - 4 cm, coriaceous; lateral nerves 3 or 4 pairs; petioles 8 - 10 mm long. Inflorescence axillary; peduncle solitary, ca 5 mm long at anthesis, 2 - 4-flowered, each subtended by a minute whorl of bracts; bracts ovate, dorsally keeled, 5 - 6 mm long; flower buds clavate-conical, erect, terete at base, 6-angled above 8 - 10 mm long. Flowers 1.5 - 2 cm long, flesh-coloured inside, dark red outside; bracts cordate or orbicular, dorsally keeled, 2 - 3 x 1.5 - 2 mm; bracteoles ovate-orbicular, 1.7 - 2.5 x 1.2 - 1.5 mm. Calyculus tubular, toothed, 2 - 2.5 mm long. Corolla funnel-shaped, with terete 4 - 7 mm long tube equally splitting on all sides up to one-third the length; lobes 6, elliptic, reflexed, up to 2 cm long. Stamens 6; filaments 3 - 4 mm long; anthers linear, ca 4 mm long, multilocellate, each theca containing 8 - 10 vertically elongated locelli, inner pair raised over the outer pair, 1.5 - 2 mm long. Ovary subglobose, 1.5 - 2 mm long; style widening towards base; stigma subcapitate. Fruits oblong or urceolate, with persistent calyculus, glabrous, smooth, 5 - 6 x 3 - 3.5 mm, dark red; calyculus 2 - 2.5 mm long.

*Fl. & Fr.* July - Feb. (probably throughout the year).

*Distrib.* India: Moist evergreen forests, at altitudes above 1200 m, on a variety of hosts. Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Notes.* Vessel pitting scalariform, uniseriate or biseriate; fibres thick-walled, narrow-lumened, pittings sparse.

Pollen 3-lobed; P - 24 (33.8) 36  $\mu$ m; E - 52 (63.3) 77  $\mu$ m; P/E - 0.54  $\mu$ m; ex. 1.5  $\mu$ m; col. 0.5  $\mu$ m.

Chromosome number: n = 12 (Barlow & Wiens, Flinders Univ. S. Austr. Sch. Biol. Sci. Bedford Park, S. Austr. 1971).

**3. Elytranthe parasitica** (L.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 315. 1929.

*Lonicera parasitica* L., Sp. Pl. 175. 1753. *Loranthus parasiticus* (L.) Druce in Bot. Exch. Club Soc. Brit. Isles 3: 420. 1914, non Merr. 1919. *Loranthus loniceroides* L., Sp. Pl., ed. 2., 473. 1762, excl. syn. Pluk.; Hook.f., Fl. Brit. India 5: 221. 1886. *Macrosolen parasiticus* (L.) Danser in Blumea 2: 36. 1936.

Twigs stout, terete, winged when young. Leaves opposite, elliptic-ovate to ovate-lanceolate, often falcate, rounded or narrowed and decurrent at base, undulate along margins, acuminate, acute to subacute at apex, (6-) 8 - 10 x (2.5-) 4 - 5 cm, coriaceous; lateral nerves 4 - 7 pairs; petioles 5 - 15 (- 22) mm long. Inflorescence axillary; peduncles 1 - 3 in each axil, each 2 - 4-flowered, subtended by 1 or 2 whorls of bracts, 1 - 1.2 cm long; peduncular bracts ovate, dorsally keeled; flower buds spatulate, strongly curved, subterete at base, 6-angled above with corresponding number of ridges with angular shoulders in mid-region, 2 - 2.5 cm long. Flowers 4.2 - 5.5 cm long, scarlet-red with green lobes; bracts and bracteoles suborbicular, dorsally keeled, glabrous, 3 - 4 x 2.5 - 3.5 mm. Calyculus tubular, with undulate margins, 1.5 - 2 mm long. Corolla funnel-shaped; tube terete, splitting into 6 lobes up to middle, 2 - 2.5 cm long, yellow inside; lobes linear-elliptic, reflexed and coiled, 3 - 3.8 cm long, pink and green. Stamens 6, erect; filaments 6 - 8 mm long; anthers linear, multilocellate, each theca containing 16 - 20 circular pairs of locelli, 3 - 4 mm long. Ovary subglobose, 2.5 - 3 mm long; style articulated, ca 3 cm long; stigma subglobose, lobed. Fruits ovoid to oblong, glabrous, smooth, crowned by persistent tubular calyculus, 6 - 7 x 4.5 mm, green.

*Fl. & Fr.* March - Oct.

*Distrib.* India: Moist evergreen forests, at high altitudes on a variety of hosts. Karnataka, Kerala and Tamil Nadu.

Sri Lanka and China.

*Notes.* Sclereids abundant in mesophyll; vessel pittings scalariform, uniseriate or biseriate; fibres excessively thick-walled with reduced pits.

Pollen 3-lobed, P - 31 (34.6) 38  $\mu$ m; E - 68 (75.6) 86  $\mu$ m; P/E - 0.57  $\mu$ m; ex. 0.21  $\mu$ m; col. 1  $\mu$ m.

Chromosome number: n = 12 (Barlow & Wiens, Flinders Univ. S. Austr. Sch. Biol. Sci. Bedford Park, S. Austr. 1971).

**4. Elytranthe pseudosilantha** Rajasek. in J. Swamy Bot. Club 3: 15, ff. 1 - 2. 1986.

Twigs subterete or winged; wings of one internode alternating with those of one above and below. Leaves opposite, broadly ovate-elliptic, almost decurrent to base of petioles, thickened and revolute along margins, obtuse at apex, 9 - 13 x 4 - 6.5 (- 9) cm, crustaceous; lateral nerves 4 or 5 pairs; petioles 4 - 7 mm long. Inflorescence axillary; peduncles 2 or 3 in each axil, each 3- or 4-flowered, short, subterete, 5 - 7 mm long; each subtended by 3 or 4 whorls of large ovate-acute bracts; flower buds curved, spatulate, 1.8 - 2.2 cm long. Flowers 3 - 4 cm long; bract and bracteoles equal, ovate or orbicular, 4 - 4.5 x 3.5 - 4 mm. Calyculus tubular, truncate with undulate margin; tube split unilaterally 2 - 3 mm long. Petals 6, united at base; tube terete, equally split up to one-third to half the length, densely white-punctate, 1.8 - 2.2 cm long; lobes 6, linear or elliptic, reflexed and coiled, ribbed, 1.2 - 1.8 cm long. Stamens 6, recurved; filaments 6 - 8 mm long; anthers linear, 4-locular, 2 - 2.5 mm long. Ovary subglobose; style 4-gonous;

stigma subglobose, lobed. Fruits broadly ellipsoid-ovoid, smooth, glabrous, crowned by persistent tubular calyculus, 9 - 11 x 7 - 8 mm.

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

*Distrib.* India: Evergreen forests above 1000 m altitude on a variety of hosts. Kerala and Tamil Nadu.

Endemic.

*Notes.* Vessel pittings scalariform; fibres excessively thick-walled, with or without pits

Pollen 3-lobed; P - 31 (35.5) 42  $\mu$ m; E - 63 (66) 77  $\mu$ m; P/E - 0.54  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m

**5. *Elytranthe psilantha*** (Hook.f.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 315. 1929. *Loranthus psilanthus* Hook.f., Fl. Brit. India 5: 222. 1886.

Kh.: *Dieng-kyajut-paroh, Pyetung-bording, Soh-pydung-lording.*

Twigs subterete or winged; wings of one internode alternating with those of one above and below. Leaves opposite, elliptic-ovate to ovate-lanceolate, rounded or cuneate at base, thickened-revolute along margins, acute to acuminate at apex, 5 - 15 x 3 - 5 cm, coriaceous; lateral nerves 8 - 10 pairs; petioles 5 - 15 mm long. Inflorescence axillary; peduncles solitary or in pairs, each 4 - 6-flowered, 1.3 - 1.5 cm long, subtended by 1 or 2 whorls of bracts, each whorl with 4 bracts; bracts broadly ovate, 2 - 3 x 1.2 - 1.5 mm; flower buds spatulate, 2.5 - 3 cm long. Flowers 4.2 - 5 cm long, reddish green; bract ovate to orbicular, dorsally keeled, 3.2 - 3.5 x 2 - 2.2 mm; bracteoles ovate, dorsally keeled, 1.8 - 2 x ca 1 mm. Calyculus tubular, unevenly lobed, 2 - 2.5 mm long. Corolla-tube split up to half the length, 2 - 2.4 cm long; lobes 6, linear, reflexed and coiled, 2 - 2.4 cm long. Stamens 6, recurved; filaments 8 - 10 mm long; anthers linear, 4-locular, 2 - 4 mm long. Ovary subglobose, smooth, 2.5 - 3 mm long; style 4-gonous; stigma subglobose, bilobed. Fruits broadly ellipsoid-ovoid to obovoid, smooth, glabrous, crowned by persistent tubular calyculus, 4 - 6 x 2.5 - 3.5 mm, bluish white when ripe.

*Fl. & Fr.* Dec. - May.

*Distrib.* India: Temperate and alpine forests. Sikkim, Arunachal Pradesh, Assam, Meghalaya and Manipur.

Endemic.

*Notes.* Vessel pittings scalariform; fibres excessively thick-walled with spicular projections and reduced pits.

Pollen 3-lobed; P - 27 (32.6) 38  $\mu$ m; E - 55 (62.9) 71  $\mu$ m; P/E - 0.52  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

### 3. *Helicanthes* Danser

Monotypic and endemic to Deccan Peninsula.

***Helicanthes elasticus*** (Desv.) Danser in Verh. Kon. Ned. Akad. Wetensch. Afd. Natuurk. Sect. II, 29(6): 55. 1933. *Loranthus elasticus* Desv. in Lam., Encycl. 3: 599. 1789; Hook.f., Fl. Brit. India 5: 216. 1886.

Mal.: *Mavu-iththil*; Tam.: *Mavil-ithil*.

Shrubs, entirely glabrous; branches pseudo-dichotomous or trichotomous, swollen at nodes. Leaves opposite, decussate, sessile or subsessile, obovate to elliptic-ovate or suborbicular, cuneate at base, undulate along margins, obtuse or subacute at apex, 5 - 12 x 2.5 - 6.5 cm, chartaceous, palmati-pinnate; lateral nerves 4 or 5 pairs. Inflorescences dichasial fascicles, intra-nodal, whorled, sunken in nodal concavities, many; flower buds lanceolate, terete, curved, glabrous, 1.5 - 2 cm long; flowers sessile, 5-merous, actinomorphic, sympetalous, 2 - 3 cm long; bracts lunate, ca 0.3 mm long. Calyculus cupular, truncate, with ca 0.8 mm high rim. Corolla-tube split equally up to middle, 0.9 - 1.4 cm long; lobes 5, linear, spirally twisted and interlocked after anthesis, as long as tube. Stamens 5, red; filaments coiled, 6 - 7 mm long; anthers linear, twisted; anther-thecae in 2 pairs, ca 2 mm long. Ovary subspherical with depressed sides, 2 - 2.5 mm long; style curved; stigma narrowly elliptic-ovate, papillate. Fruits more or less spherical, glabrous, minutely papillate with persistent truncate calyculus, 10 - 12 x 6 - 7 mm, pink when ripe.

*Fl. & Fr.* Dec. - April, July - Sept.

*Distrib.* India: On a variety of hosts at moderate altitudes above 600 m. Tamil Nadu and Kerala.

Endemic.

*Uses.* Leaves are used to check abortion, stone formation in bladder, kidney affections and eczema.

*Notes.* Sclereids present in mesophyll; vessel pittings opposite, narrowly elliptic; fibres thick-walled with spicular projections.

Pollen 3 - 4-lobed; P - 33 (36) 40  $\mu\text{m}$ ; E - 52 (57.5) 61  $\mu\text{m}$ ; P/E 0.62  $\mu\text{m}$ ; ex. 1  $\mu\text{m}$ ; col. 0.5  $\mu\text{m}$ .

Chromosome number:  $n = 8$  (Johri et al. in *Phytomorphology* 7: 336 - 354. 1957).

#### 4. *Helixanthera* Lour.

Shrubs or terrestrial root parasites, glabrous or all juvenile parts covered by conchiform hairs. Leaves opposite, subopposite or alternate, sometimes in false whorls, petiolate, elliptic-ovate, glabrous; venation curvipinnate. Inflorescences centripetal pseudoracemes or spikes; flower buds ossiform, torpedo-shaped, clavate-conical or rounded, narrowly conical or pyriform. Flowers bracteate, ebracteolate, actinomorphic, 4 - 6-merous, glabrous or with conchiform hairs, each flower subtended by a navicular or cupular bract. Calyculus entire or lobed. Petals 4, free or pseudo-sympetalous; lobes patent-reflexed. Stamens 4 - 6, erect, epipetalous; filaments flat, terete or subterete; anthers ellipsoid or ovate-oblong, basifixed, isothecate or anisothecate, elevatilobate with or without sterile apex. Ovary smooth or tubercled; style 4-gonous, articulate or not; stigma capitate, conical or clavate. Fruits smooth or tuberculate. Endosperm horned or hornless, mamillate or not mamillate.

Throughout S & SE. Asia and Africa, ca 25 species; 10 species in India.

## KEY TO THE SPECIES

- 1 a. Inflorescences centripetal pseudoracemose 2  
 b. Inflorescences spicate 6
- 2 a. Flowers 2 or 3 per peduncle; flower buds torpedo-shaped; anthers isothecate  
**6. H. ligustrina**  
 b. Flowers more than 10 per peduncle; flower buds ossiform or conical; anthers anisothecate 3
- 3 a. Bracts sigmoid; fruits urceolate in the beginning or even at mature stage 4  
 b. Bracts ovate or ovate and cucullate; fruits ovoid or broadly elliptic 5
- 4 a. Leaves with 6 or 7 pairs of lateral nerves; flower buds angular, narrowly conical; flowers horizontal on stout racemes, 1.3 - 1.5 cm long; petals more than 1 cm long; ovary subglobose; fruits smooth  
**3. H. intermedia**  
 b. Leaves with 3 or 4 pairs of lateral nerves; flower buds terete, ossiform; flowers geniculate, on slender racemes, 6 - 7 mm long; petals less than 7 mm long; ovary urceolate; fruits sparsely tubercled  
**10. H. wallichiana**
- 5 a. Twigs glabrous throughout; lenticels oblong-elliptic; flower buds ossiform; petals abruptly winged and inflated at base; style distinctly articulated; fruits smooth; endosperm with 4 horns, not mamillate  
**9. H. parasitica**  
 b. Twigs cinnamomeous brown due to conchiform hairs when young; lenticels elliptic or circular; flower buds clavate, conical; petals not inflated at base; style not articulated; fruits distinctly tubercled; endosperm hornless, mamillate  
**7. H. obtusata**
- 6 a. Leaves opposite or subopposite, glabrous throughout; flowers 5 - 6-merous 7  
 b. Leaves both opposite and alternate or only alternate, covered with conchiform hairs when young; flowers 4-merous 8
- 7 a. Branching pseudo-dichotomous; midrib evanescent towards apex; spikes terminal; flowers 5-merous; bracts lunate; filaments terete; anthers isothecate; pseudocarp ovoid  
**4. H. lambertiana**  
 b. Branching lateral; midrib extending up to apex; spike axillary; flowers 6-merous; bracts collar-like; filaments flat; anthers anisothecate; pseudocarp ellipsoid  
**8. H. odorata**
- 8 a. Flower buds torpedo-shaped; bracts linear-oblong; anthers isothecate; ovary somewhat urceolate; fruits ascidiform; endosperm not mamillate  
**1. H. coccinea**  
 b. Flower buds clavate-rounded; bracts ovate or suborbicular; anthers anisothecate; ovary depressed-globose; fruits with depressed sides or urceolate; endosperm mamillate 9
- 9 a. Calyculus annular, truncate; filaments flat; style tetragonous; endosperm horned  
**5. H. lepidophylla**  
 b. Calyculus obscurely 4-lobed; filaments terete; style terete; endosperm hornless  
**2. H. hookeriana**

**1. *Helixanthera coccinea*** (Jack) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 317. 1929.  
*Loranthus coccineus* Jack, Malayan Misc. 1: 8. 1820; Hook.f., Fl. Brit. India 5: 206. 1886.

Branches with cinnamomeous brown conchiform hairs when young, glabrous when old. Leaves alternate, elliptic or elliptic-ovate, rounded at base, entire, obtuse or subacute at apex, 7.5 - 9 x 2.5 - 3.5 cm, coriaceous, covered with cinnamomeous brown conchiform hairs when young, glabrous when old; lateral nerves 3 - 5 pairs; petioles terete, 5 - 10 mm long. Inflorescences spicate, axillary; peduncle solitary or in pairs, 10 - 12-flowered, ribbed, cinnamomeous brown with conchiform hairs when young, later becoming glabrous, 4 - 4.5 cm long; flower buds torpedo-shaped, sub-tetragonous, cinnamomeous brown, 6 - 8 mm long. Flowers 4-merous, oriented parallel to the axis, sessile, 8 - 10 mm long; bracts linear-oblong, cucullate above, manubriate, 4 - 4.5 x 1.8 - 2 mm. Calyculus obscurely 4-lobed; lobes with marginal hairs, 1 - 1.5

mm long. Petals 4, linear-oblong, abruptly inflated at base, 5 - 6 mm long. Stamens 4, erect; filaments 2 - 2.5 mm long; anthers oblong, 0.8 - 1 mm long. Ovary urceolate, 1.8 - 2 mm long; style 5 - 6 mm long; stigma conical, lobed. Fruits ascidiform, 4-gonous, sparsely tubercled, cinnamomeous brown hairy, 5 - 6 x 2.6 - 3.2 mm; calyx-rim persistent.

*Fl. & Fr.* March - Aug.

*Distrib.* India: Assam, Meghalaya and Andaman & Nicobar Islands. Myanmar, China to Malaysia, Singapore and Indonesia.

*Notes.* Vessel pittings scalariform; fibres excessively thick-walled with narrow lumen without pits or with vestigial pits.

Pollen triangular, P - 27 (29.4) 32  $\mu$ m; E - 35 (37.6) 40  $\mu$ m; P/E - 0.76  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**2. *Helixanthera hookeriana*** (Wight & Arn.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 317. 1929. *Loranthus hookerianus* Wight & Arn., Prodr. Fl. Ind. Orient. 1: 381. 1834; Hook.f., Fl. Brit. India 5: 207. 1886.

Branches terete or slightly angled; branches and leaves when young covered with pale brown conchiform hairs, glabrous when old. Leaves alternate, usually opposite when young, elliptic-ovate, attenuating and obtuse at base, undulate along margins, obtuse to acute at apex, 5 - 8 x 2 - 4 cm, coriaceous; lateral nerves 4 or 5 pairs; petioles 5 - 10 mm long. Inflorescences spicate, up to 11 cm long; peduncle solitary, 10 - 15 (- 30)-flowered, articulated, conchiform hairy, 4 - 5 cm long; flower buds clavate, inserted in shallow pits on peduncles. Flowers 4-merous, 5 - 6 mm long; bracts ovate, 1 - 1.5 mm long. Calyx obscurely 4-lobed. Petals 4, connivent for about half their length, spatulate, oblique, 3.5 - 4.2 mm long, hairy outside. Stamens 4; filaments 2.5 - 3 mm long; anthers oblong, outer pair of thecae longer than inner, 0.5 - 0.7 mm long. Ovary depressed-globose, 1.2 - 1.5 mm long; style ca 4 mm long; stigma capitate, densely granulate. Fruits globose with depressed sides or urceolate with persistent calyx, smooth, cinnamomeous brown conchiform hairy, 4 - 5 x 2.5 - 3 mm, bluish purple.

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

*Distrib.* India: Found on *Mallotus philippensis* in hills of Tamil Nadu.

Sri Lanka.

*Notes.* Mesophyll with abundant sclereids; vessel pittings scalariform; fibres excessively thick-walled, with narrow lumen and simple pits.

Pollen grains triangular, P - 25 (27.9) 33  $\mu$ m; E - 34 (36.2) 38  $\mu$ m; P/E - 0.78  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

Chromosome number: n = 9 (Barlow & Weins, Flinders Univ. S. Austr. Sch. Biol. Bedford Park, S. Austr. 1971).

**3. *Helixanthera intermedia*** (Wight) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 317. 1929. *Loranthus intermedius* Wight in Calcutta J. Nat. Hist. 6: 361. 1846; Hook.f., Fl. Brit. India 5: 205. 1886.

Shrubs; branches covered with cinnamomeous brown conchiform hairs when young, glabrous when old. Leaves opposite or subopposite, broadly ovate or elliptic, narrowed at both ends, rounded-cordate or auricled at base, obtuse at apex, 5.5 - 15 x 3.5 - 6 cm, coriaceous, cinnamomeous brown conchiform hairy when young, glabrous when old; lateral nerves 6 or 7 pairs; petioles winged towards apex, 7 - 15 cm long. Inflorescences centripetal pseudoracemes; peduncles 1 or 2 in each axil, 12 - 30-flowered, sparsely cinnamomeous brown conchiform hairy, 4.5 - 10 cm long. Flowers horizontal, 4-merous, 12 - 15 mm long, pinkish red or purplish brown, glabrous; pedicels 2.5 - 3 mm long; bracts sigmoid, 1.5 - 2 x 1.5 - 1.8 mm. Calyculus cupular, truncate, with minute hairy margins. Petals 4, narrowly spathulate, 8 - 12 mm long. Stamens 4, erect; filaments 1.5 - 2 mm long; anthers 4-lobed, 1 - 1.2 mm long. Ovary subglobose, 2 - 2.5 mm long; stigma capitate. Fruits urceolate, black, smooth, sparsely cinnamomeous brown conchiform hairy, with distinct styler scar, 2 - 2.5 x 1.5 - 1.8 mm.

*Fl. & Fr.* June - Nov.

*Distrib.* India: Evergreen forests, on a limited number of hosts, i. e. *Cinnamomum* spp., *Helicteres isora*, *Machilus macrantha*, etc. Karnataka, Kerala and Tamil Nadu.

Endemic.

*Notes.* Vessel pittings scalariform; fibres excessively thick-walled with narrow slit-like lumen or without lumen.

Pollen 3-lobed; P - 19 (22.1) 27  $\mu$ m; E - 34 (41.3) 44  $\mu$ m; P/E - 0.53  $\mu$ m; ex. 0.2  $\mu$ m; col. 1  $\mu$ m.

**4. *Helixanthera lambertiana*** (Schult.f.) Rajasek. in J. Econ. Taxon. Bot. 31(1): 183. 2007. *Loranthus lambertianus* Schult.f., Syst. Veg. 7: 118. 1829; Hook.f., Fl. Brit. India 5: 223. 1886. *Hyphear lambertianum* (Schult.f.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 319. 1929.

Branches glabrous, pseudo-dichotomously branched. Leaves opposite, elliptic-lanceolate to obovate, attenuating at both ends, somewhat decurrent towards base, subacute at apex, 6 - 6.5 x 1 - 2.2 cm, coriaceous, glabrous; lateral nerves 4 - 6 pairs, palmate-pinnate; petioles 3 - 5 mm long. Inflorescences terminal, spicate; peduncle solitary, 4 or 5-flowered, glabrous, 1.7 - 2.2 cm long. Flowers sessile, inserted in foveola of axis, 5-merous, glabrous; bracts lunate, ca 0.2 mm long, reddish brown. Petals 5, linear-oblong, up to 3.5 cm long. Stamens 5, erect; filaments 2.5 - 3 mm long; anthers linear-oblong, with two pairs of thecae, ca 2.5 mm long. Ovary globose; style tetragonous. Fruits ovoid, glabrous, smooth, ca 4.2 x 3.5 mm.

*Fl. & Fr.* Period unknown.

*Distrib.* India: Temperate Himalayas, at 2000 - 2600 m altitude. Sikkim.

Endemic.

*Notes.* This species has been included as one among the doubtful and excluded species by J. D. Hooker (Fl. Brit. India 5: 223. 1886). It is distinguishable by its *Viscum*-like habit, glabrous nature of the entire plant, terminal spikes and pentamerous large bisexual flowers.

Vessel with scalariform opposite pittings; fibres of special type, excessively thick-walled with or without slit-like discontinuous lumen with ramiform pits in the lateral walls with fairly large narrowly elliptic apertures which are criss-crossing.



**5. *Helixanthera lepidophylla*** (Walp.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 317. 1929. *Loranthus lepidophyllus* Walp., Ann. Bot. Syst. 2: 730. 1852. *L. arnottianus* Wight in Calcutta J. Nat. Hist. 6: 361. 1846 (non Korth. 1839). *L. wightii* Hook.f., Fl. Brit. India 5: 207. 1886.

Branches terete; young leaves and branches covered with pale brown conchiform hairs, glabrous when old. Leaves opposite and alternate, ovate or broadly elliptic to orbicular, rounded or narrowed at base, obtuse at apex, 2 - 4.5 x 1 - 2.5 cm, coriaceous; lateral nerves 4 or 5 pairs; petioles glabrous, 5 - 6 mm long. Inflorescence spicate, axillary, solitary; peduncle solitary, 10 - 14-flowered, brown conchiform hairy when young, glabrous at length, 3 - 5 cm long; flower buds 3 - 4 mm long; flowers 4-merous, 5 - 6 mm long; bracts suborbicular, 1 - 1.5 x 0.8 - 1 mm. Calyculus cupular, 0.5 - 0.7 mm long. Petals 4, spatulate, with inflexed margins, 4 - 8 mm long. Stamens 4; filaments 3 - 5 mm long; anthers oblong. Ovary depressed globose, smooth, ca 1.2 mm long; style 0.5 - 0.8 mm long; stigma capitate with dense granulate surface. Fruits globose with depressed sides or urceolate with persistent calyculus, smooth, brown conchiform hairy, 2 - 2.5 x 1.5 - 1.8 mm.

*Fl. & Fr.* Feb. - Sept.

*Distrib.* India: Western Ghats, on a limited number of hosts, along roadsides in evergreen and semievergreen forests. Mostly in Tamil Nadu.

Endemic.

*Notes.* Vessel pittings scalariform; fibres excessively thick-walled, lateral walls usually smooth with pittings slit-like.

Pollen grains triangular; P - 22 (25.2) 31  $\mu$ m; E - 33 (34.7) 38  $\mu$ m; P/E - 0.71  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**6. *Helixanthera ligustrina*** (Wall.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 317. 1929. *Loranthus ligustrinus* Wall. in Roxb., Fl. Ind., eds. Carey & Wall. 2: 219. 1824; Hook.f., Fl. Brit. India 5: 207. 1886.

Garó: *Suthekmi-songepa*; Kh.: *Makariang*.

Shrubs, up to 2 m tall; branches sparsely covered with cinnamomeous brown conchiform hairs when young, glabrous when old. Leaves opposite when young, alternate when old, elliptic-ovate to narrowly ovate-lanceolate, often attenuate towards base, acute, subacute or acuminate at apex, 4 - 9.5 x 1.2 - 5 cm, subcoriaceous, hairy on young branches, glabrous when old; lateral nerves 4 or 5 pairs; petioles 0.5 - 1 cm long, glabrous. Inflorescence axillary, centripetal pseudoracemes, 1 - 4 cm long, bearing 2 - 8 flowers in opposite pairs, ending in 2 or 3 (rarely up to 5) flowers at the top; peduncle solitary or paired, 5 - 15 mm long. Flowers 2 or 3 per peduncle, 4-merous, glabrous, ca 15 mm long; pedicels glabrous, 0 - 2 mm long; bracts cucullate, ovate-elliptic, 1.2 - 1.5 x 0.5 - 0.8 mm. Calyculus urceolate or cupular, truncate, 0.3 - 0.4 mm long. Petals 4, linear, widening towards base, constricted above base, 6.5 - 8 mm long, yellow or red, minutely conchiform hairy at base. Stamens 4, erect; filaments 4.5 - 5 mm long; anthers contiguous with filament, linear-oblong with subtriangular sterile apex. Ovary cupular or urceolate, warty, 2 - 2.5 mm long; style 6.5 - 7 mm long; stigma capitate or lobed with granulate surface. Fruits ellipsoid to ovoid with persistent styler scar, truncate at apex, 6.5 - 8 x 3 - 3.5 mm, green, turning to red when ripe, cinnamomeous brown, conchiform hairy.

*Fl. & Fr.* April - Nov.

*Distrib.* India: Tropical or subtropical Himalayas, up to 1500 m altitude, found on a limited number of hosts, the few recorded are *Eurya acuminata*, *Cedrela toona*, *Ficus clavata*, *Mallotus philippensis* and *Melia azedarach*. Uttar Pradesh, W. Bengal, Sikkim, Arunachal Pradesh, Meghalaya and Tripura.

Nepal, Bhutan, Bangladesh, Myanmar, S. China, Indo-china, Thailand and Philippines (Luzon).

*Notes.* Brandis (For. Fl. 395. 1902) and Kanjilal et al. (Fl. Assam 4: 121. 1940) describe this species as apparently terrestrial. However Kanjilal & Das have also furnished a variety of hosts for this species. J. D. Hooker (l. c.) suspecting that this species may be a root parasite on the basis of the statement made by Brandis, suggests that parasitism of this species should be carefully checked in the field.

Vessel pittings scalariform; fibres excessively thick-walled with narrow lumen and simple vestigial pits.

Pollen triangular; P - 24 (24.5) 26  $\mu\text{m}$ ; E - 37  $\mu\text{m}$ ; P/E - 0.70  $\mu\text{m}$ ; ex. 2  $\mu\text{m}$ ; col. 1  $\mu\text{m}$ .

Chromosome number:  $n = 9$  (Barlow & Wiens, Flinders Univ. S. Austr. Sch. Biol. Sci. Bedford Park, S. Austr. 1971).

**7. *Helixanthera obtusata*** (Schult.f.) Danser in Jard. Bot. Buitenzorg, Ser. 3, 10: 317. 1929. *Loranthus obtusatus* Schult.f., Syst. Veg. 7(2): 1650. 1830; Hook.f., Fl. Brit. India 5: 205. 1886.

Branches, axillary shoots and leaves densely cinnamomeous conchiform hairy when young, glabrous when old. Leaves opposite or subopposite, ovate to suborbicular, rounded at base, obtuse at apex, 7 - 12 x 4 - 8 cm; lateral nerves 4 - 7 pairs, petioles winged towards apex, 1.5 - 2.5 cm long. Inflorescence centripetal pseudoracemes; peduncles axillary, solitary or in pairs, with 20 - 40 flowers, 3 - 6 cm long. Flowers obliquely oriented upwards or at right angles, 4-merous, 1.5 - 2 cm long, conchiform brown hairy, except corolla and ovary; pedicels 2.5 - 6 mm long; bracts ovate, carinate, 1 - 1.2 x 0.5 - 0.7 mm. Calyculus annular with undulate margin, ca 2 mm long. Petals 4, narrowly spatulate, 13 - 17 mm long. Stamens 4, erect; filaments 1 - 1.5 cm long; anthers oblong. Ovary ovoid, rugose, 3 - 3.5 mm long; style 12 - 15 mm long; stigma capitate. Fruits broadly ovoid, densely tubercled, constricted above with collar, 7 - 8 x 3 - 3.5 mm, black or blackish brown, glabrous.

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

*Distrib.* India: Mostly in subtropical and temperate evergreen forests of Western Ghats, at 1000 - 2300 m altitude, found on a variety of hosts. Maharashtra, Karnataka, Kerala and Tamil Nadu.

Endemic.

*Notes.* This species closely resembles *H. intermedia* but can be distinguished by the number of flowers in the inflorescence (20 - 40), conical, tetragonous flower buds, annular uneven-margined calyculus, glabrous petals, rugose ovary, tubercled fruits and the subspherical hornless endosperm.

Vessels of median length, pits scalariform; fibres excessively thick-walled with smooth walls and the pittings slit-like, criss-cross and without border.

Pollen 3-lobed; P - 19 (21.6) 22  $\mu$ m; E - 42 (44.7) 47  $\mu$ m; P/E - 0.50  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**8. *Helixanthera odorata*** (Wall.) Rajasek. in J. Econ. Taxon. Bot. 31: 184. 2007. *Loranthus odoratus* Wall. in Roxb., Fl. Ind., eds. Carey & Wall. 2: 215. 1824; Hook.f., Fl. Brit. India 5: 204. 1886. *Hyphear odoratum* (Wall.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 319. 1929.

Shrubs with purplish foliage forming clumps up to 1 m or more in diam.; branches glabrous. Leaves usually opposite or rarely subopposite, elliptic-ovate, lanceolate or falcately lanceolate, rounded, obtuse, often narrow attenuate or sometimes decurrent at base, acute or sometimes acuminate at apex, entire or undulate along margins, 5 - 15 x 1.2 - 4.5 cm, coriaceous; lateral nerves 5 - 9 pairs; petioles 5 - 15 mm long. Inflorescences axillary spikes, 3 - 6 cm long; peduncles 1 or 2 in each axil, 10 - 12-flowered. Flowers sessile, alternate or opposite, inserted in excavations at right angles to the axis, 6-merous, 1.5 - 2 cm long, encircled by collar-like 4 - 4.5 mm long bracts formed by excavations. Calyculus cupular, truncate, ca 0.2 mm long. Petals obovate to spatulate, 3 - 4 mm long, thick, glabrous. Stamens 6, erect; filaments 2 - 2.5 mm long; anthers ovoid, 4-lobed. Ovary ovoid to subglobose, smooth, partly embedded in excavations, 1 - 1.5 mm long; style smooth; stigma conical, papillate. Fruits ellipsoid, 3.5 - 6 x 2.5 - 3.5 mm, smooth, orange when fresh, black or reddish brown when dry.

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

*Distrib.* India: Subtropical to temperate evergreen forests, at 1200 to 2500 m altitude, found on *Quercus* and *Lithocarpus* spp. Sikkim, Arunachal Pradesh, Assam, Meghalaya, Nagaland and Manipur.

Nepal and Bhutan.

*Notes.* Vessels with scalariform pitting; fibres are of two types - one excessively thick-walled with simple pits and another with very excessively thick-walled with ramiform pits.

Pollen triangular; P - 17 (18.6) 21  $\mu$ m; E - 25 (28); P/E - 0.70  $\mu$ m; ex. 1.5  $\mu$ m; col. 0.5  $\mu$ m.

**9. *Helixanthera parasitica*** Lour., Fl. Cochinch. 1: 142. 1790. *Loranthus pentapetalus* Roxb., Fl. Ind., eds. Carey & Wall. 2: 211. 1824; Hook.f., Fl. Brit. India 5: 206. 1886.

Nep.: *Samu-aijaru*.

Shrubs, glabrous. Leaves opposite, narrowly or broadly elliptic-ovate to ovate-lanceolate, with alternating rounded or cuneate base, entire along margins, acute to acuminate at apex, 6.5 - 12 x 1.5 - 5 cm, subcoriaceous, glabrous; lateral nerves 5 - 7 pairs; petioles 0.5 - 1.5 cm long. Inflorescences axillary, centripetal pseudoracemes; peduncles 1 - 3-together, 12 - 15-flowered, 8 - 12 cm long, cinnamomeous conchiform hairy; flower buds ossiform with distinctly raised and curved ribs at base, geniculate, 7.8 - 8.5 mm long. Flowers 4 or 5-merous, horizontal, 12 - 13 mm long, bright red, minutely conchiform hairy; bracts ovate and cucullate, acute, 1 - 1.2 x 0.8 - 1 mm; pedicels 1.2 - 1.5 mm long. Calyculus cupular, entire, truncate, ca 0.5 mm long. Petals 4 or 5, cohering towards base, ultimately spreading, linear or obovate, abruptly inflated and winged at base, 5 - 5.8 mm long. Stamens 4 or 5, erect, exserted; filaments 2.5 - 3 mm long. Ovary

tetragonous, rough, oblong, 2 - 2.5 mm long; style 4 or 5-angled, articulated at one-third high above base, 3 - 3.5 mm long; stigma slightly bilobed, capitate. Fruits broadly ellipsoid, truncate, abruptly constricted above with persistent styler scar, 6 - 8 x 4 - 5 mm, smooth, crimson-red, cinnamomeous brown conchiform hairs.

*Fl. & Fr.* Jan. - Aug.

*Distrib.* India: Tropical and subtropical warm evergreen forests, up to 1800 m altitude, found on restricted number of hosts, i. e. *Dillenia* sp., *Antidesma acidum*, *Litsea polyantha*, *Quercus dealbata* and *Vatica lanceolata*. West Bengal, Sikkim, Assam, Nagaland, Manipur, Tripura and Meghalaya.

Nepal, Bhutan, Bangladesh, Myanmar, China, Cambodia, Laos, Vietnam, Thailand, Malaysia, Indonesia and Philippines.

*Notes.* This species is characterised by the presence of basally inflated 4 or 5-angled ossiform flower-buds and articulated style.

Vessels with scalariform pitting; fibres excessively thick-walled with reduced lumen and with reduced pits.

Pollen triangular; P - 15 (17.2) 21  $\mu$ m; E - 25 (30.2) 33  $\mu$ m; P/E - 0.51  $\mu$ m; ex. 1.5  $\mu$ m; col. 0.5  $\mu$ m.

**10. *Helixanthera wallichiana*** (Schult.f.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 319. 1929. *Loranthus wallichianus* Schult.f., Syst. Veg. 7: 100. 1829; Hook.f., Fl. Brit. India 5: 204. 1886.

Shrubs; branches and leaves cinnamomeous conchiform hairy when young, glabrous when old. Leaves opposite, or alternate, elliptic to elliptic-ovate, rarely orbicular, attenuate at base, subacute or obtuse at apex, entire or denticulate along margins, 4 - 13 x 2.5 - 6 cm, coriaceous, glabrous; lateral nerves 3 or 4 pairs; petioles articulated when old, 3 - 8 mm long, glabrous. Inflorescences axillary, centripetal pseudoracemes; peduncles 1 - 3 in each axil, each with 10 - 15 flowers, 3.5 - 4 cm long, cinnamomeous conchiform hairy. Flowers scarlet red, geniculate, 4-merous, cinnamomeous conchiform hairy; pedicels at right angles to peduncles, 2 - 2.5 mm long; bracts ovate, sigmoid, up to 2 mm long. Calyculus truncate with hairy membranaceous rim. Petals 4, almost free, linear, 4 - 5 mm long, subglabrous. Stamens 4; filaments adnate to petals, free above, 3.5 - 4 mm long, red; anthers clavate, up to 1 mm long. Ovary urceolate, densely conchiform hairy, 1 - 1.5 mm long; style 4-gonous; stigma capitate. Fruits urceolate, later turning ovoid or ellipsoid, up to 4.5 x 2.5 mm, densely or sparsely conchiform hairy, sparsely tuberculate, overtopped by persistent base of calyculus.

*Fl. & Fr.* April - Nov.

*Distrib.* India: Moderate altitudes from 500 to 1500 m, found on a limited number of hosts, i. e. *Cinnamomum wightii*, *Ficus asperrima* and *Memecylon malabaricum*. Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Endemic.

*Notes.* Mesophyll contains abundant sclereids; vessel pittings scalariform; fibres very excessively thick-walled with or without narrow lumen.

Pollen 3-lobed; P - 18 (33) 27  $\mu\text{m}$ ; E - 33 (34.8) 44  $\mu\text{m}$ ; P/E - 0.66  $\mu\text{m}$ ; ex. 0.3  $\mu\text{m}$ ; col. 1  $\mu\text{m}$ .

#### EXCLUDED SPECIES

***Helixanthera terrestris*** (Hook.f.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 319. 1929. *Loranthus terrestris* Hook.f., Fl. Brit. India 5: 207. 1886.

Reported from Khasi hills of Meghalaya by Hook.f. (l. c.). It is probably a form of *H. ligustrina*.

### 5. **Macrosolen** (Blume) Rchb.

Shrubs, entirely glabrous. Leaves opposite, more or less distichous, petiolate, elliptic-ovate, curvipinnate, glabrous. Inflorescences centrifugal pseudoracemes, spikes or sometimes contracted into peduncled umbels; flower buds constricted to a neck, clavate with rounded apex; flowers bracteate, bracteolate, actinomorphic, sympetalous, 5- or 6-merous; each flower subtended by 3 unequal scale-like partially connate bracteoles, fused completely with bracts and not enclosing ovary. Calyculus tubular, truncate or lobed. Petals 5 or 6, connate; tube with distinct angular shoulders; lobes reflexed. Stamens 5 or 6; filaments subterete; anthers adnate or basifixed, linear or elliptic-ovate, isothecate, elevatilobate, without sterile apex. Ovary oblong, bearing an entire calyx-rim, smooth; style articulate above the base or not; stigma capitate or broadly elliptic-ovate. Fruits urceolate or globose, rugulose or muricate with or without collar and stylar stub.

South and South-East Asia, ca 25 species; 3 in India.

#### KEY TO THE SPECIES

- 1 a. Young internodes margined on three sides; old nodes meristematically knotty; leaves decurrent; inflorescence ramiflorous; flower buds spatulate; flowers 5-merous; corolla-lobes reflexed and coiled; anthers with sterile apex; ovary subturbinate, faintly tubercled; endosperm without thickened pads, but horned **3. *M. trigonous***
- b. Young internodes not margined, old nodes not meristematically knotty; leaves not decurrent; inflorescence axillary; flower buds clavate with rounded apex; flowers 6-merous; corolla-lobes reflexed, not coiled; anthers without sterile apex; ovary ob long, smooth; endosperm with thickened pads, hornless **2**
- 2a. Lateral nerves distinct on either surfaces; midrib evanescent towards apex; petioles flattened adaxially; flowers prominently shouldered at angles; corolla-tube splitting up to two-third the length; anthers planilobate; fruits with collar and stylar stub, rugulose; endosperm with 6 narrowly elliptic thickened pads **1. *M. cochinchinensis***
- b. Lateral nerves obscure on either surfaces; midrib extending up to tip; petioles sulcate adaxially; flowers faintly shouldered at angles; corolla-tube splitting up to middle; anthers elevatilobate; fruits without collar and hemispherical stylar stub, muricate; endosperm with 4 thickened pads **2. *M. globosus***

**1. *Macrosolen cochinchinensis*** (Lour.) Tiegh. in Bull. Soc. Bot. France 41: 122. 1984; Barlow in Fl. Malesiana, Ser. I, 13: 366, f. 35. 1997. *Loranthus cochinchinensis* Lour., Fl. Cochinch. 1: 195. 1790. *L. ampullaceus* Roxb., Fl. Ind., eds. Carey & Wall. 1: 189. 1820 & 2: 209. 1824; Hook.f., Fl. Brit. India 5: 220. 1886. *Elytranthe ampullacea* (Roxb.) G. Don, Gen. Hist. 3: 425. 1834. *E. cochinchinensis* (Lour.) G. Don, l. c. 426. 1834.

Asm.: *Raghumala*; Hindi: *Banda*.

Shrubs, 0.5 - 1 m tall; branches subterete. Leaves opposite or rarely alternate, elliptic or ovate, rounded or narrowed at base, shortly bluntly acuminate or subacute at apex, 8 - 11 x 2.5 - 7.5 cm, coriaceous, shiny above; lateral nerves 5 - 8 pairs; petioles 6 - 12 mm long. Inflorescences axillary, centrifugal pseudoracemes; peduncles 3 - 5-flowered, 1.5 - 4.5 cm long; flower buds erect, clavate, 1.3 - 1.5 cm long. Flowers 6-merous, 1.8 - 2 cm long; bracts partially united with bracteoles, ovate, 1 - 1.2 x 0.5 - 0.7 mm; bracteoles 2, incompletely connate, ovate; pedicels 1.5 - 2 mm long. Calyculus truncate with undulate margins, 0.3 - 0.5 mm long. Petals 6, united; tube terete, with distinct angular shoulders, equally splitting up to two-third the length; lobes 6, reflexed, linear or elliptic, 4 - 4.8 mm long. Stamens 6; filaments 3 - 3.5 mm long; anthers linear-oblong, adnate, 1.7 - 2 mm long. Ovary oblong, 2 - 2.5 mm long; style articulated just above base, 10 - 12 mm long; stigma broadly elliptic-ovate. Fruits urceolate, rugulose, surrounded by annular or subcordate collar with persistent stylar stub, 5 - 7 x 2.2 - 2.5 mm, pale yellow.

*Fl. & Fr.* Dec. - May.

*Distrib.* India: From sea level to 700 m altitude, reported on *Mangifera indica*. Bihar, West Bengal, Sikkim, Assam, Tripura, Meghalaya, Orissa and Andaman & Nicobar Islands.

Nepal, Bhutan, Bangladesh, Myanmar, China, Thailand, Cambodia, Vietnam, Malaysia to New Guinea.

*Notes.* Vessel pittings scalariform, narrow linear; fibres short, curved, usually angular with spicular projections.

Pollen triangular; P - 32 (36.6) 41  $\mu$ m; E - 60 (70.8) 77  $\mu$ m; P/E - 0.52  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**2. *Macrosolen globosus*** (Roxb.) Tiegh. in Bull. Soc. Bot. France 42: 442. 1895. *Loranthus globosus* Roxb., Fl. Ind., eds. Carey & Wall. 1: 187. 1820 & 2: 206. 1824; Hook.f., Fl. Brit. India 5: 220. 1886. *L. cochinchinensis* Lour., Fl. Cochinch. 1: 195, 1790, p. p. *Macrosolen cochinchinensis* (Lour.) Tiegh. in Bull. Soc. Bot. France 41: 122. 1894, p. p.

Branches not margined; nodes knotty. Leaves opposite or both opposite and alternate, elliptic, cuneate at base, obtuse or subacute at apex, 5 - 8.6 x 1.5 - 2 cm, coriaceous; lateral nerves 3 - 5 pairs; petioles 6 - 10 mm long. Inflorescences axillary, centrifugal pseudoracemes; peduncle 4 - 7-flowered, 1 - 2 cm long; flower buds clavate, 5 - 7 mm long. Flowers 6-merous, ca 12 mm long; bracts ovate, united with bracteoles, 1 - 1.5 x 0.5 - 0.6 mm; pedicels 1 - 1.3 mm long. Calyculus-tube 0.2 - 0.4 mm long. Petals 6, united; tube terete, splitting equally up to the middle, 4.5 - 5.2 mm long; lobes reflexed, elliptic or spatulate, 4 - 4.5 mm long. Stamens 6, 2.3 - 2.5 mm long; anthers elliptic-ovate, isothecate, 0.5 - 0.8 mm long. Ovary oblong, 1.5 - 2 mm long; style continuous, 4-gonous, as long as corolla; stigma capitate. Fruits globose, muriculate, mamillate without stylar stub, 4.5 - 5 x 4 - 4.5 mm, bluish black when dry.

*Fl. & Fr.* Throughout the year.

*Distrib.* India: Tropical areas in Eastern Himalayas and NE. India, up to moderate altitudes. Reported on *Eugenia javanica* and *Ficus benjamina*. West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur and Meghalaya.

Nepal, Bhutan, Bangladesh and Myanmar.

*Notes.* Vessel pitting scalariform; fibres with specula projections.

Pollen triangular; P - 32 (33.6) 36  $\mu\text{m}$ ; E - 60 (60.6) 69  $\mu\text{m}$ ; P/E - 0.56  $\mu\text{m}$ ; ex. 2  $\mu\text{m}$ ; col. 1  $\mu\text{m}$ .

**3. *Macrosolen trigonus*** (Wight & Arn.) Tiegh. in Bull. Soc. Bot. France 42: 442. 1895, in obs. *Loranthus trigonus* Wight & Arn., Prodr. Fl. Ind. Orient. 1: 386. 1834; Hook.f., Fl. Brit. India 5: 219. 1886. *Dendrophthoe trigona* (Wight & Arn.) Danser ex Santapau in Rec. Bot. Surv. India 16: 263. 1953.

Young internodes sharply trigonous or margined on three sides, thereby becoming triquetrous, older ones terete, meristematically knotty at nodes; branching lateral. Leaves opposite, subopposite or whorled, broadly elliptic-ovate or suborbicular, cuneate or rounded and decurrent at base, entire or undulate along margins, obtuse or rounded at apex, 12 - 17 x 6 - 10 cm, crustaceous, glabrous; lateral nerves 4 or 5 pairs; petioles 9 - 15 mm long. Inflorescences centrifugal pseudoracemes, usually ramiflorous; peduncles 4 - 6-whorled at nodes, each 4 - 6-flowered, 12 - 15 mm long; flower buds spatulate, slightly gibbous at base, terete above with or without angular shoulders at middle, 1.2 - 1.5 cm long. Flowers 5-merous, 1.8 - 2.5 cm long; pedicels 2 - 3 mm long; bracts united with bracteoles, broadly ovate or suborbicular, 2 - 2.5 x 2.5 - 3 mm. Calyculus-tube entire or undulate, 0.8 - 1 mm long. Petals united; tube gibbous at base, usually splitting up to middle, 8 - 10 mm long; lobes 5, linear-elliptic, reflexed and coiled, 7 - 9.5 mm long. Stamens 5; filaments coherent to petals at base, free above, 4 - 5 mm long; anthers oblong, 2 - 3 mm long, with 1.5 - 2 mm long sterile emarginate apex. Ovary ellipsoid, 1.8 - 2 mm long; style up to 1 cm long; stigma capitate. Fruits usually ellipsoid or obovoid with persistent undulate-margined calyculus tube, smooth, 8 - 15 x 4 - 5 mm.

*Fl. & Fr.* Oct. - June.

*Distrib.* India: Western Peninsula in evergreen forests at 800 m and above, often found on *Ficus* spp. Maharashtra, Karnataka, Kerala and Tamil Nadu.

Endemic.

*Notes.* While all other species of this genus parasitise on a variety of hosts belonging to different genera and families, this particular species are known to parasitise only on species of *Ficus*.

Mesophyll of the leaves contain sclereids; fibres short, curved, angular with spicular projections.

Pollen triangular, aeriolate; P - 17 (20) 28  $\mu\text{m}$ ; E - 33 (41.5) 46  $\mu\text{m}$ ; P/E - 0.51  $\mu\text{m}$ ; ex. 1.5  $\mu\text{m}$ ; col. 0.5  $\mu\text{m}$ .

Chromosome number: n = 9 (Sanjappa, Taxon 28: 393. 1979).

## 6. *Scurrula* L.

Shrubs, usually covered with candelabra or stellate hairs or both mixed in all juvenile parts. Leaves opposite or subopposite, sessile or petiolate, tomentose or mealy when young, glabrous when old, curvipinnate and rectipinnate. Inflorescences centrifugal pseudoracemes or compound dichasia; flower buds ellipsoid-clavate to spatulate. Flowers bracteate, ebracteolate, zygomorphic, sympetalous, 4-gonous. Calyculus obsolete. Petals 4, united, curved; tube terete or tetragonous, ventricose just before anthesis; lobes 4, spoon-shaped, unilaterally reflexed after anthesis. Stamens 4, erect; filaments terete or subterete, adnate to the corolla; anthers variable, basifixed, isothecate, anisothecate, circumthecate or not, elevatilobate, planilobate, with or without sterile apex. Ovary clavate or obconical, usually strongly attenuating towards base and with narrow calyx rim; smooth or rugose; style tetragonous, equal to petals; stigma conical, capitate or subglobose. Fruits tubercled or areolate, hairy or glabrous; exocarp coriaceous; endocarp viscous; seeds in the widest part of the fruit. Endosperm obovate, horned or not, mamillate or not, smooth, ribbed, with appressed scales.

South-east Asia, ca 23 species; 10 species in India.

### KEY TO THE SPECIES

- |   |  |                                  |
|---|--|----------------------------------|
| 1 | a. Flower buds distinctly tetragonous  | 2                                |
|   | b. Flower buds terete or subtetragonous  | 6                                |
| 2 | a. Mature leaves glabrous  | 3                                |
|   | b. Mature leaves hairy above   | 4                                |
| 3 | a. Inflorescence a compound dichasium  | <b>5. <i>S. fusca</i></b>        |
|   | b. Inflorescence a centrifugal pseudoraceme  | 5                                |
| 4 | a. Young twigs with stellate hairs; lateral nerves rectipinnate; midrib evanescent towards apex; filaments erect at anthesis; epigynous glands present; fruits with brown stellate hairs   | <b>7. <i>S. leenhoutsii</i></b>  |
|   | b. Young twigs with candelabra hairs; lateral nerves curvipinnate; midrib extending up to apex; filaments twisted at anthesis; epigynous glands absent; fruits glabrous  | <b>3. <i>S. eglandulosa</i></b>  |
| 5 | a. Inflorescence a centrifugal pseudoraceme; lateral nerves 5 - 7 pairs, distinct beneath, obscure above; anthers isothecate; ovary obcuneate; fruits with tubercles and reticulate markings   | <b>1. <i>S. atropurpurea</i></b> |
|   | b. Inflorescence a compound dichasium; lateral nerves 3 - 4 pairs, distinct on both surfaces; anthers anisothecate; ovary clavate; fruits tubercled, not with reticulate markings  | <b>10. <i>S. steenisii</i></b>   |
| 6 | a. Anthers without sterile apex; ovary obconical   | 7                                |
|   | b. Anthers with sterile apex; ovary clavate  | 8                                |
| 7 | a. Leaves both opposite and alternate; midrib evanescent towards apex; anthers circumthecate; epigynous glands present; fruits glabrous; endosperm horned  | <b>4. <i>S. elata</i></b>        |
|   | b. Leaves subopposite or opposite; midrib extending up to apex; anthers anisothecate; epigynous glands absent; fruits hairy; endosperm hornless  | <b>9. <i>S. pulverulenta</i></b> |
| 8 | a. Young leaves clothed with velvety shiny white mealy tomentum, consisting of elongated candelabra hairs on both surfaces; midrib evanescent towards apex; petioles 14 - 22 mm long; flower buds with abruptly acute apex; endosperm punctate | <b>2. <i>S. cordifolia</i></b>   |
|   | b. Young leaves clothed with non-velvety dull brown or rusty brown candelabra hairs mixed with stellate hairs on both surfaces; midrib extending up to apex; petioles 3-7 mm long; flower buds with clavate apex; endosperm smooth             | 9                                |



- 9 a. Leaves larger, 8 - 12 x 2 - 6 cm, pale tomentose beneath when mature; lateral nerves curvilinear; inflorescence centrifugal pseudoraceme; flower buds club-shaped, erect; corolla dark red outside and purple inside; corolla and style 8 - 15 mm long; anthers isothecate; fruits smooth; endosperm hornless, smooth **8. S. parasitica**
- b. Leaves smaller, 6 - 8 x 1.5 - 3 cm, glabrous beneath when mature; lateral nerves rectipinnate; inflorescence a compound dichasium; flower buds linear-cylindric, curved; corolla dark brown outside and red inside; corolla and style 20 - 30 mm long; anthers anisothecate; fruits rugose; endosperm horned, ribbed **6. S. gracilifolia**

**1. Scurrula atropurpurea** (Blume) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 349. 1929. *Loranthus atropurpureus* Blume in Verh. Batav. Genootsch. Kunsten 9: 186. 1823.

Branches rusty brown due to the elongated candelabra hairs intermixed with stellate hairs when young, glabrous when old. Leaves usually opposite, broadly ovate, rounded or slightly narrowed at base, acute or subacute at apex, 8 - 12 x 3 - 6 cm, coriaceous, glabrous above, rusty stellate tomentose beneath; lateral nerves 5 - 7 pairs; petioles 5 - 7 mm long, glabrous in old age. Inflorescences axillary, centrifugal pseudoracemes; peduncles 1 or 2 in each axil, each 8 - 10-flowered, candelabra hairy, up to 3.5 mm long; flower buds erect, tetragonous, spatulate, ca 1.5 cm long. Flowers erect, with stalk-like lower portion and abruptly enlarged upper portion, later ventricose at base, 1.7 - 1.9 cm long; pedicels 2.5 - 3 mm long; bracts ovate, 1.5 - 2 x 0.5 - 0.7 mm. Petals united; tube ventricose at base; median split extending up to two-third the length, 10 - 12 mm long; lobes narrowly elliptic, 4 - 5 mm long. Stamens erect; filaments 2 - 3 mm long; anthers linear. Ovary obcuneate, 3 - 3.5 mm long; style tetragonous; stigma subglobose. Fruits pyriform, brown candelabra hairy, with tubercles and reticulate markings on surface, 9 - 10 x 3.5 - 4 mm.

*Fl. & Fr.* March - Nov.

*Distrib.* India: Eastern Himalayas and North-east India, at high altitudes, found on *Glochidion thomsonii*. Sikkim, Arunachal Pradesh and Assam.

China, Thailand, Vietnam, Malaysia, Java, Philippines, Lesser Sunda Islands and Moluccas.

*Notes.* Vessels with lateral wall perforations, pittings alternate; fibres excessively thick-walled, lumened, pittings reduced.

Pollen 3-lobed; P - 22 (25.9) 30  $\mu$ m; E - 42 (43.4) 47  $\mu$ m; P/E - 0.60  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

Chromosome number reported is n = 8 (Rausch in Ber. Schweinz. Bot. Ges. 45: 5 - 61. 1936).

**2. Scurrula cordifolia** (Wall.) G.Don, Gen. Hist. 3: 421. 1834. *Loranthus cordifolius* Wall. in Roxb., Fl. Ind., eds. Carey & Wall. 2: 222. 1824; Hook.f., Fl. Brit. India 5: 209. 1886.

Branches and leaves densely covered with rusty brown shiny elongated candelabra hairs when young, glabrous when old. Leaves opposite, broadly elliptic or ovate-elliptic, rounded or cordate at base, obtuse at apex, 6 - 14 x 3 - 7 cm, crustaceous; lateral nerves 5 - 8 pairs; petioles 1.4 - 2.2 cm long. Inflorescences centrifugal pseudoracemes; peduncles 2 or 3 in each axil, each 3 - 5-flowered, 2 - 5 mm long, rusty brown candelabra hairy; flower buds spatulate, 1.5 - 2 cm long, densely candelabra hairy. Flowers 2 - 2.5 cm long, orange-red; bracts ovate, 1.5 - 2 x 0.6 - 0.7 mm. Calyculus with annular hairy rim. Petals united; tube with median split extending up to half the length, 1.5 - 1.8 cm long; lobes narrowly elliptic-ovate, 5 - 6 mm long. Stamens recurved; filaments 4 - 5 mm long; anthers oblong. Ovary clavate, 3.5 - 4 mm long; style 4-gonous; stigma

conical, minutely papillate. Fruits pyriform, 8 - 10 x 3.5 - 4 mm, smooth, mealy tomentose with shiny rusty brown elongated candelabra hairs.

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

*Distrib.* India: Tropical and subtropical regions, above 1000 m altitude, found on a variety of hosts. Jammu & Kashmir, Uttar Pradesh, West Bengal, Arunachal Pradesh, Orissa, Karnataka, Tamil Nadu and Kerala.

Nepal and Sri Lanka.

*Notes.* Few vessel members with a few large circular lateral openings; fibres moderately thick-walled, broad lumened with or without a few reduced pits.

Pollen 3-lobed; P - 28 (31.1) 35  $\mu$ m; E - 53 (57) 66  $\mu$ m; P/E - 0.54  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**3. *Scurrula eglandulosa*** Rajasek. in J. Swamy Bot. Club 3(3): 85, ff. 1 - 2. 1986.

Branches glabrous. Leaves opposite, elliptic-oblong, with decurrent base and attenuating towards both ends, 11 - 13 x 3.5 - 4.5 cm, coriaceous, glabrous; lateral nerves 7 - 9 pairs; petioles 8 - 10 mm long. Inflorescences centrifugal pseudoracemes; peduncle solitary in each axil, 6 - 8-flowered, 12 - 15 mm long, glabrous; flower buds spatulate with fusiform apex, 2.3 - 2.5 cm long, minutely pubescent. Flowers strongly curved, ca 3 cm long, glabrous; bracts ovate, acuminate, 1 - 1.5 x 0.4 - 0.5 mm; pedicels terete, 3 - 4 mm long. Calyculus shortly rimmed, truncate, ca 0.2 mm long. Petals united; tube terete at base, tapering towards apex, with median split extending up to half the length, 2 - 2.2 cm long; lobes unilaterally reflexed, linear-lanceolate, 7 - 9 mm long. Stamens twisted at anthesis; filaments 3 - 4 mm long; anthers oblong, 1.3 - 1.5 mm long. Ovary obconical, 1.5 - 2 mm long, rugose, brown candelabra hairy, gradually glabrous; style tetragonous; stigma conical with minute papillae. Fruits pyriform with persistent short calyculus limb, glabrous; young fruits ca 2.5 x 1.5 mm.

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

*Distrib.* India: E. Himalayas, at about 2000 m altitude, rare. Sikkim

Endemic.

*Notes.* Vessels thin-walled with lateral wall perforations, pittings occasionally opposite; fibres thick-walled, broad-lumened with vestigial pits.

Pollen 3-lobed; P - 24 (27) 33  $\mu$ m; E - 44 (47.5) 53  $\mu$ m; P/E - 0.56  $\mu$ m; ex. 1.5  $\mu$ m; col. 0.5  $\mu$ m.

**4. *Scurrula elata*** (Edgew.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 350. 1929. *Loranthus elatus* Edgew. in Trans. Linn. Soc., London 20(1): 58. 1846; Hook.f., Fl. Brit. India 5: 212. 1886.

Branches and leaves rusty stellate hairy when young, glabrous when old. Leaves opposite and alternate, broadly ovate to obliquely ovate, rounded at base, acuminate at apex, 3.5 - 16 x 2.5 - 9 cm, coriaceous; lateral nerves 5 - 7 pairs; petioles 1.5 - 2.5 cm long. Inflorescences centrifugal pseudoracemes; peduncle solitary, 6 - 10-flowered, 2 - 2.3 cm long; flower buds spatulate, 2.5 - 2.8 cm long, rusty stellate hairy. Flowers slightly ventricose at middle, 2.8 - 3 cm long; pedicels

slender, terete, 5 - 6 mm long, glabrous; bracts elliptic-ovate, cucullate, obtuse, 1.2 - 1.5 x 0.8 - 1 mm. Calyculus obsolete. Petals united, 2.5 - 3.5 cm long; tube slightly ventricose at middle, with median split extending to two-third the length; lobes linear-oblong, unilaterally reflexed, 2 - 2.3 cm long. Stamens erect; filaments flat; anthers linear-oblong, 2 - 3 mm long. Ovary obconical, 3 - 4 mm long, rusty stellate hairy, with epigynous glands; style 4-gonous; stigma elliptic-ovate, obtuse. Fruits obovoid or turbinate, 5 - 6 x 3 - 4 mm, areolate, glabrous.

*Fl. & Fr.* March - Sept.

*Distrib.* India: Temperate regions of Himalayas, in evergreen oak forests, at 2000 - 3200 m altitude, found on a limited number of hosts, viz. *Aesculus indica*, *Populus ciliata*, *Prunus persica*, *Rhododendron arboreum*, etc. Himachal Pradesh, Uttarakhand and Sikkim.

Nepal, Bhutan and China.

*Notes.* Few vessel members with a few large circular lateral openings; fibres moderately thick-walled, broad-lumened with or without a few reduced pittings.

Pollen 3-lobed; P - 27 (31.9) 34  $\mu$ m; E - 44 (47.1) 52  $\mu$ m; P/E - 0.70  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**5. *Scurrula fusca*** (Blume) G.Don, Gen. Hist. 3: 421. 1834. *Loranthus fuscus* Blume, Verh. Batav. Genootsch. Kunsten 9: 192. 1823 & Bijdr. Fl. Ned. Ind. 660. 1826. *L. malaccensis* Hook.f., Fl. Brit. India 5: 210. 1886.

Branches and leaves rusty brown with candelabra hairs when young, glabrous when old. Leaves opposite, elliptic, narrowed at base, obtuse at apex, undulate along margins, 2.5 - 3.5 x 1.5 - 2 cm, subcoriaceous, rusty brown with candelabra hairs when young; lateral nerves 4 or 5 pairs; petioles 3.5 - 5 mm long. Inflorescences axillary compound dichasia; peduncle 1 or 2 in each axil, each 3 - 5-flowered, 2 - 4 mm long; flower buds erect, spatulate, rusty brown with persistent candelabra hairs, 1 - 1.2 cm long. Flowers curved, ventricose at base, gradually attenuating towards apex, 1.5 - 1.7 cm long; pedicels 2.5 - 3 mm long; bract ovate, 1.5 - 2 x 0.5 - 0.6 mm. Calyculus obsolete. Petals united; tube with median split for halfway the length, 9 - 11 mm long; lobes narrowly elliptic, ca 3.5 mm long. Stamens erect; filaments 2 - 3 mm long; anthers oblong to ovate, 1 - 1.2 mm long. Ovary obcuneate, 3.5 - 4 mm long; style 4-gonous; stigma ovate. Fruits pyriform, 6 - 7 x 2 - 2.5 mm, smooth, rusty brown with short candelabra hairs.

*Fl. & Fr.* Jan. - April.

*Distrib.* India: Evergreen lowland forests at sea level. Andaman Islands. Rare.

Malaysia, Indonesia and Philippines.

*Notes.* This species is a new record for India, characterised by slender twigs, small leaves, compound dichasium, tetragonous flower-buds, small flowers, corolla with median split extending up to half the length, erect stamens, obcuneate ovary and claviform endosperm without appressed scales.

Few vessel members with a few large circular lateral openings; fibres moderately thick-walled, broad-lumened with or without reduced pits.

Pollen 3-lobed; P - 26 (27.5) 30  $\mu$ m; E - 37 (39.2) 44  $\mu$ m; P/E - 0.70  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**6. *Scurrula gracilifolia*** (Roxb. ex Schult.f.) Danser in Blumea 2: 47. 1936. *Loranthus gracilifolius* Roxb. ex Schult.f., Syst. Veg., ed. 15 bis, 7(1): 99. 1829. *L. graciliflorus* DC., Prodr. 4: 300. 1830. *L. scurrula* L. var. *graciliflorus* (DC.) Kurz, Forest Fl. Burma 2: 319. 1877; Hook.f., Fl. Brit. India 5: 209. 1886.

Branches and leaves covered with cinnamomeous brown elongated candelabra hairs intermixed with white stellate hairs when young, glabrous when old. Leaves opposite, bifarious, narrowly elliptic-ovate, oblong-lanceolate or obovate, attenuating towards both ends, shortly decurrent at base, subacute at apex, 6 - 8 x 1.5 - 3 cm, subcoriaceous; lateral nerves 5 - 7 pairs; petioles 3 - 7 mm long. Inflorescences compound dichasia; peduncles 2 or 3 in each axil, each 3 - 5-flowered, terete, 2 - 3 mm long, candelabra hairy; flower buds long cylindric with clavate apex, 1.3 - 1.8 mm long, hairy. Flowers slightly ventricose at middle, 2 - 2.7 cm long, red or reddish brown; pedicels 1 - 3.5 mm long; bract elliptic-ovate, obtuse, 0.5 - 0.8 x 0.3 - 0.4 mm. Calyculus truncate, ca 0.3 mm long. Petals 4, united, dark brown outside; tube slender, slightly ventricose at middle, with median split up to half the length, 1.5 - 2 cm long; lobes linear-lanceolate, reflexed, 5 - 8 mm long. Stamens erect or slightly recurved; filaments 1.5 - 2.5 mm long; anthers oblong, 1.2 - 1.4 mm long. Ovary clavate, 2 - 2.5 mm long; style 4-gonous; stigma elliptic-ovate. Fruits pyriform, ca 8 mm long, densely rugose, covered with short hairs and bluntly lobed calyculus, 2.3 - 2.9 x 1 - 1.2 mm.

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

*Distrib.* India: Found on *Pinus* spp. Sikkim, Arunachal Pradesh, Assam and Meghalaya.

Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, China, Thailand and Hongkong.

*Notes.* Some vessel members are with a few circular lateral openings; fibres moderately thick-walled, broad-lumened with or without reduced pits .

Pollen 3-lobed; P - 23 (28.9) 33  $\mu$ m; E - 35 (43.8) 44  $\mu$ m; P/E - 0.60  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**7. *Scurrula leenhoutsii*** Rajasek. in J. Swamy Bot. Club 3(3): 86, ff. 3 - 4. 1986.

Branches and leaves stellate hairy when young, glabrous when old; internodes widening towards top. Leaves opposite, narrowly elliptic-ovate, usually attenuating towards base, subacute at apex, 7 - 9 x 2.5 - 3 cm, cinnamomeous brown stellate hairy when young, glabrous when old; lateral nerves 3 or 4 pairs; petioles 8 - 12 mm long. Inflorescences centrifugal pseudoracemes; peduncle 1 (or 2) per axil, 8 - 10-flowered, brown stellate hairy when young, glabrous in age, 1.3 - 1.5 cm long; flower buds spatulate, 2.5 - 2.8 cm long. Flowers 3.2 - 3.7 cm long, glabrous; pedicels 1.7 - 2.1 mm long; bracts ovate, 1.5 - 2 x 1 - 1.2 mm, stellate hairy outside. Calyculus ca 0.2 mm long, with undulate rim, glabrous. Petals united; tube tetragonous, with a median split up to half the length, 2.5 - 3 cm long; lobes elliptic, acute, 7 - 8 mm long. Stamens erect; filaments 2.5 - 3.5 mm long; anthers linear, , 4.5 - 5.2 mm long. Ovary obconical, rugose, 1 - 1.2 mm long; epigynous glands faintly or distantly 4-lobed; style 4-gonous; stigma ovoid or conical, minutely papillate. Fruits pyriform, sparsely or densely rugose, brown stellate hairy when young; young fruits 2.5 - 2.8 x 1.5 - 1.7 mm.

*Fl. & Fr.* April - Sept.

*Distrib.* India: Found on *Rhododendron* spp. in open forests. E. Himalayas: W. Bengal (Darjeeling), Sikkim and Arunachal Pradesh.

Endemic.

*Notes.* Vessel members with lateral perforations, pittings alternate, elliptic; fibres thick-walled, broad-lumened with reduced pits; aperture slit-like, criss-cross.

Pollen triangular, 3-lobed; P - 27 (32.2) 33  $\mu$ m; E - 48 (52.1) 55  $\mu$ m; P/E - 0.61  $\mu$ m; ex. 1.5  $\mu$ m; col. 0.5  $\mu$ m.

**8. *Scurrula parasitica*** L., Sp. Pl. 110. 1753; Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 352. 1929. *Loranthus scurrula* L., Sp. Pl., ed. 2, 472. 1762; Hook.f., Fl. Brit. India 5: 208. 1886. *L. laevigatus* Wall. ex DC., Prodr. 4: 302. 1830. *L. scurrula* L. var. *laevigatus* (Wall. ex DC.) Hook.f., l. c. 209. *L. scurrula* L. var. *bengalensis* Hook.f., l. c. 209.

Kh.: *Dieng-mang-kariang*; Nep.: *Aijiru*.

Shrubs, 1 - 3 m tall; branches and leaves covered with rusty candelabra hairs intermixed with stellate hairs when young, glabrous when old. Leaves opposite to subopposite, subsessile or petiolate, oblong-elliptic or ovate to orbicular, rounded or subcordate at base, obtuse or acute at apex, 8 - 12 x 2 - 6 cm, coriaceous; lateral nerves 4 - 8 pairs; petioles up to 1 cm long. Inflorescences axillary centrifugal pseudoracemes; peduncles 1 or 2 in each axil, each 2 - 8-flowered, 4 - 7 mm long, stellate hairy; flower buds club-shaped or spatulate, candelabra hairy. Flowers 2 - 2.5 cm long; bracts ovate or elliptic-ovate, 1.5 - 2 x ca 1 mm; pedicels 1 - 2 mm long. Calyculus obsolete or up to 4 mm long. Petals united; tube gibbous, median split up to two-third the length, 1.2 - 1.5 mm long, dark reddish brown outside, purplish inside; lobes sagittate, 5 - 6 mm long, greenish yellow. Stamens with 1.8 - 2.5 mm long filaments, purplish at base, reddish above; anthers oblong, 1.5 - 1.8 mm long. Ovary clavate, 2 - 2.3 mm long; style up to 1 mm long; stigma broadly conical. Fruits pyriform, 7 - 10 x 2.5 - 3 mm, smooth, pale green, rusty brown due to candelabra hairs.

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

*Distrib.* India: Found on a variety of hosts along fringes of forests. Throughout the country.

Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, China, Thailand, Taiwan, Vietnam, Malaysia, Indonesia, Philippines, Moluccas and Timor.

*Notes.* A variable species with respect to the foliage and inflorescence.

Mesophyll with abundant sclereids; few vessel members with large circular lateral openings; fibres moderately thick-walled, broad-lumened with or without a few undulated pits.

Pollen 3-lobed; P - 22 (30.1) 33  $\mu$ m; E - 53 (56.3) 60  $\mu$ m; P/E - 0.56  $\mu$ m; ex. 2  $\mu$ m; col 1  $\mu$ m.

**9. *Scurrula pulverulenta*** (Wall.) G.Don, Gen. Hist. 3: 421. 1834; Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 353. 1929. *Loranthus pulverulentus* Wall. in Roxb., Fl. Ind., eds. Carey & Wall. 2: 221. 1824; Hook.f., Fl. Brit. India 5: 311. 1886.

Branches terete; young internodes flattened, widening towards top, densely white

stellate hairy, later glabrous. Leaves opposite or subopposite, broadly elliptic-ovate, rounded or acute at base, acute or obtuse at apex, usually crisped margined, (6 -) 12 - 16 x (3 -) 6 - 8 cm, subcoriaceous, white or rusty stellate hairy on both surfaces when young, glabrous when old; lateral nerves 5 - 9 pairs; petioles (1 -) 1.5 - 2.5 cm long. Inflorescences centrifugal pseudoracemes; peduncle more than one in each axil, each 6 - 10-flowered, 2 - 3 cm long; flower buds spatulate, 2 - 2.5 cm long, densely stellate hairy; flowers 2.7 - 3 cm long; pedicels 1.5 - 2 mm long; bract scaly, 1.5 - 2 x 0.5 - 0.6 mm. Calyculus obsolete. Petals united; tube ventricose beneath the neck, with median split up to half the length, 12 - 16 mm long; lobes linear, unilaterally reflexed, 5 - 7 mm long. Stamens erect; filaments 5 - 6 mm long; anthers linear-oblong, 4 - 4.2 mm long. Ovary obconical, 2 - 2.2 mm long; style filiform, 2 - 3 cm long; stigma small, subcapitate. Fruits pyriform, 7 - 12 x 3 - 4 mm, smooth, white stellate hairy.

*Fl. & Fr.* Sept. - March.

*Distrib.* India: Tropical regions in Himalayas and North-east India, at 1000 to 1500 m altitude, found on a variety of hosts, particularly in deciduous forests. Uttarakhand, Sikkim, Arunachal Pradesh, Manipur, Mizoram, Meghalaya, Madhya Pradesh and Maharashtra.

Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, China and Thailand.

*Notes.* Pundir & Adhin (Indian J. Forest. 5: 138. 1982) reports self-parasitism in this species. Pundir (Indian J. Forest. 18: 74 - 79. 1995) further lists several hosts for this species from Doon Valley in Uttarakhand.

Few vessel members with a few large circular openings; fibres moderately thick-walled, broad-lumened, with or without reduced pits.

Pollen 3-lobed; P - 22 (24.8) 27  $\mu$ m; E - 40 (43) 46  $\mu$ m; P/E - 0.58  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

Chromosome number: n = 9 (Bir, Gill & Bedi, Taxon 28: 402. 1979).

**10. *Scurrula steenisii*** Rajasek. in J. Swamy Bot. Club 3(3): 88, ff. 5 - 6. 1986.

Branches covered with elongated candelabra hairs intermixed with white stellate hairs when young, glabrous when old. Leaves opposite, ovate to elliptic, rounded at base, subacute or rarely obtuse at apex, 6.5 - 10 x 3 - 5 cm, coriaceous, rusty brown hairy as in branches when young, glabrous above and rusty brown on lower surface when old; lateral nerves 3 or 4 pairs; reticulate venation prominent; petioles 9 - 13 mm long, glabrous. Inflorescences compound dichasia; peduncles 2 or 3 in each axil, each 4 or 5-flowered, 2 - 3 mm long; flower buds spatulate, 1.3 - 1.5 cm long, hairy. Flowers 1.6 - 1.8 cm long; pedicels 2.5 - 3 mm long; bract conical, 0.8 - 10 x 0.3 - 0.4 mm. Calyculus ca 0.5 mm long. Petals united; tube ventricose at base, with median split up to two-third the length or even up to base, 8 - 12 mm long, sparsely pubescent with candelabra hairs; lobes narrowly obovate, unilaterally reflexed, 2.5 - 3 mm long. Stamens erect; filaments 2 - 3 mm long; anthers oblong, ca 0.7 mm long. Ovary clavate, 2.5 - 3 mm long, cinnamomeous brown candelabra hairy; stigma globose, minutely papillate. Fruits pyriform, usually distally tubercled; young fruits ca 5 x 2 mm.

*Fl. & Fr.* Aug. - Oct.

*Distrib.* India: Found on *Grewia* spp. in deciduous forests. Assam and Tripura.

Endemic.

*Notes.* A very distinct species with leaves bearing prominent reticulate venation.

Vessels with lateral perforations, pitting opposite; fibres thick-walled, lumened, without pits.

Pollen triangular, 3-lobed; P - 24 (26.3) 28  $\mu\text{m}$ ; E - 40 (42.7) 44  $\mu\text{m}$ ; P/E - 0.60  $\mu\text{m}$ ; ex. 1.5  $\mu\text{m}$ ; col. 0.5  $\mu\text{m}$ .

#### DOUBTFUL AND EXCLUDED SPECIES

**1. *Scurrula biflora*** (Desr.) G.Don, Gen. Hist. 3: 422. 1834. *Loranthus biflorus* Desr. in Lam., Encycl. 3: 600. 1789; Hook.f., Fl. Brit. India 5: 222. 1886.

**2. *Scurrula ferruginea*** (Roxb. ex Jack) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 350. 1929 & 11: 432. 1931; Barlow in Fl. Malesiana Ser. I, 13: 385. 1997. *Loranthus ferrugineus* Roxb. [Hort. Bengal. 87. 1814, nom. nud.] ex Jack, Malayan Misc. 1: 279, t. 59. 1820; Hook.f., Fl. Brit. India 5: 210. 1886.

*Notes.* This species is known from Myanmar, S. China, Vietnam, Malay Peninsula, Sumatra, Palawan, Celebes and W. Java. Barlow (1997) included India while citing the distribution of the species but no collection from India could be examined. The report of this species from Goa by Bennet & Sahni (Indian Forester 103: 475. 1977) is based on wrong identification.

**3. *Scurrula rugulosa*** (B. Heyne ex Roth) G.Don, Gen. Hist. 3: 422. 1834. *Loranthus rugulosus* B. Heyne ex Roth, Nov. Pl. Sp. 198. 1821; Hook.f., l. c. 5: 223. 1886.

**4. *Scurrula turbinata*** (DC.) G.Don, Gen. Hist. 3: 424. 1834. *Loranthus turbinatus* DC., Prodr. 4: 305. 1830; Hook.f., l. c. 5: 223. 1886.

**5. *Scurrula umbellifera*** (Schult.f.) G.Don is ***Taxillus umbellifer*** (Schult.f.) Danser.

#### 7. *Taxillus* Tiegh.

Shrubs; juvenile parts covered with candelabra hairs mixed with stellate hairs and/or abietiform hairs mixed with stellate hairs. Leaves alternate, opposite or subopposite, sessile or petiolate, glabrous above and hairy beneath as in juvenile parts or glabrous on both surfaces, palmate-pinnate and curvipinnate. Inflorescence simple dichasium, reduced dichasium or compound dichasium; flower buds spatulate or ventricose. Flowers bracteate, ebracteolate, zygomorphic, sympetalous, 4 or 5-merous. Calyculus obsolete or present and lobed. Petals 4 or 5, united; tube terete or ventricose; lobes 4 or 5, unilaterally reflexed or obliquely erect after anthesis. Stamens 4 or 5, erect; filaments terete or subterete; anthers isothecate or anisothecate, with or without sterile apex. Ovary attenuated toward base; style tetragonous, tumid or continuous; stigma capitate or subglobose, smooth. Fruits pseudocarps, smooth or papillate or with reticulate markings, glabrous or hairy.

South and South-east Asia from Indian subcontinent to Malesia, ca 35 species; 13 species in India.

## KEY TO THE SPECIES

- 1 a. Leaves opposite or both opposite and alternate; flowers tetramerous; hairs when present in flowers both of candelabra and stellate types 2  
 b. Leaves always alternate; flowers pentamerous; hairs when present in flowers both of abietiform and stellate types 9
- 2 a. Flower buds clavate or spatulate 3  
 b. Flower buds ventricose 7
- 3 a. Inflorescence simple dichasium **9. T. reflexilobus**  
 b. Inflorescence compound dichasium 4
- 4 a. Midrib evanescent towards apex 5  
 b. Midrib extending up to apex 6
- 5 a. Branchlets glabrous; leaves attenuate at apex; peduncles 5 – 8-flowered; calyculus obsolete **7. T. kuijtii**  
 b. Branchlets hairy; leaves acute to obtuse at apex; peduncles 3 – 4-flowered; calyculus not obsolete **12. T. umbellifer**
- 6 a. Lenticels circular; bark brown or black; petioles 10 - 12 mm long; flower buds subtetragonous with clavate apex; ovary cupular, slightly rugulose **10. T. rugosus**  
 b. Lenticels elliptic; bark purplish brown; petioles 5 - 8 mm long; flower buds terete with globose apex; ovary oblong-cylindric, smooth **5. T. erectiflorus**
- 7 a. Mature leaves clothed with candelabra hairs mixed with pale brown stellate hairs beneath; inflorescence simple dichasium; corolla-lobes spatulate; ovary subturbinate **13. T. vestitus**  
 b. Mature leaves glabrous on both surfaces; inflorescence reduced dichasium; corolla-lobes elliptic or ovate; ovary turbinate 8
- 8 a. Leaves petiolate; flowers pedicellate; bracts ovate, shorter than ovary; flower buds clavate with conical apex **1. T. assamicus**  
 b. Leaves sessile or subsessile; flowers sessile; bracts obovate, longer than ovary; flower buds ventricose **4. T. danserianus**
- 9 a. Bracts longer than calyculus 10  
 b. Bracts shorter than calyculus 11
- 10 a. Leaves narrowly obovate; lateral nerves curvipinnate; bracts elliptic, one-time longer than ovary; flower buds rounded at apex; calyculus and corolla ultimately becoming glabrous **2. T. courtallensis**  
 b. Leaves orbicular to suborbicular; lateral nerves palmatipinnate; bracts obovate, 3 or 4-times longer than ovary; flower buds clavate at apex; calyculus and corolla with persistent hairs **6. T. heyneanus**
- 11 a. Corolla glabrous; anthers multilocellate; ovary oblong-cylindric; endosperm horned **3. T. cuneatus**  
 b. Corolla clothed with abietiform hairs mixed with stellate hairs; anthers quadrilocellate; ovary subturbinate; endosperm hornless 12
- 12 a. Nodes meristematically knotty; inflorescence simple dichasium; calyculus irregularly lobed; anthers without sterile apex; style articulated; endosperm punctate in upper quarter region **7. T. recurvus**  
 b. Nodes not meristematically knotty; inflorescence reduced dichasium; calyculus regularly toothed; anthers with sterile apex; style not articulated; endosperm completely smooth **11. T. tomentosus**

**1. Taxillus assamicus** Danser in Blumea 3: 401. 1940.

Branches and leaves cinnamomeous stellate hairy, mixed with a few abietiform hairs when young, glabrous when old. Leaves opposite and alternating towards apices of branchlets, elliptic, decurrent at base, subacute at apex, 3 - 12 x 2 - 7 cm, coriaceous; lateral nerves 3 or 4



pairs; petioles 7 - 11 mm long. Inflorescence axillary, reduced dichasium; peduncle solitary, 2-flowered, 1 - 2 mm long, rusty puberulous; flower buds clavate, 1.5 - 2 cm long, sparsely stellate-hairy, glabrous in age. Flowers 4-merous, 2.2 - 2.5 cm long; pedicels 2.5 - 3.5 mm long; bract ovate, 1.5 - 1.6 x 0.8 - 1 mm. Calyculus annular. Petals united; tube ventricose at middle, 1.4 - 1.8 cm long, median split up to one-third the length; lobes ovate, 2 - 2.5 mm long. Stamens 4, erect; filaments 4 - 5 mm long; anthers elliptic-ovate, 0.5 - 0.8 mm long. Ovary turbinate, 1.5 - 1.8 mm long; style terete; stigma subglobose. Fruits ellipsoid, truncate at apex, 6 - 7 x 4 - 5 mm, sparsely rusty brown stellate hairy with reticulate markings at apex.

*Fl. & Fr.* June - Jan.

*Distrib.* India: Found on *Eurya japonica* and *Quercus griffithii*. Assam and Meghalaya.

Endemic.

*Notes.* Vessels transversely porous with lateral perforations; fibre thick-walled, broad-lumened; pits reduced.

Pollen 3-lobed; P - 19 (23.7) 27  $\mu\text{m}$ ; E - 33 (40.5) 44  $\mu\text{m}$ ; P/E - 0.60  $\mu\text{m}$ ; ex. 1.5  $\mu\text{m}$ ; col. 0.5  $\mu\text{m}$ .

**2. *Taxillus courtallensis*** (Gamble) Danser in Verh. Kon. Ned. Akad. Wetensch. Afd. Natuurk., Tweede Sect. II, 29(6): 123. 1933. *Loranthus courtallensis* Gamble, Fl. Madras 2(7): 1252. 1925 (repr. ed. 2: 877. 1957). *L. bracteatus* Rich. var. *angustifolius* Hook.f., Fl. Brit. India 5: 213. 1886.

Branches and leaves covered with pale brown abietiform hairs mixed with abundant stellate hairs showing banded appearance when young, glabrous when old; nodes prominently knotty with leaf-scars. Leaves alternate, obovate, narrowly cuneate at base, 2.5 - 3.5 x 0.8 - 1.5 cm, crustaceous, glabrous or sparsely stellate hairy; lateral nerves obscure, sometimes with 1 or 2 distinct pairs; petioles 3 - 6 mm long. Inflorescences axillary, simple dichasia; peduncle 1 or 2 in each axil, each 2 or 3-flowered, 3 - 4 mm long, hairy; flower buds 2 - 2.5 cm long, hairy. Flowers 5-merous, 2.8 - 3 cm long; pedicels 2 - 3 mm long; bracts boat-shaped, 5 - 6 x 2.5 - 3 mm. Calyculus 5-toothed. Petals 5, united; tube ventricose with median split up to half the length, 2 - 2.4 cm long; yellowish green, becoming orange-yellow; lobes 5, linear to oblong, reflexed, 4 - 5 mm long. Stamens 5, 2 - 2.5 mm long, greenish at base, red above; anthers oblong, ca 4 mm long; anther-thecae 2 pairs, 1.5 - 2 mm long. Ovary turbinate, 1.8 - 2 mm long; style 4-gonous, stigma subcapitate, minutely papillate. Fruits oblong-ellipsoid, 10 - 12 x 3 - 3.5 mm, usually smooth with persistent calyculus and hairy rim.

*Fl. & Fr.* June - Dec.

*Distrib.* India: Deciduous and semievergreen forests, up to 1000 m altitude. Tamil Nadu (southern districts).

Sri Lanka.

*Notes.* Vessel members with lateral wall perforations, pittings alternate; fibres excessively thick-walled, with narrow or much reduced lumen; pits absent.

Pollen 3-lobed; P - 24 (26) 28  $\mu\text{m}$ ; E - 44 (56.3) 57  $\mu\text{m}$ ; P/E - 0.46  $\mu\text{m}$ ; ex. 2  $\mu\text{m}$ ; col. 1  $\mu\text{m}$ .

**3. *Taxillus cuneatus*** (B. Heyne ex Roth) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 354. 1929. *Loranthus cuneatus* B. Heyne ex Roth, Nov. Pl. Sp. 193. 1821; Hook.f., Fl. Brit. India 5: 214. 1886.

Branches glabrous, minutely stellate hairy intermixed with a few rusty brown abietiform hairs when very young, branching usually with somewhat prominent knotty nodes. Leaves alternate, sometimes in fascicles of 3, obovate, narrowly cuneate and merging with petiole at base, obtuse and often retuse at apex, entire along margins, 1.5 - 4.5 x 0.5 - 2.5 cm, fleshy to subcoriaceous, usually glabrous on both surfaces; lateral nerves usually obscure, when visible 2 or 3 pairs; petioles very short. Inflorescences axillary, reduced dichasia, solitary in each axil, consisting of flowers in diads or rarely in triads; peduncle 2.7 - 3 mm long, glabrous; flower buds spatulate, glabrous. Flowers 5-merous, 1.5 - 2.5 cm long; pedicels 1.5 - 2.5 mm long; bracts elliptic to ovate-elliptic, clasping ovary, 1 - 2.5 x 0.8 - 1.3 mm. Calyculus-tube subcylindrical, irregularly 5-toothed; teeth triangular, 2 - 2.5 mm long. Petals 5, united, up to 3 cm long; tube 9 - 15 mm long, 5-ribbed, with median split up to half the length, greenish yellow outside, orange inside; lobes 5, linear-elliptic, 4 - 8 mm long. Stamens 5; filaments 1.5 - 2 mm long, dark red; anthers linear-oblong. Ovary oblong-cylindric, 2 - 2.5 mm long, glabrous or minutely stellate hairy; style tetragonous; stigma subcapitate, minutely papillate. Fruits obconic, truncate, crowned with persistent unevenly lobed calyculus, 8 - 10 x 3.5 - 5 mm, sparsely tubercled, glabrous, red.

*Fl. & Fr.* Jan. - Nov.

*Distrib.* India: Deccan and Western Peninsula, from Konkan southwards, from 700 m and above, occurring on a variety of hosts in open forests. Andhra Pradesh, Maharashtra, Karnataka and Kerala.

Sri Lanka.

*Notes.* Sclereids abundant in mesophyll, vessel members with lateral perforations, pittings alternate; fibres excessively thick-walled, with narrow or much reduced lumen, pittings absent or vestigial pits present.

Pollen 3-lobed; P - 23 (24.3) 26  $\mu$ m; E - 35 (38.5) 40  $\mu$ m; P/E - 0.61  $\mu$ m; ex. 1.5  $\mu$ m; col. 0.5  $\mu$ m.

**4. *Taxillus danserianus*** Rajasek. in J. Swamy Bot. Club 3(4): 157, ff. 1 - 2. 1986 (as '*danseriana*').

Branches with cinnamomeous brown candelabra hairs mixed with stellate hairs when young, glabrous when old. Leaves opposite, sessile or subsessile, broadly elliptic-ovate, rounded at base, obtuse at apex, 3.2 - 3.8 x 1.5 - 3 cm, coriaceous, hairy when young, glabrous when old; lateral nerves 4 or 5 pairs. Inflorescences axillary, reduced dichasia; peduncle one in each axil, 2-flowered, 0.5 - 0.8 mm long, hairy; flower buds 1.2 - 1.4 cm long, covered with elongated candelabra hairs mixed with abietiform hairs, persistent throughout. Flowers sessile, 4-merous, 1.3 - 2 cm long; bracts 2 or 3, obovate, foliaceous. Calyculus indistinct. Petals 4, united; tube ventricose in middle, with median split almost up to base, 8 - 10 mm long; lobes 4, elliptic or spatulate, 4 - 5 mm long. Stamens 4, with flat filaments, 1.5 - 2 mm long; anthers linear-oblong, 1.3 - 1.6 mm long. Ovary turbinate, 2 - 2.5 mm long; style tetragonous; stigma subcapitate, bilobed, minutely papillate. Fruits not seen.

*Fl.* Oct. - Dec.

*Distrib.* India: Coastal forests. Goa.

Endemic.

*Notes.* Vessels with lateral perforations, pitting alternate; fibres very excessively thick-walled with or without narrow slit-like lumen, with vestigial pits or without pits.

Pollen 3-lobed; P - 22 (24.4) 25 µm; E - 35 (39.4) 44 µm; P/E - 0.6 1 µm; ex. 2 µm; col. 1 µm.

**5. *Taxillus erectiflorus*** Rajasek. in J. Swamy Bot. Club 3(4): 159, ff. 3 - 4. 1986.

Branches glabrous. Leaves opposite and subopposite, elliptic, attenuating towards both ends, acute at apex, 7 - 7.5 x 2 - 2.2 cm, subcoriaceous, glabrous; lateral nerves 3 or 4 pairs; petioles 5 - 8 mm long, glabrous. Inflorescence axillary, compound dichasium; peduncle solitary, 5 - 7-flowered, 4 - 5 mm long; flower buds spatulate, 1.5 - 2 cm long, glabrous. Flowers 4-merous, 2.8 - 3 cm long; pedicels 5 - 6 mm long; bract conical, ca 0.5 x 0.2 mm. Calyculus obsolete. Petals 4, united; tube ventricose in the middle, with median split up to half the length, 1.5 - 1.8 cm long; lobes 4, spatulate, 4 - 5 mm long. Stamens 4, 1.5 - 2 mm long; filaments flat; anthers elliptic-oblong. Ovary oblong-cylindrical, 5 - 7 mm long; style 4-gonous, 1.8 - 2 cm long; stigma capitate, minutely papillate. Fruits not seen.

*Fl.* Dec.

*Distrib.* India: In plains of Assam.

Endemic.

*Notes.* Vessels with lateral perforations, pittings alternate, minute, circular; fibres thick-walled, broad-lumened with reduced pits.

Pollen 3-lobed; P - 26 (33) 40 µm; E - 50 (51.1) 58 µm; P/E - 0.61 µm; ex. 2 µm; col. 1 µm.

**6. *Taxillus heyneanus*** (Schult.f.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 355. 1929. *Loranthus heyneanus* Schult.f., Syst. Veg. 7: 106. 1829 (non Schult.f. 1830). *L. bracteatus* B.Heyne ex Roxb., Fl. Ind., eds. Carey & Wall. 2: 220. 1824 (non Rich, 1792); Hook.f., Fl. Brit. India 5: 213. 1886. *Taxillus bracteatus* (B.Heyne ex Roxb.) Tiegh. in Bull. Soc. Bot. France 42: 256. 1895.

Branches densely covered with white shiny abietiform hairs intermixed with stellate hairs when young; nodes prominently ribbed with leaf scars. Leaves alternate (apparently clustered due to congested axillary shoots), orbicular to ovate, attenuate at base, rounded at apex, 1.5 - 5 x 1 - 6 cm, crustaceous, evanescently hairy on both surfaces; lateral nerves 3 - 5 pairs; petioles 1 - 1.5 cm long, hairy to glabrous. Inflorescence axillary, shortly peduncled or sessile simple dichasium; peduncle 1 or 2 in each axil, 3 (or 4)-flowered, 8 - 10 mm long, hairy; flower buds ventricose with clavate apex, 2 - 2.5 cm long, hairy. Flowers 5-merous, 3 - 4 cm long; pedicels 2 - 3.5 mm long; bracts obovate to oblanceolate, foliaceous, 8 - 10 x 3 - 6 mm. Calyculus 5-lobed, 3 - 4 mm long; lobes triangular to lanceolate, acute, reflexed, 1.2 - 1.5 mm long. Petals 5, united; tube ventricose at middle, with median split up to two-third the length, 2 - 2.5 cm long, pilose; lobes 5, linear-lanceolate, reflexed, 4 - 6 mm long, thin. Stamens 5; filaments ca 1.5 mm long;

anthers oblong, 1 - 2 mm long. Ovary turbinate, 2 - 2.5 mm long; style 1.8 - 2 cm long; stigma, bifid or depressed. Fruits broadly ellipsoid, crowned by persistent calyculus, 9 - 12 x 3 - 4 mm, smooth, sparsely hairy.

*Fl. & Fr.* April - Nov.

*Distrib.* India: Deccan and Western Peninsula, found on a variety of hosts in scrub jungles, roadsides and deciduous forests, at low altitudes. Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Endemic.

*Notes.* Vessels with lateral perforations, with tyloses; fibres excessively thick-walled, with narrow lumen.

Pollen 3-lobed; P - 24 (26) 30  $\mu$ m; E - 41 (47.7) 55  $\mu$ m; P/E - 0.54  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**7. *Taxillus kuijttii*** Rajasek. in J. Swamy Bot. Club 3(4): 160, ff. 5 - 6. 1986.

Branches glabrous; young internodes slightly widening towards top. Leaves opposite or rarely subopposite, broadly elliptic-ovate, cuneate or rounded at base, attenuate at apex, (6 - ) 9.5 - 13.5 x 3.5 - 4.5 cm, coriaceous, glabrous; lateral nerves 3 - 4 pairs; petioles 8 - 10 mm long, glabrous. Inflorescences axillary, compound dichasia; peduncles 3 in each axil, each 5 - 8-flowered, 8 - 12 mm long, glabrous; flower buds spatulate, 1.8 - 2 cm long, glabrous. Flowers 4-merous, 2.5 - 2.8 mm long; pedicels 3 - 4 mm long; bract ovate, ca 0.2 x 0.1 mm, minutely rusty pubescent. Calyculus obsolete. Petals 4, united; tube with median split extending one-third to half the length, 1.6 - 1.8 cm long; lobes 4, elliptic-ovate, 4 - 5 mm long. Stamens 4; filaments 2.2 - 2.5 cm long; anthers ellipsoid. Ovary oblong-cylindric, 2.5 - 3 mm long; style subtetragonous; stigma cone-shaped, minutely papillate. Fruits not seen.

*Fl.* Jan. - April.

*Distrib.* India: Assam (Sibsagar District).

Endemic and rare.

*Notes.* Vessels with lateral perforations, pittings larger, alternate, elliptic-ovate, crowded; fibres thick-walled, pits reduced with slit-like apertures without border.

Pollen 3-lobed; P - 24 (30.7) 36  $\mu$ m; E - 50 (53.8) 58  $\mu$ m; P/E - 0.57  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**8. *Taxillus recurvus*** (Wall. ex DC.) Tiegh. in Bull. Soc. Bot. France 42: 256. 1895. *Loranthus recurvus* Wall. ex DC., Prodr. 4: 299. 1830; Hook.f., Fl. Brit. India 5: 213. 1886.

Branches covered with rusty brown abietiform hairs intermixed with stellate hairs when young, glabrous when old; nodes prominently raised, meristematically knotty. Leaves alternate, elliptic-ovate or obovate, cuneate or rounded at base, slightly decurrent into petioles, 3 - 7 x 1.3 - 3.5 cm, coriaceous, densely hairy when young, glabrous above and densely or sparsely stellate hairy beneath when old; lateral nerves 2 or 3 pairs; petioles 8 - 10 mm long. Inflorescences axillary and ramiflorous, simple dichasia, sessile or shortly peduncled; peduncles 2 or 3 in each axil, 3 (or 4)-flowered, elongating at fruiting stage, 2 - 3 mm long; flower buds 1.5 - 1.8 cm long,

stellate hairy. Flowers 5-merous, 2 - 2.5 cm long; pedicels 3 - 3.5 mm long; bracts ovate, clasping nearly three-fourth of the ovary, 3 - 3.2 x 2.8 - 3 mm. Calyculus distinct, irregularly 5-lobed. Petals 5, united; tube ventricose at base, 1 - 1.3 mm long; lobes 5, linear-elliptic, 4 - 5 mm long. Stamens 5; filament, 1.3 - 1.5 cm long; anthers linear-ovate. Ovary subturbinate, 3 - 3.5 mm long; style 4-gonous; stigma subcapitate, bilobed. Fruits urceolate, smooth, crowned with calyculus, 6 - 7 x 3 - 3.5 mm, hairy to glabrous.

*Fl. & Fr.* Nov. - May.

*Distrib.* India: Western Ghats in shola forests, above 2000 m altitude, found on a limited number of hosts, which are either shrubs or small trees, along fringes of forests and in open forests. Karnataka, Kerala and Tamil Nadu.

Endemic.

*Notes.* Vessels with lateral perforations, pitting alternate; fibres thick-walled, broad-lumened, pits with reduced slit.

Pollen 3-lobed; P - 31 (33.3) 38  $\mu$ m; E - 56 (50.1) 62  $\mu$ m; P/E - 0.56  $\mu$ m; ex. 2  $\mu$ m; col 1  $\mu$ m.

**9. *Taxillus reflexilobus*** Rajasek. in J. Swamy Bot. Club 3(4): 162, ff. 7 - 8. 1986.

Branches covered with rusty brown candelabra hairs mixed with stellate hairs when young, glabrous when old, terete. Leaves opposite, elliptic-ovate, rounded at base, acute at apex, thickened along margins, 5.5 - 5.8 x 2.4 - 2.8 cm, coriaceous, hairy as on branches on both surfaces when young, glabrous when old; lateral nerves 3 or 4 pairs, curvipinnate, obscure on both surfaces; petioles 2.5 - 3 mm long, hairy when young, glabrous when old. Inflorescences axillary, simple dichasia; peduncles 2 or 3 in each axil, each with 2 or 3 flowers, 1 - 1.5 mm long, glabrous; flower buds spatulate, 2.5 - 3 cm long, sparsely hairy excepting corolla. Flowers 4-merous, 3.3 - 3.7 cm long; pedicels 2.5 - 3 mm long, puberulous to glabrous; bract elliptic, 0.6 - 1 x 0.5 - 0.6 mm, rusty pubescent. Calyculus ca 0.2 mm long, obscurely 4-lobed. Petals 4, united; tube terete at base, with median split up to one-third the length, 2.3 - 2.6 mm long; lobes 4, elliptic, 5 - 6 mm long. Stamens 4; filaments 1.5 - 2.5 mm long; anthers ellipsoid, 3.7 - 4 mm long. Ovary oblong-cylindric, 2 - 2.5 mm long, sparsely rusty stellate hairy; style tetragonous; stigma club-shaped. Fruits oblong, minutely warted, rusty pubescent (young fruits ca 2 x 1 mm).

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

*Distrib.* India: On hilly regions, at ca 1800 m altitude. Arunachal Pradesh and Assam.

Endemic.

*Notes.* Vessels with lateral perforations, thin-walled, pittings alternate, large, elliptic; fibres thick-walled with narrow lumen, without pits.

Pollen 3-lobed; P - 23 (24.8) 27  $\mu$ m; E - 42 (43.8) 46  $\mu$ m; P/E - 0.57  $\mu$ m; ex. 1.5  $\mu$ m; col. 0.5  $\mu$ m.

**10. *Taxillus rugosus*** Rajasek. in J. Swamy Bot. Club 3: 164, ff. 9 - 10. 1986.

Branches glabrous. Leaves opposite, broadly elliptic or ovate, cuneate at base, subacute at apex, 9 - 12 x 3.5 - 6 cm, crustaceous, glabrous; lateral nerves 4 or 5 pairs; petioles 10 - 12 mm

long. Inflorescences axillary, compound dichasia; peduncle solitary, 5 - 7-flowered, 4 - 6 mm long, glabrous; flower buds spatulate, 1.5 - 1.7 cm long, glabrous. Flowers 4-merous, 2 - 2.5 cm long, glabrous; pedicels 3 - 5 mm long; bract suborbicular, 0.3 - 0.5 mm long. Calyculus obsolete. Petals 4, united; tube slightly ventricose at base, with median split up to half the length, 1.5 - 1.7 cm long; lobes 4, spatulate, 9 - 10 mm long. Stamens 4; filaments 1.5 - 2 mm long; anthers linear-oblong, recurved. Ovary cupular, 1.5 - 3 mm long, rugulose; style 4-gonous; stigma capitate, minutely papillate. Fruits not seen.

*Fl.* Jan.

*Distrib.* India: Assam and Mizoram.

Endemic.

*Notes.* Vessels with lateral perforations, pittings larger, elliptic-ovate; fibres thick-walled, broad-lumened with reduced pits without border.

Pollen 3-lobed; P - 30 (31.9) 34  $\mu$ m; E - 44 (46.5) 50  $\mu$ m; P/E - 0.70  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**11. *Taxillus tomentosus*** (B. Heyne ex Roth) Tiegh. in Bull. Soc. Bot. France 42: 256. 1895. *Loranthus tomentosus* B. Heyne ex Roth, Nov. Pl. Sp. 191. 1821; Hook. f., Fl. Brit. India 5: 212. 1886. *L. gibbosus* Talbot, Syst. List Trees, Shrubs Bombay ed. 2, 289. 1902.

Branches rusty abietiform hairy, intermixed with white stellate hairs when young, glabrous when old. Leaves alternate, obovate, oblanceolate or broadly elliptic-ovate, cuneate or sometimes rounded at base, thickened along margins, obtuse at apex, 2.5 - 7 x 1.5 - 3.5 cm, coriaceous, hairy as on branches on both surfaces when young and on upper surface only when old; lateral nerves 3 or 4 pairs; petioles 5 - 10 mm long, cinnamomeous abietiform hairy, mixed with stellate hairs. Inflorescences axillary, reduced dichasia, sessile or shortly peduncled; peduncles solitary or in pairs, each 2 or 3-flowered; flower buds 1 - 1.2 cm long, brown abietiform hairy. Flowers 5-merous, 1.8 - 2.2 cm long; pedicels 2.5 - 3 mm long; bract broadly ovate, 2.5 - 3 x 1.8 - 2 mm. Calyculus 5-toothed, 1.5 - 3 mm long, rusty pubescent. Petals 5, united; tube ventricose at base, with median split up to two-third the length, 1 - 1.3 cm long; lobes 5, narrowly elliptic to lanceolate, acute, 3 - 4 mm long. Stamens 5, 1.3 - 1.5 mm long; filaments up to 2 mm long; anthers oblong, 1 - 2 mm long. Ovary subturbinate, 2.5 - 3 mm long; style up to 1.5 cm long; stigma deeply bilobed, papillate. Fruits urceolate, crowned with persistent unevenly toothed calyculus, 8 - 10 x 4 - 4.5 mm, smooth, brown abietiform hairy, mixed with persistent stellate hairs.

*Fl. & Fr.* Jan. - Aug.

*Distrib.* India: Western Ghats of peninsular India, up to 1000 m altitude, on a variety of hosts in open forests. Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Notes.* Mesophyll with abundant sclereids; vessels with lateral perforations, pitting alternate; fibres thick-walled, broadly lumened with reduced pits.

Pollen 3-lobed; P - 24 (25.5) 28  $\mu$ m; E - 43 (49.8) 47  $\mu$ m; P/E - 0.58  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**12. *Taxillus umbellifer*** (Schult.f.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 11: 445. 1931. *Loranthus umbellifer* Schult.f., Syst. Veg. 7(1): 97. 1829; Hook.f., Fl. Brit. India 5: 211. 1886, p. p. *L. umbellatus* Wall. in Roxb., Fl. Ind., eds. Carey & Wall. 2: 222. 1824, non Roth 1821. *Scurrula umbellifera* (Schult.f.) G.Don, Gen. Hist. 3: 421. 1834.

Branches lenticellate, greyish, covered with dark brown candelabra hairs intermixed with stellate hairs when young, glabrous when old. Leaves opposite, rarely alternate, elliptic-ovate to oblong-elliptic, acute to attenuating towards base, undulate along margins, acute to obtuse at apex, (4 -) 7.5 - 10 x (2 -) 2.5 - 5 cm, with dense hairs as in branches; lateral nerves 4 - 7 pairs; petioles 5 - 13 mm long. Inflorescences usually peduncled compound dichasia of umbels, axillary or sometimes at leafless nodes; peduncle solitary (or in pairs), 3 or 4 flowered, 0.5 - 4 mm long; flower buds clavate to spatulate, 1 - 1.3 cm long, evanescently hairy. Flowers 1.5 - 4 cm long; pedicels 1.2 - 1.5 cm long; bracts broadly ovate to suborbicular, 0.8 - 1 x 0.4 - 0.5 mm. Calyculus ovoid, with annular rim and obscurely 4-toothed, rusty pubescent. Petals united; tube terete or slightly gibbous, 1 - 1.3 cm long with median split up to half the length, brownish green with reddish base outside; lobes 4, unilaterally reflexed, oblong, 4 - 6 mm long. Stamens erect; filaments 2 - 3 mm long; anthers linear-oblong, 1 - 1.2 mm long. Ovary clavate, 2 - 3 mm long, smooth; style filiform, 10 - 15 mm long; stigma conical, papillate. Fruits pyriform, pilose, rugose, 8 - 10 x 2 - 2.5 mm, smooth.

*Fl. & Fr.* July - Jan.

*Distrib.* India: Subtropical and temperate forests, 600 - 2300 m altitudes, found on *Styrax serrulatus* in evergreen forests. Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, Assam and Meghalaya.

Bhutan, Nepal, Myanmar and China.

*Notes.* Vessel pittings alternate; few vessel members with large circular lateral openings; fibres moderately thick-walled, broad-lumened with or without reduced pits.

Pollen 3-lobed; P - 24 (26.1) 29  $\mu$ m; E - 38 (40.7) 43  $\mu$ m; P/E - 0.63  $\mu$ m; ex. 2  $\mu$ m; col. 1  $\mu$ m.

**13. *Taxillus vestitus*** (Wall.) Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 10: 355. 1929. *Loranthus vestitus* Wall. in Roxb., Fl. Ind., eds. Carey & Wall. 2: 218. 1824; Hook.f., Fl. Brit. India 5: 213. 1886. *Scurrula vestita* (Wall.) G.Don, Gen. Hist. 3: 422. 1834.

*Kh.:* *Soh-meka-riang*.

Branches cinnamomeous candelabra hairy, mixed with pale brown shiny stellate hairs when young, glabrous when old. Leaves opposite and subopposite, ovate or ovate-elliptic, narrowed and rounded at base, recurved along margins, subacute or obtuse at apex, 2.5 - 9 x 1.8 - 3.8 cm, crustaceous, cinnamomeous hairy on both surfaces when young, glabrous above and hairy beneath when old; lateral nerves 4 - 6 pairs; petioles (3 -) 7 - 10 (- 12) mm long. Inflorescences axillary, simple dichasia, shortly peduncled or sessile, usually 3 in each axil, bearing 2 or 3 flowers; peduncles, if present, 0.8 - 1 mm long; flower buds 1.5 - 1.7 cm long, brown hairy. Flowers sessile, 4-merous, 2 - 2.5 x 1 - 2.2 mm. Calyculus annular. Petals 4, united; tube articulate at base, with median split up to half way, 1.4 - 1.7 cm long, brown tomentose outside; lobes 4, spatulate 4 - 5 mm long. Stamens 4, 3 - 4 mm long; filaments flat; anthers oblong-elliptic. Ovary subturbinate, 2 - 3 mm long; style 4-gonous; stigma capitate. Fruits broadly ellipsoid, 8 - 12 x 3 - 3.5 mm, orange when ripe, sparsely cinnamomeous hairy when young, papillate when old.

*Fl. & Fr.* July - Feb.

*Distrib.* India: Tropical regions of Eastern Himalayas and North-east India, 1000 to 1800 m altitude, on *Quercus griffithii* and *Symplocos spicata*, in rain forests. Uttarakhand, Assam, Nagaland, Manipur, Mizoram and Meghalaya.

Pakistan, Nepal and China.

*Notes.* Wood reddish white, compact, close-grained; vessels with lateral perforations, pittings alternate, circular to ovate; fibres thick-walled, broad-lumened with reduced pits.

Pollen 3-lobed; P - 18 (21.2) 25 µm; E - 28 (36.9) 44 µm; P/E - 60 µm; ex. 1.5 µm; col. 0.5 µm.

#### DOUBTFUL SPECIES

**Taxillus sericus** Danser in Blumea 2: 50, f. 1, a – b. 1936; Qui Huaxing et al., in Fl. China 5: 235. 2003.

*Notes.* Known to occur in China (Yunnan) and India (Sikkim). However, no specimen could be examined from Sikkim.

### 8. **Tolypanthus** (Blume) Rchb.

Shrubs, glabrous or juvenile parts with vermilion-red stellate hairs. Leaves opposite and alternate, petiolate or sessile; major venation curvipinnate. Inflorescence a capitulum, axillary or ramiflorous; involucre bracts 4 or 5, ovate, free or connate, enclosing a cluster of 3 or 4 flowers; flower buds ventricose. Flowers ebracteolate, actinomorphic, 5-merous, sympetalous, covered with stellate or anvil hairs. Calyculus-tube entire or lobed. Petals 5, united; tube straight, ventricose, divided halfway; lobes 5, linear, reflexed after anthesis. Stamens 5, erect or recurved; filaments flat or tetragonous; anthers anisothecate, circumthecate or not, elevatilobate, with or without sterile apex. Ovary subglobose, smooth; style 4-gonous; stigma conical or subglobose. Fruits pseudocarps, hidden by persistent bracts, smooth. Endosperm horned, mamillate.

India, Myanmar to Malesia, 5 species; 3 in India.

#### KEY TO THE SPECIES

- 1 a. Involucral bracts 4, free; peduncles 2 or 3 in each axil; corolla not transversely ridged; stamens recurved; anthers without sterile apex; stigma conical-capitate **1. T. involucratus**
- b. Involucral bracts 5, connate; peduncle solitary in each axil; corolla transversely ridged; stamens erect; anthers with sterile apex; stigma subglobose 2
- 2 a. Bark ridged; lenticels circular; young branches and leaves glabrous; leaves distinctly petiolate, not amplexicaule at base; inflorescence axillary; flower buds with subacute apex; flowers with distinct thickenings; calyculus entire; corolla-lobes not lunately humped dorsally; filaments tetragonous **2. T. lageniferus**
- b. Bark fissured; lenticels transversely elongated; young branches and leaves covered with vermilion-red stellate hairs; leaves sessile or subsessile, amplexicaule at base; inflorescence usually ramiflorous; flower buds with truncate apex; flowers with faint sinuate thickenings; calyculus 5-lobed; corolla-lobes lunately humped dorsally; filaments terete **3. T. lunatus**



**1. *Tolypanthus involucratus*** (Roxb.) Tiegh., Bull. Soc. Bot. France 42: 248, in obs. 1895. *T. involucratus* Blume, Syst. Veg. ed. 15, bis (Roemer & Schult.f.) 7(2): 1731. 1830, nom. invald. *Loranthus involucratus* Roxb. [Hort. Bengal. 87. 1814, nom. nud.] Fl. Ind., eds. Carey & Wall. 2: 208. 1824; Hook.f., Fl. Brit. India 5: 218. 1886.

Asm.: *Birikhamara*.

Shrubs, up to 1 m high; young shoots tomentose; branches glabrous. Leaves opposite and subopposite, broadly elliptic-ovate to ovate-lanceolate, slightly asymmetric, rounded or narrowed at base, undulate along margins, obtuse at apex, 4 - 17 x 3 - 9 cm, coriaceous, glabrous; lateral nerves 4 - 6 pairs; petioles 5 - 10 mm long, glabrous. Inflorescences axillary; peduncles 2 or 3 together, 3 - 3.5 mm long; involucre bracts 4, foliaceous, ovate-lanceolate, 1.5 - 2 x 0.6 - 0.8 cm; flower buds 1.8 - 2.3 cm long, densely rusty anvil hairy. Flowers sessile, 2 - 2.5 cm long, red. Calyculus 5-toothed. Petals ca 1.3 cm long, red; tube almost splitting up to base; lobes 5, linear, 0.8 - 1 cm long. Stamens recurved; filaments 2 - 3 mm long; anthers elliptic-oblong; anther-thecae 2 pairs, 1.5 - 2 mm long. Ovary subglobose, 3 - 3.5 mm long; style tetragonous; stigma broadly conical-capitate, papillate. Fruits broadly ellipsoid, densely cinnamomeous strigose-hairy, crowned by persistent enlarged calyculus, 5.5 - 5.8 x 2.8 - 3 mm, orange-red.

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

*Distrib.* India: Tropical and subtropical forests, up to 1000 m, found on *Lagerstroemia parviflora*, *Dillenia indica* and *Styrax serrulatus* in riparian forests. Sikkim, Assam, Meghalaya, Manipur and Tripura.

Bhutan and Bangladesh.

*Notes.* Vessels with lateral perforations; fibres thick-walled with few reduced pits .

Pollen 3-lobed; P - 26 (34.8) 36 µm; E - 38 (40.2) 44 µm; P/E - 0.62 µm; ex. 2 µm; col. 1 µm.

**2. *Tolypanthus lageniferus*** (Wight) Tiegh. in Bull. Soc. Bot. France 42: 249. 1895. *Loranthus lageniferus* Wight, Icon. Pl. Ind. Orient. t. 306. 1840; Hook.f., Fl. Brit. India 5: 218. 1886.

Branches glabrous. Leaves alternate or subopposite, elliptic-ovate, rounded at base, subacute or obtuse at apex, entire along margins, 7 - 9 x 3.5 - 6 cm, membranous to subcoriaceous, sparsely brown stellate hairy on both surfaces; lateral nerves 3 - 5 pairs; petioles 5 - 8 mm long, glabrous. Inflorescences axillary; peduncle solitary, 4 - 5 mm long, involucre bracts cupular, lobed, ca 2.5 x 2 cm, bright red, faintly veined; flower buds 2.5 - 3 cm long. Flowers in groups of 3 - 5, 3.5 - 4 cm long, glabrous except at base. Calyculus entire, 0.7 - 1 mm long. Petals red, 2.8 - 3.2 cm long; lobes 5, reflexed, linear, 6 - 8 mm long. Stamens erect; filaments 1.5 - 3 mm long; anthers linear-oblong, 2.3 - 3.5 mm long; anther-thecae 2 pairs. Ovary turbinate, white stellate hairy, 2 - 3 mm long; style tetragonous; stigma subglobose. Fruits ovoid to oblong, with unevenly rimmed persistent calyculus, 7 - 7.5 x 3 - 3.2 mm, smooth, minutely and sparsely white stellate hairy.

*Fl. & Fr.* June - Nov.

*Distrib.* India: Tropical and subtropical deciduous or semideciduous forests, up to 1200 m altitude, found on *Adina cordifolia*, *Helicteres isora*, *Holarrhena pubescens* and *Olea dioica*. Maharashtra, Goa, Karnataka, and Kerala.

Endemic.

*Notes.* Sclereids abundant in mesophyll tissue. Vessels with lateral perforations; fibres thick-walled with narrow slit-like pits.

Pollen 3-lobed; P - 25 (27.3) 31  $\mu\text{m}$ ; E - 40 (45.7) 50  $\mu\text{m}$ ; P/E - 0.60  $\mu\text{m}$ ; ex. 2  $\mu\text{m}$ ; col. 1  $\mu\text{m}$ .

**3. *Tolypanthus lunatus*** Rajasek. in J. Swamy Bot. Club 4: 1, ff. 1-2. 1987.

Branches when young densely vermilion-red stellate hairy, glabrous when old. Leaves alternate and opposite, sessile to subsessile, elliptic to ovate-orbicular, amplexicaule at base, undulate along margins, 3 - 6 x 2 - 4.5 cm, coriaceous, densely vermilion-red stellate hairy on both surfaces when young, glabrous when old; lateral nerves 3 or 4 pairs. Inflorescences usually ramiflorous (axillary); peduncle solitary, 3 - 5 mm long; flower buds 1.5 - 2 cm long, sparsely white stellate hairy. Calyculus 5-lobed. Petals united; tube 3 - 3.2 cm long, transversely ribbed; lobes 5, linear, 6 - 8 mm long. Stamens erect; filaments 1.5 - 2 mm long; anthers linear-oblong; thecae 2 pairs. Ovary subglobose or turbinate, 1 - 1.5 mm long, densely cinnamomeous stellate pubescent; style 4-gonous; stigma subglobose. Fruits not seen.

*Fl. & Fr.* Dec.

*Distrib.* India: Evergreen rain forests. Karnataka (Mysore).

Endemic.

*Notes.* Vessels with lateral wall perforations; fibres thick-walled, broad-lumened with reduced pits.

Pollen 3-lobed; P - 23 (24.9) 26  $\mu\text{m}$ ; E - 38 (41.6) 42  $\mu\text{m}$ ; P/E - 0.60  $\mu\text{m}$ ; ex. 2  $\mu\text{m}$ ; col. 1  $\mu\text{m}$ .

## VISCACEAE

(V. N. Sanjai & N. P. Balakrishnan)

Shrubs or herbs, perennial, chlorophyllous but parasitic on aerial parts of host plants, attachment by a single primary haustorium, pubescent or glabrous, monoecious or dioecious; stems usually forked, much branched, with swollen and articulated nodes; internodes terete, often angular or flattened, often green. Leaves present or absent, opposite, single, entire, sometimes reduced to scales; stipules absent. Inflorescences axillary or terminal, unit of inflorescence a cyme, either solitary or sometimes aggregated to form racemose or spicate compound inflorescences or condensed to dense clusters. Flowers minute, unisexual, monochlamydous; perianth sepaline, petaline or vestigial, lobes 2 - 4, valvate; stamens as many or less than the number of perianth lobes, adnate to their inner surface or free; anthers free or sometimes cohering into synandrium, basifixed, 1- to many-loculed, opening by pores or slits, pollen spherical; ovary inferior, unilocular, with a short placental column; ovules not distinct, sporogenous cells located at the base of the placental column; style short, sometimes conical; stigma simple, sessile, capitate or nipple-shaped. Fruits fleshy, berry-like, one-seeded, covered by a sticky layer developing in a zone internal to vascular bundles, indehiscent or elastically or passively dehiscent.

Cosmopolitan, predominantly in tropical regions with a few species in the temperate areas, 7 genera and about 400 species; 4 genera and 19 species in India.

*Literature.* BARLOW, B. A. (1997). Viscaceae in Flora Malesiana Ser. I, 13: 403 – 442. LUSHINGTON, A. W. (1902). Identification of Loranthaceae by their leaves. Indian Forester 28: 58 – 68. SANJAI, V. N. & N. P. BALAKRISHNAN (2001). A note on the cryptic mimicry exhibited by Indian Viscaceae. Indian J. Forest. 24: 233 - 234. SANJAI, V. N. & N. P. BALAKRISHNAN (2001). A note on hyper-parasitism in Indian Viscaceae. Indian J. Forest. 24: 235 - 236. SANJAI, V. N. & N. P. BALAKRISHNAN 2006 (2007). A revision of Indian Viscaceae. Rheedea 16(2): 73 – 109.

### KEY TO THE GENERA

- 1 a. Internodes flattened in one plane, leafless, up to 20 cm long; inflorescence pubescent; anthers united into a single unit **3. Korthalsella**
- b. Internodes flattened in different planes, terete or angular, leafy or leafless, size varies; inflorescence glabrous; anthers not united into a single unit 2
- 2 a. Mature plants always less than 8 cm long, leafless, and dioecious **1. Arceuthobium**
- b. Mature plants always more than 8 cm long, leafy or leafless, monoecious or dioecious 3
- 3 a. Inflorescence a spike of 3-flowered cymes; anthers with free filaments, opening by slits **2. Ginalloa**
- b. Inflorescence cymose or subracemose, 3- to 5-flowered; anthers sessile, attached to the perianth lobes, opening by pores **4. Viscum**

#### **1. Arceuthobium** M. Bieb.

Herbs or shrubs, dioecious, semi parasitic on stems (sometimes endophytic), 0.5 - 7 cm long, glabrous, variously coloured, tufted; branches dichotomous or verticillate, jointed, terete or slightly angular, compressed. Leaves absent or reduced to minute opposite and connate scales. Flowers axillary or terminal on branchlets, decussate or whorled; peduncle absent;

pedicel short to nearly absent, coloured, 2 – 4 mm across, monochlamydous. Male flowers: sessile, subglobose or ovoid in mature bud, with a central nectary; perianth lobes 3 or 4 (rarely up to 7), free; stamens equal to perianth lobes; anthers sessile and adnate to each perianth lobe, spreading, circular, unilocular, dehiscing by a slit. Female flowers: pedicellate, ovoid to ellipsoid in mature bud, epigynous; perianth lobes 2, adnate to ovary, persistent; ovary inferior, ovate, compressed; style single, short; stigma round or capitate; ovules not distinct. Fruits baccate, ovoid, 1-seeded, mucilaginous and bi-coloured (distal and basal portions of different shades), explosive at maturity; seeds without true integuments, usually 3 - 5 mm long, ovoid to lanceolate, containing one (rarely 2) distal, cylindrical embryo, with copious endosperm.

North to Central America, West Indies, Mediterranean, NE tropical Africa, Sino-Himalayas to W. Malesia, ca 45 species; 2 species in India.

*Host range.* This genus is parasitic exclusively on conifers and not reported from any other plant species and thus exhibiting a very narrow host range for almost all the species. Some are restricted to a single host species. Secondary hosts are there when they are growing in association with a heavily infested primary host. Poor soil conditions and poor stem growth rate of the hosts are favourable to *Arceuthobium*.

*Notes.* The genus *Arceuthobium* holds the unique distinction of having representations in both the New and Old World. They occur in all the continents except Antarctica, Australia, South America and Africa.

This genus is economically important being a major parasite of the coniferous forests of the world, inducing “witches’ brooms,” which cause their hosts to suffer retarded growth and eventually die. In North American forestry, this is the most serious of all diseases. A substantial area of forests get infested leading to serious loss in timber volume and quality. There are some medicinal importance attributed to this genus.

#### KEY TO THE SPECIES

- 1 a. Plants always visible for less than 3 mm long outside the host body, endophytically growing, appearing only as brown pustules on the surface of the host **1. A. minutissimum**
- b. Plants always visible for more than 5 mm long outside the host body and well branched **2. A. oxycedri**

#### **1. *Arceuthobium minutissimum* Hook.f., Fl. Brit. India 5: 227. 1886.**

Minute stem parasites without any visible stem, appearing as green or brown pustules on the bark of the host, the inconspicuous stem ramifies inside the bark tissue, which rarely project above the surface for only up to 3 mm length; staminate plants yellow green; pistillate plants greenish, usually about twice as long as the staminate plants; primary branches many, arising from basal cups, without secondary branching; joints up to 2 mm long; sheaths minute, 2-toothed. Shoots: basal portions of the dominant shoots ca 1 mm in diam.; third internodes 0.5 - 1.4 mm long, 0.3 - 1 mm wide; flower-branches piercing the epidermis of the host and appearing as minute 2-lipped cups. Male flowers: sessile in the cup, 2 - 2.5 mm across; perianth mostly (3 -) 4 (- 5)-merous, free; lobes ca 0.8 x 0.8 mm; anthers 0.4 - 0.5 mm across. Female flowers: pedicellate; perianth slightly bifid. Fruits on minute branches composed of 2 joints, berries, 2 - 2.5 x 1 - 1.5 mm, with persistent perianth on its tip.

*Fl. & Fr.* June - Oct.

*Distrib.* India: Western Himalayas, usually in the dry regions in Upper and Lower Bashahr and Kulu in Himachal Pradesh and in the four divisions of Kashmir.

Bhutan, Nepal and Pakistan.

*Hosts.* So far reported only on *Pinus wallichiana*, *Abies pindrow* and *Cedrus deodara*.

*Notes.* J. D. Hooker (l. c.) while describing this plant mentioned that it is the minutest plant that he could recollect. The principal host of this plant is *Pinus wallichiana*. This plant causes considerable damage by killing the top of the blue pine saplings of about 1.8 meters high. It is also observed that the plant is parasitic on younger portions, probably due to the difficulty in penetrating the thick bark of the older portions. No medicinal importance has been attributed to this species. The dissemination of the plant occurs by bursting of its ripe fruits and ejecting the seeds.

**2. *Arceuthobium oxycedri*** (DC.) M.Bieb., *Fl. Taur.-Caucas. Suppl.* 3(4): 629. 1819; R.Parker, *Fl. Pl. Punjab* 440. 1918; Naithani in *Fl. Pl. India, Nepal & Bhutan* 370. 1990. *Viscum oxycedri* DC., *Fl. Franc.*, ed. 3, 4: 274. 1805.

Small tufted evergreen glabrous dioecious, partial stem-parasites, up to 10 cm high, entirely glabrous. usually verticillately branched; branches jointed; basal shoots 1 - 4 mm across; internodes terete, 5 - 9 x ca 1 mm; often markedly wider at the top than at the base. Leaves reduced to triangular connate scales forming a small cup-like sheath at nodes. Male flowers: sessile, 1.5 - 2.5 mm across; perianth mostly 3-merous, occasionally 4-merous and rarely 2-merous; anthers unilocular, opening by an aperture. Female flowers: pedicellate, 1 or 2 together, usually 3-partite; ovary inferior; style short; stigma minute. Fruit a berry, ovoid; mature fruit ca 3 x 1.5 - 2 mm.

*Fl. & Fr.* June - Sept.

*Distrib.* India: Western Himalayas in Jammu & Kashmir, Himachal Pradesh and hills of Uttarakhand (Garhwal region). This is the most common widespread species of the genus.

Bhutan, Nepal, Pakistan, China, Russia, Ukraine, Tajikistan, Turkmenistan, Germany, Spain, Morocco and France.

*Notes.* The plant is important medicinally, having properties more or less similar to that of *Viscum album*. It is usually parasitic on the genera *Juniperus*, *Cupressus*, *Thuja* and *Platyclusus*. *A. oxycedri* damages Juniper forests in many areas. Jamal & Beg (Natural infection of mistletoes in Pakistan. In: *Proc. Pakistan Forestry Congress: 1975 November 4 - 8, 187 - 189*) reported 50% tree mortality in the host *Juniperus macropoda*.

*Chromosome number.* n = 13 - 17 (Pisek, A. *Akad. Wiss. Wien Math.- Nat. Kl. Sitzber. Abt.*, 133: 1 - 15. 1924).

*Hosts.* *Juniperus oxycedrus*, *J. excelsa*, *J. macropoda*, *Cupressus macropoda*, etc.

## 2. *Ginallia* Korth.

Semiparasitic shrubs, less than 1 m high, monoecious, glabrous; stems di- or trichotomously branched, with terete slender internodes, bearing a sheath-like thickening

(cataphylls) above each node. Leaves normally developed, entire, opposite, unifacial, curvined, often with 1 - 5 elongated veins, usually visible on both surfaces; rudimentary leaves forming a boat-shaped collar encircling the stems. Inflorescences terminal and axillary, in spikes of decussate pairs of cymes (triads); flowers unisexual, sessile, the central flower of the triad usually being female and the laterals male; bracts small, in pairs, bracts of each pair of opposite cymes united to form a cupular rim; bracteoles of the lateral flowers subtending each cymule, small, free, entire to densely fimbriate. Male flowers: globose or slightly flattened, 0.5 - 1 mm long; perianth lobes 3, free, triangular, valvate; stamens 3, free from perianth segments; filaments short; anthers basifixed, disc-shaped, opening by longitudinal slits. Female flowers: cylindrical or narrowly ellipsoid; ca 2 mm long; perianth 3-merous; lobes 3, united, persistent, triangular to suborbicular; ovary inferior; style short and stigma mamilliform. Fruits narrow, ovoid to ellipsoid, smooth or tuberculate, crowned by persistent perianth lobes, bright red in colour with viscous pericarp.

India to Sri Lanka, eastwards and south-eastwards through Malesia to New Guinea and Solomon Islands, ca 8 species; 2 species in India (Andaman Islands).

*Notes.* The basic inflorescence unit is a small dichasium (a cymule which is a triad), usually with both male and female flowers. The spicately arranged cymule is a consistent feature of *Ginalloa*, although in some species the flowers are solitary.

#### KEY TO THE SPECIES

- 1 a. Leaves stiffly coriaceous, 1 - 4 cm broad; flowers sunk in the fleshy rachis of the spikes and by a thin dilation of the rachis **1. *G. andamanica***
- b. Leaves thinly coriaceous, 0.5 - 1 cm broad; flowers enclosed in a cupular bract **2. *G. helferi***

**1. *Ginalloa andamanica*** Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 41(2): 309. 1872 & Forest Fl. Burma 2: 326. 1877; Hook.f., Fl. Brit. India 5: 228. 1886; L. Rasingam et al. in J. Threatened Taxa 2(9): 1158, f. 1. 2010.

Semiparasitic shrubs, ca 80 cm high, dichotomously branched; branchlets black, terete, longitudinally wrinkled, glabrous, with whitish, ellipsoid lenticels and rudimentary cataphyll-like leaves (ca 1 mm long); internodes up to 4 cm long. Leaves opposite, obovate, suborbicular or ovate-oblong, oblique and attenuate at base, decurrent into petioles, rounded at apex, entire to wavy, 2 - 6.5 x 1 - 4 cm, thickly coriaceous, glabrous, faintly 3-nerved from base; petioles up to 2 mm long. Spikes axillary and terminal and in forks of stem branches, ca 5 cm long; bracteoles entire to shortly fimbriate. Flowers minute, clustered, dioecious, sunk in the fleshy rachis of the spikes and by a thin dilation of the rachis; perianth segments 3, triangular. Fruits ellipsoid, angled, ca 7 x 3 mm, glabrous, slightly tuberculate, crowned by the persistent perianth.

*Fl. & Fr.* Feb. - June.

*Distrib.* India: Semiparasitic on *Artocarpus chama* Buch.-Ham. in inland evergreen forests. Andaman & Nicobar Isl., Little Andaman Island, between Krishna Nallah and Nanjappa Nagar, 15 May 2007, L. Rasingam 25930 (PBL). Extremely rare and endangered.

Endemic.

**2. *Ginalloa helferi*** (C.Presl) Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 40(1): 64. 1871 & Forest Fl. Burma 2: 326. 1877; Hook.f., Fl. Brit. India 5: 228. 1886; Karthig. et al. in Indian J. Forest. 32: 302, f. 2. 2009. *Viscum helferi* C.Presl, Epimel. Bot. 256. 1849.

Parasitic shrubs; stems slender, terete, glabrous, dichotomously branched. Leaves opposite, subsessile, obovate to oblanceolate, narrowed and cuneate at base, rounded, obtuse to retuse at apex, entire, 2.5–6 x 0.5–1 cm, 3–5-nerved from base, thinly coriaceous. Spikes axillary and terminal at the forks of stem branches, 3–6 cm long. Flowers minute, enclosed by annular involucre; perianth segments 3, triangular, acute; stamens 3, sessile; ovary ovoid, ca 2 mm long. Berries ovoid, 1-seeded.

*Fl. & Fr.* Aug. – Oct.

*Distrib.* India: Parasitic on *Dillenia andamanica* C.E. Parkinson, in inland forests. Andaman & Nicobar Isl., Rutland Island, South Andamans, 14 Sept. 2002, *K. Karthigeyan* 6906 (PBL). Extremely rare and endangered.

Myanmar.

### 3. *Korthalsella* Tiegh.

Monoecious, epiphytic semi-stem-parasites, undershrubs or herbs, perennial, less than 10 cm high, glabrous except the floral clusters; stems articulated at nodes; internodes often flattened or terete, if flattened, the flattening being always in the same plane, forming a cladode. Leaves rudimentary, opposite, united in pairs to form collars at the top of internodes subtending floral clusters. Flowers in cup-like involucre at the apex of internodes, developing successively in lateral clusters, surrounded and separated by multicellular sparsely branched thick-walled brown hairs (derived from floral bracts) often forming a raised mound (floral cushion); floral clusters sometimes coalescing and completely encircling the stem at each node; first formed flower male and arising in axillary position and subsequent flowers mostly female and developing laterally to the first and often also in further transverse rows below the first. Male flowers: globose in bud, attenuate at the base and shortly stipitate, 3-merous; perianth lobes persistent, triangular, valvate; stamens 3, 2-locular, introrse, connate into a globose synandrium with 6-loculi opening towards the centre with the slits and pouring out the pollen from a single apical pore. Female flowers: globose, clavate or pear-shaped in the bud state, usually less than 0.5 mm long, 3-merous; perianth lobes triangular, persistent, valvate; ovary inferior; stigma nipple-shaped. Fruits clavate, pear-shaped or ellipsoid, up to 3 mm long crowned by persistent perianth lobes, containing one flattened seed in the upper portion, explosively dehiscent.

Asia, Australia and Africa, from Japan to Australia and New Zealand, extending eastwards to several Pacific Archipelagos and westwards to Indian Ocean Islands and Ethiopia, about 30 species; one species in India.

*Note.* The hairs, which form the floral cushion, are probably modifications of very densely fimbriate floral bracts, and hence are probably homologous to the hairs of some *Ginalloa* species.

*Literature.* DANSER, B. H. (1937). A revision of the genus *Korthalsella*. Bull. Jard. Bot. Buitenzorg. Ser.3, 14: 115 - 159.

***Korthalsella japonica*** (Thunb.) Engl. in Engl. & Prantl, Nat. Pflanzenfam. 1: 138. 1897. *Viscum japonicum* Thunb. in Trans. Linn. Soc. London 2: 329. 1794. *V. opuntia* Thunb., Fl. Jap. 64. 1784, nom. superfl.; Hook.f., Fl. Brit. India 5: 226. 1886. *Korthalsella opuntia* (Thunb.) Merr. in Bot. Mag. (Tokyo) 30: 68. 1916, nom. illeg.

Yellowish, aerial partial stem-parasites, up to 15 (-20) cm long, much branched; branching di- or trichotomous, main stem with about 8 - 25 internodes, the unbranched extremities with about 5 internodes, often densely flabellately branched by the occurrence of collateral branches arising from the nodes; plants basally cylindrical and flattened at the apex, the following internodes strongly flattened, narrow spathulate to oblong-spathulate, 10 - 25 mm long, 4 - 8 mm broad, with a prominent midrib and usually 3 - 5 lateral veins. Leaves rudimentary, encircling the node, 0.2 - 0.5 mm long, thin, truncate. Floral cushion with or without a few hairs, if present they are probably modifications of very small bracts, scarcely protruding, reddish. Flowers in a cluster from the axils with the exception of the lowermost, gradually emerging from the axils, first few-flowered and later many, up to 8 per cluster, the opposite clusters meet and encircle the stem. Male flowers: solitary, globose, ca 0.75 mm; anthers united to form a synandrium in the centre. Female flowers: ca 1.5 x 0.7 mm; ovules not distinct. Fruits subpyriform, usually 1 - 2 mm long.

*Fl. & Fr.* March - Aug.

*Distrib.* India: In arid areas on inner hills in moist deciduous forests between 1000 to 2500 m, in the Himalayan ranges and high hills of Western Ghats in the south, absent in other places. Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh and Tamil Nadu (Nilgiri Hills). This disjunct distribution is probably due to the lack of the required altitudinal range, hosts in the intervening areas, and adds to several such examples of affinities between the Himalayas and Nilgiri Hills of South India.

*Habitat & Ecology.* In India, it is mostly found in humid forests above 1800 m but extends to savannah vegetations at the specified altitude. It is never recorded in the lowlands of India, though the occurrence is not so frequent. Specificity of hosts might have played a key role in its distribution.

Pakistan, Sri Lanka, Bhutan, Japan, Myanmar, China, Thailand, Vietnam, Malesia, Australia, East Africa, Indian Ocean Islands and Pacific Islands.

*Hosts.* Various species of *Rhododendron* are the most favourite hosts for this species, though occasionally it occurs on *Eurya japonica*, *Quercus semicarpifolia* and seldom on other hosts. Conifers are generally avoided.

#### 4. *Viscum* L.

Epiphytic semi-parasites on stems and branches of hosts, glabrous, monoecious or dioecious, herbs or shrubs, spreading along branches, di- or trichotomously branched, sometimes pendulous; nodes swollen; internodes terete or compressed or flattened decussately, often longitudinally ridged or striate. Leaves opposite, present and normally developed or rudimentary, entire, unifacial, coriaceous, curvined, usually with 3 or 5 visible veins; rudimentary leaves bract-like, up to 1 mm long. Flowers unisexual, usually 4-merous, small, arranged in terminal or axillary and sometimes solitary or fascicled inflorescences, usually in triads, middle flowers of the triad being female, the lateral ones male or vice versa, sometimes all female or all male; bracts small, triangular, in pairs forming boat-shaped cupule subtending each cymule. Male flowers: flattened, 0.5 - 1.5 mm long, 4-merous; perianth shortly tubular at base, lobes triangular, valvate; stamens sessile, epiphyllous; anthers disc-shaped, multi-loculate, opening by pores, sessile and fused to the perianth lobes, pistillode absent. Female flowers: cylindrical, oblong, up to 3



mm long, 4-merous; perianth lobes triangular, sometimes persistent; ovary inferior, adnate to the perianth; ovules not distinct; style short; stigma small, sessile, nipple-shaped, round, flat or capitate. Fruit a berry, narrowly ellipsoid, transparent; perianth lobes rarely persistent as a crown on the fruit.

Europe, throughout Africa, and eastwards to Asia and Australia, about 67 species, 15 species in India of which 4 are endemic.

*Literature.* DANSER, B. H. (1941). The British-Indian species of *Viscum* revised and compared with those of South-eastern Asia, Malaysia and Australia. *Blumea* 4: 260–321. RAO, R. S. (1957). A revision of the Indo-Malayan species of *Viscum* Linn. *J. Indian Bot. Soc.* 36: 113–168.

#### KEY TO THE SPECIES

- 1 a. Plants dioecious, leafy, leaves lanceolate, to elliptic-lanceolate or obovate-lanceolate; the central flower subtended by a cupule **2. V. album**
- b. Plants monoecious, leafy or leafless; leaf-shape varies; cupule for the central flower present or absent 2
- 2 a. Internodes flattened; leaves few, lanceolate; inflorescence a 3-flowered cyme with the central flower female **10. V. mysorensis**
- b. Internodes terete, angular or flattened; leaves few or many, shape varies; inflorescence cymose or subracemose with the central flower either male or female 3
- 3 a. All leafless (rarely leafy in *V. ramosissimum*); internodes flat, angular or terete; inflorescence sessile 4
- b. All leafy; internodes terete; inflorescence sessile or pedunculate 5
- 4 a. Internodes distinctly 4-angled; flowers arranged laterally **3. V. angulatum**
- b. Internodes terete or flattened; flowers arranged laterally or encircling the node 6
- 5 a. Central flower male; leaves cuneate, subtruncate, ovate, obovate or lanceolate 9
- b. Central flower female; leaves lanceolate, oblong or ovate-acute 10
- 6 a. Internodes flattened, flattening in a plane at right angles to the preceding one; inflorescences laterally placed **4. V. articulatum**
- b. Internodes terete; inflorescences lateral or around the node 7
- 7 a. Fruits verruculose, subglobose; plants erect **7. V. loranthi**
- b. Fruits smooth, globose to ovoid; plants drooping 8
- 8 a. Branches strong; inflorescence encircling the node; fruits with persistent bracteal cup **8. V. malurianum**
- b. Branches slender; inflorescence lateral; fruits without bracteal cup **13. V. ramosissimum**
- 9 a. Leaves falcate; young fruits smooth, flask-shaped; inflorescence sessile; internodes terete **9. V. monoicum**
- b. Leaves variously shaped; young fruits smooth or warty, globose or oblong; inflorescence sessile or pedunculate; internodes terete or slightly angular 11
- 10 a. Inflorescence sessile; fruits warty, leaves larger, ca 5 x 2 - 3.5 cm **12. V. ovalifolium**
- b. Inflorescence pedunculate; fruits smooth; leaves smaller, 2 - 5 x 0.5 - 2 cm 13
- 11 a. Young fruits warty; internodes longitudinally grooved; leaves ovate, obovate or oblong **6. V. heyneanum**
- b. Young fruits smooth; internodes not grooved; leaves lanceolate, cuneate or subtruncate 12
- 12 a. Inflorescence distinctly pedunculate, at times subracemose; internodes terete throughout; leaves lanceolate, thick; perianth lobes (rarely 3) 2 in male and 3 in female **5. V. capitellatum**

- b. Inflorescence sessile, always cymose; upper internodes slightly angled; leaves cuneate, or subtruncate or suborbicular; perianth lobes 3 in both male and female **15. V. trilobatum**
- 13 a. Inflorescences subracemose, sometimes with female flowers only; leaves lanceolate to ovate lanceolate; fruit globose; internodes longitudinally grooved **14. V. subracemosum**
- b. Inflorescences cymose or subracemose, heterosexual; leaves of various shapes; fruits globose or oblong; internodes terete or longitudinally grooved 14
- 14 a. Leaves lanceolate; branches slender; inflorescences always 3-flowered **1. V. acaciae**
- b. Leaves ovate or obovate; branches strong, terete; inflorescences up to 5-flowered **11. V. orientale**

**1. *Viscum acaciae*** Danser in Blumea 4: 298, t. 1. 1941; Sanjai & N.P.Balacr. in J. Econ. Taxon. Bot. 25: 18, f. 1. 2001.

Monoecious leafy evergreen herbaceous partial stem-parasites, drooping, up to 75 cm long; stems dichotomously branched; branches at each node 3 or 2; nodes slightly swollen; internodes gradually more delicate towards the apices, short. Leaves lanceolate or spatulate, tapering at base, rounded at apex, entire or slightly wavy along margins, with 3 distinct longitudinal veins, 1.5 - 7 x 0.5 - 2 cm; petioles 2 - 5 mm long. Inflorescence solitary, axillary, up to 6 at each node, cymose, 3 (- 5)-flowered; peduncles 3 - 7 mm long, bearing a navicular cup of bracts formed of 2 segments at its apex, each bract triangular, ca 3 x 2 mm, bearing a 3-flowered triad in it, the central flower large and female, the laterals male. Male flowers: wedge-shaped, sessile, ca 1.5 x 1 mm; perianth lobes 4, of two types, 2 larger and 2 smaller; larger lobes ca 1 x 0.7 mm, broadly ovate with broad base and rounded apex, bearing an anther on its inner surface; smaller perianth lobes ca 1 x 0.5 mm; stamens 2, sessile; anthers ca 0.7 x 0.7 mm, opening by pores;. Female flowers: sessile, oblong, clavate, ca 3 x 1 mm; perianth lobes 4, ca 1 x 0.7 mm, caudate; ovary inferior; style short; stigma globular. Fruits drupaceous, oblong, 5 - 8 x 3 - 5 mm, abruptly tapering at base into the stalk, smooth.

*Fl. & Fr.* Feb. - Aug.

*Distrib.* India: Karnataka.

Myanmar.

*Hosts.* The usually noticed hosts are *Acacia leucophloea* and *Santalum album*. In Bangalore, this species was collected from *Santalum album*. In this case, *Viscum acaciae* was seen mimicking the leaf and stem of its host in appearance and it was very difficult to distinguish the parasite from the host. The host *Santalum album* had more or less lanceolate leaves, which is being mimicked by the parasite.

**2. *Viscum album*** L., Sp. Pl. 2: 1023. 1753; Hook.f., Fl. Brit. India 5: 223. 1886. *V. costatum* Gamble in Bull. Misc. Inform. Kew 1913: 46. 1913. *V. album* var. *meridianum* Danser in Blumea 4: 274. 1941.

Dioecious semi-parasitic yellow-green shrubs, up to 75 cm high; stems di- or trichotomously or umbellately branched; nodes swollen; internodes terete. Leaves normal, opposite, sessile or subsessile, lanceolate-elliptic to obovate-lanceolate or sometimes obovate-cuneate, usually oblique, obtuse or rotund at apex, entire, abruptly narrowed towards the base, 2.5 - 10 x 0.5 - 3.7 cm, thinly coriaceous, with 3 - 9 longitudinal nerves connected together by indistinct reticulate veins. Inflorescences cymose, terminal or axillary, peduncled. Male flowers:

3 together, the central being the older, the laterals younger, all in a connate cup of two acute bracts which are triangular; flowers globose, ca 2.5 x 2.5 mm; perianth lobes 4; stamens 4; anthers sessile, attached to the inner surface of perianth lobes. Female flowers: 3 - 5 together, protected by a pair of connate acute bracts forming a cupule; flowers oblong, ca 2 x 1 mm; perianth lobes 4, perianth-tube fused with the inferior ovary; style short; stigma flat. Fruits globose or ellipsoid, 4 - 8 mm long; seeds 5 - 6 mm long, embedded in a white viscid pulp.

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

*Distrib.* India: High altitudes of the Himalayas, particularly in the states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand (Garhwal Himalayas), Sikkim, Arunachal Pradesh and Nagaland.

Europe, Bhutan, Myanmar, China and Vietnam.

*Uses.* There is a belief that the plants called 'European mistletoe' possess some magical properties. It is medicinally important and the crude drugs prepared from this plant have potential to cure tumour.

*Pollen.* Rounded convex, almost spherical, prolate, spheroidal, tricolporate. 38.1 - 35 µm (Feur, S. M. & J. Kujit, Amer. J. Bot. 69: 1 - 12. 1982).

*Chromosome no.* From Europe: n = 10 (Pisek, Jahrb. Ber. Dutsch. Bot. Ges. 40: 406 - 409. 1923).

*Hosts.* Various species of *Abies* and *Ulmus*.

**3. *Viscum angulatum*** B. Heyne ex DC., Prodr. 4: 283. 1830; Hook. f., Fl. Brit. India 5: 225. 1886. *V. ramosissimum* Wight, Icon. Pl. Ind. Orient. 3: t. 1017 tantum, 1845.

Mar.: *Bandaguli*.

Monoecious, green or yellowish, herbaceous or shrubby, semi-stem-parasites, usually hanging; stems slender, angular; branches numerous, more than 2 or rarely decussate at nodes. Leaves scaly, mostly not visible, up to 0.5 mm long, sometimes prophylls seen at the base of the branches. Inflorescences sessile, lateral, 1 or 3-flowered, if 1-flowered it is female and subtended by 2 bracts which are connate at base; if 3-flowered, the central one is female and the laterals male with individual bracts. Male flowers: globose, laterally compressed and wedge-shaped towards the base, ca 1 x 1 mm; perianth lobes 4, broadly ovate, ca 0.5 x 0.5 mm; stamens 4, sessile; anthers attached to the perianth lobes, opening by pores. Female flowers: ca 1.2 x 0.5 mm; perianth lobes 4, broadly ovate, ca 0.5 x 0.5 mm; ovary inferior; style short, conical and stigma nipple-shaped. Fruits baccate, subglobose to globose, up to 4 mm in diameter, with persistent bracts at base.

*Fl. & Fr.* Feb. - Aug.

*Distrib.* India: Confined to the peninsular India and includes the whole of the Western Ghats from the border areas of Gujarat and southwards covering Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu and southern areas of Andhra Pradesh.

Asia and Australia.

*Pollen.* Triangular, slightly convex, subprolate, tricolporate, 32.5 - 26.2  $\mu\text{m}$  (Feur & Kujit, Amer. J. Bot. 69: 1 - 12. 1982).

*Chromosome no.* From Taiwan:  $n = 11$  (Feung, Taiwania 11: 113 - 118. 1965).

*Hosts.* Reported on *Opilia amentacea*, *Ziziphus xylopyra*, *Olea dioica* and *Terminalia cuneata*.

**4. *Viscum articulatum*** Burm.f., Fl. Indica 211. 1768; Hook.f., Fl. Brit. India 5: 226. 1886 (incl. var. *dichotomum*). *V. nepalense* Spreng., Syst. Veg. 4(2): 47. 1827. *V. dichotomum* D. Don, Prodr. Fl. Nepal. 147. 1825 (non Gilbert 1792, nec Spreng 1825). *V. attenuatum* DC., Prodr. 4: 284. 1830. *V. opuntioides* Heyne ex DC., Prodr. 4: 284. 1830; Roxb., Fl. Ind., ed. Carey 3: 764. 1832. *V. liquidambaricolum* Hayata, Icon. Pl. Formos. 5: 194, tt. 71, 72. 1915.

Guj.: *Vando*; Mar.: *Banda*.

Monoecious, evergreen, semi-parasitic shrubs, drooping, up to 100 cm long; stems slender; branches decussate, sometimes more than 2 at each node. Leaves rudimentary, scale-like, obtuse, 0.5 - 0.7 mm long; scales at the bases of the branches indistinct. Inflorescence cymose, sessile, in a triad, up to 2.5 x 2 mm, 3 (- 5)-flowered, usually with one central female flower subtended by a pair of small scaly bracts united into a cup, then a pair of lateral male flowers, one on either side below the upper bracteal cup and in the axils of another pair of lower decussately developed bracts, ca 0.7 mm long. Male flowers: sessile, globose, laterally compressed towards the base, ca 1 x 1 mm; perianth lobes 4, free, ovate, with another attached internally, ca 0.5 x 0.4 mm; stamens 4; anthers sessile, attached to the perianth lobes, ca 0.3 x 0.4 mm, dehiscent by pores. Female flowers: sessile, oblong, ca 1.5 x 1 mm; bracts 2, panduriform, coherent, ca 1 x 1 mm; perianth lobes as in the male flowers; ovary inferior; style short; stigma nipple-shaped. Fruits subglobose to ovoid or oblong, green when young, yellow when mature, 3 - 4 mm in diam.; pulp highly viscous, whitish with a bright green seed.

*Fl. & Fr.* Dec. - June.

*Distrib.* India: Throughout India except in Punjab, southern areas of Himachal Pradesh and central to north-west regions of Gujarat.

Sri Lanka, Nepal, Bhutan, China, Myanmar, Thailand, Vietnam, Malesia and Australia.

*Uses.* The plant is important medicinally. It is used as an aphrodisiac and as a febrifuge. A paste of the plant when applied to cuts and wounds heals them quickly. It contains oleonic acid, ceryl oleonolate and meso inositol.

*Pollen.* Rounded convex, almost spherical, prolate spheroidal to subprolate, tricolporate, 34.2 - 30  $\mu\text{m}$  (Feur & Kujit, Amer. J. Bot. 69: 1 - 12. 1982).

*Chromosome no.* From Taiwan:  $n = 11$ ,  $2n = 22$  (Feung, Taiwania 11: 113 - 118. 1965). From Australia:  $n = 12$  (Barlow, Proc. Linn. Soc. N. S. Wales 88: 151 - 160. 1963).

**5. *Viscum capitellatum*** Sm. in Rees, Cyclop. 37: Viscum no. 18. 1817; Hook.f., Fl. Brit. India 5: 225. 1886, p. p.

Monoecious, evergreen, semi-parasitic herbs, up to 15 cm long, densely branched, decussate and divaricate at lower portions of the stem to more or less umbellate towards the apices; internodes terete, smooth, swollen at the nodes, ca 6 x 0.5 cm. Leaves partly normally developed, sessile, opposite, sometimes lacking or reduced to scales; normal leaves 1 - 2 x ca 0.5 cm, orbicular-ovate or spatulate, thick, entire. Inflorescence cymose, axillary, up to 6 at each node; peduncles up to 3 mm long, bearing a navicular bracteate cup at its apex with 3 (- 5) flowers, the central flower male, the laterals female. Male flowers: sessile, obovate, ca 2 x 1 mm; perianth lobes 2, with serrate margins; stamens 2, sessile; anthers 2-locular, attached to the inner surface of the perianth lobes, ca 0.8 x 0.8 mm. Female flowers: bracteolate, oblong, ca 2.5 x 1 mm; perianth lobes 3, free, subulate, ca 0.5 x 0.7 mm; ovary inferior; style very short; stigma conical. Fruit a drupe, ellipsoid or ovoid, smooth, shiny when fresh, distinctly constricted just below the perianth bearing a rim.

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

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

Sri Lanka.

*Pollen.* Rounded convex, almost spherical, subprolate, tricolporate, 32.9 - 27.5  $\mu\text{m}$  (Feur & Kujit, Amer. J. Bot. 69: 1 - 12. 1982).

*Hosts.* The main hosts are *Dendrophthoe falcata*, *Loranthus bracteatus*, *Loranthus tomentosus* and *Erythroxylon monogynum*.

**6. *Viscum heyneanum*** DC., Prodr. 4: 278. 1830. *V. heyneanum* var. *liocarpum* Danser in Blumea 4: 305. 1941. *V. verruculosum* Wight & Arn., Prodr. Fl. Ind. Orient. 1: 379. 1834; Hook.f., Fl. Brit. India 5: 224. 1886. *V. orbiculatum* Wight, Icon. Pl. Ind. Orient. 3: 13, t. 1016. 1845; Hook.f., l. c., 224. 1886. *V. orientale* sensu Thwaites, Enum. Pl. Zeyl. 136. 1859 (non Willd., 1806); Hook.f., l. c. 5: 224. 1886.

Evergreen monoecious, partial stem-parasites, up to 40 cm long, much branched; branches dense and sometimes whorled apically, often decussate towards the apices. Leaves sessile or subsessile, normal, opposite, orbicular-ovate to obovate or elliptic to oblanceolate, attenuate to narrowed at base, acute to rounded at apex, entire or slightly wavy along margins, 1.5 - 3 x 0.6 - 1.5 cm, glossy above, subcoriaceous, with 3 - 5 longitudinal nerves with a distinct network of veins. Inflorescence cymose, usually lateral and axillary, up to 5 at each node; peduncle up to 4 mm long or absent, bearing up to 2 mm long navicular cup of 2 bracts at apex, enclosing 3 sessile flowers; the flowers all female, all male or heterosexual; bracts 1.5 - 2 mm long, connate at base. Male flowers: obovoid, ca 1.9 x 1.4 mm; perianth lobes 4, deltoid, ca 1.5 x 1 mm; stamens 4; anthers sessile, suborbicular, ca 0.2 x 0.2 mm;. Female flowers: slightly compressed, ca 2 x 1.1 mm; perianth lobes 4, ca 0.7 x 0.4 mm; ovary inferior; style short, cylindrical; stigma nipple-shaped. Fruit a berry, oblong, ca 5 x 2 mm, slightly warty, with a crown of persistent or subsistent perianth lobes.

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

*Distrib.* India: Andhra Pradesh, Karnataka, Kerala and Tamil Nadu, and extending to Andaman & Nicobar Islands

Sri Lanka.

*Hosts.* *Punica granatum*, *Helecteris isora*, *Rhizophora* sp., *Memecylon umbellatum*, *Mallotus philippensis*, *Grewia flavescens*, *Syzygium jambolanum* etc.

**7. *Viscum loranthi*** Elmer, Leafl. Philipp. Bot. 8: 3089. 1919. *V. osmastonii* Raizada in Indian Forester 60: 537, t. 55. 1934.

Monoecious dark green semi-stem-parasites found exclusively on loranthaceous members, up to 25 cm high; stems rigid, much branched at base; branches decussate. Leaves rudimentary or absent. Inflorescence sessile, forming a cluster of cymes at the apex of each internode just below the node, each 3-flowered, sessile, subtended by a cupule, the central flower being female, the laterals male, at times all the flowers female. Male flowers: ovoid, ca 0.7 mm long; perianth lobes 4. Female flowers: oblong, ca 1 mm long; perianth lobes 4, triangular; ovary inferior, verruculose; style very short with nipple-shaped stigma. Fruits ca 5 X 2 mm, drupaceous, sessile, subglobose to globose, coarsely wrinkled, crowned by persistent perianth lobes.

*Fl. & Fr.* May - Sept.

*Distrib.* India: Uttarakhand, Assam and Manipur.

Myanmar, China, Indonesia and Philippines.

*Hosts.* Mostly seen on the loranthaceous hosts, i. e. *Taxillus vestitus*, *Scurrula cordifolia*, *S. pulverulenta* and *Dendrophthoe falcata*.

**8. *Viscum malurianum*** Sanjai & N.P.Balacr. in Nord. J. Bot. 21: 267, f. 1. 2001.

Monoecious leafless, semi-stem-parasites, drooping from the branches and trunks of host trees; stems densely branched. Leaves absent. Inflorescence cymose, usually arising from the nodes, up to 8 together, sessile, usually with a central female flower and two lateral male flowers, enclosed in a depression at the node. Male flowers: sessile, ca 3 x 2 mm, enclosed in a 4-lobed involucre cup, ca 1.5 x 1.5 mm; each lobe triangular, serrate along margins, ca 1 x 1 mm, enclosed in another 2-lobed bracteal cupule of ca 1.7 x 2 mm; perianth lobes 4, suborbicular, ca 1.5 x 1 mm; stamens 4: anther lobes united, ca 1 x 0.5 mm, attached along the inner side of the perianth lobes. Female flowers: sessile, ca 4 x 2 mm, protected by two consecutive covering, the outer covering formed of a 4-lobed involucre cup, ca 1.5 x 1.5 mm, almost flower-like with a central seat; the upper cup formed by fusion of 2 bracts, ca 2 x 2.5 mm; perianth lobes 4, triangular, ca 0.7 x 0.5 mm; ovary inferior, ca 2 x 1 mm; style short; stigma round. Fruit a berry, globose to ovoid, 3 - 5 mm in diam., with persistent bracteal cup.

*Fl. & Fr.* March - July.

*Distrib.* India: Malur in Karnataka State.

Endemic.

**9. *Viscum monoicum*** Roxb. ex DC., Prodr. 4: 278. 1830; Hook.f., Fl. Brit. India 5: 224. 1886. *V. benghalense* Roxb. ex Wight & Arn., Prodr. Fl. Ind. Orient. 1: 379. 1834. *V. edgeworthii*

Brandis, Ind. Trees 552. 1906. *V. orientale* Talbot, Forest Fl. Bombay & Sind 2: 421. 1911 (non Willd., 1806).

Tam.: *Pullurivi*.

Monoecious, evergreen, semiparasitic shrubs, 30 - 75 cm long, drooping from branches and trunks of the host, much branched; a pair of prophylls, usually indistinct, present at the base of every branch. Leaves normal, subsessile, opposite, asymmetric, elliptic to lanceolate, attenuate at base, acute or acuminate at apex, thinly coriaceous, entire or wavy along margins, dull or slightly shiny, palmately 5-nerved from the base. Inflorescence cymose at the axils of the leaves, aggregated at nodes, up to 6 at each node, sessile or subsessile; peduncle up to 2 mm long, bearing a boat-shaped pair of connate acute bracts of 1 mm length at its apex, enclosing a cluster of 3 flowers, the central one being male, the laterals female or all flowers female. Male flowers: sessile, oblong, ca 2 x 1 mm; perianth lobes 4, subcordate at base, ca 1.2 x 1 mm, bearing an anther on its inner surface; stamens 4: anthers 2-loculed, attached to the inner side of the perianth lobes. Female flowers: clavate or obovate, ca 2.5 x 1 mm; perianth with 4 triangular lobes, ca 1 x 0.7 mm; ovary inferior; style short; stigma capitate. Fruits usually oblong, attenuate to rounded at base, truncate at apex, green, glossy, smooth, 4 - 6 x 2 - 3 mm.

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

*Distrib.* India: Starting from the northeast, extending to the central India and further towards west and southwards to South India and Sri Lanka. Bihar, West Bengal, Sikkim, Assam, Manipur, Tripura, Mizoram, Orissa, Madhya Pradesh, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka, Bhutan, Bangladesh, Myanmar. China, Vietnam and Thailand.

*Notes.* The plant is a powerful narcotic and is poisonous to animals. The leaves of this species parasitic on *Strychnos nux-vomica* possess poisonous properties, more or less similar to that of the host. They are dried and used as a substitute for the medicinal chemicals, strychnine and brucine, obtained from *Strychnos* trees.

**10. *Viscum mysorense*** Gamble in Bull. Misc. Inform. Kew 1925: 329. 1925 & Fl. Madras 2 (7): 1259. 1925 (repr. ed. 2: 881. 1957); Sanjai & N.P. Balakr. in J. Econ. Taxon. Bot. 25: 16, f. 1. 2001.

Plants possess a golden yellow colour on all parts; stems over 50 cm long, di- or trichotomously branched at nearly all the nodes, basal portion terete, 5 - 6 cm long, up to 3 mm thick, longitudinally wrinkled, slightly thickened at the nodes. Leaves dimorphic, the larger ones normally developed only at some nodes, the largest leaf lanceolate or spatulate, rounded at the apex, decurrent into a short petiole, up to 4 x 1 cm, thickly coriaceous, with 3 longitudinal nerves; petioles abaxially rounded and adaxially flat or canaliculate; the scale-like leaves appearing at most of the nodes, ca 0.5 mm long; prophylls 2, at the bases of all ramifications. Inflorescences usually axillary, sessile or shortly pedunculate, 1 - 3 flowered cymes; peduncle up to 1 mm long, bearing at apex 2 opposite acute bracts forming together a navicular cup up to 2 mm long, each bearing one sessile flower in its axil, devoid of a bracteal cup and usually male, rarely female, ca 1 mm long and compressed between the bracts and the middle flower; the middle flower female, rarely sessile and without bracteal cup, usually very shortly pedicellate and surrounded by a cup composed of two small bracts alternating with those of the lower pair. Fruits not seen.

*Distrib.* India: Known only from the type *Meebold* 8207 (K) from type locality Arisikere in Karnataka.

Endemic.

**11. *Viscum orientale*** Willd., Sp. Pl. ed. 4, 4(2): 737. 1806; Hook.f., Fl. Brit. India 5: 224. 1886, p. p. *V. verticillatum* Roxb. [Hort. Bengal. 105. 1814, nom. nud.] Fl. Ind., ed. Carey 3: 764. 1832.

Hindi: *Banda*; Tel.: *Chandra-badamika*, *Sundara-badanika*; Sant.: *Banda*; Tam.: *Pilluli*.

Semiparasitic monoecious dark green herbs, up to 50 cm long, bushy in general appearance; stems strongly branched. Leaves opposite, ovate or oblong, cuneate and tapering into a short petiole at base, obtuse, rounded or acuminate at apex, entire, 2 - 6 x 0.6 - 3 cm, thinly coriaceous, usually with 3 distinct longitudinal nerves; prophylls present at the bases of all the branchings. Inflorescences cymose, lateral on the nodes, with up to 8 cymes at each node; peduncles 1 - 5 mm long, bearing a navicular cup at the apex, formed of two bracts; central flower being female and larger, the laterals small and male. Male flowers: strongly compressed, obovate with rounded or flat base, 2 - 5 x ca 1 mm; perianth lobes 4, ca 0.9 x 0.7 mm, with an anther attached on the inner side; stamens 4; anthers attached to the perianth lobes internally. Female flowers: oblong, ca 3 x 1 mm; perianth lobes as in male flowers; ovary inferior; style short; stigma capitate. Fruits subglobose to oblong or ovoid, contracted at apex, ca 6 x 5 mm, dull with minute granules, smooth.

*Fl. & Fr.* Usually during Feb. - June. However, in many areas it was found to bear the flowers or fruits throughout the year.

*Distrib.* India: North-east India to peninsular India and Andaman & Nicobar Islands, up to 2000 m altitude. Bihar, Orissa, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka., China and Australia.

*Uses.* A poultice of the leaves is useful for neuralgia. The plants are burnt and the ashes rubbed on the body for the treatment of itches. They are used in earache. An unnamed alkaloid has been reported from the plant (Wealth of India - Raw Materials Vol. X).

*Chromosome no.* From Sri Lanka: n = 10 - 13 (Wiens & Barlow in Taxon 20: 332. 1971).

**12. *Viscum ovalifolium*** Wall. ex DC., Prodr. 4: 278. 1830; Hook.f., Fl. Brit. India 5: 225. 1886, p. p. *V. orientale* (auct. non Willd. 1806) Benth. in Hooker's London J. Bot. 2: 222. 1843; Danser in Bull. Jard. Bot. Buitenzorg, Ser. 3, 11: 466. 1931.

Monoecious, evergreen, partial parasites on stems and branches of host trees; stems slender to robust, up to 1.5 m long, sparingly branched, glabrous, flattened towards apical portion. Leaves normal, opposite, lanceolate, ovate, oblong or obovate, attenuate at base, tapering into a very short petiole, obtuse or subacute at apex, entire, coriaceous, dull on both surfaces, inequilateral, 5 - 9 x 2 - 3.5 cm, with 3 - 5 longitudinal nerves. Inflorescences usually



lateral, at first single, sessile or subsessile, often a 3-flowered cyme with the middle flower female and laterals male; flowers enclosed in a navicular cup of bracts about 2 mm long. Male flowers: sessile, compressed longitudinally, ca 1 mm long; perianth lobes 4, triangular; stamens 4; anthers attached to tepals. Female flowers: oblong, 1.5 - 2 mm long, sessile; perianth lobes 4, triangular; ovary inferior; style short, conical; stigma capitate. Fruits suborbicular to ellipsoid, somewhat contracted at base, distinctly warty till ripening, 5 - 6 x ca 4 mm, covered by slightly enlarged conical style.

*Fl. & Fr.* Jan. - April.

*Distrib.* India: Assam, Manipur and Andaman & Nicobar Islands.

Bhutan, Myanmar, China, Thailand, Laos, Vietnam, Cambodia, Hongkong, Malaysia, Indonesia, Philippines and Queensland (Australia).

*Pollen.* Rounded, convex, almost spherical, subprolate, tricolporate. 39.7 - 31.4  $\mu\text{m}$  (Feur & Kujit, Amer. J. Bot. 69: 1 - 12. 1982).

*Chromosome no.*  $n = 11$  (Barlow, Proc. Linn. Soc. N. S. Wales 89: 268 - 272. 1964).

*Host.* *Quercus incana*.

**13. *Viscum ramosissimum*** Wall. ex Wight & Arn., Prodr. Fl. Ind. Orient. 1: 380. 1834; Hook.f., Fl. Brit. India 5: 225. 1886.

Monoecious, pendulous, herbaceous partial stem-parasites, very rarely erect on the branches as well as on main trunks of the host; stems slender; branches numerous, decussate or more than two at each node; nodes swollen. Leaves generally absent. Inflorescences usually sessile and lateral, 1- or 3-flowered, if 1-flowered, then female ones subtended by 2 bracts connate at base; if 3-flowered, the central one being female and the laterals male with individual bracts; bracts triangular, ca 0.7 x 0.7 mm. Male flowers: subglobose, compressed laterally, ca 1 x 1 mm; perianth lobes 4, broadly ovate, ca 0.7 x 0.5 mm; stamens 4; anthers sessile, orbicular, attached to the perianth lobes on the inner surface, ca 0.5 mm across. Female flowers: oblong, ca 1.7 x 0.7 mm; perianth lobes 4, ca 0.5 x 0.2 mm; ovary inferior; style short, slightly conical; stigma nipple-shaped. Fruits small, drupaceous, subglobose to globose.

*Fl. & Fr.* Feb. - Aug.

*Distrib.* India. Western Ghats of Maharashtra, Karnataka, Kerala and Tamil Nadu and in the southern parts of Andhra Pradesh.

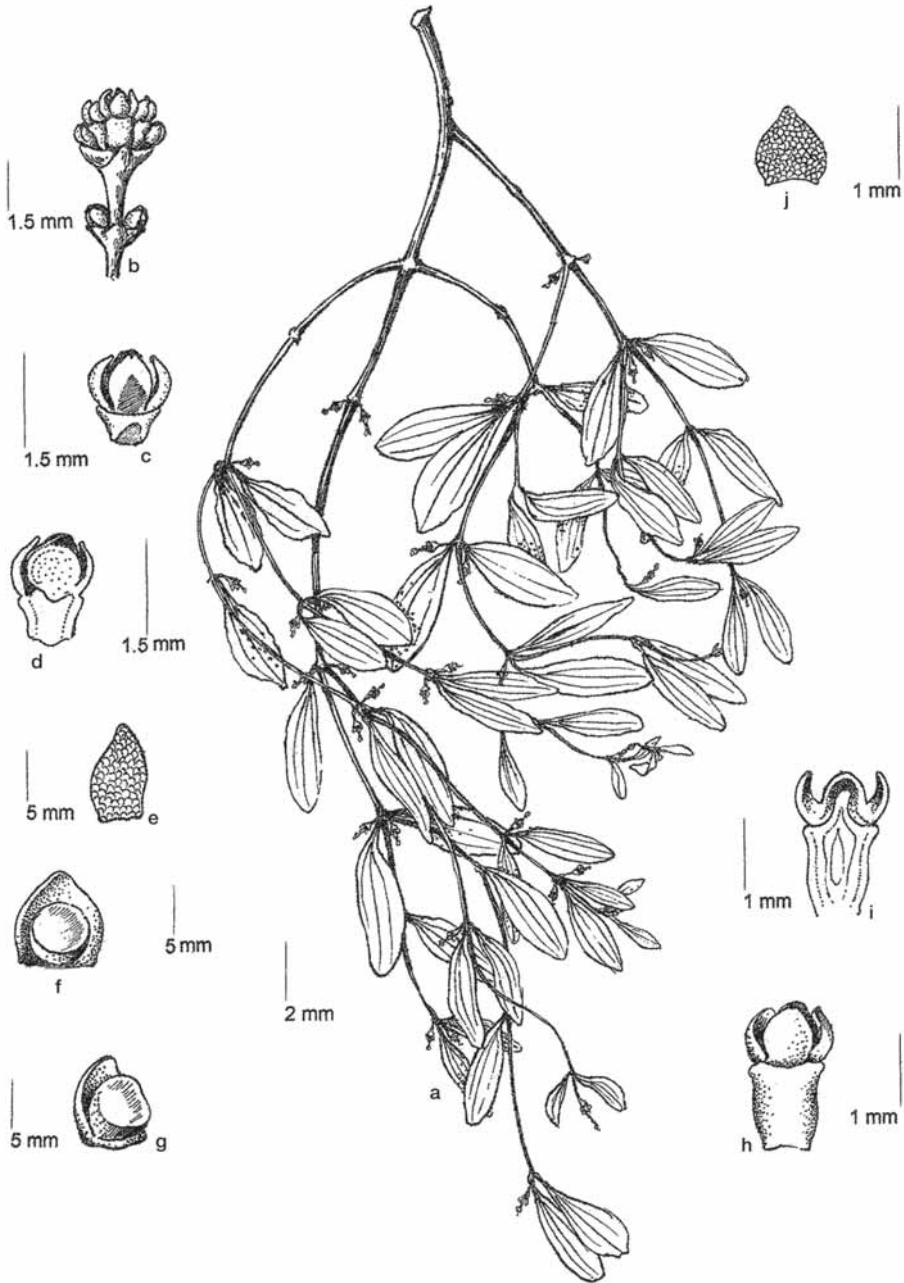
Sri Lanka.

*Pollen.* Triangular, slightly convex, prolate, tricolporate, 35.4 - 25.9  $\mu\text{m}$ . (Feur & Kujit, Amer. J. Bot. 69: 1 - 12. 1982).

**14. *Viscum subracemosum*** Sanjai & N.P.Balacr. in Rheedeia 10: 113 - 116, f. 1. 2000.

**Fig. 1**

Monoecious evergreen herbaceous partial parasites on stems and branches of hosts, up to 75 cm long, di- or trichotomously branched; branches slender, dark green. Leaves opposite,



**Fig. 1.** *Viscum subracemosum* Sanjai & N.P.Balacr.: a. habit; b. inflorescence; c. male flower; d. l. s. of male flower; e. male sepal; f & g. large perianth lobe of male flower with anther; h. female flower; i. l. s. of female flower; j. single perianth lobe with female flower.

lanceolate, tapering towards base, rounded at apex, 3 - 6 x 1.5 - 2.5 cm, with 3 veins. Inflorescences mostly subracemose, rarely cymose, pedunculate; flowers enclosed in a cupule formed out of 2 connate bracts; bracts ca 1 x 1 mm, broadly ovate, acute, cordate at base; flowers usually 5 in a group, the central flower female and the laterals male; at times all inflorescences female. Male flowers: sessile, subglobose, ca 1.5 x 1 mm; perianth lobes 4, of two types; stamens 2; anthers sessile, attached to the inner surface of the larger perianth lobes, dehiscent by pores. Female flowers: oblong, ca 2 x 1 mm; perianth lobes 4, broadly ovate, ca 1 x 0.5 mm; ovary inferior; style short; stigma nipple-shaped. Fruit a berry, globose, smooth, up to 5 mm in diam.

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

*Distrib.* India: Karnataka and Tamil Nadu.

Endemic.

**15. *Viscum trilobatum*** Talbot, Forest Fl. Bombay & Sind 2: 419, f. 479. 1911. *V. capitellatum* Hook.f., Fl. Brit. India 5: 225. 1886, p. p. (non Sm., 1817); T. Cooke, Fl. Bombay 2(3): 552. 1906, p. p.; Gamble, Fl. Madras 2(7): 1258. 1925 (repr. ed. 2: 881. 1957), p. p.

Evergreen, monoecious, erect, herbaceous semi-stem parasites, up to 25 cm long, decussately branches below and dichotomously towards upper portions; nodes swollen. Leaves normal, opposite, sessile or subsessile, obovate or suborbicular, wavy along margins, 0.7 - 2 x 0.5 x 1.5 cm, coriaceous; main nerves 3, distinct above; petioles up to 2 mm long. Inflorescences cymose, shortly peduncled, mainly axillary at nodes, up to 6 at each node; peduncles up to 5 mm long, bearing a boat-shaped cup of 2 connate bracts enclosing 3 sessile flowers, the central one being large and male, the laterals female. Male flowers: sessile, pandurate, ca 2.5 x 1.5 mm; perianth lobes 3, triangular, ca 1.5 x 1.5 mm; stamens 3; anthers 2-loculed, attached to and placed opposite to the perianth lobes on the inner side. Female flowers: sessile, oblong, ca 2 x 1 mm; perianth lobes 4, ca 0.7 x 1 mm; ovary inferior; style short; stigma capitate. Fruit a drupe, subglobose or ovoid, smooth, with ridges, ca 5 x 4 mm.

*Fl. & Fr.* Feb. - June.

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

Endemic.

*Pollen.* Rounded convex, almost spherical, prolate spheroidal, tricolpate. 34.4 - 30.7  $\mu\text{m}$ . (Feur & Kujit, Amer. J. Bot. 69: 1 - 12. 1982).

*Hosts.* Mostly on *Dendrophthoe falcata*, *Loranthus bracteatus* and *Excoecaria agallocha*.

## SANTALACEAE

(V. N. Sanjai & N. P. Balakrishnan)

Herbs, perennial, shrubs or trees, usually partial parasites, mostly on roots or sometimes on stems of hosts, sometimes growing independently as epiphytes. Leaves alternate or opposite, simple, entire, foliaceous or reduced to scales and exstipulate, pinnately or palmately veined. Inflorescence a dichasial raceme, spike or head, or the flowers solitary and axils. Flowers: minute, regular, monochlamydous, bisexual, unisexual or polygamous with perigynous or epigynous disc. Perianth simple, tubular; tube reduced in male; in female the lower part adnate to the ovary, (3 -) 4 (- 5)-lobed, toothed or cleft above, valvate in bud, often petaloid; stamens 3 or 5, inserted opposite to the perianth lobes and between the lobes of the disc; filaments short, broad; anthers 2-loculed, dehiscing longitudinally; disc epigynous or perigynous; ovary inferior, semi-inferior or superior, unilocular with 1 - 4 ovules suspended from the top of the free central placenta; style short; stigma entire or 3 - 5-lobed. Fruits indehiscent nuts or fleshy drupes; seeds solitary, without testa and with a small embryo at the end of the large endosperm, which is copious and fleshy.

Mostly in the tropical and subtropical regions, but some extending to temperate regions also, ca 34 genera and ca 540 species; 6 genera and 12 species in India.

*Literature.* NASIR, Y. J. (1984). Santalaceae. In: E. Nasir & S. I. Ali (eds.). Flora of Pakistan, no. 159: 1 - 6. PHILCOX, D. (1999). Santalaceae. In: Dassanayake & Clayton (eds). Rev. Handb. Fl. Ceylon 13: 198 - 202.

### KEY TO THE GENERA

- |   |  |                       |
|---|--|-----------------------|
| 1 | a. Plants epiphytic, stem-parasites  | 2                     |
|   | b. Plants terrestrial, root-parasites  | 3                     |
| 2 | a. Leaves present  | <b>1. Dufrenoya</b>   |
|   | b. Leaves absent   | <b>3. Phacellaria</b> |
| 3 | a. Herbs, up to 35 cm high; leaves linear  | <b>7. Thesium</b>     |
|   | b. Shrubs or trees, up to 10 m tall; leaves elliptic, ovate, obovate or orbicular  | 4                     |
| 4 | a. Leaves opposite; flowers bisexual   | <b>5. Santalum</b>    |
|   | b. Leaves alternate; flowers unisexual   | 5                     |
| 5 | a. Thorns present; flowers spicate   | <b>6. Scleropyrum</b> |
|   | b. Thorns absent; flowers solitary, clustered or cymose  | 6                     |
| 6 | a. Deciduous shrubs or small trees, up to 10 m tall; leaves 10 - 18 x 3 - 8 cm, pubescent beneath; perianth lobes 5; stigma capitate | <b>4. Pyrularia</b>   |
|   | b. Evergreen shrubs, up to 3 m tall; leaves 2.5 - 4 x 0.5 - 2 cm, glabrous; perianth lobes 3 or 5; stigma 3- or 4-fid                | <b>2. Osyris</b>      |

### 1. *Dufrenoya* Chatin

(synonym: *Henslowia* Blume)

Shrubby semiparasitic on trunks and branches of host trees, with spreading erect or twining branches, monoecious or dioecious. Leaves alternate, simple, palmately 5 - 9-veined from base, exstipulate, coriaceous. Flowers very minute, axillary or solitary, monochlamydous. Male flowers: sessile or in short peduncled clusters; perianth-tube free; lobes 5 or 6, triangular; disc circular; stamens 5 or 6, inserted at the bases or middle of the perianth-lobes; anthers

didymous. Female flowers: solitary or clustered; perianth adnate to the ovary; staminodes sterile or absent; ovary inferior, obovoid; ovules 2 or 3; style minute; stigma subsessile, discoid or lobed. Fruits drupaceous, fleshy, ovoid, obovoid, ellipsoid or subglobose; seed stellately lobed; embryo linear.

Subtropical and tropical regions of India, China and Malesia, ca 14 species; 4 species in India.

*Literature.* MALHOTRA, C., BALODI, B. & S. SINGH (1988). Two little known plants from western Himalaya. *J. Econ. Taxon. Bot.* 12: 237 - 240.

#### KEY TO THE SPECIES

- |  |                                 |
|--|---------------------------------|
| 1 a. Young branches distinctly angled; stigma subsessile                                   | <b>2. <i>D. platyphylla</i></b> |
| b. Young branches distinctly terete or irregularly longitudinally fissured; stigma sessile | 2                               |
| 2 a. Flowers pedicellate; internodes irregularly and longitudinally fissured               | <b>4. <i>D. sessilis</i></b>    |
| b. Flowers sessile; internodes not fissured  | 3                               |
| 3 a. Leaves elliptic-ovate to obovate with distinct petioles                               | <b>1. <i>D. granulata</i></b>   |
| b. Leaves broadly ovate; petioles indistinct   | <b>3. <i>D. robusta</i></b>     |

**1. *Dufrenoya granulata*** (Hook.f. & Thomson ex A.DC.) Stauffer in Vierteljahrsschr. Naturf. Ges. Zurich 114: 70. 1969. *Henslowia granulata* Hook.f. & Thomson ex A.DC. in DC., Prodr. 14: 632. 1857; Hook.f., Fl. Brit. India 5: 232. 1885. *Dendrotrophe granulata* (Hook.f. & Thomson ex A.DC.) A.N.Henry & B. Roy in Bull. Bot. Surv. India 10: 276. 1969.

Nep.: *Ainjeru*.

Evergreen dioecious semi-parasitic shrubs on stems and branches of hosts, ca 40 cm high; stems warted; branches woody, terete, twining, thickly pustulate. Leaves elliptic-ovate to obovate, entire along margins, attenuate at base, obtuse or mucronate at apex, sometimes slightly falcate, 1.4 – 8 x 0.9 – 3 cm, distinctly 5 (or 6)-nerved; main nerves parallel, converging to base; petioles flat, narrowly winged, ca 1.2 cm long. Inflorescences axillary, spicate; male inflorescences fasciculate or umbellate; female inflorescences solitary or paired; peduncles ca 4 mm long, ridged, clothed with imbricating ovate bracts; flowers sessile, ovoid. Male flowers: in clusters, sessile or on short scaly ca 2 mm long peduncles; perianth tube absent or very small; lobes 4 – 6, ca 1 mm long, incurved at apex; stamens 4 – 6. Female flowers: solitary or on short scaly ca 4 mm long peduncles, sessile, small; perianth tube adnate to the ovary; lobes as in male flowers; ovary ovoid or obovoid, ca 3 mm long; style short, cylindrical; stigma subsessile. Drupes oblong-ovoid, 8 - 10 mm in diam., red or dark purple.

*Fl. & Fr.* April – June.

*Distrib.* India: Evergreen, broad-leaved and temperate forests, at 1500 – 2500 m altitudes. Parasitic on various species of *Quercus* or *Rhododendron*. Himachal Pradesh, West Bengal, Sikkim and Assam.

Nepal, Bhutan, Myanmar and China.

**2. *Dufrenoya platyphylla*** (Spreng.) Stauffer in Vierteljahrsschr. Naturf. Ges. Zurich 114: 70. 1969. *Viscum platyphyllum* Spreng., Syst. Veg. 4(2): 47. 1827. *V. heteranthum* Wall. ex A.DC.,

Prodr. 4: 279. 1830. *Henslowia heterantha* (Wall. ex A.DC.) Hook.f. & Thomson ex A.DC. in DC., Prodr. 14: 632. 1857; Hook.f., Fl. Brit. India 5: 233. 1886. *Dufrenoya heterantha* (Wall. ex A.DC.) Chatin, Compt. Rend. Hebd. Seances Acad. Sci. 51: 657. 1860. *Dendrotrophe heterantha* (Wall. ex A.DC.) A.N.Henry & B.Roy in Bull. Bot. Surv. India 10: 274. 1969.

Nep.: *Ajeru*.

Semi-parasitic shrubs on stems and branches of hosts, evergreen, 1 – 4 m tall; stems and old branches woody, twining. Leaves sessile, broadly ovate, obovate to elliptic, cuneate at base, rounded, cordate or often acute at apex, 2 – 7 x 1 – 4 cm, coriaceous, with 5 – 7 distinct basal, parallel venation; petioles flat, narrowly winged. Inflorescences axillary, spicate; peduncles 3 – 6 mm long; males fasciculate; females solitary, 3 or 4 in a fascicle; bracts broadly ovate; flowers ovoid, sessile; involucre bracts 4 – 6, ovate, acute, often minutely ciliate, shorter than flowers. Male flowers: sessile, in scaly clusters of 4 or 5; perianth-lobes 5, somewhat inflexed, ovate; stamens as many as the perianth-lobes. Female flowers: small, in clusters of 3 – 10; pedicels ca 5 mm long; perianth-tube fused to the ovary; lobes as in male flowers; style conical; stigma subsessile, suborbicular, shortly 5-lobed. Drupes oblong-ellipsoid, 3 – 4 mm long, red or orange.

*Fl. & Fr.* April - Aug.

*Distrib.* India: Subtropical evergreen broad-leaved forests, at 800 to 2000 m altitudes. Uttarakhand and Sikkim.

Nepal, Bhutan, Myanmar, China (Yunnan) and Malaysia.

**3. *Dufrenoya robusta*** Stauffer in Vierteljahrsschr. Naturf. Ges. Zurich 114: 69. 1969; Deb & R.M.Dutta in J. Econ. Taxon. Bot. 10: 52. 1987.

Semi-parasitic on stems and branches of hosts, evergreen, up to 1 m high; stems and branches terete, woody, smooth. Leaves broadly ovate, attenuate at base to a short petiole, rounded or acute at apex, 2 – 6.5 x 0.8 – 3.5 cm; basal nerves 5 – 7, distinct, parallel, with reticulate minor venation. Flowers in small clusters at the axils of leaves. Male flowers: sessile, small; perianth-lobes 4 or 5, slightly conical; stamens 4 or 5, placed opposite to the perianth-lobes. Female flowers: sessile, small; perianth-tube adnate to the ovary; lobes 4 or 5, subconical; style short, more or less cylindrical; stigma sessile or subsessile. *Fruits* drupaceous, oblong-ovoid or obovoid.

*Fl. & Fr.* Nov. – June.

*Distrib.* India: Mizoram.

Endemic.

**4. *Dufrenoya sessilis*** (Craib) Stauffer in Vierteljahrsschr. Naturf. Ges. Zurich 114: 69. 1969; Deb & R.M.Dutta in J. Econ. Taxon. Bot. 10: 52. 1987. *Henslowia sessilis* Craib in Bull. Misc. Inform. Kew 1911: 455. 1911.

Small evergreen semiparasitic shrubs, profusely branched; branchlets 2 – 5 mm thick, glabrous, irregularly and longitudinally fissured. Leaves ovate to lanceolate, attenuate at base

to a short petiole, obtuse at apex, 2.5 – 7.5 x 1.3 – 3.3 mm, coriaceous, glabrous, transverse nerves indistinct. Flowers: bisexual, in axillary fascicles; perianth-lobes 4 or 5, conical, broad at base; stamens 4 or 5, opposite to the perianth-lobes; style short, cylindrical; stigma sessile. Fruits globose to subglobose, with small bracteoles at base.

*Fl. & Fr.* Sept. – May.

*Distrib.* India: Assam, Nagaland, Manipur and Mizoram.

Thailand.

## 2. *Osyris* L.

Evergreen glabrous shrubs, dioecious; branches ribbed, angular. Leaves alternate, numerous, subsessile, entire, pinnately nerved. Inflorescences axillary; male ones cymose; bisexual and female ones often 1-flowered; bracts and bracteoles on male inflorescences caducous. Flowers: trimerous, unisexual or bisexual. Male flowers: shortly pedicellate; perianth 3 or 4 lobed, each lobe bearing a single stamen; anther-thecae separated, sterile in female flowers. Female flowers: solitary, axillary; perianth-tube short, solid, adnate to the ovary; perianth-lobes 3 or 4, triangular, valvate with a tuft of hairs at the face; stamens sterile, short, inserted at the base of perianth-lobes, alternating with the lobes of the disc; ovary inferior, enclosed in the solid perianth-tube; ovules 2 – 4, pendulous from a short stout central placenta; style short or long; stigma minutely 3 – 4-fid. Fruits with an apical scar; seeds globose; embryo small, terete or with dilated cotyledons, in the centre of copious fleshy endosperm.

Southern Europe (Mediterranean regions), Africa to India, ca 6 species; one in India.

***Osyris quadripartita*** Salzm. ex Decne., Ann. Sci. Nat., Bot. Ser. 2, 6: 65. 1836. *O. wightiana* Wall. [Cat. no. 4036. 1831, nom. nud.] ex Wight, Icon. Pl. Ind. Orient. 5: 17, t. 1853. 1852. *O. arborea* Wall. [Cat. no. 4035. 1831, nom. nud.] ex A.DC. in DC., Prodr. 14: 633. 1857; Hook.f., Fl. Brit. India 5: 232. 1886; Kanjilal et al., Fl. Assam 4: 130. 1940. *O. arborea* var. *puberula* Hook.f., l. c. 232. 1886.

Kan.: *Kuriganda*; Mar.: *Popli*.

Shrubs or small trees, semi-parasitic on roots of hosts, up to 3 m tall, twiggy with angled branches. Leaves crowded on branches, ovate to elliptic-oblong, elliptic-lanceolate or obovate-orbicular, acute or attenuate at base, obtuse, rounded and sharply mucronate at apex, 1 – 4.5 x 0.4 – 3 cm, with a single prominent vein on the lower surface; petioles 1 – 3 mm long. Flowers: minute, polygamous, bi- or unisexual, in axillary peduncled fascicles, racemiform cymes, umbels or clusters, shortly pedicelled; peduncles 4 – 5 mm long; bracteoles linear, 1 – 1.5 mm long. Male flowers: in small peduncled axillary 5 – 10-flowered umbellate clusters; pedicels ca 2 mm long; perianth ca 1.5 mm long; perianth-lobes 3 or 4, triangular, concave, ca 1.5 X 1 mm, enclosing a prominent disc in the middle; stamens stalked, transversely dehiscent. Female and bisexual flowers: mostly solitary, axillary; pedicels 5 - 15 mm long; perianth-lobes 3, urceolate, adnate to the ovary; style very short, thick; stigma peltate, with 3 or 4 recurved lobes. Fruits drupaceous, globose or broadly ellipsoid, with a prominent disc at top, 4 - 6 x 3 - 5 mm, yellow to reddish when ripe.

*Fl. & Fr.* Aug. – April.

*Distrib.* India: Subtropical Himalayas, NE. India, Central India and peninsular India, often on rocky places, up to 2000 m altitude. Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Orissa, Madhya Pradesh, Andhra Pradesh, Goa, Kerala and Tamil Nadu.

Sri Lanka, Nepal, Bhutan, Myanmar, Thailand, Indo-china, China, Africa and S. Europe.

*Use.* The leaves used as a substitute for tea in Garhwal Himalayan areas of Uttarakhand.

Chromosome number:  $2n = 30$  (Virendrakumar & Subramanyam, Chromosome atlas of flowering plants of Indian subcontinent, Vol. 1. Dicotyledons).

### 3. *Phacellaria* Benth.

Small shrubby parasites on stems of host trees, with fascicled stems. Leaves absent or reduced to rudimentary scales. Flowers: minute, solitary or fascicled, sessile or sunk in the branch, ebracteate, unisexual or bisexual, monochlamydous. Male flowers: perianth tube short, solid; lobes 3 - 6, valvate; stamens as many as and opposite to and inserted at the base of the perianth lobes; filaments short, compressed; anthers cordate, 2-loculed, longitudinally dehiscing; disc flat or slightly conic. Female flowers: perianth-tube adnate to the ovary; lobes 4 - 8, valvate; ovary inferior, 1-loculed; ovules 2 or 3, pendulous from and appressed to the top of a conical central column; styles short, stout; stigmas entire or 3-lobed. Bisexual flowers: similar to female ones. Fruits drupaceous, ovoid or oblong with a crown of persistent perianth-lobes; seed solitary.

NE. India, Myanmar to Malesia, ca 8 species; one in India.

*Literature.* DANSER, B. H. (1939). A revision of the genus *Phacellaria* (Santalaceae). *Blumea* 3: 212 - 235.

***Phacellaria compressa*** Benth. in Benth. & Hook.f., *Gen. Pl.* 3 (1): 229. 1880; Hook.f., *Fl. Brit. India* 5: 235. 1886. *P. wattii* Hook.f., l. c. 236. 1886. *P. ferruginea* W.W.Sm. in *Notes Roy. Bot. Gard. Edinburgh* 10: 188. 1918 (non Hand.-Mazz. 1929).

Semi-parasites, mostly dioecious, rarely with a few female flowers or bisexual flowers on the male plants; stems up to 20 cm long, flattened; tender portions terete, up to 1 mm thick and covered by broad acuminate imbricate bracts of ca 1 x 0.7 mm; prophylls none or indistinct. Flowers: unisexual, each with a distinct involucre of numerous small bracteoles, the first few flowers axillary, the following ones from the axils of bracteoles, inserted on a slight thickening of the stem; bracts imbricate, ovate or obovate, ca 0.8 × 0.5 mm; bracteoles numerous, forming involucre, small. Male flowers: sessile, depressed, up to 2 mm long; perianth obovoid, ca 2 x 1.5 mm; lobes 4 - 6, ; disc flat; stamens alternate with perianth-lobes; filaments flattened. Female flowers: sessile; perianth-lobes 4 - 6; disc at the base, oblong, acuminate; ovary unilocular; style short, fused with the disc; stigma truncate. Drupes ovoid, oblong-ovoid, ovoid-ellipsoid, 4 - 6 × 1.5 - 4 mm, glabrous, crowned by persistent perianth-lobes, glabrous.

*Fl. & Fr.* Feb. - June.



*Distrib.* India: Arunachal Pradesh and Manipur.

Myanmar, Thailand and China (Yunnan).

#### 4. *Pyralaria* Michx.

Trees or shrubs, dioecious, deciduous; young branches and inflorescences white hirsute. Leaves alternate, petiolate, pinnately veined; lateral nerves conspicuous. Inflorescences terminal on leafy axillary shoots, raceme-like or thyrsoid with umbellate branches, spicate, or cymose; female flowers subtended by well-developed leaves, axillary and solitary; bisexual flowers at apex of inflorescences, rarely 1-flowered, bracteate. Flowers polygamous, paired or solitary. Male flowers: perianth-tube turbinate, solid and free, 5-lobed; stamens 5, inserted at the base of the lobes; filaments very short; anthers ovoid, longitudinally dehiscent; ovary and style rudimentary. Female flowers: perianth tube adnate to ovary, 5-lobed, valvate, hairy on the face; disc slightly raised, flat, lobed, between the perianth-lobes; stamens sterile in female flowers; ovary inferior; ovules 2 or 3, pendulous from a free short straight basal column; style columnar, tubular; stigma capitate. Fruits drupaceous, tapering at base, with withered perianth-lobes at apex; seeds globose; embryo short, subterete near the top of the endosperm.

India, Nepal, Sikkim, Bhutan, Myanmar, China and SE. USA, 2 - 3 species; one in India.

***Pyralaria edulis*** (Wall.) A.DC. in DC., Prodr. 14: 628. 1857; Hook.f., Fl. Brit. India 5: 230. 1886; Kanjilal et al., Fl. Assam 4: 131. 1940. *Sphaerocarya edulis* Wall. in Roxb., Fl. Ind., eds. Carey & Wall. 2: 371. Mar – Jun 1824; Tent. Fl. Nepal. 1: 19, t. 10. Jul – Dec 1824.

Nep.: *Amphi*.

Shrubs or trees, thorny, up to 5 m tall; branches stout, with or without spines, villous when young; nodes thickened; vegetative buds covered with silky white orbicular imbricating scales. Leaves elliptic-oblong or ovate, cuneate at base, acute to acuminate at apex, entire or crenulate towards apex along margins, 5 – 12 x 2 – 5 cm, coriaceous, glabrous and glossy on upper surface, long hairy beneath when young; lateral nerves 4 – 8 pairs, prominent beneath; petioles 3 – 6 mm long. Flowers polygamous, axillary or terminal, solitary or in racemose panicles, bracteolate; pedicels 2 – 3 mm long. Male flowers: in racemes or panicles; perianth-tube solid; lobes 5, triangular; stamens 4 or 5; disc between the stamens, 4- or 5-lobed, consisting of scales. Female flowers: solitary; perianth-lobes 5; ovary pubescent; style short, columnar; stigma capitate. Drupes pyriform, globose, subglobose to obovoid, crowned by the persistent perianth-tube, 3 – 4 cm long; epicarp tough, glutinous, traversed by vessels; endocarp globose; seeds subglobose.

*Fl. & Fr.* March – Oct.

*Distrib.* India: Subtropical Central and Eastern Himalayas and Meghalaya, at 800 – 2000 m altitudes. Sikkim, West Bengal, Arunachal Pradesh, Assam, Meghalaya and Manipur.

Nepal, Bhutan, Myanmar and China.

*Uses.* Fruits are edible. Timber is white and hard, used for making domestic bowls, spoons and other kitchen implements.

## 5. *Santalum* L.

Trees or shrubs, initially semi-parasitic on roots of other plants, later independent, glabrous; branches slender. Leaves opposite to subopposite, rarely alternate, entire. Flowers axillary or in terminal trichotomous paniculate cymes, 5-merous, bisexual; bracts minute. Perianth-tube campanulate or ovoid, adnate to the base of ovary, lobes 4 or 5, valvate, with a tuft of hairs on the face; stamens 4 or 5, short, united at the base or throat of the perianth-lobes; disc consisting of fleshy scales alternating with stamens; ovary superior during anthesis and later half-inferior to inferior; style elongate; stigma 2 or 3-lobed; ovules 2 or 3, inserted below the top of a long acuminate free central column, reflexed. Fruits drupaceous, annulated at top by the deciduous perianth; seeds subglobose; endosperm copious; embryo terete, slender; radicle longer than the cotyledons.

Mainly in Australia, extending to Hawaii, Malesia and Indian subcontinent, ca 25 species; one in India.

*Literature.* SRIMATHI, R. A., H. D. KULKARNI & K. R. VENKATESAN (1983). Phenotypes of Sandal (*Santalum album* L.). J. Bombay Nat. Hist. Soc. 80: 25 – 246.

***Santalum album* L.**, Sp. Pl. 349. 1753; Hook.f., Fl. Brit. India 5: 231. 1886.

Hindi: *Chandan, Safed-chandan*; Kan: *Chandanum, Gundada, Srigandha*; Kon.: *Chamdan*; Mal.: *Chandanam, Gandharajan*; Mar.: *Chandan*; Tam.: *Akkam, Anukkam, Chandanam, Sandanam, Sandana-maram, Srigandam*; Tel.: *Chandanam*; Sans.: *Chandana*; Urdu: *Sandal*.

Evergreen trees, up to 4 m high, glabrous; branches slender, dark brown to black. Leaves elliptic-ovate to ovate-lanceolate, cuneate, acute, rounded or obtuse at base, acute to subacute at apex, 3 – 7 x 1.5 – 4 cm, membranous, glabrous, glaucous beneath; lateral nerves 5 or 6 pairs, indistinct; petioles 1 - 2 cm long. Inflorescences axillary or terminal, in trichotomous paniculate cymes, ca 5 cm long. Flowers: 4 - 5 mm across, brownish purple, reddish or straw-coloured; pedicels opposite, 1 – 1.5 mm long; perianth-lobes broadly triangular, ca 1.5 mm long; stamens 4 or 5; filaments short, inserted at the mouth of perianth-tube; anthers ovoid, with distinct parallel thecae; ovary at first free, later semi-inferior, 1-loculed; stigma 3-lobed. Fruits subglobose or obovoid, ca 1 x 0.8 cm, smooth, black when ripe with juicy flesh, crowned by the base of the deciduous perianth; seeds subglobose.

*Fl. & Fr.* Feb. – July.

*Distrib.* India: Predominantly in tropical deciduous and moist semi-deciduous forests of Peninsular India, south of Vindhya Mountains, ascending to 1500 m altitude. Parts of Rajasthan and Uttar Pradesh, Madhya Pradesh, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Uses.* Heartwood is strongly scented and is in great demand for the oil and for carvings. The roots and stems contain the volatile oil with the principal component Santalol, occurring in two isomer forms, the alpha-santalol and beta-santalol. The oil extracted from the heartwood is commercially called Sandal-wood oil, and is very aromatic and highly valuable in perfume industry. Sandal-wood powder with honey and rice water is given in diarrhoea. Sandal-wood

paste cools the body where it is applied, reducing any burning sensation. The paste applied to the forehead of a patient with high fever, produces cooling effect. It also acts as an antiseptic. The paste with turmeric paste reduces pimples on face.

*Note.* Chromosome number:  $n = 10, 20, 40$  (Virendrakumar & Subramanyam, Chromosome atlas of flowering plants of the Indian subcontinent, Vol. 1. Dicotyledons. 1986).

## 6. *Scleropyrum* Arn., nom. cons.

Trees, often with axillary spines, evergreen. Leaves alternate. Flowers crowded in short catkin-like axillary spikes at the leafless nodes and branchlets, polygamous. Perianth-tube of male solid and free, of female and in bisexual flowers adnate to the ovary; perianth-lobes 4 or 5, valvate or subimbricate with a tuft of hairs on the face; stamens 4 or 5, inserted at opposite to and at the base of the perianth-lobes, short; filaments bifid; anther-thecae separate, individually stalked, dehiscing transversely; disc annular, undulate; ovary inferior, enclosed by the perianth-tube; style short, stout; stigmas large, peltate; ovules 3, pendulous from the top of a free central column. Fruits drupaceous, with thick pedicel, crowned by the remains of the perianth-lobes, indehiscent; exocarp thick, fleshy; endocarp hard; seed solitary, subglobose; endosperm copious; embryo terete, central; cotyledons oblong.

India, Sri Lanka, Myanmar, Indo-china, Thailand to Malaysia, ca 6 species; one in India.

***Scleropyrum pentandrum*** (Dennst.) Mabb. in Taxon 26: 533. 1977. *Pothos pentandrus* Dennst. in Schlüssel Hortus Malab. 16: 33. 1818 (as "*pentandra*"). *Sphaerocarya wallichiana* Wight & Arn. in Edinburgh Philos. J. 15: 180. 1832. *Scleropyrum wallichianum* (Wight & Arn.) Arn. in Mag. Zool. Bot. 2: 550. 1838; Hook.f., Fl. Brit. India 5: 234. 1886. *Antidesma parasitica* Dillwyn, Rev. Hortus Malab. 33. 1839, nom. illeg., incl. type of *Pothos pentandrus* Dennst. 1818; Mabb. in Taxon 26(5–6): 533.1977. **Figs. 2 A - B**

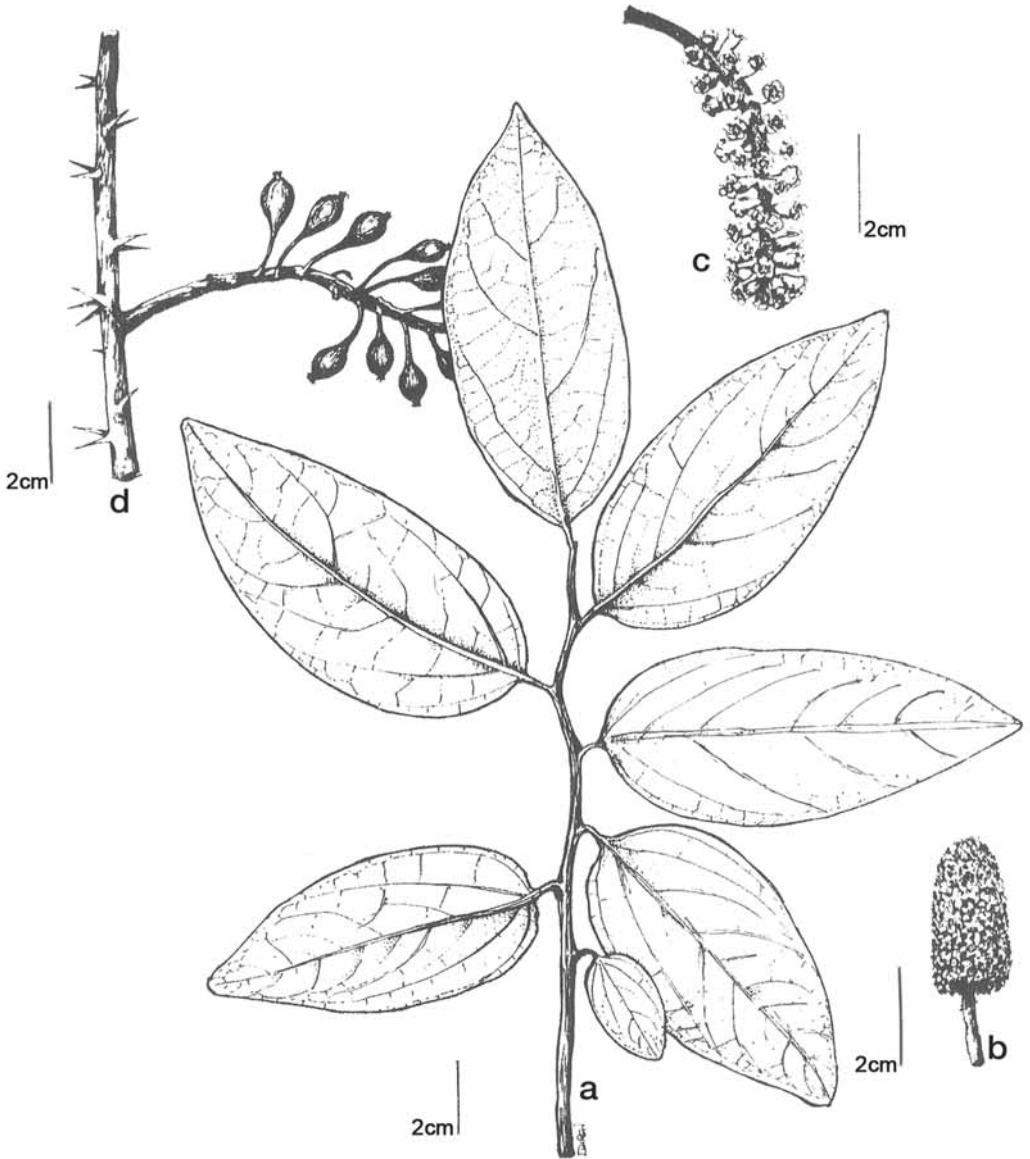
Kan.: *Bodliga*; Kon.: *Eltikamoto*.

Thorny trees, up to 10 m tall; young branches stout, anafractuous; thorns axillary, conical, sharp, 0.5 – 1.5 cm long. Leaves elliptic-ovate or oblong-ovate, cordate, obtuse, rounded or truncate at base, acute, acuminate or subobtuse at apex, (5 -) 7 – 15 x (2 -) 4 – 8 cm, glabrous, bright red when young, coriaceous, palmately 3-nerved at base, with 5 irregular lateral nerves above on the middle nerve; petioles ca 3 mm long. Flowers sessile, in drooping spikes, at the leafless nodes of stems and branches, 2 – 5 cm long, densely pubescent; bracts triangular-acuminate to filiform, ca 1.5 mm long, scarious, caducous. Perianth-tube pubescent outside; lobes 4 or 5, ovate; stamens 4 or 5; filaments bifid; anthers divaricate; thecae on separate branches of bifid filaments; disc annular, undulate; ovary 1-loculed; style short, flask-shaped; stigma peltate. Fruits on a thick ca 1.2 mm long pedicel, ovoid-ellipsoid or pyriform, tapering to top, ca 2.5 x 2 cm, purple-red when ripe.

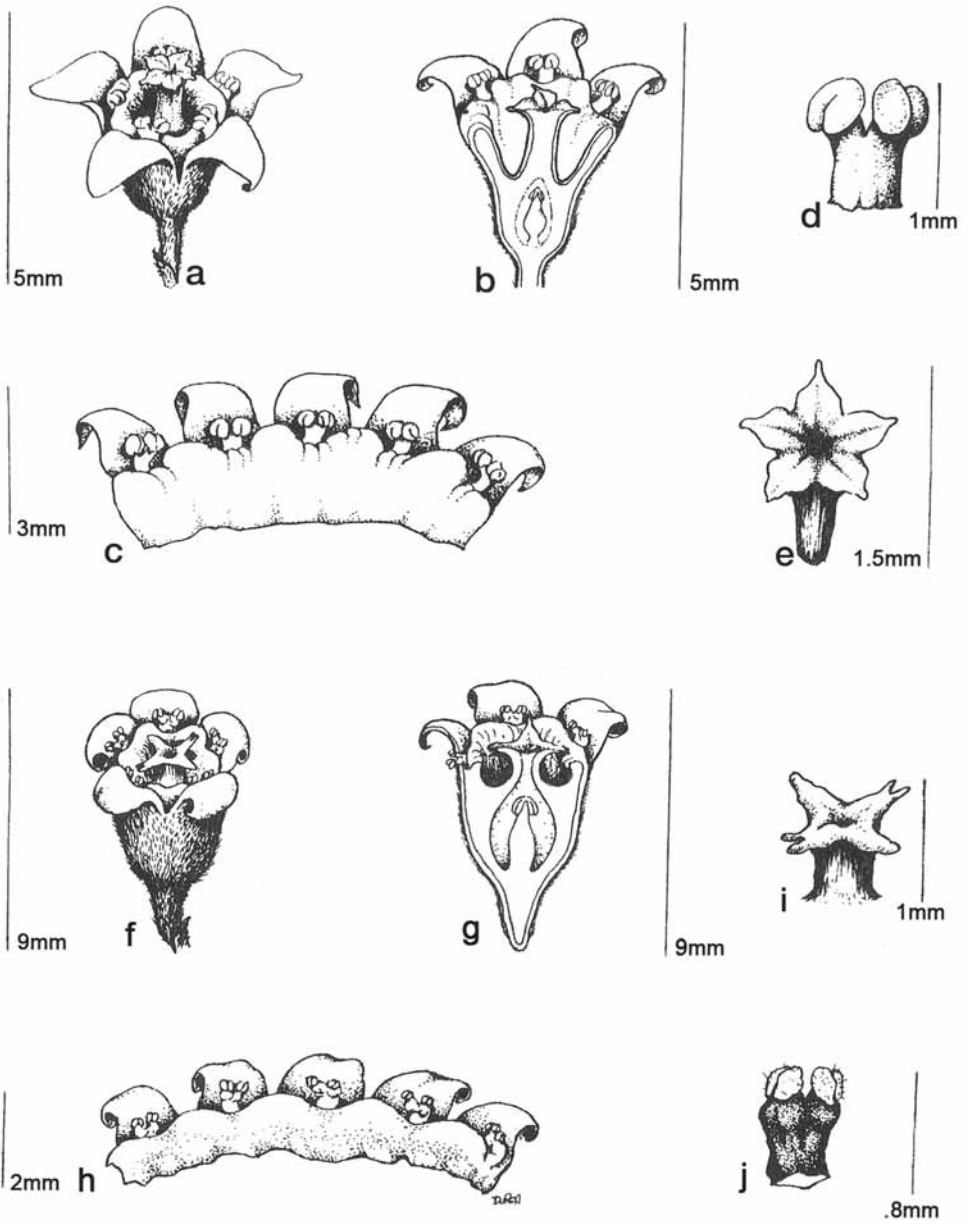
*Fl. & Fr.* Dec. – April.

*Distrib.* India: In semievergreen forests, mainly in moist montane areas, along the Western Ghats from Konkan southwards, ascending up to 1700 m altitude. Goa, Karnataka, Kerala and Tamil Nadu.

Sri Lanka, Myanmar, China, Cambodia, Laos, Vietnam and Malaysia.



**Fig. 2 A.** *Scleropyrum pentandrum* Dennst.: a. habit; b. bisexual inflorescence; c. female inflorescence; d. twig with fruits.



**Fig. 2 B.** *Scleropyrum pentandrum* Dennst.: a. bisexual flower: top view; b. l. s. of flower; c. perianth split opened showing disc and stamens; d. stamen; e. style & stigma; a' – d': female: a'. flower; b'. l. s. of flower; c'. perianth split opened showing disc and stamens; d'. style & stigma; e'. stamen.

## 7. *Thesium* L.

Annual or perennial herbs or rarely shrubs, often root parasites on grasses, decumbent or erect, slender with woody base, evergreen, often hemi-parasites on roots. Leaves alternate, usually sessile, linear or scale-like, 1 – 3-nerved; lateral nerves indistinct. Inflorescences apparently terminal, dichotomous racemes, often paniculate, rarely cymose or axillary, solitary. Flowers: bisexual, minute, white or yellowish green, with a slender pedicel bearing a linear leaf-like bract and 2 bracteoles; perianth campanulate or infundibuliform; perianth-tube cylindrical, tubular or funnel-shaped, adnate to ovary at basal part; perianth-limb divided above into 5 or rarely 4 linear-acute valvate lobes; each lobe hooded at apex; stamens 5 (or 4), inserted at the base of the perianth-lobes; filaments inserted; disc inconspicuous, connate to the base of perianth-tube; ovary inferior, sessile or slightly stalked; ovules 2 or 3, pendulous from a basal free, often flexuous or crumpled column; style short or long; stigma capitate or 3-lobulate. Fruit a small nut, often weakly ribbed, bearing remnants of perianth; exocarp dry, membranous, rarely fleshy; endocarp bony, slightly ridged; endosperm fleshy; embryo terete, straight or oblique; cotyledons small; radicle as long as or longer than the cotyledons.

Temperate and subtropical regions of Old World, many in Africa, ca 325 species; 5 species in India.

### KEY TO THE SPECIES

- |  |                                |
|--|--------------------------------|
| 1 a. Flowers sessile   | 2                              |
| b. Flowers pedicellate   | 3                              |
| 2 a. Plants non-parasitic; taproot system distinct, not stoloniferous  | <b>4. <i>T. unicaule</i></b>   |
| b. Plants parasitic; taproot system indistinct, stoloniferous  | <b>5. <i>T. wightianum</i></b> |
| 3 a. Leaves 1 – 2 cm long; bracts 6 – 12 mm long; perianth funnel-shaped; perianth lobes narrowly oblong, acute, distinctly recurved   | <b>1. <i>T. emodi</i></b>      |
| b. Leaves 2.5 – 3.5 cm long; bracts 3 – 6 mm long; perianth bell-shaped; perianth lobes broadly oblong to ovate, obtuse, slightly recurved   | 4                              |
| 4 a. Plants with taproot, not stoloniferous; peduncles 3 – 12 mm long; bracts linear to linear-lanceolate, 1-nerved; bracteoles shorter than bracts and flower in length; flowers 2.5 – 3.5 mm long; pedicels 1 – 3 mm in flower, up to 12 mm long in fruit        | <b>2. <i>T. himalense</i></b>  |
| b. Plants without tap root, stoloniferous; peduncles 10 – 20 mm long; bracts leaf-like, 1 – 3-nerved; bracteoles 4 – 7 mm long, equalling or exceeding the flower in length; flowers 3.5 – 5 mm long; pedicels 7 – 10 mm long in flower, up to 20 mm long in fruit | <b>3. <i>T. hookeri</i></b>    |

**1. *Thesium emodi*** Hendrych in Feddes Repert. 70: 152, f. 2. 1965. *T. himalense* auct. non Royle ex Edgew. 1846: sensu Hook.f., Fl. Brit. India 5: 229. 1886, p. p.

Herbs perennial; rhizomes long, slender; stems ascending, sparsely branched, slender, 5 - 15 cm long. Leaves sparse, sessile, oblong, entire, sharply pointed, 7 - 25 × 1.5 - 2 mm, glabrous, 1-nerved. Inflorescences raceme-like, with solitary flowers; bract inserted at pedicel base, leaf-like, linear-lanceolate, 10 - 15 mm long. Flowers: pedicels 5 - 9 mm long; bracteoles 2, narrowly oblong, 4 - 6 mm long. Perianth 5.5 - 6.5 mm long, greenish yellow or pale green outside; tube campanulate, funnel-shaped; lobes oblong, acute, becoming incurved after anthesis. Stamens 5, not exerted. Ovary on ca 1.5 mm long stalk; stigma capitate, about twice as wide as style. Fruits ellipsoid, ca 4 x 3 mm, with longitudinal veins, pale yellow; persistent perianth subterete, ca 2 mm.

*Fl. & Fr.* May – June.

*Distrib.* India: Open pastures at 3500 – 4000 m altitude. Sikkim.

Nepal, Bhutan and China (Yunnan).

**2 *Thesium himalense*** Royle [Ill. Bot. Himal. Mts. 1: 322. 1839, nom. nud.] ex Edgew. in Trans. Linn. Soc., London 20: 88. 1846; Hook.f., Fl. Brit. India 5: 229. 1886, p. p. *T. pachyrhizum* A. DC. in DC., Prodr. 14: 646. 1857. *T. himalense* var. ? *pachyrhizum* (A. DC.) Hook.f., l. c. 5: 230. 1886. *T. indicum* Hendrych in Acta Horti. Bot. Prag. 110. 1962.

Herbs, perennial, slender, decumbent, ascending, or straggling, sometimes erect, 10 – 30 cm high, parasitic on roots of other plants; rhizomes brownish, divaricate, thick; branches slender. Leaves sessile, linear to linear-lanceolate, subacute at apex, 15 – 35 x 1 - 2 mm, 1-nerved, glabrous; basal leaves smaller and scale-like, appressed to the stem. Inflorescences simple racemes or panicles, few-flowered; bracts 3, one much larger than the other two. Flowers: 2.5 – 3.5 mm long, bisexual; pedicels 3 – 5 mm long, up to 12 mm in fruits; perianth-tube infundibuliform, 2.5 - 4 mm long; lobes broadly oblong to ovate, cuculiform at anthesis, one or both margins auricled, ca 1.5 mm long; stamens 5; filaments less than 1 mm long; anthers adnate to perianth lobes by a connective of hairs, oblong, less than 1 mm long; style short, linear; stigma capitate. Fruits shortly stipitate, ellipsoid to subglobose or ovoid, 2.5 – 3 mm long; longitudinal nerves distinct.

*Fl. & Fr.* May – July.

*Distrib.* India: Himalayas, grassy slopes of alpine regions, at 2500 - 4100 m altitudes. Jammu & Kashmir, Himachal Pradesh and Sikkim.

Pakistan, Nepal, Bhutan and China (Tibet, Yunnan).

**3. *Thesium hookeri*** Hendrych, Acta Horti Bot. Prag. 109. 1962.

Perennial herbs, root-parasites, 15 – 35 cm high; rhizome thick, spreading, stoloniferous; stems erect, ascending or decumbent, usually simple, rarely branched. Leaves sessile, oblong or linear to linear-lanceolate, acuminate at apex, 20 – 55 x 2 – 4 mm, 1- or 3-nerved. Flowers: axillary, solitary, 3.5 – 5 mm long; pedicels 7 – 20 mm long in fruit, obliquely erect; bracts foliaceous, oblong to linear-oblong, 1.5 - 3.5 cm long; bracteoles 2, linear, 5 – 10 mm long; perianth campanulate, 3.5 – 5 mm long, white; lobes 5, triangular-ovate, shortly stipitate, involute. Fruits ellipsoid to subglobose, 2.5 – 3.5 mm long, reticulately nerved.

*Fl. & Fr.* April – Aug.

*Distrib.* India: NW Himalayas, at 2500 - 3500 m altitude. Himachal Pradesh and Jammu & Kashmir.

Pakistan.

*Note.* This species is closely related to *T. himalense* Royle, but distinguishable by the broader leaves, larger flowers and bracts.

**4. *Thesium unicaule*** Haines in J. Asiat. Soc. Bengal, 1919, n. s. 15: 316, t. 10. 1919 (publ. 1920) & Bot. Bihar Orissa 5: 804. 1924.

Herbs, erect, weak, non-parasitic, up to 35 cm high, green; stems solitary, very slender, with fastigiated branches, glabrous. Leaves numerous, alternate, linear or acicular, the lower 2.5 – 3.5 cm long, the upper smaller and bearing flowers in their axils. Flowers: bisexual, sessile in

the axils of bracts, ca 3 mm long; bracts similar to leaves; bracteoles 2, sessile, linear, ca 2 mm long; perianth-lobes 4, fleshy, oblong, ca 3 mm long, white-margined, slightly villous inside and with some hairs behind the anthers; stamens equal to and opposite to the perianth-lobes; ovary inside the hypanthium cup; ovules 1 – 3, minute. Fruits globose to ellipsoid, with two linear bracts adnate to base of leaf below the fruit, becoming bottle-shaped.

*Fl. & Fr.* April – June.

*Distrib.* India: Amidst grasses. Bihar (Chota Nagpur hills).

Endemic.

**5. *Thesium wightianum*** Wall. [Cat. 4037. 1831, nom. nud.] ex Hook.f., Fl. Brit. India 5: 230. 1886.

Herbs, perennial, evergreen, root-parasites, erect, up to 20 cm high; branches slender, short or straggling, arising from a wider root-stock. Leaves linear-lanceolate, acute at apex, sometimes curved inwards, up to 7 mm long, yellowish green. Flowers: solitary, axillary, never terminal, bisexual, white or yellowish white; bracts and bracteoles always shorter than the fruits, sometimes absent; perianth-lobes 5 (or 4), more or less conical, broad at base; stamens glabrous; filaments equal to the perianth-lobes; styles short; stigma capitate. Fruit a nut, spherical, ribbed, crowned by persistent perianth.

*Fl. & Fr.* April – June.

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

Endemic.

*Note.* Chromosome number:  $n = 20$  (Virendrakumar & Subramanyam, Chromosome atlas of flowering plants of the Indian subcontinent, Vol. 1. Dicotyledons, 1986).

#### EXCLUDED SPECIES

***Thesium jarmilae*** Hendrych, in Acta Horti. Bot. Prag. 110. 1962; Grierson & D.G. Long in Fl. Bhutan 1(1): 141. 1983. *T. hookeri* Hendrych var. *jarmilae* (Hendrych) Y.J. Nasir in Fl. Pakistan 159: 5, f. 1, I–K. 1984.

A decumbent herb with 1.5 – 2.5 cm long bracts, 5 – 8 mm long bracteoles, 3 – 4 mm long perianth and 5 – 6 mm long fruits. The type specimens are from Tibet. Grierson & D.G. Long (l. c.) report it at 3300 m altitude from Chumbi Valley in Tibet, adjacent to Sikkim and Bhutan. Nasir (l. c.) treats it as a variety of *T. hookeri* Hendrych and reports it from Chitral, Baltistan and Karakorum hill ranges from 4200 – 4500 m altitudes. No specimen seen from India. Probably it occurs at high altitudes of Kashmir and Sikkim.

#### EXCLUDED GENUS

#### **Champereia** Griff.

*Champereia griffithiana* Planch. ex Kurz occurs in India. Though the genus was included in Santalaceae in Hooker's Fl. Brit. India 5: 236. 1886, it is now generally considered as belonging to the family Opiliaceae by Backer & Bakhuizen (Fl. Java 2, 1965) and by several other workers of Malesia. The genus is treated under the family Opiliaceae in Flora of India, Vol. 5.



## BALANOPHORACEAE

(N. P. Balakrishnan)

Herbs, holoparasitic, glabrous, fleshy with tuberous root-stocks, without chlorophyll and roots, parasitic on roots of trees; stems short, erect, attached by suckers to host root and at the point of contact a cylindrical or subspherical branched or unbranched solid tuber develops. Leaves absent or scale-like. Flowers: minute, actino-morphic or zygomorphic, unisexual, in monoecious or dioecious, globose, ellipsoid or clavate, many-flowered simple or branched spadices, intermixed with bracts or hairs; peduncles stout, simple, annual, arising from tuberous annual or perennial rootstocks. Male flowers: pedicellate or sessile; perianth absent or present, subentire, or (2 -) 3 - 4 (- 8)-lobed; tepals valvate in bud, later spreading and often reflexed, free or connate into a narrow tube shortly split at apex; stamens 3 - 5 or many; filaments absent or fleshy, free or united into a column; anthers connate into a many-loculed head; locules dehiscing by pores or valves or irregularly. Female flowers: sessile, not supported by bracts; perianth absent or shortly 2 - 3-lipped and adnate to ovary, minutely toothed; ovary 1 - 3-loculed; ovule solitary in each cell, pendulous; styles 2 or 1, slender or absent; stigma simple or capitellate. Fruits small, nut-like, 1-seeded achene, indehiscent, crustaceous; seed adherent to pericarp; testa thin, rarely thick or absent; embryo minute, undivided; endosperm copious, oily, densely granular.

Tropical and subtropical regions of the world, mostly in upland forests, 18 genera and ca 44 species; 2 genera and 8 species in India.

*Literature.* HANSEN, B. (1976). Balanophoraceae. In: C.G.G.J. van Steenis (ed.). Fl. Malesiana I, 7: 783 - 805, ff.1 -26. NASIR, Y. J. (1980). Balanophoraceae. In: Nasir, E. & S. I. Ali (eds). Flora of Pakistan 135: 1 - 3.

### KEY TO THE GENERA

- 1 a. Monoecious or dioecious; stems of inflorescences bearing scale-like leaves; young spadices not enveloped by floral bracts; flowers not mixed by hairs; perianth of male flowers 3 - 5-lobed; stamens 3 - 5 or many, connate into an ovoid-globose or flattened column; style 1
- b. Dioecious; stems of inflorescences leafless or sometimes warted; young spadices tightly enclosed by marginally cohering broad peltate floral bracts; flowers mixed by hairs; perianth of male flowers entire or 3-lobed; stamens 3, forming an elongated column; styles 2

#### 1. *Balanophora*

#### 2. *Rhopalocnemis*

### 1. *Balanophora* J.R. Forst. & G. Forst.

(Including *Acroblastum*)

Herbaceous root parasites, monoecious or dioecious (inflorescences bisexual or unisexual), glabrous; rhizome simple or branched, often stellate warty; stems breaking through rootstock within a short cupular sheath. Leaves 2 - 40, whorled, opposite, distichous or spirally arranged, scale-like, sessile by a broad base, accrescent upwards. Inflorescences spadix-like, terminal, enveloped by topmost leaves or not. Male flowers: inserted on the main rachis in axils of short wide truncate bracts, pedicelled; sepals 3 - 5, usually 4, free, valvate in bud, later patent-reflexed; stamens 3 - 5, opposite to tepals or several entirely connate into an ovoid globose or flattened column; filaments short; anthers free or connate; anther-thecae linear, vertical. Female flowers: on numerous crowded minute lateral spadiceles, mixed with club-shaped bodies; sepals

absent; ovary 1-loculed; ovule 1, pendulous; style 1, slender; stigma terminal, small. Fruits minute, crustaceous, indehiscent, nut-like; seeds globose, adhering to pericarp; embryo subglobose, consisting of only 2 or 3 cells.

Madagascar to Japan, S. & S.E. Asia to Australia and Polynesia, in tropical to temperate areas, ca 15 species; 7 in India.

*Literature:* GRIFFITH, W. (1846). On the Indian species of *Balanophora* and on a new genus of the family Balanophoraceae. Trans. Linn. Soc. London 20: 93 – 108, tt. 3 – 8. HANSEN, B. (1972). The genus *Balanophora* J.R. Forster & G. Forster - A taxonomic monograph. Dansk. Bot. Ark. 28: 1 - 188, ff. 1 - 44, tt. 1 - 8. MURATA, J. (1988). Morphology and distribution of *Balanophora fungosa* J.R. et G. Forst. (Balanophoraceae). J. Jap. Bot. 63: 201 – 210, illus.

### KEY TO THE SPECIES (Adapted from Hansen, l. c.)

- 1 a. Plants monoecious, male and female flowers in the same inflorescence 2
- b. Plants dioecious, male and female flowers in different inflorescences 4
- 2 a. Leaves 2 - 4, more or less connate at base, in one whorl at midrib of stem; male flowers mostly 3-merous; anthers transversely opening **6. B. involucreta**
- b. Leaves 6 - 12, free in 2 or more rows above the stem; male flowers 4 - 5-merous; anthers longitudinally opening
- 3 a. Leaves distichous; male flowers sessile, bisymmetric or zygomorphic **1. B. abbreviata**
- b. Leaves spirally arranged, rarely opposite; male flowers pedicellate **3. B. fungosa**
- 4 a. Specimens with male flowers only (flowers at proximal and distal parts of inflorescences not typically developed) 5
- b. Specimens with female flowers only 9
- 5 a. Male flowers mostly 3-merous; anthers 3, transversely opening 6
- b. Male flowers mostly 4 - 6-merous; anthers united into a conspicuous synandrium; thecae longitudinally opening, in some species many times transversely divided 7
- 6 a. Leaves verticillate, in one whorl or more or less connate **6. B. involucreta**
- b. Leaves opposite, decussate, rarely spirally arranged, never verticillate **4. B. harlandii**
- 7 a. Male flowers zygomorphic, 4- or 6-merous, rarely 5- or 7 - 14-merous; lateral tepals narrow, acute, median tepals wide, truncate **7. B. polyandra**
- b. Male flowers actinomorphic, 4- or 5-merous, rarely 3- or 6-merous; tepals all acute or obtusely acute 8
- 8 a. Sepals ovate; synandrium hemispherical; leaves distichous or some-times apparently spirally arranged **2. B. dioica**
- b. Sepals oblong-elliptic to elliptic-lanceolate; synandrium elongated, oblong-elliptic, slightly obconical and somewhat compressed in anterior-posterior direction; leaves always spirally arranged **5. B. indica**
- 9 a. Leaves whorled or opposite and decussate 10
- b. Leaves distichous or spirally arranged 11
- 10 a. Leaves 3 in a whorl, about the middle of the stem, more or less connate **6. B. involucreta**
- b. Leaves 6 - 12, opposite and decussate **7. B. polyandra**
- 11 a. Leaves distichous, densely imbricate **2. B. dioica**
- b. Leaves spirally arranged, not densely imbricate 12
- 12 a. Spadicles without flowers in lower part **4. B. harlandii**
- b. Spadicles with flowers in lower part 13
- 13 a. Female inflorescences ovoid, stem short **7. B. polyandra**
- b. Female inflorescences otherwise shaped, stem various 14
- 14 a. Female inflorescences mostly ellipsoid, basal flowers with style 2.5 - 3 (- 3.5) times longer than ovary **2. B. dioica**

- b. Female inflorescences depressed-spherical, spherical, obovoid or ellipsoid; basal flowers with style (3.5 -) 4 - 5 times longer than ovary

**3. B. fungosa**

**1. *Balanophora abbreviata*** Blume, Enum. Pl. Javae 1: 87. 1827; Arekal & Shivam. in Curr. Sci. 44: 97. 1975. *B. polyandra* auct. non. Griff., 1844: Haines, Bot. Bihar Orissa 5: 806. 1924; Mooney, Suppl. Bot. Bihar Orissa 133. 1950.

Plants monoecious, 5 - 10 (- 15) cm long from the point of fusion with host root to the top of inflorescence; tubers single or several together in a mass, branching from base; single tuber obconical, narrowed at base, broad near top, 1 - 2 cm long, finely granular. Leaves 3 - 7, distichous, slightly imbricate, ovate, obtuse or emarginate at apex, 1 - 2 x 0.7 - 1.5 cm. Male flowers: 10 - 20, in 1 - 2 cm long area below the female portion of spadices, sessile or with ca 1 mm long pedicels; flowers (3 -) 4 - 5 (- 8)-merous, bisymmetric or slightly zygomorphic; tepals 1.5 - 2 mm long, if 4-merous, then the 2 lateral tepals narrow, ovate, acute and 2 median tepals wide, truncate or almost square; synandrium broadly ovoid, ca 1 x 1.5 - 2 mm, laterally compressed; anthers divided into 16 - 20 parallel loculi. Female flowers: in up to 1.5 cm long area at the apex of the main axis of ovoid, ca 1.5 x 1 cm spadices and on lower part of spadices; carpels ovoid or ellipsoid, minute, 300 - 450  $\mu$ m long; the largest flowers with 950 - 1100  $\mu$ m long carpels.

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

*Distrib.* India: Subtropical evergreen forests, 500 - 1000 m. West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, Orissa, Karnataka and Andaman Islands.

Africa (Congo, Madagascar), Nepal, Bhutan, SW. China, Vietnam, Thailand and Myanmar to Malesia, up to Tahiti Islands.

**2. *Balanophora dioica*** R.Br. ex Royle, Ill. Bot. Himal. Mts. 1: 330. 1836; 2: t. 79 ('99 or 78a'). 1839; Hook.f., Fl. Brit. India 5: 237. 1886. *Cordyceps racemosa* Berkeley in Hooker's J. Bot. Kew Gard. Misc. 6: 212, t. 8, f. 3. 1854.

Plants dioecious (inflorescences unisexual), ochre-yellow to brown or red purple, 5 - 15 (- 25) cm high from the point of fusion with host root; tubers single or several together in a lobed mass, branching or lobed from base; single tuber 0.5 - 2.5 cm wide, subspherical. Leaves 5 - 10, distichous, rarely spirally arranged, imbricate and much appressed, oblong, obtuse or emarginate at apex, sheathing at base, 1 - 2.5 x ca 1 cm. Spadices unisexual, fleshy, ellipsoid or clavate, 1.5 - 4.5 x 1 - 1.5 cm; bracts surrounding flowers linear-lanceolate. Male flowers: sessile or shortly pedicelled, actinomorphic; pedicels 5 - 9 mm long; tepals 4 or 5 (- 6), valvate in bud, patent-reflexed when fully open, ovate, ca 2 x 1 mm, concave, fleshy; synandrium hemispherical, 0.5 - 1 x 1 - 1.5 mm; anthers 4 or 5, 2-loculed, conduplicate, horseshoe-shaped with 2 halves folded towards each other; locules opening longitudinally by curved slit. Female flowers: on main axis of spadices or on lower part of spadices; spadices 1000 - 1050  $\mu$ m long, with the lower two-third cylindrical, 150 - 200  $\mu$ m wide, upper one-third obovate, truncate, 420 - 470  $\mu$ m wide; tepals absent; stigma flat, white, papillate with slightly protruding cells at top; cuticular ridges of cells on top part low, but conspicuous; largest flowers with pistils ca 1150  $\mu$ m; carpels ellipsoid, about 440 x 200  $\mu$ m. Fruits minute; seeds adherent to pericarp.

*Fl. & Fr.* Sept. - Feb.

*Distrib.* India: Tropical and subtropical Himalayas, common in Meghalaya, between 500 - 2500 m. Sikkim, West Bengal, Assam, Arunachal Pradesh and Meghalaya.

Nepal, Bhutan, Myanmar and China.

*Note.* Sharma (J. Econ. Taxon. Bot. 26: 103 – 104, f. 1. 2002) reports this species from Delhi, having collected it from Hamdard University Campus growing on the roots of *Pithecellobium dulce* (Roxb.) Benth.

**3. *Balanophora fungosa*** J.R.Forst. & G.Forst., Char. Gen. Pl. 99, t. 50. 1775; Hansen in Dansk Bot. Ark. 28: 100, f. 19. 1972.

Plants monoecious (inflorescence bisexual), pale yellow to orange-yellow or brown, sometimes with pinkish tinge, 6 - 12 cm high from point of fusion or in a mass, 10 - 15 cm wide, branching from base; single tuber subspherical or depressed, ca 1.5 x 2.5 cm, granular with stellate warts on surface; stems 2.5 - 11 cm long. Leaves 15 - 30, spirally arranged, rarely subopposite, imbricate, obtuse, slightly cucullate, 2 - 3 x 1.5 - 2 cm. Male flowers: 2 - 20 in 0.5 - 1 cm high zone just below the female part of spadices, 4 or 5-merous, actinomorphic; bracts truncate, rudimentary, 1 - 2 mm long; pedicels 3 - 7 mm long; tepals ovate-elliptic; synandrium ovoid to ellipsoid, slightly compressed, elevated on 0.5 - 1 mm long torus; anthers 4 or 5, horseshoe-shaped. Female flowers: many on main axis and a few also on lower part of spadices; spadices ovoid or subspherical, 1 - 3.5 x 1.5 - 3 cm; spadicles 1100 - 1150  $\mu\text{m}$  long, or with a cylindrical 100  $\mu\text{m}$  wide lower part and an obconical 170 - 240  $\mu\text{m}$  wide upper part; cuticular ridges of top cells small and inconspicuous, present only where cells border each other; largest female flowers with ca 1250  $\mu\text{m}$  long pistils; carpels ca 400  $\mu\text{m}$  long.

*Fl. & Fr.* June - Jan.

*Distrib.* India: Dense primary rain forests, up to 1000 m. Manipur.

China, Japan (Ryukyu Islands), Indonesia, Philippines, New Guinea, NE. Australia and Pacific Islands.

**4. *Balanophora harlandii*** Hook.f. in Trans. Linn. Soc. London 22: 426, t. 75. 1859.

Plants dioecious (inflorescences unisexual), (6 -) 10 - 16 (- 20) cm long from point of fusion with host root; tubers in a mass branching from the base; single tuber 1 - 2.5 cm wide; stems slender, 7 - 10 mm thick. Leaves at the lower one-third to two-third part decussate in (3 -) 5 - 10 (- 17) pairs or subopposite or spirally arranged, imbricate or not, 2.5 - 4.5 x 1.5 - 2.5 cm. Male flowers: spadices ovoid or ellipsoid, 1.8 - 2.5 (- 4.5) x 1.5 - 2 cm; bracts one for each flower, several fused together forming a number of hexagonal pits, from bottom of which the flowers arise; pedicels (3 -) 5 - 7 mm long; flowers 3-merous; tepals up to 2.5 x 4.5 mm; anthers forming a flat depressed synandrium, transversely dehiscent. Female flowers: on main axis of spadices only; spadices subspherical to ovoid or ellipsoid, 1.5 - 2.5 x 1 - 2 cm; spadicles obconical, truncate, 3 or 4 times longer than wide, 730 - 960  $\mu\text{m}$  long, 70 - 120  $\mu\text{m}$  wide at base, 270 - 500  $\mu\text{m}$  wide at top; cuticular ridges mostly absent; largest flowers with ca 690  $\mu\text{m}$  long pistils and ca 170  $\mu\text{m}$  long carpels.

*Fl. & Fr.* July - Feb.

*Distrib.* India: At about 2300 m altitude in Nagaland.

China, Japan, Taiwan and Thailand.

*Notes.* The only hosts recorded so far are *Ficus* spp.

**5. *Balanophora indica*** (Arn.) Griff. in Trans. Linn. Soc. London 20: 95. 1846; Hook.f., Fl. Brit. India 5: 237. 1886; Gamble, Fl. Madras 2(7): 1263. 1925 (repr. ed. 2: 885. 1957). *Langsdorffia indica* Arn. in Ann. Nat. Hist. 2: 37. 1838. *Balanophora fungosa* ssp. *indica* (Arn.) Hansen in Dansk Bot. Ark. 28: 100, f. 20. 1972. *B. elkinsii* Blatt. in J. Bombay Nat. Hist. Soc. 33: 309, illus. 1929. *B. dioica* auct. non R.Br. ex Royle, 1839: sensu Gamble, l. c. 1263. 1925 (repr. ed. 2: 885. 1957).

Plants dioecious (inflorescences unisexual), yellow to orange-yellow or pink, 2 - 26 cm high; tubers single or sometimes branched from base, subspherical to cylindrical, 5 - 25 cm wide; stems elongated, covered by scaly leaves. Leaves 10 - 27, spirally arranged, closely imbricate, elliptic, ovate to suborbicular, slightly cucullate, broad at base, obtuse or truncate at apex, 2.5 - 3.5 x 1.5 - 2 cm, golden yellow, purple or orange, glabrous. Male flowers: spadices ovoid, obovoid to ellipsoid or cylindrical, 2 - 7 (- 10) x 2 - 6 (- 7) cm, fleshy; flowers (3 -) 4 - 5 (- 6)-merous, actinomorphic; bracts one for each flower, 5 or 6-angular, truncate, ca 5 x 4 mm; pedicels 7 - 22 x 2 - 4 mm; sepals 4 or 5, oblong-elliptic, cucullate, 7 - 10 x 2.5 - 4 mm, fleshy; synandrium slightly compressed, obconical, oblong-elliptic, 16 - 22-ridged, 2.5 - 7 x 2 - 4 mm; anthers (3 -) 4 - 5 (- 6), horseshoe-shaped; pollen grains 3-porate, spheroidal, triangular with semicircular curved aperture membranes in polar view, 10 - 22  $\mu$ m in diam. Female flowers: spadices subglobose, depressed, ellipsoid or obovoid, 1 - 7 x 1 - 5 (- 8) cm, bright red or purple; flowers on main axis of spadices as well as on cylindrical spadices; cuticular ridges all over the surface; perianth absent; largest flowers with pistils 1500 - 1900  $\mu$ m long; carpels 250 - 500  $\mu$ m long, 150 - 350  $\mu$ m wide.

India, Thailand, Indo-china, Hainan, Malaya, Sumatra, Pacific Islands and Australia (Queensland), 5 varieties; 4 in India.

#### KEY TO THE VARIETIES

- 1 a. Tubers consisting of elongated cylindrical repeatedly branching parts from an entangled mass; single tubers cylindrical, 9 - 13 mm long; leaves 1.2 - 1.7 cm long, 0.8 - 1.1 cm wide; pedicels 5 - 8 mm long **5.3. var. minor**
- b. Tubers in a mass apparently shortly branched from one point; single tubers subspherical, 0.5 - 10 cm across; leaves 2 - 3 cm long, 1.5 - 2 cm wide; pedicels 7 - 10 mm long 2
- 2 a. Single tubers up to 6 cm long and wide; leaves up to 3 cm long and 2 cm wide; female spadices oblong, obovoid to ellipsoid, 2 - 6 cm long, 1 - 4 cm wide; synandrium up to 2 mm wide **5.2. var. indica**
- b. Single tubers up to 10 cm long and wide; leaves up to 5 cm long and 3 cm wide; female spadices globose or subglobose, 4 - 5 cm across; synandrium up to 4 mm wide 3
- 3 a. Plants 9 - 13 cm high; leaves broadly elliptic to oblong-lanceolate, up to 5 cm long; number of leaves 10 - 20; male spadices up to 3.5 x 4.5 cm; male bracts 5-angled, 3 - 4 x ca 3 mm **5.1. var. agastyamalayana**

- b. Plants 20 - 26 cm high; leaves suborbicular to orbicular, up to 3 cm long; number of leaves 21 - 27; male spadices up to 14 x 7.5 cm; male bracts 6-angled, 7.5 - 13 x 5 - 8 mm

**5.4. var. *tirunelveli*ensis**

**5.1. var. *agastyamalayana*** M.B.Viswan., Prem Kumar & N. Ramesh in Rheedea 10: 121. f. 1. 2000.

*Fl.* Jan. - May.

*Distrib.* India: Evergreen tropical to subtropical forests of southern Western Ghats, at about 1200 m altitude. Tamil Nadu.

Endemic.

*Notes.* Parasitic on roots of *Euonymus dichotomus*.

**5.2. var. *indica***

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

*Distrib.* India: Evergreen subtropical forests, in shaded forest floors, between 500 - 2500 m; NE. India and W. Ghats of Peninsular India. Assam, Manipur, Andhra Pradesh, Mahara-shtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka, Bangladesh, Myanmar, SW. China, Vietnam, Laos, Thailand, Malaysia, Indonesia, Philippines, Australia and Pacific Islands.

**5.3. var. *minor*** Eichler in DC., Prodr. 17: 145. 1873. *Balanophora fungosa* ssp. *indica* var. *minor* (Eichler) Hansen in Dansk Bot. Ark. 28: 106, f.22. 1972.

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

*Distrib.* India: Evergreen subtropical forests, 1500 - 2000 m. Tamil Nadu.

Thailand.

*Notes.* Parasitic on roots of *Litsea* sp., *Millettia* sp., *Pithecellobium* sp., etc.

**5.4. var. *tirunelveli*ensis** M.B.Viswan., Prem Kumar & N. Ramesh in Rheedea 10: 123, f. 2. 2000.

*Fl. & Fr.* Jan. - May.

*Distrib.* India: Evergreen tropical or subtropical forests of southern Western Ghats, at about 1200 m altitude. Tamil Nadu.

Endemic.

*Notes.* Parasitic on *Euonymus dichotomus*.

**6. *Balanophora involucrata*** Hook.f. in Trans. Linn. Soc., London 22: 30, 44, tt. 4 - 7. 1856 & Fl. Brit. India 5: 237. 1886.

Plants monoecious or dioecious (inflorescences bisexual or unisexual), erect, fleshy, glabrous, yellowish white to yellow or red, 8 - 15 (-20) cm long from fusion point with host root;

tubers in a mass, up to 10 cm in diam., branching from base; single tuber urceolate with more or less irregularly lobed rim, 3 - 5 x 1.5 - 2 cm. Stems stout, bursting through the rootstock, sheathed halfway by 2 - 4 verticillate scaly leaves in one whorl at the middle of the stem, partially connate, ovate, 2 - 3 x 1 - 1.5 mm. Spadices unisexual or bisexual, ovoid or subglobose, 2 - 3.5 x 1 - 2 cm, red or yellow. Male flowers in bisexual spadices confined to a zone of about 5 mm high, just below the female portion or when unisexual, the spadices ovoid, 1 - 3.5 x 0.9 - 3.5 cm; bracts short, truncate or in unisexual flowers connate together, forming more or less hexagonal alveoles from the bottom of which male flowers appear; pedicels 2 - 7 mm long; perianth limb lobes 3 (4 or 5), broadly ovate-obtuse, ca 1.7 mm long, thick; synandrium subglobose, much depressed; anthers 4, transversely oblong. Female flowers: spadices ovoid, 1 - 2 x 0.8 - 2; spadices obconical; flowers on main rachis of inflorescences only, numerous, interspersed with globulate or clavate bracts, 0.5 - 0.8 mm long; cuticular ridges on top cells narrow, forming complicated labyrinth-like system; ovary ovoid, compressed, ca 0.2 mm long; largest flowers with pistils up to 700  $\mu$ m long; carpels ca 200  $\mu$ m long.

*Fl.* June - Oct., *Fr.* July - Dec.

*Distrib.* India: Cool montane coniferous forests, 1500 - 4500 m on Himalayas from Kashmir to NE. India and Peninsular India.

Nepal, Bhutan, Tibet, China to E. Asian subcontinent.

*Notes.* Parasitic on *Acer* spp., Araliaceae, *Berberis* spp., *Rhododendron* spp., *Quercus* spp., *Pinus* spp., *Rubus* spp., etc. The rootstock forms large woody knots on tree roots, which find use for making drinking cups in Bhutan and Sikkim.

**7. *Balanophora polyandra*** Griff. in Proc. Linn. Soc. London 1: 220. 1844; Hook.f., Fl. Brit. India 5: 238. 1886. *Acroblastum ambavanense* Reddi in Willdenowia 5: 389, f.1. 1969.

Plants dioecious (inflorescences unisexual), brick red, (5 -) 8 - 15 (- 25) cm long from point of fusion with host root; tubers several together in a mass, branching from the base; single tubers subspherical, 1.5 - 2.5 cm across, granular with scattered stellate warts. Leaves 6 - 12, opposite, decussate in 4 rows, or sometimes very densely set and apparently spirally arranged, elliptic-lanceolate. Male flowers: spadices ellipsoid, 3 - 7 (- 12) cm long, 1 - 2 (- 3) cm thick; pedicels short, up to 2 mm long; bracts very short and inconspicuous; flowers zygomorphic due to lateral elongation, 4- (5 - 6)-merous; main tepals 2 in normal 4-merous flowers, wide and truncate or almost square; lateral tepals 2, ovate, acute; in some cases both median tepals bipartite making the flowers 5 or 6-merous; synandrium broad, laterally much elongated, somewhat flat-topped; anther locules many times transversely divided into 20 - 60 smaller locelli, each about 2 times longer than wide. Female flowers: spadices ovoid or ellipsoid, 2 - 4 (- 7) x 1 - 2.5 (- 3) cm; spadices large, 1500 - 2300  $\mu$ m long with a cylindrical basal part, about half to three-fourth the total length, 230  $\mu$ m wide; head broadened, truncate, obovate, 800 - 900  $\mu$ m wide; cuticular ridges of top cells absent; largest flowers with pistils up to 2200  $\mu$ m long and carpels ca 700  $\mu$ m long and 380  $\mu$ m wide.

*Fl. & Fr.* Aug. - Feb.

*Distrib.* India: Subtropical forests, 1000 - 3000 m. Sikkim, West Bengal, Assam, Arunachal Pradesh, Nagaland, Manipur and Maharashtra.

Nepal, Bhutan, Myanmar, SW. China.

## 2. *Rhopalocnemis* Jungh.

Plants dioecious or monoecious (inflorescences bisexual or unisexual) with a large basal tuber at the point of contact with the host root; tuber starchy, irregularly corrugated; stems breaking through the outer tissue of the tuber, which in turn forms a conspicuous irregularly lobed sheath around the base of the stem, leafless or with spirally arranged slightly curved warty scales. Inflorescences spadix-like, ellipsoid or cylindrical, unisexual or bisexual, when young covered by flattened, marginally cohering tips of hexagonal peltate bract-like scales which are caducous in flakes at anthesis; the central area of scale often developing a wart or a slightly recurved structure much resembling the scales on lower part of stem; flowers mixed with numerous hairs. Male flowers: with tubular perianth adnate to ovary, entire or shortly and irregularly splitting or apparently irregularly 4-lobed; stamens 3, forming a column and a synandrium of anthers united into a columnar head containing many thecae in 2 or 3 layers. Female flowers: with perianth adnate to the ovary and forming 2 low lips at the top of the ovary, one anterior and another posterior, alternating with 2 slender caducous styles; ovary 2-lobed, slightly compressed in anterior-posterior direction; styles 2, slender; stigma capitate.

Eastern Himalayas, Indo China and Malaysia. Monotypic.

***Rhopalocnemis phalloides*** Jungh., Nov. Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 18 (Suppl. 1): 215. 1841; Hook.f., Fl. Brit. India 5: 239. 1886. *Phaeocordylis areolata* Griff. in Proc. Linn. Soc., London 1: 219–220. 1844 & Trans. Linn. Soc., London 20: 100, t. 8. 1846.

Plants yellowish with brownish heads, (3 -) 5 - 12 (- 15) cm high; tubers 6–13 x 6–20 cm, hard and strongly irregularly corrugate on surface; basal sheath around stem 1 - 5 cm long, irregularly lobed. Stem below spadix cylindrical, 2 - 8 x 2 - 5 cm, without or with spirally arranged slightly recurved warty scales. Spadices elongate-oblong, 7 - 20 x 3 - 7 cm; bract-scales peltate, 4 - 5 mm across at top part, central part often developing a recurved tubercle resembling the scales on lower part of stem. Male flowers: sessile, surrounded by numerous supporting nectariferous hairs; bisexual plants always with male flowers in lower part; staminal column exserted, 8 - 10 mm long. Female flowers: mostly minute; styles bent down beneath the bracts, projecting as minute hairs when released.

*Fl. & Fr.* July - Sept.

*Distrib.* India: Humid forests of mountains, 1000 - 2500 m. Sikkim, Arunachal Pradesh and Meghalaya.

Nepal, Bhutan, China, Thailand, Vietnam and Malesia.



## BUXACEAE

(T. Chakrabarty & N. P. Balakrishnan)

Trees, shrubs, rarely subshrubs or perennial herbs, monoecious or dioecious, mostly glabrous, evergreen. Leaves alternate or opposite, simple, entire, rarely toothed, penninerved or rarely 5- or 3-nerved. Inflorescences mostly axillary, rarely pseudo-terminal, cymose fascicles, dense-flowered spiciform racemes, rarely head-like or flowers solitary; flowers unisexual or rarely a few bisexual, actinomorphic, each in axil of a bract, shortly pedicelled or sessile, with male flowers more numerous than female flowers, sometimes male flowers in capitate clusters (in *Simmondsia*). Male flowers: sepals usually 4, 5 or 6, rarely absent, often basally short connate; petals and disc absent; stamens 4 - 6, rarely 10 - 12, when 4 then opposite to sepals, when 6 two pairs opposite to inner sepals; anthers large, oblong, basifixed, sessile or borne on fairly long filaments; thecae dehiscing longitudinally by 2 valves; pistillode present or absent. Female flowers: often solitary or in 2 - 7-flowered pendulous racemes, often pedicellate; sepals as in male; staminodes absent; ovary superior, mostly 3-locular, sometimes 2- or 4-locular; ovules 1 or 2 per locule, on axile placentation, pendulous or patent from apex or axis, anatropous, with a dorsal raphe, bitegmic, crassinucellate; styles (2 -) 3 (- 4), free or basally connate, contiguous or widely separated and undivided, persistent; stigmas decurrent. Fruits capsular and loculicidally dehiscent, sometimes explosively, or occasionally fleshy, berry-like and indehiscent; seeds 1 or more, compressed, often glossy black, sometimes with a caruncle; endosperm fleshy, copious, rarely absent (in *Simmondsia*); embryo straight, linear, terete; cotyledons flat or thick.

Warm temperate and subtropical regions of both hemispheres, showing disjunct distribution, mostly in eastern Asia (Japan, China, Indo-china and N.E. India), scarce in eastern America to Andes, absent in Polynesia and Australia, 4 genera and ca 70 species; 2 genera and 8 species indigenous and one genus with one species cultivated in India.

*Literature.* CHAKRABARTY, T. & N. P. BALAKRISHNAN (2005). The family Buxaceae in the Indian subcontinent. *J. Econ. Taxon. Bot.* 29: 173 – 186, t. 1.

### KEY TO THE GENERA

- 1 a. Plants dioecious; male flowers with 4 or 5 sepals; stamens 10 - 12; rudimentary pistil absent in male flowers (Cult.) **Simmondsia**
- b. Plants monoecious; male flowers with 4 or 6 sepals; stamens 4 - 6; rudimentary pistil present in male flowers 2
- 2 a. Leaves opposite; female flowers in upper part of the racemes or flower-clusters, above the male flowers; fruits loculicidally dehiscent capsules, 6-seeded; seeds with caruncle **1. Buxus**
- b. Leaves alternate; female flowers at the base of the racemes, below the male flowers; fruits subdrupaceous, indehiscent, 3-seeded; seeds without caruncle **2. Sarcococca**

### 1. *Buxus* L.

Shrubs or dwarf trees, monoecious, evergreen, glabrous. Leaves opposite, sessile or subsessile, entire, penninerved, coriaceous. Inflorescences axillary spikes, short, dense-flowered; bracts often numerous, like sepals but smaller; flowers solitary in each bract, sessile or pedicellate, the terminal one often female, the remainder male. Male flowers: sepals 4 - 6, 2-seriate, imbricate, unequal; stamens 4 - 6, opposite to sepals; filaments inserted on receptacle around the pistillode, free, exserted; anthers dorsifixed near the base, oblong at length, recurved; connective thick;

anther-thecae introrse, parallel, opening by longitudinal slits; pistillode truncate or 3-lobed, rarely absent. Female flowers: sepals 4 - 6, 2-seriate, imbricate, outer ones smaller; ovary tricarpellary, 3-locular; ovules 2 in each locule, pendulous from outer angle of the locule; styles 3, short, thick, distant or rarely contiguous at the base. Fruits capsular, ovoid, 3-horned at apex formed by the persistent styles, coriaceous, loculicidally dehiscent into 3, 2-seeded and 2-horned valves; seeds oblong, somewhat 3-sided, carunculate; testa shiny black; endosperm rather fleshy; cotyledons oblong.

Old World, West Indies, North and Central America, temperate and subtropical areas, absent from E. Pacific and Australia, ca 50 species; 3 species in India.

*Literature.* HATUSIMA, S. (1942). A revision of the Asiatic *Buxus*. J. Dept. Agric. Kyushu Imp. Univ. 6: 261 - 341, tt. 16 - 27. PURI, G. S. (1948). The genus *Buxus* in Pleistocene of Kashmir. Indian Forester 74: 354 - 357.

#### KEY TO THE SPECIES

- 1 a. Dwarf shrubby plants; leaves elliptic or subspathulate, 5 - 12 mm long **1. *B. microphylla***  
 b. Tall shrubby plants; leaves oblong-lanceolate, 2.5 - 7.5 cm long **2**
- 2 a. Young branches hoary pubescent; leaves finely hairy to glabrous, whitish-papil- late below with inconspicuous nerves; horns of fruits erect **2. *B. papillosa***  
 b. Young branches hirsute with spreading hairs; leaves glabrous except the hirsute midrib and petiole, not whitish-papillate, but with conspicuous nerves; horns of fruits divergent **3. *B. wallichiana***

**1. *Buxus microphylla*** Siebold & Zucc., Fl. Jap. 34. 1836 & in Abh. Akad. Muench. 4(2): 142. 1846. *B. sempervirens* L. var. *microphylla* (Siebold & Zucc.) Hook.f., Fl. Brit. India 5: 267. 1887. *B. japonica* Müll.Arg. var. *microphylla* (Siebold & Zucc.) Müll.Arg. in DC., Prodr. 16(1): 20. 1869.

Stunted shrubs, 1.5 - 2 m high; branchlets sparsely and minutely brown pubescent when young, soon glabrous. Leaves broadly elliptic, suborbicular, orbicular-spathulate to spathulate-oblong or sometimes oblong, acute at base, decurrent into petioles, rounded and mucronulate at apex, 5 - 12 x 3 - 8 mm, coriaceous, glabrous or minutely brown pubescent on midrib above; lateral nerves inconspicuous; petioles 1.5 - 3 mm long, flat, minutely brown pubescent. Inflorescences axillary, glomerate; bracts suborbicular, ca 0.7 x 0.5 mm, thin. Male flowers: sessile; sepals 2 + 2, thin, suborbicular, ca 1 x 1 mm, glabrous; stamens 4; filaments ca 1 mm long; anthers oblong, ca 1 mm long; pistillode minute. Female flowers: sepals 3 + 2 - 3, suborbicular, thin, ca 1.5 x 1.2 mm, glabrous; ovary trigonous, ca 1 mm in diam.; styles 3, ca 1 mm long; stigmas suborbicular. Fruits subglobose, 7 - 10 x 7 - 9 mm, walnut brown; horns 3, erect, 3 - 5 mm long; seeds compressed-ovoid, pointed at apex, ca 5 mm long, black, glossy.

*Fl. & Fr.* June - Sept.7

*Distrib.* India: On dry rocks at 3500 - 4000 m altitudes. Uttarakhand.

Japan and Taiwan.

**2. *Buxus papillosa*** C.K.Schneid., Ill. Handb. Laubholz. 2: 139. 1907; Bor, Man. Indian For. Bot. 108. 1953. *B. sempervirens* auct. non L., 1753; Hook.f., Fl. Brit. India 5: 267. 1885, p. p.

Eng.: Box-wood Tree.

Undershrubs, shrubs or small trees, monoecious, up to 3 m tall; stems crooked; branchlets brown hirtellous, glabrous later on. Leaves opposite, subsessile, ovate, narrowly oblong-lanceolate, linear-lanceolate or narrowly elliptic-oblong, rounded and attenuate at base, decurrent into a minute petiole, acute to obtuse, rounded or retuse at apex, entire, 2.5 - 7.5 x 0.8 - 1.5 cm, coriaceous, glabrous above, white papillate and minutely hairy or glabrescent beneath; venation indistinct; petioles 1 - 3 mm long, puberulous. Inflorescences axillary, 8 - 12 mm long, few-flowered racemose spikes or glomerules, with sessile flowers, the terminal flower usually female, surrounded by closely arranged male flowers. Male flowers: sepals 4 (2 + 2), oblong or suborbicular, bilobed at apex, 2 - 3 x 1 - 2 mm; stamens 4 or 5, exserted; filaments ca 1.5 mm long; anthers ca 1.5 mm long, 3 times as long as broad; pistillode ca 1.5 mm long or absent. Female flowers: sepals 6, in 2 or 3 series, broadly oblong to suborbicular, 2 - 3 x 1.5 - 2 mm, outer ones smaller; ovary 3-locular, ca 2 mm long, the three corners ending in thick short up to 1 mm long styles. Fruits oblong-ovoid, 3-locular, 3-horned, woody, wrinkled, 7 - 10 x 7 - 12 mm, walnut brown; horns 2 - 3 mm long, upright; seeds 3 - 6, oblong-ovoid, obscurely trigonous, ca 5 x 3 mm, smooth with vertical fissures, shiny black.

*Fl. & Fr.* (Feb.-) March - May (-Aug.)

*Distrib.* India: Hot dry slopes, in temperate hills, at 1200 - 3000 m altitude, sometimes cultivated as hedge plant in plains. Himachal Pradesh, Uttarakhand, Sikkim, Meghalaya and Tamil Nadu.

Pakistan, Nepal and Bhutan.

*Uses.* Wood yellowish white, used for engraving, turning, carving and for making mathematical instruments.

**3. *Buxus wallichiana*** Baill., Monogr. Buxac. 63. 1859. *B. sempervirens* auct. non L., 1753: Hook.f., Fl. Brit. India 5: 267. 1885, p. p.

Hindi: *Chikri*.

Shrubs or trees, 3 - 10 (- 15) m tall; branchlets of young shoots 4-angled, hirsute to puberulous with spreading hairs when young. Leaves oblong-elliptic, lanceolate to oblanceolate or narrowly obovate to linear-lanceolate, cuneate at base, obtuse or apiculate at apex, (1.5 -) 3.5 - 6 x 0.7 - 1.8 cm, coriaceous, glabrous except the hirsute midrib above and petiole; lateral nerves numerous, distinct; petioles 1 - 2 mm long. Inflorescences axillary, spicate to glomerate; flower clusters rounded, 5 - 8 mm in diam. Male flowers: sessile; sepals 2 + 2, broadly oblong to suborbicular, 2 - 3 x 1.5 - 2 mm; stamens 4 or 5; filaments ca 2 mm long; anthers oblong, ca 1.5 mm long; pistillode small. Female flowers: sessile; sepals 3 + 3, suborbicular, 2 - 3 x 1.5 - 2 mm, thin; ovary ellipsoid, 2 - 3 mm in diam.; styles 3, ca 1 mm long. Fruits oblong-ellipsoid to subglobose, 7 - 10 x 5 - 6 mm, walnut brown; horns 3, divergent, 2 - 3 mm long; seeds compressed-ovoid, ca 5 x 3 mm, black, glossy.

*Fl. & Fr.* Dec. - March (-May).

*Distrib.* India: Temperate regions of W. Himalayas, in moist areas, preferring shaded situations, at 1300 - 3000 m altitudes. Jammu & Kashmir (Jammu region), Himachal Pradesh and Uttarakhand.

Afghanistan, Pakistan, Nepal, Bhutan and Myanmar.

*Uses.* Provides timber of silky texture, even-textured and works to an ivory finish. It is used for making croquet balls, geometrical and musical instruments, snuff boxes, combs and fine carvings on cabinet work. Reports indicate that the leaves are fatal to cattle.

#### EXCLUDED SPECIES

**Buxus rugulosa** Hatus. var. **prostrata** (W.W.Sm.) M. Cheng in Fl. Republ. Popularis Sin. 45(1): 27. 1980. *B. microphylla* Siebold & Zucc. var. *prostrata* W.W.Sm. in Notes Roy. Bot. Gard. Edinburgh 10: 16. 1917. *B. rugulosa* var. *intermedia* Hatus. in J. Dept. Agric. Kyushu Imp. Univ. 6: 305, f. 15 c-j, t. 8, f. 1. 1942.

This variety native of Nepal and W. China, has been reported from Kumaon hills of Uttarakhand by Hatusima (1942). However, there is no subsequent report from the area nor seen any specimen from India. Hence, it is doubtful whether it really occurs in India.

**Buxus sempervirens** L. Sp. Pl. 2: 983. 1753.

A much-branched evergreen shrub of northern temperate zone of Europe and Asia is commonly cultivated as hedge plant in Cinchona plantations in Nilgiri hills of Tamil Nadu and Simla of Himachal Pradesh of Western Himalaya.

## 2. *Sarcococca* Lindl.

Evergreen shrubs or small trees, monoecious. Leaves simple, alternate, exstipulate, coriaceous, glossy, usually adaxially decurrent into petioles at the extreme base, entire along margins (in Indian species), penninerved or weakly (3 -) 5-nerved at base (basal pair of lateral nerves frequently slightly stronger than the subsequent pairs and ascending up to 90% way up the lamina); lateral nerves slender, brochidodromous; nervules usually faint; petioles channelled above. Inflorescences axillary, either more or less compact clusters or erect spikes, up to 2.5 cm long, unisexual or bisexual, the uppermost pseudo-terminal; flowers solitary in each bract, male and female flowers either in same inflorescence with male towards apex and females at base or in different glomerules with the females at the base of the raceme, with a solitary male at top, apetalous; bracts 2 in male but several in female flowers. Male flowers: sessile or shortly pedicellate, small; 2-bracteate and bracteolate or ebracteolate; sepals 4 - 6, in 2 series, imbricate, similar to bracteoles, persistent; petals absent; stamens 4 - 6, opposite to sepals, free; filaments inserted on receptacle around vestiges of pistillode, exerted; anthers oblong, introrse, 2-loculed, versatile, dehiscent longitudinally; pistillode urn-shaped or cupular. Female flowers: sessile or shortly pedicellate, small, bracteolate or ebracteolate; sepals 4 - 6, often indistinguishable from the bracteoles, imbricate; ovary bi- or tricarpellary, 2 or 3-locular; locules biovulate; styles 2 or 3, connate below into a column, free, persistent. Fruits baccate, indehiscent, fleshy or somewhat dry; endocarp bony; seeds 1 or 2 per fruit, globose or hemispherical; testa crustaceous, brownish or black; albumen fleshy; cotyledons thick, flat.

Afghanistan, Pakistan, through Indian subcontinent to Central China and Sri Lanka, extending to South-east Asia, up to Philippine Islands, about 11 species; 4 species in India.

*Notes.* Species of this genus are sometimes difficult to separate from each other because of the very narrow differences. It was not possible to separate *S. brevifolia* and *S. zeylanica*

from *S. coriacea* due to too many intermediate characters and therefore these species are united herein.

In Index Nominum Genericorum, *S. pruniformis* Lindl. is given as the type species of the genus *Sarcococca* Lindl. Since the name *S. pruniformis* is illegitimate being composed of two species, *S. saligna* and *S. coriacea*, both of which antedate *S. pruniformis*, Sealy (l. c. 118. 1986) proposes *S. coriacea* (Hook.) Sweet as the type species of the genus *Sarcococca* Lindl.

*Literature:* SEALY, J. R. 1986. A revision of the genus *Sarcococca* (Buxaceae). Bot. J. Linn. Soc. 92: 117 – 159, ff. 1 – 7.

#### KEY TO THE SPECIES

- |   |   |
|---|---|
| 1 a. Ovary and fruits 2-locular   | <b>1. <i>S. coriacea</i></b>                      |
| b. Ovary and fruits 3-locular   | 2   |
| 2 a. Branchlets puberulous  | 3   |
| b. Branchlets glabrous  | 4   |
| 3 a. Leaves (1.5 -) 2 - 3.5 (- 4) cm broad, caudate at apex; cauda 10 - 30 mm long; female flowers 5 – 6 mm long; female sepals 5 or 6, 3 – 4 mm long   |   |
|   | <b>4.2. <i>S. wallichii</i> forma membranacea</b> |
| b. Leaves (0.5 -) 1 – 2 (- 2.5) cm broad, acuminate at apex; acumen 5 - 10 mm long; female flowers 7 – 9 mm long; female sepals 4 (- 5), 2 – 2.5 mm long  | <b>2. <i>S. hookeriana</i></b>                    |
| 4 a. Leaves 1.5 - 4 cm broad; male flowers ebracteate; male sepals 3 – 4.5 mm long; filaments 6 – 8.5 mm long; female flowers 7 - 9 mm long with 3 - 4 pairs of separated bracteoles; seeds ca 8 x 5 mm                       | <b>4.1. <i>S. wallichii</i> forma wallichii</b>   |
| b. Leaves 1 – 2.5 cm broad; male flowers usually bracteolate; male sepals 2.5 – 3.5 mm long; filaments 4 – 7 mm long; female flowers 4 - 6 mm long with (3 -) 4 or 5 (- 6) pairs of imbricating bracteoles; seeds ca 6 x 4 mm | <b>3. <i>S. saligna</i></b>                       |

**1. *Sarcococca coriacea*** (Hook.) Sweet, Hort. Brit., ed. 1, 491. 1826. *Pachysandra? coriacea* Hook., Exot. Fl. 2: t. 148. 1825. *Sarcococca pruniformis* Lindl. in Bot. Reg. 12: t. 1012. 1826 (var. *latifolia* Lindl.); Hook.f., Fl. Brit. India 5: 266. 1887, p. p.; Kanjilal et al., Fl. Assam 4: 134. 1940. *S. trinervia* Wight, Icon. Pl. Ind. Orient. 5: 22, t. 1877. 1852; Gamble, Fl. Madras 2: 1264. 1925 (repr. ed. 2: 885. 1957). *S. saligna* var. *brevifolia* Müll.Arg. in DC., Prodr. 16(1): 12. 1869. *S. pruniformis* var. *brevifolia* (Müll.Arg.) Hook.f., l. c. 267. 1887. *S. brevifolia* (Müll.Arg.) Stapf ex Gamble, l. c. 1265. 1925. *S. saligna* non (D.Don) Müll.Arg., 1869: Mooney, Suppl. Bot. Bihar Orissa 29. 1950; Deb., Fl. Tripura 1: 200. 1981; Harid. & R.R.Rao, Forest Fl. Meghalaya 2: 764. 1987.

Kh.: *Tiw-deng-pah*; Nep.: *Chilne*.

Shrubs, 1.5 - 2 (-3) m high, entirely glabrous. Leaves elliptic, oblong-elliptic (or narrowly so), narrowly oblong to oblong-lanceolate, rounded to cuneate or acute at base, apiculate, acuminate or caudate at apex, (3.5 -) 7 – 11 (- 16) x (1 -) 2 - 3.5 (- 6) cm, chartaceous to thinly coriaceous; lateral nerves 6 - 12 pairs (basal pair prominent, ascending to 50 - 90% way up the lamina); petioles 5 - 15 mm long. Inflorescences axillary, unisexual, the males 0.8 - 2.5 cm long, (5 -) 8 - 16-flowered, the females 1 - 2 cm long, often paired, 1 – 4 (- 8)-flowered) or bisexual with 1 - 4 female flowers subtending the male flowers; bracts ovate, triangular or deltoid, 0.7 - 2.5 x 0.5 - 2 mm. Male flowers: sessile or pedicels up to 1.5 mm long; bracteoles absent; sepals 4, ovate to ovate-oblong, 1.5 - 4 x 1 - 2 mm; stamens 4, filaments 3 - 8 mm long; anthers oblong, 1.5 - 2.5 mm long. Female flowers: ca 5 mm across: pedicels ca 2 mm long; bracteoles 4 - 8 (2 - 4 pairs) in

subopposite pairs, triangular, ovate-triangular or deltoid, concave, 0.5 - 1.5 x 0.3 - 1.2 mm; sepals 4 - 6, similar to bracts, 1 - 2.5 x 0.7 - 2 mm; ovary ovoid, 1 - 2 x 0.7 - 1.5 mm, glabrous, bilocular; styles 2, 2 - 3 mm long, recurved above. Fruits ovoid, obliquely ellipsoid or subglobose, tipped by remains of style, 7 - 9 x 6 - 8 mm, fleshy.

*Fl. & Fr.* Nov. - May.

*Distrib.* India: Shaded places in forests, at 500 - 2500 m altitude. Himachal Pradesh, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, Orissa, Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu.

Sri Lanka, Nepal, Bhutan and Myanmar.

**2. *Sarcococca hookeriana*** Baill., Monogr. Buxac. 53. 1859; Müll.Arg. in DC., Prodr. 16(1): 13. 1869; Sealy in Hooker's Icon. Pl. 35: t. 3470. 1947 & in Bot. J. Linn. Soc. 92: 151, f. 5. 1986; H.Hara in Enum. Fl. Pl. Nepal 3: 202. 1982. *S. pruniformis* var. *hookeriana* (Baill.) Hook.f., Fl. Brit. India 5: 267. 1887.

Undershrubs, ca 50 cm high or shrubs 1 - 2 m high; branchlets minutely grey or tawny pubescent. Leaves oblong to elliptic-lanceolate or narrowly oblong-elliptic, acute or cuneate at base, attenuate-acuminate or sometimes acute to apiculate at apex, (3 - ) 4 - 8 (- 11) x (0.5 - ) 1 - 2 (- 2.5) cm, thinly coriaceous or chartaceous, tawny puberulous on midrib above; lateral nerves 6 - 10 per side (the basal pair ascending one third way up the lamina); petioles 3 - 12 mm long, puberulous to glabrous. Inflorescences axillary, unisexual (the males 1 - 2 cm long, 3 - 8-flowered, the females 1 - 1.5 cm long, 1 - 4-flowered) or bisexual with 1 or 2 female flowers subtending the male flowers; rachis puberulous; bracts ovate, 2 - 4 x 1 - 2 mm. Male flowers: 6 - 8 mm long; pedicels 1 - 2 mm long; bracteoles absent or 1 or 2, inserted near the sepals; sepals 4, ovate-triangular, 3 - 4 x 2 - 2.3 mm, glabrous; filaments 4 - 7 mm long; anthers oblong, 2 - 3 mm long. Female flowers: 6 - 9 mm long; pedicels 3 - 6 mm long; bracteoles 3 - 5 pairs (the uppermost pair inserted close to the sepals and scarcely distinguishable from them), triangular, deltoid-acuminate or linear-lanceolate to lanceolate, 1.5 - 3 x 0.6 - 1.5 mm; sepals 4 (or 5), ovate-triangular, 2 - 3 x 1 - 2 mm; ovary ovoid, ca 2 x 1.5 mm; styles 3, 2.5 - 3.5 mm long, bilobed at apex. Fruits subglobose to ovoid-subglobose, 6 - 9 x 7 - 10 mm, unlobed or shallowly 3-lobed or 3-angled; seeds plano-convex, ca 5 x 4.5 mm, dark brown; fruiting pedicels 5 - 7 mm long.

*Fl. & Fr.* April - Oct.

*Distrib.* India: Scattered in subtropical to temperate forests, often along streams, between 1900 - 2900 (-3500) m altitudes. West Bengal and Sikkim.

Nepal, Bhutan and China (Tibet).

*Uses.* Wood hard, sometimes used to make walking sticks. Used as ornamental garden plant with fragrant flowers.

**3. *Sarcococca saligna*** (D.Don) Müll.Arg. in DC., Prodr. 16(1): 11. 1869. *Buxus saligna* D.Don, Prodr. Fl. Nepal. 63. 1825. *Sarcococca pruniformis* var. *angustifolia* Lindl. in Bot. Reg. 12: sub t. 1012. 1826. *S. pruniformis* auct. non Lindl., 1826: Hook.f., Fl. Brit. India 5: 266. 1887, p.p.

Shrubs, 1 - 2 m high, entirely glabrous. Leaves lanceolate, narrowly lanceolate-oblong to linear-lanceolate, cuneate or acute at base, attenuate-caudate at apex, (3 - ) 6 - 11 (- 15) x 1 - 2 (-

2.5) cm, chartaceous to thinly coriaceous; lateral nerves 6 - 14 per side (the basal pair ascending to 50 - 70% way up the lamina); petioles 3 - 15 mm long. Inflorescences axillary, bisexual (usually in the distal axils), 1 - 2 cm long, with 1 - 4 female flowers at basal nodes and 3 - 8 male flowers crowded towards apices of the axis or unisexual (usually in the proximal axils), up to 1 cm long, with 1 - 4 female flowers or rarely consisting of solely male flowers; bracts triangular to broadly ovate, 1 - 2 x 0.7 - 1.5 mm; pedicels absent or very minute. Male flowers: subsessile, 2-bracteolate or ebracteolate; bracteoles ovate, 1.5 - 2 x 0.7 - 1.2 mm; sepals 4, the outer broadly ovate to triangular, 2 - 3 x 1 - 2 mm, the inner ovate-oblong, 2.5 - 3.5 x 1.5 - 2.3 mm; filaments 4 - 8 mm long; anthers oblong, 1.5 - 2 mm long. Female flowers: 4 - 6 mm long; bracteoles (3 -) 4 or 5 (- 6) pairs, imbricate, triangular to broadly ovate, 1 - 1.5 x 0.7 - 1 mm; sepals (4 -) 5 or 6, triangular to ovate-triangular, 1.5 - 2.5 x 0.8 - 1.8 mm; ovary ovoid, ca 2 x 1.5 mm, glabrous, 3-locular; styles 3, 2 - 3 mm long. Fruits subglobose, 7 - 8 x 7 - 10 mm, unlobed; fruiting pedicels 3 - 4 mm long.

*Fl. & Fr.* June - Nov.

*Distrib.* India: Common in subtropical forests or temperate meadows between 2000 - 3500 m altitude, usually as forest undergrowth at shaded places. Jammu & Kashmir, Himachal Pradesh, Uttarakhand and West Bengal.

Afghanistan, Pakistan, Nepal China and Taiwan.

**4. *Sarcococca wallichii*** Stapf in Bull. Misc. Inform. Kew 1916: 37. 1916; Sealy in Hooker's Icon. Pl. 35: t. 3469. 1947 & in Bot. J. Linn. Soc. 92: 145, f. 4. 1986.

Shrubs or small trees, (0.5 -) 1 - 3 m high, entirely glabrous or with puberulous branches. Leaves narrowly elliptic-oblong, lanceolate-elliptic, lanceolate-oblong to lanceolate, acute or cuneate at base, caudate at apex, 7 - 11 (- 14) x (1.5 -) 2 - 4 cm, chartaceous to thinly coriaceous; lateral nerves slender, 8 - 12 per side (the first pair ascending to 50 - 70% way up the lamina); petioles 7 - 15 (- 20) mm long. Inflorescences axillary, bisexual (1 - 2.5 cm long, consisting of 1 - 2 female flowers at the base and 5 or 6 male flowers above them) or unisexual (up to 1.5 cm long, consisting of 1 or 2 female flowers); rachis occasionally sparsely puberulous; bracts triangular to ovate, 1 - 2 x 0.8 - 1.5 mm. Male flowers: sessile or pedicellate (pedicels up to 2 mm long), usually ebracteolate or rarely 2-bracteolate; sepals 4, ovate to ovate-triangular, 3 - 4 x 1.5 - 3 mm; filaments 5 - 8.5 mm long; anthers narrowly oblong, 1.5 - 2 mm long. Female flowers: 7 - 9 mm long; pedicels 5 - 6 mm long; bracteoles 3 or 4 pairs on pedicels, ovate to triangular, 1 - 2 x 0.8 - 1.5 mm; sepals 5 or 6, ovate, triangular or deltoid, 1.5 - 2.5 x 1 - 2 mm; ovary ovoid, ca 2 x 1.5 mm, glabrous; styles 3, 2 - 3.5 mm long. Fruits subglobose or oblong (? when immature), 8 - 10 x 6 - 8 mm; fruiting pedicels 6 - 8 mm long.

#### KEY TO THE FORMA

- 1 a. Small bushy shrubs, up to 1 m high, with puberulous branches; female flowers 5 - 6 mm long  
**4.1. forma membranacea**
- b. Tall shrubs or small trees, 1 - 3 m high, entirely glabrous; female flowers 7 - 9 mm long  
**4.2. forma wallichii**

**4.1. forma membranacea** Sealy in Bot. J. Linn. Soc. 92: 146. 1986.

A small bush, distinguished from forma *wallichii* in the puberulous young branchlets.

*Fl.* April.

*Distrib.* India: Known to occur at about 2400 m altitude in Manipur.

Endemic.

**4.2. forma wallichii**

*Fl. & Fr.* May – Dec.

*Distrib.* India: Scarce in subtropical forests at 1500 - 2300 m altitudes. Arunachal Pradesh, Sikkim, West Bengal, Assam, Meghalaya and Manipur.

Nepal, Bhutan, Myanmar and China.

CULTIVATED GENUS

**Simmondsia** Nutt.

North America, in California, Arizona and Mexico, monotypic.

*Literature.* KAKKAR, L 1973. Leaf vasculature in *Simmondsia californica*. Proc. Indian Sci. Congr. 60(3): 293 – 294.

**Simmondsia californica** Nutt. in London J. Bot. 3: 400, t. 16. 1844.

Shrubs, dioecious, minutely hairy. Leaves opposite, subsessile, entire. Male flowers: in subglobose axillary clusters, sessile or shortly pedunculate, each flower solitary below each small bract; sepals 5, broad, imbricate; stamens 10 - 12; filaments short; anthers oblong; thecae parallel, contiguous, laterally 2-valved; pistillode absent. Female flowers: mostly solitary and much larger than male flowers; sepals 5 or 6, imbricate, the inner much longer than in male, foliaceous; ovary 3-locular; ovule solitary in each locule; style linear, undivided, papillose-hairy, caducous. Fruits capsular, oblong-ovoid, shiny; pericarp coriaceous, longitudinally 3-valved; seed solitary by abortion; testa coriaceous, very little or absent; cotyledons thick and fleshy.

*Fl. & Fr.* Period unknown.

*Distrib.* India: Rajasthan (cultivated).

*Uses.* This plant, commonly called 'Jojoba' and produces oil, which is similar to the whale sperm oil. It is a polyunsaturated liquid wax, which finds use as lubricants under high pressure in automobile transmissions. It can be used in high-speed machinery operating under high temperature and high pressures. Recently this oil has found use as gasoline fuel for automobiles and has become of high commercial value.



## EUPHORBIACEAE, sensu lato

Trees, shrubs or herbs, some climbing or twining, monoecious or dioecious; stems sometimes succulent and/or with latex; xylem vessel perforation plates scalariform, simple or both. Leaves alternate or rarely opposite or whorled, simple or sometimes palmately lobed or compound, the margins entire or serrate; stipules free, rarely connate or absent, deciduous or persistent; venation pinnate or palmate; indumentum simple, stellate or lepidote, sometimes absent. Inflorescences terminal or axillary, occasionally cauliflorous, basically cymose, thyrses or racemes, or these often grouped into panicles; flowers solitary or in glomerules, these often grouped into spiciform or capitate thyrses or cyathia. Flowers: unisexual, actinomorphic, anemophilous or entomophilous, the parts hypogynous, rarely perigynous (in *Bridelia*). Perianth segments mostly not differentiated into sepals and petals, in some genera differentiated into sepals and coloured petals; sepals free or rarely connate, valvate or imbricate, sometimes reduced or absent, (1-) 3 - 6 (-8), sometimes distinctly coloured; petals if present free, variously coloured; disc present or absent, intrastaminal or extrastaminal, entire, annular or dissected into separate glands. Stamens (1 -) 3 - 50 (- 300) (always solitary in *Euphorbia*); filaments free or connate; anthers mostly 2-locular, basifixed or rarely dorsifixed, sometimes the thecae separate, longitudinally dehiscent, introrse or extrorse; pollen grains tectate or semi-TECTATE, (2-) 3 (- 10)-colporate (inaperturate or polytrema). Gynoecium syncarpous; ovary (1 -) 2 - 5 (- 20)-locular; placentation axile; ovules 1 or 2 in each locule, anatropous or hemitropous, rarely orthotropous, inserted beneath an obturator, crassinucellate with 2 integuments; nucellus often beaked; embryo sac mostly 8-nucleate; styles usually 3, free or variously connate, each usually bifid, rarely multifid. Fruits capsular, schizocarpic, elastically dehiscent into 2-valved cocci from a persistent columella, sometimes baccate or drupaceous. Seeds 1 or 2 per locule (rarely one or two seeds per fruit); seed-coat thin to indurate, sometimes with sarcotesta; endosperm fleshy, copious or moderate, rarely scanty or absent; embryo straight to arcuate or folded; cotyledons usually broader than radicle, thin to moderately thick.

Cosmopolitan, except for the arctic and cool temperate regions of northern Hemisphere; mainly in tropical and subtropical regions, ca 322 genera and ca 8900 species; 70 genera and ca 410 species in India.

*Notes.* Recent molecular studies and the evidences obtained therein have changed the concept of the family Euphorbiaceae and the trend now is to divide the family into several segregate families and merger of several genera. The creation of the family Phyllanthaceae based on the subfamily Phyllanthoideae of Euphorbiaceae and the merger of the genera *Breynia*, *Glochidion* and *Sauropus* with *Phyllanthus* (Hoffmann *et al.*, 2006 and Kathriarachchi *et al.*, 2006) necessitate a number of name changes. Accordingly, Chakrabarty and Balakrishnan (2009) transferred the taxa of the above genera occurring in Indian subcontinent to *Phyllanthus*. However, dividing the family Euphorbiaceae into segregate families is a new concept and needs wide consensus before acceptance. Hence, in the present treatment, Euphorbiaceae, sensu lato is maintained.

*Literature.* BALAKRISHNAN, N. P. & T. CHAKRABARTY (2007). The family Euphorbiaceae in India – a synopsis of its profile, taxonomy and bibliography. Dehra Dun. CHAKRABARTY, T. & N. P. BALAKRISHNAN (2009). Transfer of Indian species of *Breynia*, *Glochidion* and *Sauropus* to *Phyllanthus* (Phyllanthaceae) – new combinations and new names. J. Econ. Taxon. Bot. 33(3): 712 – 716. GOVAERTS, R., D. G. FRODIN & A. RADCLIFFE-SMITH (2000). World Checklist and Bibliography of Euphorbiaceae (and Pandaceae). Vols. 1 – 4. Kew. HOFFMANN, P., KATHRIARACHCHI, H. & K. J. WURDACK

(2006). A phylogenetic classification of *Phyllanthaceae* (*Malpighiales*; *Euphorbiaceae* sensu lato). Kew Bull. 61(1): 37 - 53. KATHIARACHCHI, H., R. SAMUEL, P. HOFFMANN, J. MLINAREC, K. J. WURDACK, H. RALIMANANA, T. F. STUESSY & M. W. CHASE (2006). Phylogenetics of tribe *Phyllanthae* (*Phyllanthaceae*; *Euphorbiaceae* sensu lato) based on nrITS and plastid matK DNA sequence data. Amer. J. Bot. 93 (4): 637 – 655.

#### KEY TO THE SUBFAMILIES

- 1 a. Locules of ovary each with 2 ovules; milky latex absent, intraxylary phloem, and stinging hairs absent; indumentum simple or rarely lepidote or dendritic; embedded foliar glands rare; pollen grains binucleate; seeds ecarunculate; endosperm copious or absent 2
- b. Locules of ovary each with a single ovule; latex often present; indumentum various; pollen grains binucleate or trinucleate; seeds carunculate or not; endosperm usually copious 3
- 2 a. Leaves alternate, very rarely opposite, stipulate, simple and unlobed (trifoliolate in *Bischofia*); petals present or absent; pollen grains tricolporate or porate, sexine not with conspicuous spines; seeds ecarunculate **V. PHYLLANTHOIDEAE**
- b. Leaves alternate, opposite or whorled, stipulate or exstipulate, simple or trifoliolate; petals absent; pollen grains colpoidorate to porate, sexine spiny; seeds carunculate or not **IV. OLDFIELDIOIDEAE**
- 3 a. Milky latex absent; laticifers (if present) not articulate; leaves simple or lobed, rarely compound; indumentum simple or stellate; petals present or absent; pollen grains binucleate, mostly tricolporate, sexine reticulate to rugose-perforate **I. ACALYPHOIDEAE**
- b. Latex reddish or yellowish to milky (rarely absent); laticifers usually present, articulate or not; leaves simple to palmately lobed or compound; pollen grains binucleate or trinucleate 4
- 4 a. Latex clear to reddish or whitish, innocuous; laticifers articulate or not; leaves often palmately veined, lobed or compound; indumentum simple or often stellate; inflorescence dichasial paniculate to spicate; bracts usually not biglandular at base; sepals imbricate to valvate, usually completely covering anthers in bud; petals mostly present; floral disc often with staminodes; pollen grains mostly porate or inaperturate with 'crotonoid' pattern of polygonally arranged sexinous processes **II. CROTONOIDEAE**
- b. Latex whitish, often caustic or poisonous; laticifers not articulate (rarely absent); leaves simple (rarely lobed), pinnately veined or triplinerved; indumentum simple or often absent, never typically stellate; inflorescence racemose, spicate, capitate or cyathial; bracts mostly biglandular at base; sepals imbricate or obsolete; anthers mostly not covered in bud; petals absent; floral disc usually without staminodes; pollen grains tricolporate, colpi usually marginate, sexine reticulate to more often perforate-lectate **III. EUPHORBIOIDEAE**

#### Subfamily I. ACALYPHOIDEAE Asch.

Trees, shrubs or herbs; milky latex absent or rarely represented by coloured exudate; indumentum simple or hairs often branched or lepidote. Leaves alternate or rarely opposite, simple or palmately lobed or rarely compound, often with foliar glands; stipules usually present. Inflorescences racemose or spicate or reduced to glomerules or solitary flowers; bracts present, sometimes glandular. Male flowers: sepals imbricate or often valvate; petals and disc absent or present; stamens 2 - 100 or rarely more, free or connate; pistillode absent or present. Female flowers: sepals (2 -) 3 - 6 (- 12), imbricate or open at anthesis, sometimes connate; petals and disc absent or present; ovary 2 - 4-locular; styles entire or bifid or multifid; ovules solitary in each locule, anatropous. Fruits capsular or baccate or drupaceous; seeds carunculate or ecarunculate; testa sometimes fleshy; endosperm usually copious; cotyledons longer and broader than radicle.

Worldwide, mostly in tropical and subtropical areas, ca 116 genera; 22 genera in India.

## KEY TO THE TRIBES

- 1 a. Sepals of male flowers distinctly imbricate or else flowers enclosed in bibracteolate involucre; petals absent; pollen grains rugulose or micropunctate 2
- b. Sepals of male flowers valvate or slightly imbricate; flowers not in bibracteolate involucres; petals present or absent; pollen grains various, not micropunctate 3
- 2 a. Filaments connate; pistillode conspicuous; seeds carunculate; testa dry  
Tribe 4. CHAETOCARPEAE
- b. Filaments free; pistillode small or absent; seeds ecarunculate; testa fleshy  
Tribe 5. CHEILOSEAE
- 3 a. Petals present, at least in male flowers 4
- b. Petals absent 5
- 4 a. Plants dioecious; indumentum always simple; anther-connective enlarged; antherthecae pendulous  
Tribe 2. AGROSTISTACHYDEAE
- b. Plants monoecious; indumentum at least in part malpighiaceous, stellate or lepi dote; anther-connective not enlarged; anther-thecae not pendulous  
Tribe 6. CHROZOPHOREAE
- 5 a. Plants often scandent or twining, sometimes with stinging hairs; styles unlobed, mostly connate into a distinct column  
Tribe 8. PLUKENETIEAE
- b. Plants rarely scandent, never with stinging hairs; styles free or basally connate (if long-connate, then styles bifid) 6
- 6 a. Leaves eglandular; indumentum simple; staminate disc present; pollen exine coarsely reticulate, colpi mostly inoperculate  
Tribe 9. PYCNOCOMEAE
- b. Leaves with glands; indumentum stellate or simple; staminate disc absent or if present then pollen colpi operculate 7
- 7 a. Indumentum stellate; stamens inflexed in bud (except in *Koiloceras*); pollen grains coarsely reticulate or perforate-tectate  
Tribe 7. EPIPRINEAE
- b. Indumentum simple or stellate; stamens not inflexed in bud; pollen grains finely perforate-tectate to rugulose 8
- 8 a. Pollen colpi inoperculate or scarcely operculate, often reduced; disc in male flowers if present interstaminal; seeds carunculate or ecarunculate; testa dry or fleshy  
Tribe 1. ACALYPHEAE
- b. Pollen colpi operculate; disc in male flowers if present intrastaminal; seeds mostly ecarunculate; testa dry  
Tribe 3. ALCHORNEAE

## Tribe I. ACALYPHEAE Bartl.

## (S. R. M. Susila Rani &amp; N. P. Balakrishnan)

Trees or shrubs, monoecious or dioecious, perennial or annual; indumentum simple, stellate or lepidote-scaly. Leaves alternate or opposite, sometimes whorled, entire, lobed or sometimes palmatilobed, penninerved or palmatinerved, glandular or eglandular, often with basal macular glands, bistipulate. Inflorescences axillary or terminal, racemes or spikes, simple or paniculate, rarely clustered, unisexual or bisexual. Male flowers: clustered at axils of bracts, rarely solitary; calyx closed in bud, splitting into 4 segments; disc glandular, intra-staminal or extra-staminal or absent; stamens 4 - many; filaments erect, free or rarely connate; anthers mostly 2-loculed or rarely 4-loculed, rarely 3-loculed; connectives narrow or broad, truncate; pistillode absent or rarely developed. Female flowers: solitary or few in spikes; sepals mostly 3 - 6, free or connate, also spathaceous; ovary 2 - 4-locular, rarely 1- or 8 - 9-locular; ovule solitary in each locule; styles long or short, free or connate at base, entire or plumose. Fruits capsular or drupaceous, smooth or muricate, echinate or tubercled, rarely indehiscent; seeds carunculate or ecarunculate; testa dry or fleshy; endosperm fleshy; cotyledons broad, flat, rarely narrow or linear.

Pantropical, subtropical or rarely temperate, ca 30 genera; 10 genera in India.

## KEY TO THE GENERA

- 1 a. Stipule opposite to petiole base and encircling the stem; inflorescences terminal; styles bifid; seeds carunculate **9. Ricinus**
- b. Stipule beside the petiole base and not encircling stem; inflorescences axillary; styles unlobed; seeds ecarunculate or rarely carunculate 2
- 2 a. Stamens in dense globose heads of branched filaments connate into fascicles 3
- b. Stamens not in dense globose heads of branched filaments, not connate into fascicles 4
- 3 a. Plants monoecious, small trees, not rheophytic; indumentum simple or with glandtipped hairs; leaves in pseudo-whorls or opposite or subopposite, narrowly cordate at base, with scale hairs beneath; female flowers solitary; sepals of female flowers conspicuous, persistent and enlarged in fruit; ovary and fruits muricate; fruits densely clothed with tubercles, each bearing a stinging hair **5. Lasiococca**
- b. Plants dioecious, rigid shrubs, rheophytic; indumentum simple or lepidote; leaves alternate, willow-shaped, narrow and not cordate at base, without scale hairs beneath; female flowers in compound spikes; sepals of female flowers small, caducous; ovary smooth; fruits smooth, tomentose or sparingly tuberculate **4. Homonoia**
- 4 a. Female bracts large, foliaceous; anther-thecae twisted and vermiculiform; pollen porate **1. Acalypha**
- b. Female bracts small, foliaceous; anther-thecae normal, not vermiculiform; pollen colporate 5
- 5 a. Indumentum usually stellate; leaves often opposite, rarely alternate, often with embedded laminary glands and usually glandular-granulose as well 6
- b. Indumentum usually simple; leaves alternate, eglandular or with embedded laminary glands, not glandular-granulose 7
- 6 a. Leaves opposite or alternate; anther-thecae globose, separated by linear or broad connectives; ovary and fruits often echinate or muricate; fruits capsular, dehiscent **7. Mallotus**
- b. Leaves opposite; anther-thecae parallel; connectives absent; ovary and fruits smooth; fruits drupaceous, indehiscent **10. Trevia**
- 7 a. Herbs with opposite leaves; styles simple **8. Mercurialis**
- b. Shrubs, trees or herbs with alternate leaves; styles bifid 8
- 8 a. Anther-thecae parted by the connective, erect or pendulous; inter-staminal disc present; styles unlobed **2. Clooxylon**
- b. Anther-thecae not parted by the connective; inter-staminal disc absent 9
- 9 a. Styles bifid; anthers globose, 2 or 4-locular, apiculate; pollen grains vermiculate rugulose; testa dry or fleshy **3. Cleidion**
- b. Styles simple; anthers cross-shaped, 3 or 4-locular, not apiculate; pollen grains spinulose-rugulose; testa usually fleshy **6. Macaranga**

**1. Acalypha L.**

Herbs, shrubs or small trees, perennial or annual, mostly monoecious. Leaves alternate, often pellucid-punctate, palmatinerved or penninerved, petiolate; stipules minute, rarely paired. Inflorescences axillary or sometimes terminal spikes or lax panicles, unisexual or bisexual, when bisexual the sexes are diversely arranged, males commonly in slender dense-flowered spikes, with one or a few female flowers at base, or the females alone in relatively short less dense-flowered racemes; female bracts often foliaceous, lobed or dentate and accrescent in fruit. Male flowers: mostly minute, with or without bracts; calyx closed in bud, splitting valvately into 2 - 4 segments; petals and disc absent; stamens many, often 8, inserted on a raised central receptacle; filaments free; anther-thecae divaricate, linear, distinct, uniform, often twisted or flexuous;

pistillode absent. Female flowers: 1 - 4 in each bract; sepals 3 or 4, imbricate, often minute, shortly connate; ovary (2 or) 3-loculed; styles usually conspicuous, lacinate or lacerate into filiform segments. Fruits capsular, (2 or) 3-locular, with crustaceous cocci, enclosed in accrescent subtending bracts; seeds ovoid or rounded, smooth, sometimes with a conspicuous hilum or caruncle; testa crustaceous, smooth to pitted or tuberculate.

Pantropical, excepting Hawaii and Pacific Islands, a few in temperate regions, ca 450 species; 10 species in India.

*Literature.* SUSILA RANI, S. R. M. & N. P. BALAKRISHNAN (2007). Diversity in the inflorescences and bracts of the genus *Acalypha* L. (Euphorbiaceae) in India. *J. Econ. Taxon. Bot.* 31(1): 91 – 97.

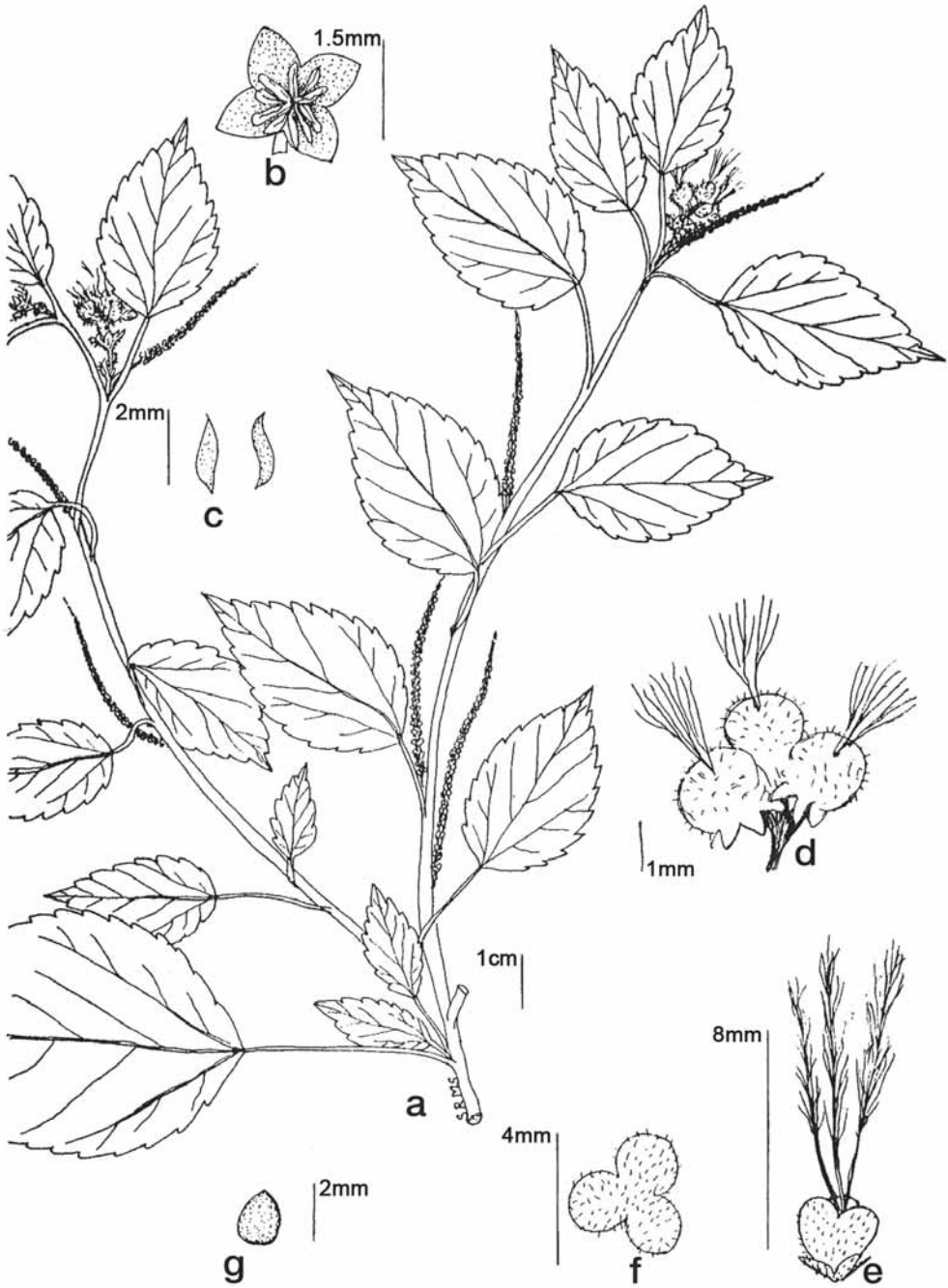
#### KEY TO THE SPECIES

- |   |   |                                |
|---|---|--------------------------------|
| 1 | a. Female spikes paniculate, terminal; female bracts minute   | <b>9. <i>A. paniculata</i></b> |
|   | b. Female and male spikes axillary or terminal; female bracts large   | 2                              |
| 2 | a. Spikes ending with allomorphic flowers   | 3                              |
|   | b. Spikes without allomorphic flowers   | 5                              |
| 3 | a. Female bracts without definite shape, but deeply 3 - 5-lobed; lobes linear, strap- shaped  | <b>10. <i>A. superba</i></b>   |
|   | b. Female bracts campanulate or tubular, not deeply lobed   | 4                              |
| 4 | a. Female bracts almost tubular, fimbriate along the rim with long subulate hispid teeth, eglandular  | <b>3. <i>A. ciliata</i></b>    |
|   | b. Female bracts campanulate, not tubular, shortly toothed along margins, bordered with long hispid gland-tipped hairs  | <b>8. <i>A. malabarica</i></b> |
| 5 | a. Spikes unisexual; female spikes terminal; male spikes axillary   | <b>1. <i>A. alnifolia</i></b>  |
|   | b. Spikes bisexual; female and male flowers in the same axillary or terminal spikes   | 6                              |
| 6 | a. Female bracts very few, 1 - 5 in each spike  | 7                              |
|   | b. Female bracts many, 8 – 20 in each spike   | 8                              |
| 7 | a. Female bracts cup-like, dentate, 5 - 6 mm across   | <b>5. <i>A. fruticosa</i></b>  |
|   | b. Female bracts rounded, rhombate or orbicular, 1.5 - 2 cm across  | 9                              |
| 8 | a. Inflorescences terminal and axillary; female bracts 8 – 10 in each spike, large, shallowly and obtusely toothed, without gland-tipped hairs along margins, less crowded on spikes, enclosing the female flowers  | <b>6. <i>A. indica</i></b>     |
|   | b. Inflorescences all axillary; female bracts 18 – 20 in each spike, small, crenate with gland-tipped hairs along margins, more crowded on spikes; female flowers situated above the bracts, not enclosed by bracts | <b>7. <i>A. lanceolata</i></b> |
| 9 | a. Female bracts 3 – 5 in each spike, ovate-deltoid or rhombate, glandular, 3 - 5- flowered   | <b>2. <i>A. australis</i></b>  |
|   | b. Female bracts 1 or 2 in each spike, rounded, reniform or orbicular, eglandular, 1 - 2- flowered  | <b>4. <i>A. dalzellii</i></b>  |

**1. *Acalypha alnifolia*** Klein ex Willd., *Sp. Pl.* ed. 4, 4: 525. 1805; Müll.Arg. in DC., *Prodr.* 15(2): 843. 1866; Hook.f., *Fl. Brit. India* 5: 415. 1887. **Fig. 3**

Tam.: *Sirukurunjan*.

Herbs or shrubs, up to 2 m high; branchlets hispid to tomentose. Leaves ovate, elliptic-ovate to lanceolate, deltoid, rounded, truncate or subcordate at base, crenate to serrate along



**Fig. 3.** *Acalypha alnifolia* Klein ex Willd.: a. habit; b. male flower; c. stamens; d. female spike (diagrammatic); e. female flower; f. fruit; g. seed.

margins, acute to subacuminate at apex, (1 -) 3 - 10 x 1 - 8 cm, membranous to coriaceous, pilose-velutinous on both sides or only above and densely white soft woolly tomentose beneath; main basal nerves 3 or 4; lateral nerves 4 - 6 pairs; petioles (0.5 -) 1 - 6 cm long, densely pubescent. Male spikes usually in lower leaf-axils, dense-flowered, 1.5 - 10 cm long; flowers 1 - 1.5 mm across, subsessile; sepals 4, ovate or ovate-lanceolate, 0.5 - 1 mm across, puberulous; stamens 15 - 19; filaments ca 0.3 mm long; anthers linear, vermiculiform, 0.2 - 0.4 mm long. Female spikes terminal, 1 - 3 cm long, few-flowered; bracts folded, cupular to campanulate, 4 - 8 mm across, dentate, each 1- or 3-flowered; flowers sessile; calyx-lobes 3, ovate to ovate-lanceolate, 0.5 - 0.8 mm across; ovary 2 - 3 mm across, tomentose, glandular; styles 3, filiform, fimbriate or plumose, 1 - 1.5 cm long, pilose. Capsules enclosed by bracts, trilobed, 3 - 4 mm across, hispid to tomentose; seeds ovoid, subglobose, ca 2 mm across, smooth, dark red to reddish brown.

*Fl. & Fr.* Throughout the year.

*Distrib.* India: Scrub jungles, on dry slopes with poor soil, sunny areas, up to 1000 m altitude. Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Endemic.

*Uses.* Valaya tribals of Tamil Nadu use the leaf juice mixed with 100 ml of cow's milk two times daily for six months against diabetes (Rajendran et al. in Indian J. Trad. Med. 1: 62. 2002).

*Notes.* Chromosome number.  $2n = 20$  (Harvey, Taxon 15: 155 - 163. 1966; Datta, Taxon 16: 341 - 350. 1967; Krishnappa & Reshme, Taxon 24: 533 - 547. 1980).

**2. *Acalypha australis* L., Sp. Pl. 1004. 1753; Singh in Indian Forester 93: 186. 1967. *A. chinensis* Roxb., Fl. Ind., ed. Carey 3: 677. 1832.**

Herbs, monoecious, annual; branches erect or ascending, finely pubescent. Leaves elliptic-lanceolate to ovate-lanceolate, broadly cuneate to truncate or rounded at base, crenate-serrate along margins, acute to acuminate at apex, 3 - 6 x 1.5 - 3 cm, membranous to chartaceous, pilose or sparsely hispid; main nerves 3 or 4 at base; lateral nerves 4 or 5 pairs; petioles 1 - 2.5 cm long, finely pubescent; stipules subulate to lanceolate, up to 1 mm long. Flowers in axillary peduncled spikes. Male flowers: minute, sessile and clustered in upper part of 1 - 1.5 cm long spikes; sepals 3 or 4, ovate-lanceolate, 0.5 - 0.6 mm long; stamens 8 - 10; filaments up to 0.2 mm long; anthers vermiculiform, 0.3 - 0.5 mm long. Female flowers: at lower part of the spikes, 2 or 3 fertile ones mixed with 3 - 5 sterile flowers enclosed in each bract; bracts foliaceous, folded, ovate-deltoid or rhombate, crenate-serrate, 1.5 - 2 x 1 - 1.5 cm, glandular-ciliate; fertile flowers sessile, 1 - 1.5 mm across, sepals 3 or 4, irregular, ovate-lanceolate, ca 1 mm across; ovary 2-loculed, ca 1 mm across, hirsute; styles 3, filiform, lacinate, 1 - 3 mm long. Capsules ovoid, 2 - 4 mm across, pilose; seeds globose to subglobose, ca 2 mm across.

*Fl. & Fr.* April - Dec.

*Distrib.* India: Introduced and now a common weed in Tea gardens, along embankments and in moist shaded places in forests, at 500 to 1000 m altitudes. Uttarakhand (Garhwal Himalayas).

China, Taiwan, Laos, Korea, Japan, Philippines and Australia.

*Note.* Chromosome number:  $2n = 14$  (Hsu, *Taiwania* 14: 11 - 27. 1968).

**3. *Acalypha ciliata*** Forssk., *Fl. Aegypt.-Arab.* 162. 1775; Hook.f., *Fl. Brit. India* 5: 417. 1887. **Fig. 4**

Guj.: *Dadra, Runchalo-dadri*; Punj: *Kokali, Kuppi*.

Herbs, erect, annual, 30 - 80 cm high, flaccid; stems ascending, sparingly branched; branches pubescent. Leaves ovate to ovate-lanceolate or ovate-rhombate, cuneate, rounded, truncate or obtuse at base, sharply toothed along margins, caudate-acuminate or apiculate at apex, 2 - 12 x 1.5 - 8 cm, coriaceous, pilose on nerves, gland-dotted; main nerves 3 - 5 at base; lateral nerves 5 - 8 pairs above the basal; petioles 2 - 8 (- 12) cm long, finely pubescent; stipules subulate, up to 2 mm long. Spikes axillary, androgynous, 1 - 4 cm long, ending in allomorphic flowers. Male flowers: 0.5 - 0.7 mm across, few, sessile, clustered at apex; sepals 4, ovate to suborbicular, 0.5 - 0.7 mm across, glandular pubescent; stamens 8 - 12; filaments ca 0.1 mm long; anthers linear, ca 0.3 mm long. Female flowers: 1 - 3 mm across, several at axils of bracts; bracts leafy, folded, campanulate, 4 - 6 x 5 - 8 mm, fringed or fimbriate at rim, hispid or finely pubescent, gland-dotted; sepals 3, ovate to ovate-lanceolate, 0.5 - 0.7 mm long; ovary 3-loculed, 0.7 - 1 mm across, sparsely hispid; styles 3, filiform, laciniate, 1 - 2 mm long. Capsules 3-lobed, 3 - 4 mm across, glabrous; seeds ovoid to subglobose, ca 2 mm across, smooth.

*Fl. & Fr.* July - Dec.

*Distrib.* India: Along bushes and hedges near gardens, weed of cultivated fields, wastelands, hill slopes and scrub jungles, from 1000 to 2600 m altitude. Throughout India from Jammu & Kashmir to Tamil Nadu.

Tropical Africa, Southern Arabia, Pakistan, Nepal, Sri Lanka and Java.

*Uses.* Roots used as a laxative and vermifuge. Juice of leaves smeared on poisonous stings and on various skin diseases.

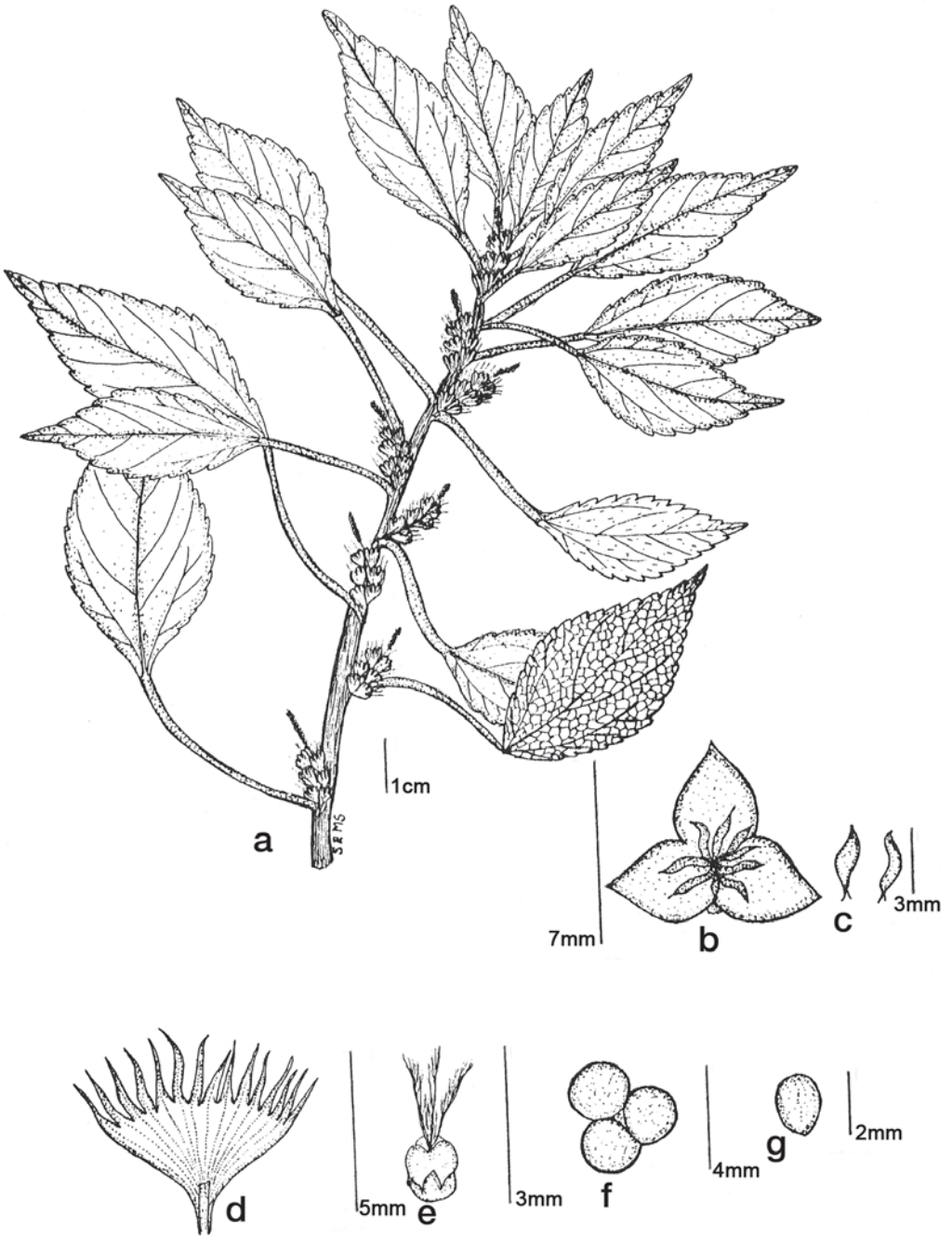
*Note.* Chromosome number:  $2n = 20$  (Harvey, *Taxon* 15: 155 - 163. 1966; Champault, *Bull. Soc. Bot. Fr.* 117: 137 - 168. 1970).

**4. *Acalypha dazellii*** Hook.f., *Fl. Brit. India* 5: 414. 1887.

Herbs or shrubs, erect, 30 - 50 cm high; branchlets subglabrous. Leaves elliptic-lanceolate to ovate-lanceolate, acute, broadly cuneate or obtuse at base, shallowly crenate-dentate along margins, acute to acuminate at apex, 4 - 7 x 2 - 4 cm, membranous to coriaceous, subglabrous or finely pubescent on both sides, basally trinerved, eglandular; lateral nerves 4 - 6 pairs above basal; petioles 1.5 - 3 cm long; stipules minute, caducous. Male inflorescences not seen. Female flowers: in axillary solitary long-peduncled 1 or 2-flowered bracts; bracts foliaceous, reniform to orbicular, folded, shallowly dentate along margins, 1 - 1.5 cm across; bracteoles at the axils of peduncle, linear-lanceolate, 3 - 5 x 1 - 1.5 mm; sepals 3, ovate-lanceolate, up to 3 mm across; ovary 3-loculed, ca 2 mm across, finely pubescent or subglabrous; styles 5 - 15 mm long, plumose. Fruits not seen.

*Fl. & Fr.* Period not known.





**Fig. 4. *Acalypha ciliata* Forssk.:** a. twig with spikes; b. male flower; c. stamens; D. female bract split opened; E. female flower; F. female flower; G. fruit; H. seed.

*Distrib.* India: Moist wastelands. Maharashtra.

Endemic and very rare, not collected since the type collection by Dalzell in 1878.

**5. *Acalypha fruticosa*** Forssk., Fl. Aegypt.-Arab. 161. 1775; Hook.f., Fl. Brit. India 5: 415. 1887. **Fig. 5**

Eng.: Birch-leaved *Acalypha*; Kan.: *Chinni*; Mal.: *Kuppameni*, *Sinnimaram*; Tam.: *Aathathazhai*, *Cini*, *Sinni*; Tel.: *Chinni*.

Shrubs or undershrubs, 0.5 - 2.5 m high, with waxy glands; branchlets finely pubescent; young parts greyish puberulous. Leaves ovate-oblong, rounded, acute to obtuse at base, serrate to crenate along margins, acute, acuminate or sometimes obtuse or subobtuse at apex, 1.5 - 5 x 1.5 - 3.5 cm, membranous to chartaceous, pilose or pubescent on both sides, with yellowish glands beneath; basal nerves palmate, 2 - 4 pairs; lateral nerves 2 - 4 pairs; petioles 1 - 2.5 cm long; stipules subulate or linear, up to 2 mm long; Spikes axillary or terminal, 1 - 5 cm long, arising singly, paired or 3 together from above the scars of fallen leaves. Male flowers: many, clustered along the spikes, followed by sterile flowers; pedicels up to 0.3 mm long, pubescent; sepals 4, ovate-lanceolate, ca 0.5 mm long, pubescent; stamens 10 - 15; filaments ca 0.2 mm long; anthers vermiculiform, 0.3 - 0.5 mm long. Female flowers: 2 - 3 mm across, few at the very base of the spike or in separate small clusters resembling few-flowered spikes in the axils of young leaves; bracts leafy, folded, dentate along margins, 5 - 6 mm across, glandular, 1- or 2-flowered; sepals 3, ovate to ovate-lanceolate, 0.7 - 1 mm long, pubescent; ovary 2 - 3 mm across, glandular, pubescent; styles 3, filiform, laciniate, up to 1 cm long. Capsules ovoid, trilobed, 3 - 4 mm across, tomentose; seeds subglobose or ovoid, ca 2 mm across, smooth.

*Fl. & Fr.* Feb. - Aug.

*Distrib.* India: Commonly seen in rocky soil along hill slopes and roadsides. Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

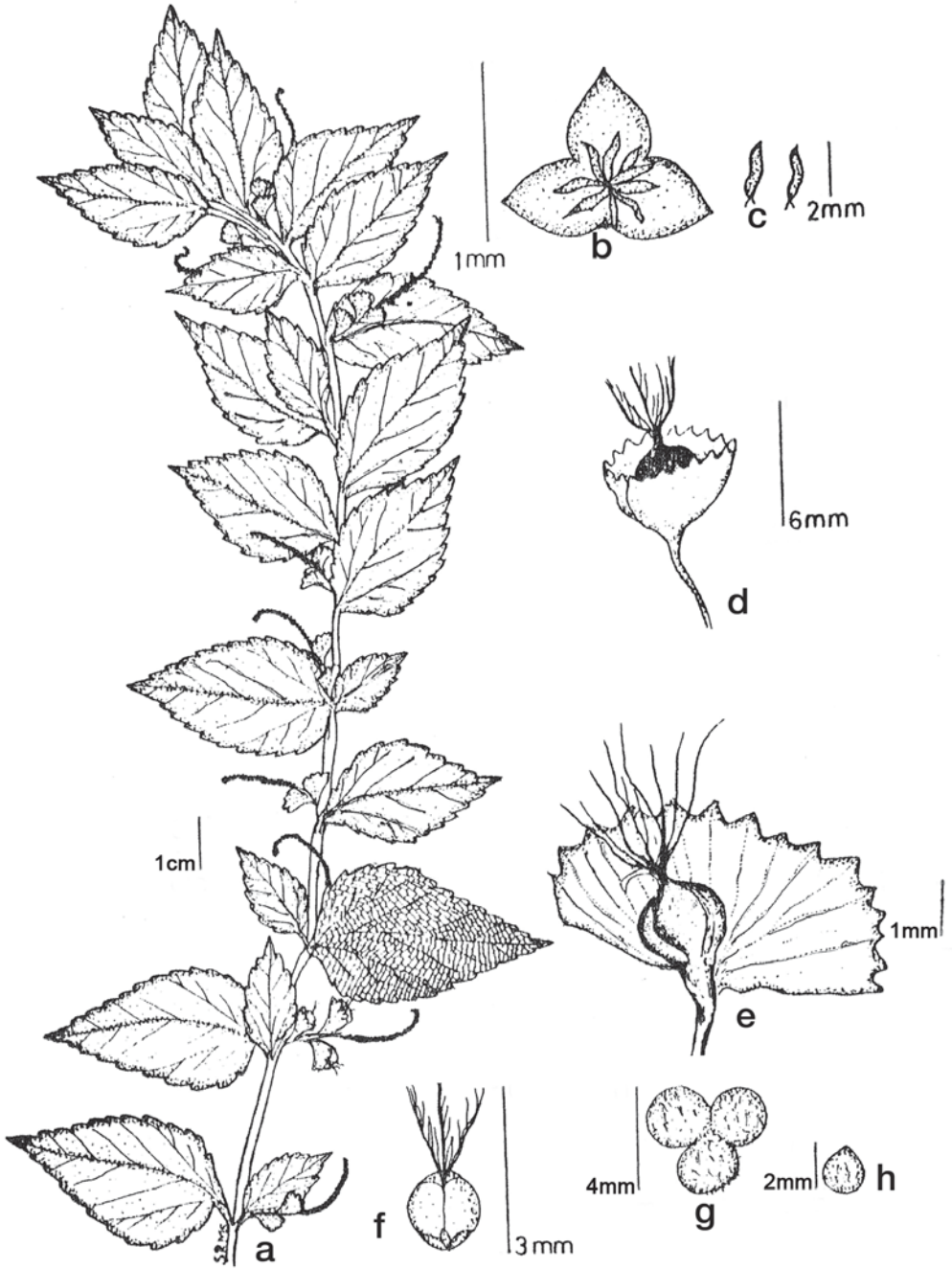
Tropical Africa, Arabia, Sri Lanka, Myanmar and Java.

*Uses.* The leaves are alternative and agreeable stomachic in dyspepsia and other ailments.

**6. *Acalypha indica*** L., Sp. Pl. 1003. 1753; Dalzell & A.Gibson, Bombay Fl. 228. 1861; Hook.f., Fl. Brit. India 5: 416. 1887.

Beng.: *Mukta-jhuri*; Guj.: *Dadano*, *Dadro*, *Vinchikanto*; Hindi: *Khokle*, *Kuppi*; Kan.: *Kuppigida*; Mal.: *Kuppameni*; Mar.: *Khokte*, *Khopli*, *Kuppi*; Sans.: *Harita-manjari*; Tam.: *Kuppaimeni*; Tel.: *Kuppichettu*, *Pippinta*.

Herbs, monoecious, annual, erect, 40 - 90 cm high; stem simple or branched, finely pubescent. Leaves elliptic-ovate, rhombate-ovate or broadly ovate cuneate, rounded or attenuate at base, crenate or serrulate along margins, acute or abruptly acuminate at apex, 2 - 7 x 1.5 - 5 cm, membranous to subcoriaceous, sparsely hispid above, finely pubescent beneath; main nerves 3 - 5 at base; lateral nerves 3 - 5 pairs; petioles 3 - 8 cm long; stipules subulate, up to 2 mm long. Spikes axillary or terminal, 1.5 - 9 cm long, finely pubescent. Male flowers: clustered at the upper portion of the spike, followed by a tuft of sterile flowers, terminating in an allomorphic flower; flowers subsessile, ca 1 mm across; pedicels ca 0.3 mm long; sepals 4, obovate, ca 0.5 mm



**Fig. 5.** *Acalypha fruticosa* Forssk.: A. twig with spikes; B. male flower; C. stamens; d. female flower enclosed in folded bract; e. female bract split opened f. female flower; g. fruit; h. seed.

across; stamens 10 – 15; filaments ca 0.2 mm long; anthers vermiculiform, 0.4 - 0.5 mm long. Female flowers: many, one each in the axils of bracts from base to above the middle of the spike; bracts alternate, cup-shaped, denticulate along margins, 5 - 13 mm across; flowers sessile, 1 - 2 mm across; sepals 3, ovate-lanceolate, 0.5 - 0.7 mm long; ovary 1 - 1.5 mm across, densely whitish tomentose; styles 3, filiform, laciniate, 2 - 4 mm long. Capsules completely enclosed by bracts, ovoid, trilobed, 3 - 4 mm across, densely minutely pubescent, mixed with a few short stipitate pale brown glands.

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

*Distrib.* India: Coastal plains to 1000 m altitude, wastelands, moist shaded riverbanks and wetlands, often a troublesome weed in cultivated fields and gardens. Gujarat, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Madhya Pradesh, Andhra Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Widespread in Old World tropics.

*Uses.* The fresh and dry plant is a gastro-intestinal irritant and used as substitute for ipecacuanha. Leaves used externally in scabies and eczema. In Unani medicine, a decoction of the entire plant used as a speedy and safe laxative. The juice of the fresh leaves is a reliable emetic. Steyn (Chem. Abstr. 32: 8617. 1938) found that the plant contains HCN and causes intense dark brown discoloration of blood and gastro-intestinal irritation in rabbits.

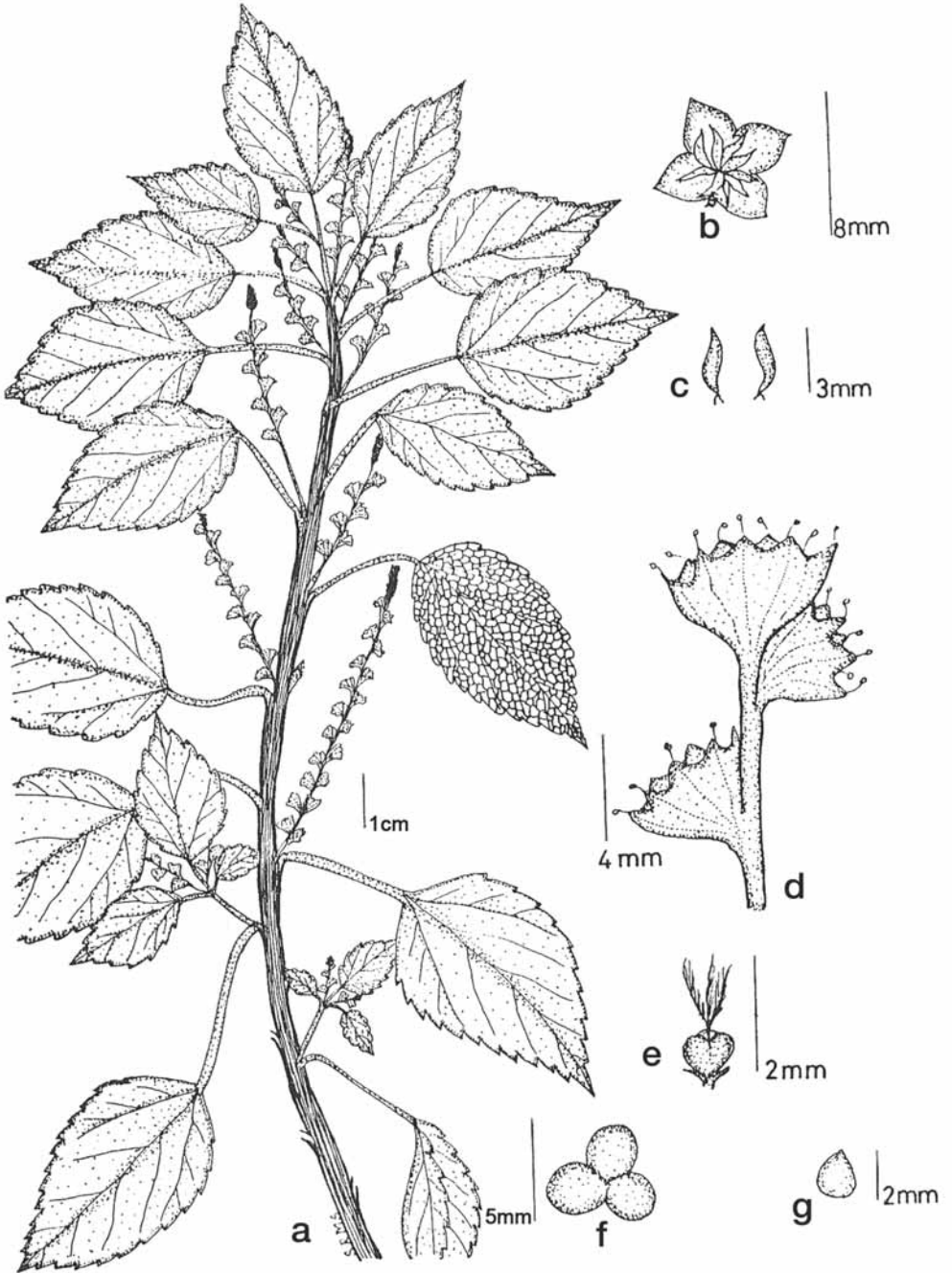
*Note.* Chromosome numbers:  $n = 14$  (Thombre, Curr. Sci. 28: 206 - 207. 1959);  $2n = 18$  (Sharma & Jash, Proc. 45th Indian Sci. Congr., Part 3: 302 - 303. 1958);  $2n = 20$  (Gajapathy, Bull. Bot. Surv. India 3: 49 - 51. 1961);  $n = 14$  (Sanjappa, Taxon 28: 274. 1979).

**7. *Acalypha lanceolata*** Willd., Sp. Pl. ed. 4, 4: 524. 1805; T. Cooke, Fl. Bombay 2(3): 612. 1906. *A. fallax* Müll.Arg. in Linnaea 34: 43. 1865 & in DC., Prodr. 15(2): 872. 1866; Hook.f., Fl. Brit. India 5: 416. 1887. **Fig. 6**

Herbs, erect or ascending, 20 - 50 cm high; branches hirsute or finely pubescent. Leaves crowded, broadly ovate to ovate-lanceolate, cuneate, rounded or truncate at base, crenate-serrate or dentate along margins, acute, to subacuminate at apex, 1 - 10 x 0.8 - 8 cm, membranous to thinly coriaceous, finely pubescent, gland-dotted; main nerves 3 - 4 at base; lateral nerves 4 - 6 pairs; petioles 0.5 - 9 cm long; stipules filiform, ca 2 mm long. Spikes axillary, sessile or peduncled, 1.5 - 8 cm long. Male flowers: 0.5 - 0.8 mm across, few, clustered in a small head, concealed in uppermost bracts; bracts ovate, 0.5 - 0.7 mm across; sepals 4, ovate to ovate-lanceolate, ca 0.5 mm across; stamens 8 - 15; filaments ca 0.1 mm long; anthers vermiculiform, 0.2 - 0.3 mm long. Female flowers: 1 - 2 mm across, solitary in each bract; bracts reniform or campanulate folded, 3 - 4 mm across, shallowly dentate; sepals 3, ovate to ovate-lanceolate, 0.5 - 0.8 mm across, pubescent; ovary ca 0.8 mm across, densely pubescent; styles 3, filiform, 2 - 4 mm long; stigma fimbriate. Capsules 3-lobed, 2 - 2.5 x 4 - 5 mm, with hispid hairs from glandular bases; seeds ovoid to globose-ovoid, 1.5 - 2 mm across.

*Fl. & Fr.* June - Nov.

*Distrib.* India: A weed in gardens, roadsides and cultivated fields, at low altitudes. Gujarat,



**Fig. 6.** *Acalypha lanceolata* Willd.: a. habit; b. male flower; c. stamens; d. female bracts arranged in spike; e. female flower; f. fruit; g. seed.

Rajasthan, Madhya Pradesh, Uttar Pradesh, West Bengal, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu and Andaman Islands.

Sri Lanka, Bangladesh, Myanmar, China, Thailand, Indo-china, through Malesia to Polynesia.

*Note.* Chromosome numbers:  $n = 14$  (Sanjappa, Taxon 28: 274. 1979);  $2n = 38$  (Datta, Taxon 16: 341 - 350. 1967, as *A. fallax*);  $2n = 42$  (Banerji, Bull. Bot. Soc. Bengal 3: 29 - 32. 1949, as *A. fallax*).

**8. *Acalypha malabarica*** Müll.Arg. in Linnaea 34: 42. 1865 & in DC., Prodr. 15(2): 871. 1866; Hook.f., Fl. Brit. India 5: 416. 1887. **Fig. 7**

Herbs, annual, erect, 30 - 40 cm high; branches finely pubescent. Leaves ovate to ovate-lanceolate or elliptic to elliptic-lanceolate, cuneate to subtruncate at base, crenate-serrate along margins, acute to subobtusate at apex, 1.5 - 6 x 1.2 - 3 cm, membranous to thinly coriaceous, pilose or hispid on both surfaces, gland-dotted beneath; basal nerves 3 - 5 from the base; lateral nerves 4 - 6 pairs; petioles 1.5 - 6 cm long; stipules subulate to linear, up to 3 mm long. Spikes axillary, up to 3 cm long, androgynous, finely pubescent. Male flowers: ca 0.5 mm across, very few, clustered near the apex of spikes at axils of ca 5 mm long bracts; sepals 4, ovate-lanceolate; stamens 10 - 15; filaments ca 0.1 mm long; anthers vermiculiform, ca 0.2 mm across. Female flowers: 2 - 2.5 mm across, numerous; bracts 1 or 2-flowered, leafy, subcampanulate, folded, ca 5 mm across; sepals 3 or 4, ovate to ovate-lanceolate, 0.5 - 0.8 mm across, hispid along margins; ovary ca 0.5 mm across, glandular-pubescent; styles 3, filiform, laciniate, 1.5 - 2 mm long. Capsules 3-lobed, 3 - 4 mm across, pubescent with glandular-based hairs or nearly glabrous.

*Fl. & Fr.* Aug. - Nov. or throughout the year in hot humid places.

*Distrib.* India: Wastelands, as a weed in cultivated areas, near tanks and in low-lying fields, up to 700 m altitude. Gujarat, Rajasthan, Uttar Pradesh, Madhya Pradesh, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

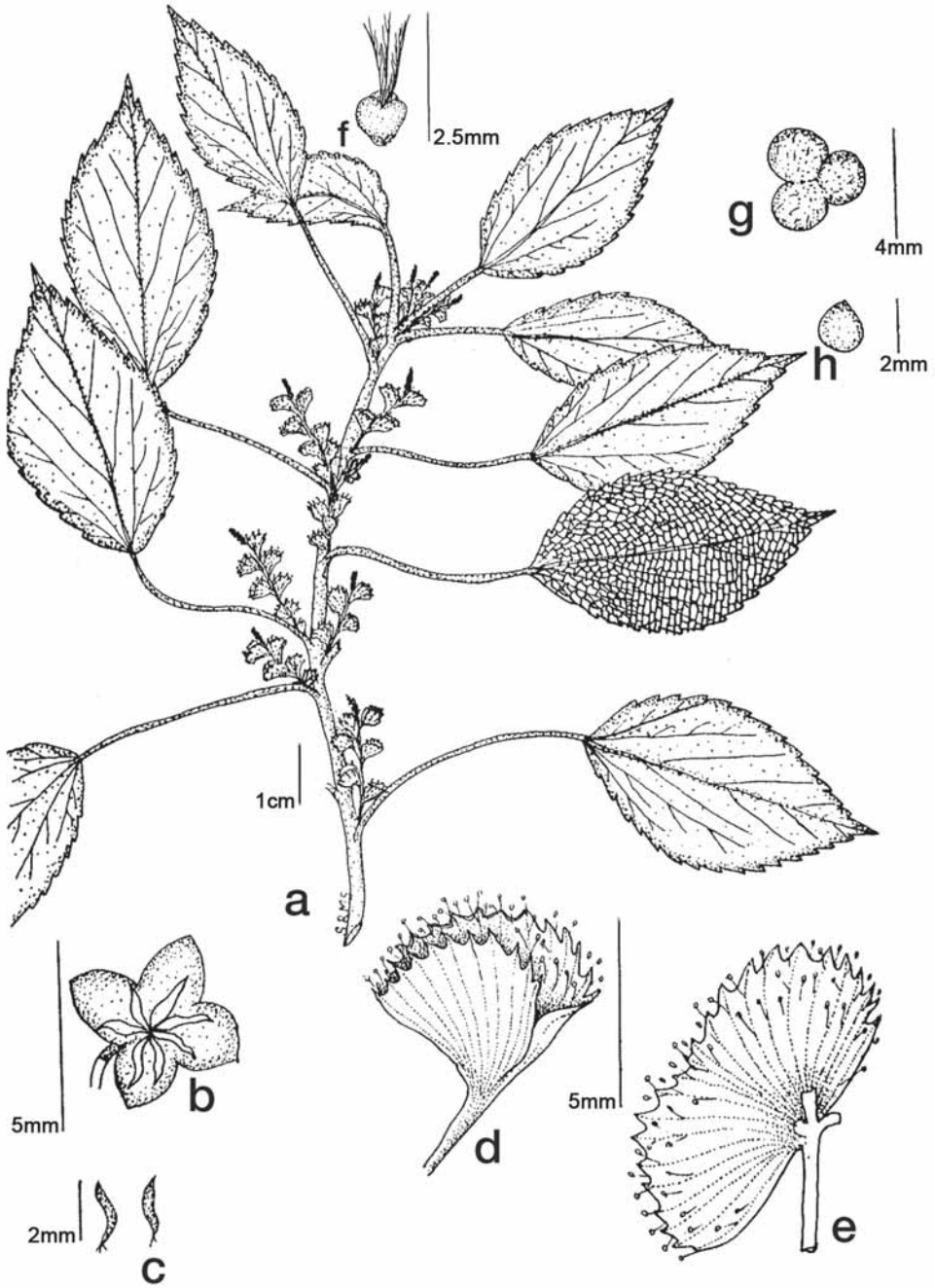
Endemic.

*Note.* Chromosome number:  $n = 14$  (Sanjappa, Taxon 28: 274. 1979).

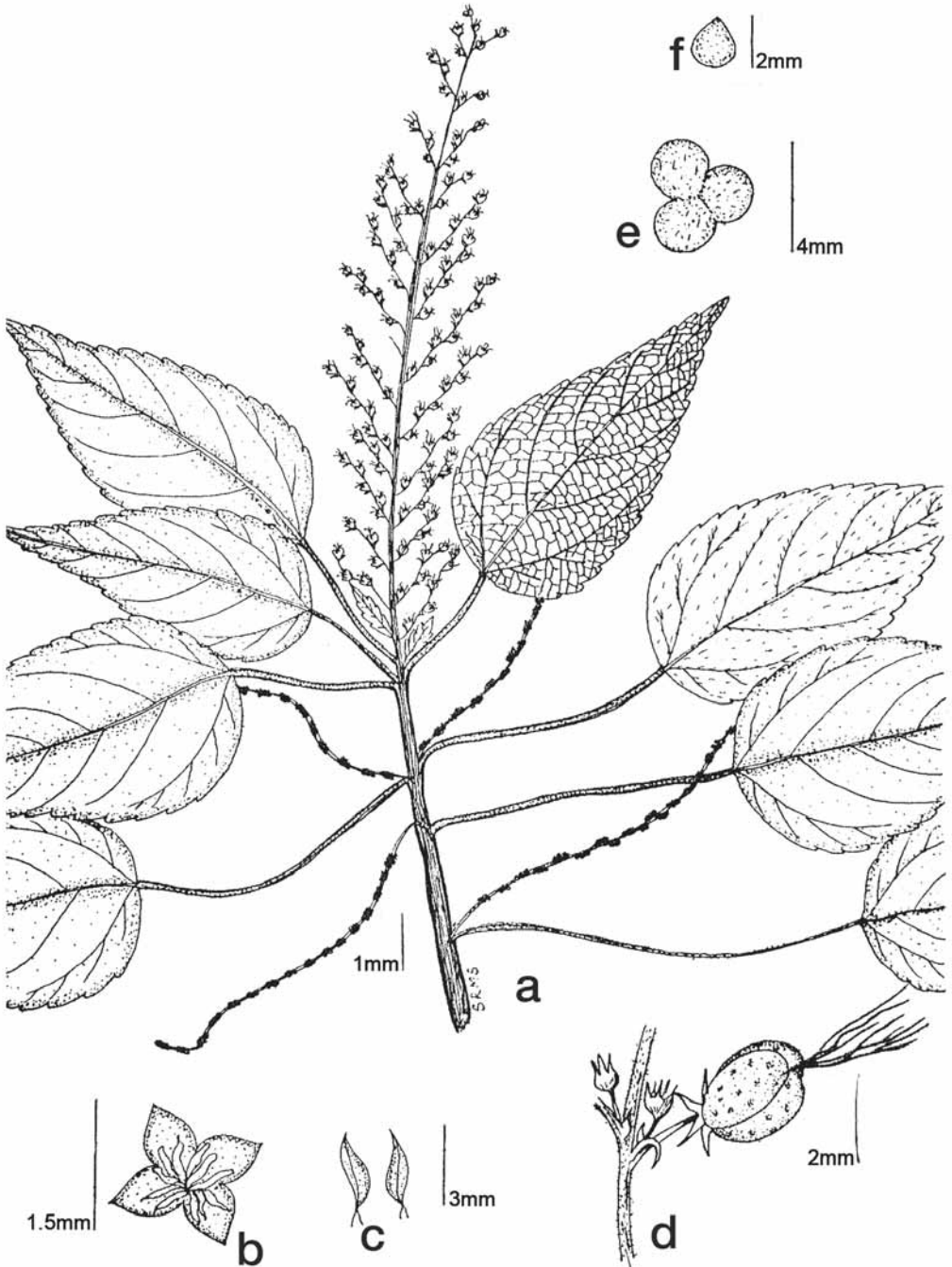
**9. *Acalypha paniculata*** Miq., Fl. Ned. Ind. 1(2): 406. 1859; Hook.f., Fl. Brit. India 5: 415. 1887. *A. racemosa* Wall. ex Baill., Etude Euphorb. 443. 1858, nom. illeg., vide Müll.Arg. in DC., Prodr. 15(2): 802. 1886; Santapau & Wagh in Bull. Bot. Surv. India 5: 105. 1963. *A. wallichii* Thwaites, Enum. Pl. Zeyl. 271. 1861. **Fig. 8**

Mal.: *Valia-kuppameni*; Tam.: *Valia-kuppameni*.

Herbs or undershrubs, erect, 0.5 - 2 m high; stems and branches finely pubescent. Leaves broadly ovate to ovate-lanceolate, broadly cuneate, rounded or subcordate at base, serrate or dentate along margins, acuminate at apex, 2.5 - 15 x 1.3 - 11 cm, membranous to coriaceous, pubescent on both sides, more dense beneath; basal nerves 3 - 5; lateral nerves 6 - 7 pairs; petioles 1.5 - 15 cm long; stipules subulate, up to 3 mm long. Male flowers: 1 - 1.5 mm across, clustered on axillary 3 - 20 cm long spikes; pedicels up to 0.7 mm long; sepals 4, ovate-



**Fig. 7.** *Acalypha malabarica* Müll.Arg.: a. habit; b. male flower; c. stamens; d. female bract; e. female bract split opened; f. female flower; g. fruit; h. seed.



**Fig. 8.** *Acalypha paniculata* Miq.: a. twig with spikes; b. male flower; c. stamens; d. female flower; e. fruit; f. seed.



lanceolate, 0.5 - 0.7 mm across; stamens 10 - 15; filaments up to 0.2 mm long; anthers vermiculiform, ca 0.3 mm long. Female flowers: 1 - 2 mm across, in terminal laxly much-branched, 5 - 25 cm long panicles; bracts ovate-lanceolate, 0.8 - 1 mm long, each supporting 3 flowers; pedicels 1 - 2 mm long; sepals 3 - 4, oblong to lanceolate, 0.5 - 1 x 0.3 - 0.5 mm; styles 3 - 7-partite, filiform, lacinate, ca 1.5 mm long, finely hairy. Capsules 3-lobed, 3 - 4 mm across, glandular-pubescent.

*Fl. & Fr.* July - Feb.

*Distrib.* India: Moist and shaded places near villages in wastelands and roadsides, from plains to 1200 m altitude. Madhya Pradesh, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Tropical Africa, India and Sri Lanka.

*Note.* Chromosome number:  $2n = 20$  (Gajapathy, Bull. Bot. Surv. India 3: 49 - 51. 1961; Datta, Taxon 16: 341 - 350. 1978; Krishnappa & Reshme, Taxon 29: 537. 1980).

**10. *Acalypha superba*** Forssk., Fl. Aegypt.-Arab. 162. 1775; Govearts et al., World Checkl. & Bibl. Euphorbiaceae 1: 40. 2000. *A. brachystachya* Hornem. in Enum. Pl. Hort. Hafn. 1. 1807 & Hort. Bot. Hafn. 2: 909. 1815; Hook.f., Fl. Brit. India 5: 416. 1887. **Fig. 9**

Herbs, annual, erect, 20 - 50 cm high; branches pubescent to subglabrous. Leaves ovate to ovate-lanceolate, rounded to subcordate at base, crenate-serrate along margins, subacute to acuminate at apex, 1.5 - 5 (- 8) x 1 - 3 (- 6) cm, membranous to subcoriaceous, pilose or subglabrous above, finely pubescent beneath, gland-dotted, 3-nerved at base; lateral nerves 4 - 6 pairs above basal; petioles 1 - 4 (- 8) cm long; stipules linear, up to 2 mm long. Inflorescences axillary, congested, androgynous, 0.5 - 1.5 cm long. Male flowers: few, clustered at apical portion of spikes, subsessile, 0.5 - 0.8 mm across; sepals 4, ovate-lanceolate, 0.5 - 0.7 mm across, hairy; stamens 10 - 15; filaments up to 0.2 mm long; anthers vermiculiform, 0.2 - 0.3 mm across. Female flowers: 2 or 3 clustered in the axil of each bract, 1 - 1.5 mm across; bracts cut into 3 - 5 lobes; sepals lanceolate, ca 0.5 mm long, hyaline; ovary 1 - 1.5 mm across, densely pubescent; styles 3, pectinately lacinate, 1 - 2 mm long. Capsules 3-lobed, 4 - 5 mm across, hispid, totally concealed inside large green bracts.

*Fl. & Fr.* Sept. - March.

*Distrib.* India: Moist sheltered places especially in subtropical forests, at 500 to 1500 m altitude. Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Meghalaya, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Tropical C. & E. Africa, Pakistan, Sri Lanka, Nepal, Bhutan, Myanmar, Indo-China, Thailand, Sumatra, Java, Lesser Sunda Islands, Timor and Celebes.

*Note.* Chromosome numbers:  $2n = 20, 24$  (Champault, Bull. Soc. Bot. France 117: 137 - 168. 1970);  $2n = 24$  (Datta, Taxon 16: 341 - 350. 1967).

#### CULTIVATED SPECIES AND VARIETIES

- |   |   |                                |
|---|---|--------------------------------|
| 1 | a. Leaves entirely green  | (2) <b><i>A. hispida</i></b>   |
|   | b. Leaves variously coloured and mottled, if green then variously mottled | 2                              |
| 2 | a. Leaves ovate, cordate, russet-brown, blotched with paler spots         | (4) <b><i>A. stachyura</i></b> |
|   | b. Leaves broadly ovate-lanceolate, variously coloured and mottled        | 3                              |



**Fig. 9.** *Acalypha superba* Forssk.: a. twig with spikes; b. male flower; c. stamens; d. female bracts; e. female flower; f. fruit; g. seed.

- 3 a. Leaves bronze green, variously mottled (1) *A. amentacea* ssp. *wilkesiana*  
 b. Leaves bright green, variously mottled (3) *A. integrifolia* ssp. *marginata*

**1. *Acalypha amentacea*** Roxb. ssp. *wilkesiana* (Müll.Arg.) Fosberg in Smithsonian Contr. Bot. 45: 10. 1980; Govaerts et al., World Checkl. & Bibl. Euphorbiaceae 1: 48. 2000. *A. wilkesiana* Müll.Arg. in DC., Prodr. 15(2): 817. 1866.

Shrubs, up to 3 m tall. Leaves broadly ovate-lanceolate or oblanceolate, broadly cuneate, to cordate at base, acuminate at apex, deeply dentate with prominent rounded yellow teeth along margins, 8 - 30 x 5 - 12 cm, pilose or sparsely pubescent on both sides, often variegated, 3-nerved at base; lateral nerves 8 - 12 pairs; petioles 3 - 9 cm long, white glaucous, densely pubescent; stipules subulate, 2 - 3 mm long. Male spikes: axillary or terminal, 5 - 10 cm long; flowers 1.5 - 2 mm across, clustered at axils of bracts; sepals 4, ovate, concave, ca 1 mm across; stamens 6 - 8; filaments ca 0.2 mm long; anthers ca 0.5 mm long. Female spikes: axillary or terminal, 3 - 8 cm long, dense with conspicuous styles; bracts lanceolate, partly folded, 4 - 5 x 2 - 3 mm; sepals ovate-lanceolate, 1 - 1.5 x ca 0.7 mm, pubescent; ovary globose, ca 2 mm across, densely pubescent; styles lacinate, 7 - 9 mm long, sparsely pubescent. Fruits and seeds unknown.

Cultivated in tropical gardens in India, as an ornamental plant.

Notes. *Chromosome number*: ca 200 (Gill et al., Cytologia 38: 391 - 401. 1973).

**2. *Acalypha hispida*** Burm f., Fl. Indica 303, t. 61, f. 1. 1768; Hook.f., Fl. Brit. India 5: 417. 1887. *Caturus spiciflorus* Roxb., Fl. Ind., ed. Carey 3: 760. 1832, non L., 1767.

Mal.: *Vattathali*.

An ornamental garden shrub, up to 1.5 (- 2) m high, with ovate or suborbicular green leaves, pendulous catkin-like female inflorescences and red flowers with a dense mat of crimson red style.

Ellis (J. Econ. Taxon. Bot. 10: 205. 1987) reports that domestic cats of Andaman Islands are greatly fond of the roots of this species.

**3. *Acalypha integrifolia*** Willd. ssp. *marginata* (Poir.) Couda in Kew Bull. 34: 42. 1979; Govaerts et al., World Checkl. & Bibl. Euphorbiaceae 1: 69. 2000. *Tragia marginata* Poir. in Lam., Encycl. 7: 725. 1806. *A. marginata* (Poir.) Spreng., Syst. 3: 879. 1826; Müll.Arg. in DC., Prodr. 15(2): 850. 1866.

**4. *Acalypha stachyura*** Pax in Repert. Spec. Nov. 7: 110. 1909. *A. macrophylla* Ule in Verh. Bot. Ver. Brandenb. 1: 79. 1908, nom. illeg.

There are several variable forms in this species, called Fire Dragon, Mandarin's Robe, Copper Leaf and Dead Nettle. The leaves are bronze-green, variegated with orange-red, dull red or dark and pale green spots.

## 2. *Claoxylon* A.Juss.

Trees or shrubs, rarely herbs, dioecious or monoecious, evergreen. Leaves alternate, lower ones rarely opposite, often pellucid-dotted above in living plants with protruding points which become scabrous when dry, penninerved, rarely palmately 3-nerved at base, usually

long-petioled; stipules small or minute. Flowers small, in axillary or lateral spikes or racemes, solitary or 2 together. Male flowers: 1 - many fascicled in each bract; calyx subglobose, closed in bud, splitting into 3 or 4 valvate segments; petals and disc absent; stamens 3 - 60 or more, free, inserted on or around a central flat, vaulted, convex or elevated receptacle, often intermixed with intrastaminal glands or long linear scales or hairs; filaments free, short; anthers erect; thecae distinct, connate at base, free above, extrorsely dehiscent; pistillode absent. Female flowers: solitary in each bract; sepals 3 (- 5), shortly connate at base; disc absent or consisting of petal-like hypogynous scales, glandular, enlarged, 2 - 3-lobed with elongate liguliform lobes alternating with the carpels; staminodes absent; ovary (2 -) 3 (- 4)-loculed; ovule solitary in each locule; styles same number as ovary-locules, coarsely papillose inside, often plumose; stigmas short, divided into fringed segments or rarely smooth. Fruits schizocarpic capsules, 2 or 3 (- 4)-locular, deeply or shallowly lobed, fleshy or coriaceous, dehiscent loculicidally and septicidally or indehiscent; seeds subglobose, with a fleshy outer and hard foveolate-reticulate crustaceous inner layer (testa), thinly arillate or not arillate; endosperm fleshy; cotyledons broad, flat.

Paleotropical, spread over Africa, Asia, Australia, extending eastwards to Pacific Islands, up to Society Islands, ca 113 species; 9 species in India.

*Literature.* PRAIN, D. (1911). A review of the genera *Erythrococca* and *Micrococca*. Ann. Bot. (Usteri) 25: 575 - 638. SAGUN, V. G. & P. VAN WELZEN (2002). Revision of the Malaysian species of *Micrococca* (Euphorbiaceae). Blumea 47: 149 - 155. SUSILARANI, S. R. M. & N. P. BALAKRISHNAN (1992). *Claoxylon wightii* Hook. f. (Euphorbiaceae) and its allies. J. Econ. Taxon. Bot. 16: 733 - 736. SUSILARANI, S. R. M. & N. P. BALAKRISHNAN (1995). A revision of the genus *Claoxylon* Adr. Jussieu (Euphorbiaceae) in India. Rheedea 5: 113 - 141, ff. 1 - 8.

*Notes.* Following Prain (1911), Sagun & van Welzen (2002) treat *Micrococca* and *Claoxylon* as independent genera. However, they have not seen the paper by Susila Rani & Balakrishnan (l. c. 1995), nor have they studied Indian species of *Claoxylon*. *Micrococca* Benth. is based on certain differentiating characters, i. e. the herbaceous nature, the opposite lower leaves, interrupted racemes, lesser number (3 - 20) of stamens, plumose styles, loculicidally and septicidally dehiscent capsules with thinly arillate seeds. However, analysis of all Indian species of *Claoxylon* indicated that these characters are variable and often becomes intermediate. There are two species endemic to India, *C. beddomei* and *C. wightii*, which show a bridge between *Micrococca* and *Claoxylon*. The herbaceous nature of *M. mercurialis* continues into *Claoxylon* where the species are subshrubs, shrubs or trees. The lower leaves are sometimes opposite in *C. anomalum* and they are subopposite in *C. wightii*. The interrupted racemes occur in both genera but only in varying degrees. The stamen number varies from 3 to 10 in *Micrococca* and from 20 to 60 or more in *Claoxylon*. *M. mercurialis* itself shows regional variation with 3 stamens in Asia and 9 stamens in Africa. *C. beddomei* and *C. wightii* show 5 - 20 stamens. The disc lobes are present in female flowers of both genera; only the length *versus* breadth varies showing different lengths in Indian species, sometimes becoming minute and indistinct. In *C. anomalum*, the female disc is annular with three lobes and each lobe triangular and appressed to the ovary. In *C. indicum*, *C. beddomei* and *C. wightii*, the female disc consists of 3 oblong-ligulate lobes each 1 - 2 mm long. The capsules of *C. indicum* dehisce both loculicidally and septicidally. In other species, there are no records to show whether both types of dehiscence occur or not, a feature that only careful field observation will show. At the same time, there are certain dependable and invariable characters common to both these genera, i. e. the constantly 3-sepaled male flowers, the divaricate anther-thecae which are connate at

base and free above, the stamens mixed with ciliate scales or glands, the presence of pits over seeds, etc., which indicate commonality and propinquity of these genera. Therefore, keeping them separately is not justified by facts. It is also not practical to differentiate them by any decisive character. Therefore, they are combined and treated here as a single genus, as was done by Mueller Argoviensis (1866) and J. D. Hooker (1887).

#### KEY TO THE SPECIES

- 1 a. Stamens (3 -) 5 - 12 (- 20) 2
- b. Stamens 20 - 60 or more 4
- 2 a. Male receptacle without interstaminal glands, with extra-staminal glands outside the stamens **2. C. beddomei** 3
- b. Male receptacles with interstaminal glands, without extra-staminal glands 3
- 3 a. Annual herbs or sometimes perennial subshrubs; racemes bisexual, equal to or longer than leaves **7. C. mercurialis**
- b. Perennial shrubs; racemes unisexual, shorter than leaves **9. C. wightii**
- 4 a. Male receptacle elevated, eglandular and glabrous in between the stamens, with a ring of pilose hairs below the stamens **1. C. anomalum**
- b. Male receptacle convex or flat, not elevated, glandular and often with scales or hairs intermingled with stamens, without a ring of pilose hairs below the stamens 5
- 5 a. Capsules flattened, inflated at middle, 2-locular, 2-lobed, cuneate at base, conspicuously beaked at apex **8. C. rostratum**
- b. Capsules globose, 3-locular, 3-lobed, not cuneate at base, nor beaked at apex 6
- 6 a. Interstaminal glands on receptacle mixed with minute hyaline scales, not mixed with tufts of hairs **4. C. khasianum**
- b. Interstaminal glands on receptacle mixed with hyaline scales and also a tuft of long hairs 7
- 7 a. Petioles glandular at apex; male racemes 20 - 40 cm long; stamens 20 - 40, rarely more **3. C. indicum**
- b. Petioles eglandular at apex; male racemes 8 - 18 cm long; stamens 35 - 60 8
- 8 a. Capsules shallowly 3-lobed, thinly puberulous, smooth **5. C. longifolium**
- b. Capsules deeply 3-lobed, covered with hirsute prickles **6. C. longipetiolatum**

**1. *Claoxylon anomalum*** Hook.f., Fl. Brit. India 5: 412. 1887, emend. V.S.Raju & C.N.Mohanan in J. Econ. Taxon. Bot. 5: 1202. 1984; Susila & N.P.Balacr. in Rheedeia 5(2): 116, f. 1. 1995.

#### Fig. 10

Shrubs, 1 - 2 m high, dioecious; branchlets puberulous or glabrous; indumentum simple. Leaves narrowly elliptic to oblanceolate or elliptic-lanceolate, acute or cuneate at base, long-acuminate at apex, crenate-serrate along margins, (8-)15 - 20 x 3 - 6 cm, membranous to chartaceous, punctate, puberulous on nerves; lateral nerves 6 - 9 pairs, stipules caducous; petioles up to 7.5 cm long, with 2 - 4 glands at apex. Inflorescences racemose, axillary, simple, up to 3 cm long; peduncles 2 - 5 mm long. Male flowers: bracts 3, with one main and two lateral ones, each carrying 1 - 2 flowers; pedicels ca 1 mm long; calyx-lobes 3, triangular, 1 - 1.5 mm long; stamens 25 - 40; filaments minute or absent; anthers 0.3 - 0.5 mm across. Female flowers: bracts 3, triangular, 2 - 4 mm across; single-flowered; pedicels 2 - 4 mm long; calyx-lobes 3, ovate-lanceolate, 1 - 2 mm long; ovary trigonous, usually 3-locular, occasionally 2 or 4-locular, 2 - 4 mm across, puberulous, styles 3, not clearly distinguishable from ovary; disc annular, 3-lobed; scales 3, free, 2 - 5 mm long, spreading, plumose-papillose. Fruits depressed-globose, deeply 3-



**Fig. 10. *Cloxylon anomalum* Hook.f.:** a. twig with male inflorescences; b. twig with fruits; c. female bract – inner and outer views; d. male bracts; e. male bud; f. stamens; g. seed.

lobed, 1 - 1.5 cm across, sparsely puberulous; seeds globose, smooth, ca 6 mm across, arillate; testa foveolate.

*Fl. & Fr.* Jan. - Oct.

*Distrib.* India: Wet evergreen or semi evergreen forests, along margins of streams in valleys, occasionally ascending on slopes of hills, up to 1500 m. Kerala (Idukki) and Tamil Nadu (Courtallam).

Endemic to southern parts of Western Ghats.

**2. *Claoxylon beddomei*** Hook.f., *Fl. Brit. India* 5: 413. 1887; Susila & N.P Balakr. in *Rheedea* 5(2): 128, f. 5. 1995. *Micrococca beddomei* (Hook.f.) Prain in *Ann. Bot. (Usteri)* 25: 630. 1911; Gamble, *Fl. Madras* 2(7): 1328. 1921 (repr. ed. 2: 929. 1957). **Fig. 11**

Shrubs, dioecious, 2 - 3 m high; young shoots hispid. Leaves elliptic-lanceolate, cuneate or narrow-rounded at base, acuminate at apex, coarsely dentate, serrate to entire along margins, 5 - 18 x 2 - 5 cm, coriaceous or membranous, glabrous or pilose; lateral nerves 8 - 12 pairs; petioles 2 - 7 cm long; stipules subulate, up to 0.5 mm long. Racemes axillary, 3 - 15 cm long. Male flowers: 3 - 5 mm across; pedicels 3 - 7 mm long, sparsely pubescent; calyx lobes 3, ovate, 2 - 3 mm across, finely hairy; stamens 5 - 12 or 15 - 20, filaments minute; anthers linear; glands extra-staminal. Female flowers: 4 - 5 mm long, solitary; pedicels 1 - 1.2 cm long; sepals 3, ovate to suborbicular 2 - 4 mm across; ovary 3-loculed, ca 3 mm across, subglabrous; ligule scales 3, attached to ovary; styles 1 - 2 mm long. Fruits trilobed, 8 - 10 mm across, glabrous or strigose-hispid; seeds globose, 3 - 4 mm across, deeply foveolate.

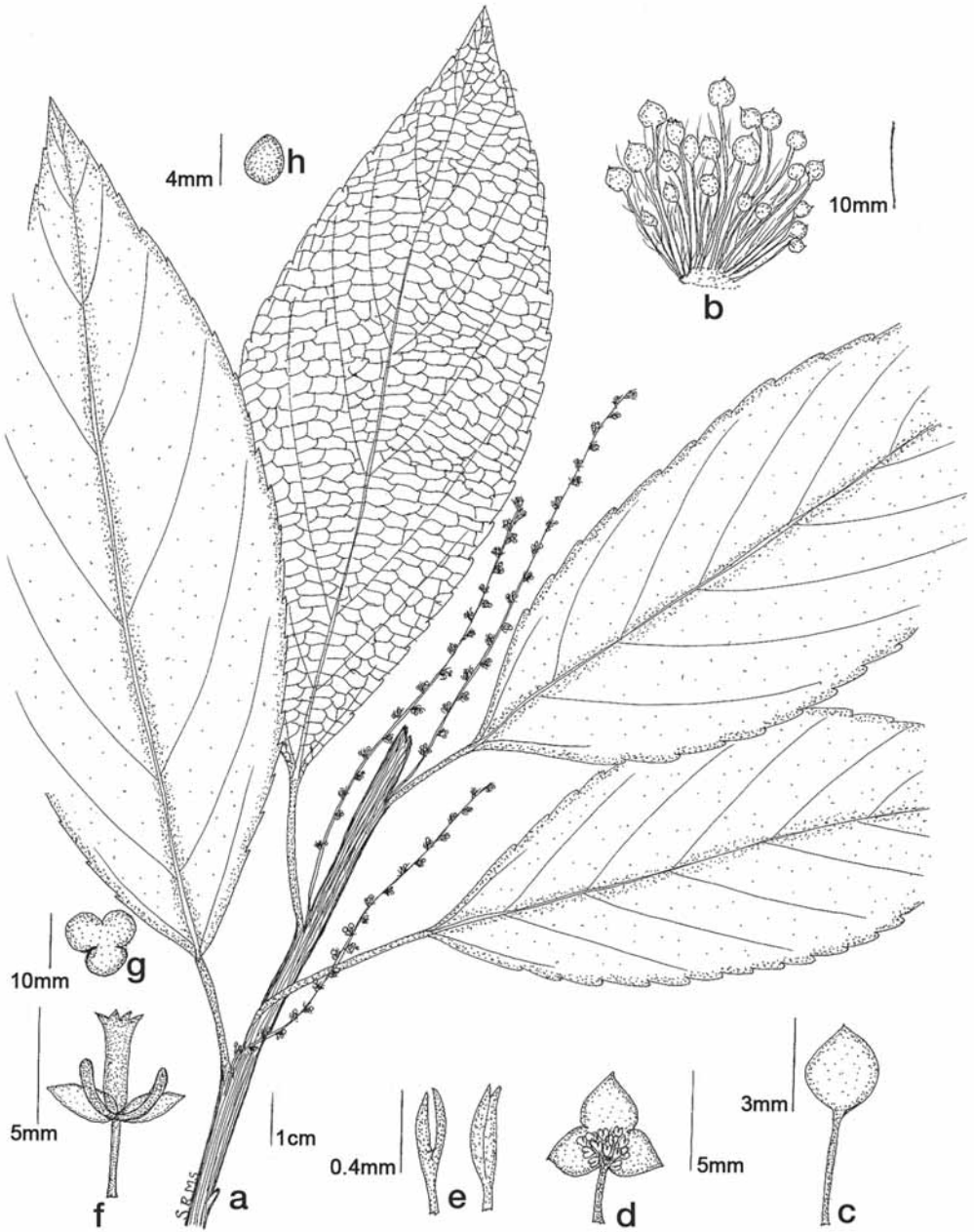
*Fl. & Fr.* June - Nov.

*Distrib.* India: Common in hill slopes, in estates, along roadsides in forests and other shaded places, between 700 - 1100 m altitudes. Kerala and Tamil Nadu.

Endemic.

**3. *Claoxylon indicum*** (Reinw. ex Blume) Hassk., *Cat. Hort. Bot. Bogor. Alter.* 235. 1844; Hook.f., *Fl. Brit. India* 5: 411. 1887; Susila & N.P. Balakr. in *Rheedea* 5(2): 119, f. 2. 1995. *Erythrochilus indicus* Reinw. ex Blume, *Bijdr. Fl. Ned. Ind.* 615. 1826. *Claoxylon polot* sec. Merr., *Interpr. Rumph. Herb. Amboin.* 200. 1917; Thoth. in *Indian Forester* 101: 179. 1975 (non Burm.f. 1768).

Shrubs or trees, 4 - 10 m tall; branchlets hollow, puberulous; all parts greyish pubescent or tomentellous. Leaves broadly ovate to elliptic-ovate or lanceolate to oblong-lanceolate or suborbicular, cuneate, acute, truncate or subcordate at base, subentire and sinuate, crenate-dentate and irregularly glandular along margins, acute to shortly acuminate at apex, (12 -) 15 - 35 (- 45) x 8 - 15 (- 25) cm, membranous to chartaceous, glabrous or minutely pilose above, soft pubescent or stellate beneath, penninerved; lateral nerves 6 - 12 pairs; petioles 3 - 15 (- 18) cm long; stipules early caducous. Male flowers: in scattered clusters or fascicles of subsessile flowers, arranged on axillary or terminal pendulous 5 - 40 cm long racemes, densely whitish pubescent; bracts ovate-lanceolate, 1 - 1.5 mm across; pedicels 2 - 4 mm long; sepals oblong-



**Fig. 11. *Claosylon beddomei* Hook.f.:** a. twig with inflorescences; b. flower cluster; c. male bud; d. male flower; e. stamens; f. female flower; g. fruit; h. seed



ovate to lanceolate, 2 - 3 mm long; stamens 15 - 40, intermixed with glands and filiform 0.4 - 0.9 mm long scales, with a tuft of white villous hairs; filaments connate at base; anthers 2-loculed. Female flowers: solitary in axils of bracts on (2 -) 5 - 12 (- 15) cm long racemes; bracts ovate-lanceolate, 1 - 1.5 mm across; flowers 2 - 4 mm across; pedicels 2 - 3 mm long, articulate, elongating in fruits; sepals 3, connate at base, spathaceous, ovate-lanceolate or triangular, 2 - 3 x 1 - 2 mm; disc lobed; ovary subglobose, 1.5 - 2 mm across, 3-locular, hirsute; scales 3, attached to ovary. Fruits depressed-globose to subglobose, trigonous, 7 - 10 mm in diam., bright red, finely softly tomentose or yellowish pubescent; cocci keeled; seeds globose, 3 - 4 mm across.

*Fl.* Jan. - April; *Fr.* March - Sept.

*Distrib.* India: Evergreen or mixed forests, beach forests on sandy or clayey soil. Andaman & Nicobar Islands.

Myanmar, China, Vietnam, Thailand and throughout Malesia to New Guinea.

**4. *Claoxylon khasianum*** Hook.f., *Fl. Brit. India* 5: 411. 1887; Kanjilal et al., *Fl. Assam* 4: 210. 1940; Susila & N.P.Balacr. in *Rheedea* 5(2): 127. 1995. *C. khasianum* var. *serrulatum* Hook.f., l. c. 411. 1887, (as '*serrulata*').

**Fig. 12**

Shrubs or small trees, 2 - 10 m tall; stems hollow. Leaves linear-lanceolate, elliptic-lanceolate or oblong-lanceolate, acute, cuneate-obtuse or rounded at base, acute to acuminate at apex, crenate-dentate, obscurely serrate or serrulate (each tooth ending with a gland) along margins, 10 - 25 x 6 - 19 cm, membranous to chartaceous, finely pubescent on nerves beneath; lateral nerves 6 - 12 pairs; petioles 3 - 15 cm long. Male flowers: clustered in filiform 5 - 30 cm long hirsute spikes; flowers in axils of bracts, 3 - 5 mm across; bracts ovate, 1 - 2 x ca 1 mm; pedicels 2 - 3 mm long; sepals 3 (-4), ovate, ca 3 x 2 mm; stamens 35 - 40 or ca 50, mixed with hyaline ca 0.5 mm long scales or glands; filaments up to 3 mm long; anther-thecae 0.5 - 0.7 mm across. Female flowers: 3 - 7 mm across, solitary, in 3 - 9 cm long panicles; ovary 5 - 8 mm across, white pubescent; styles 3, 3 - 5 mm long, plumose. Fruits 3-lobed, globose, 1 - 1.8 cm across, hirsute or finely pubescent, thinly crustaceous; seeds globose, 6 - 8 mm across.

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

*Distrib.* India: Mainly in hills and mountains, 1000 - 1600 m. Assam, Meghalaya and Nagaland.

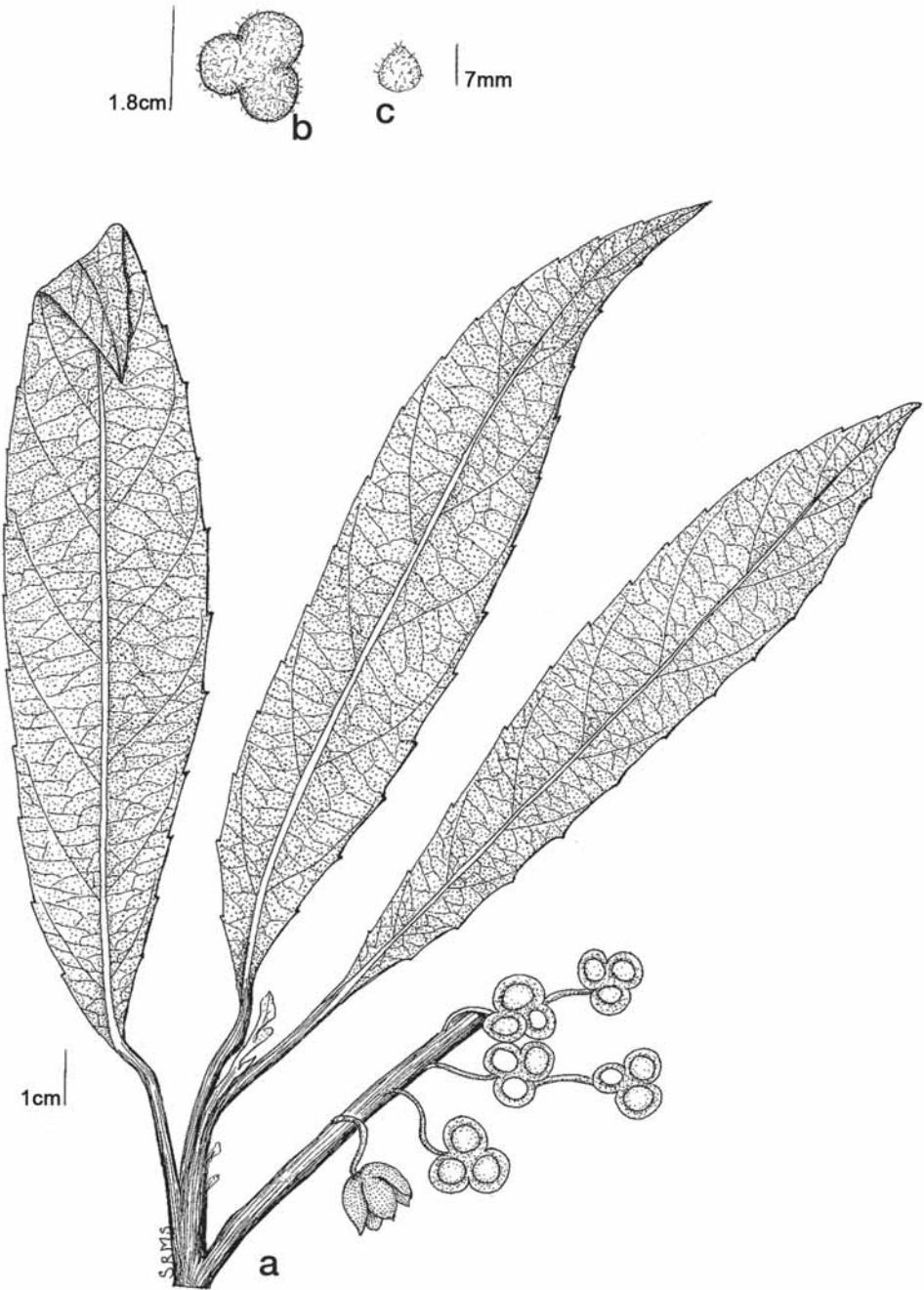
Bangladesh, Myanmar, China and Vietnam.

*Notes.* Chromosome number:  $2n = 96$  (Sarkar et al., *Taxon* 27: 53 - 61. 1978).

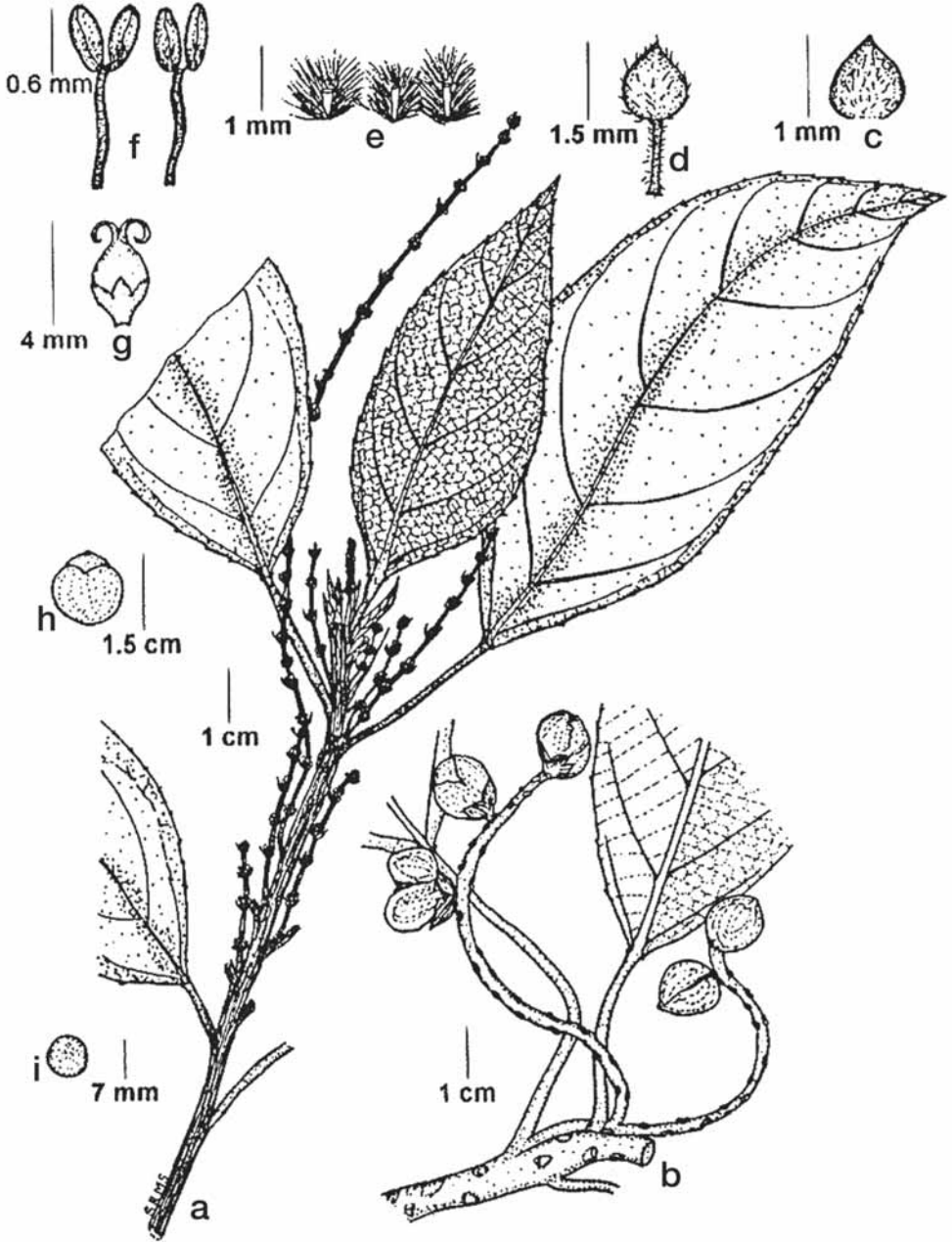
**5. *Claoxylon longifolium*** (Blume) Endl. ex Hassk., *Cat. Hort. Bot. Bogor.* 235. 1844; Hook.f., *Fl. Brit. India* 5: 411. 1887; Susila & N.P.Balacr. in *Rheedea* 5(2): 122, f. 3. 1995. *Erythrochilus longifolius* Blume, *Bijdr. Fl. Ned. Ind.* 616. 1826.

**Fig. 13**

Shrubs or small trees, up to 9 m tall, evergreen. Leaves elliptic-lanceolate, obovate to elliptic-oblong-lanceolate, narrowed at both ends, attenuate, acute, obtuse, truncate or rounded at base, crenate-serrate, irregularly toothed with glands or subentire along margins, acute or caudate at apex, 12 - 25 x 5 - 10 cm, chartaceous to subcoriaceous, subglabrous (finely pubescent on young leaves) or minutely puberulous beneath; lateral nerves 6 - 12 pairs; petioles 2 - 12 cm



**Fig. 12.** *Claoxylon khasianum* Hook.f.: a. female plant; b. fruit; c. seed.



**Fig.13.** *Claosylon longifolium* (Blume) Endl. ex Hassk.: a. twig with male inflorescences; b. twig with fruits; c. male bract; d. male bud; e. intrastaminal glands; f. stamens; g. female flower; h. fruit; i. seed.

long, finely puberulous. Male flowers: in terminal or axillary pendulous 8 - 20 (- 30) cm long racemes; flowers clustered in axils of bracts; bracts ovate, up to 1 mm across; pedicels 3 - 4 mm long; sepals 3, oblong-ovate, 2 - 3 mm across; stamens 35 - 50; filaments free, 1 - 1.5 mm long, with 0.5 - 1 mm long hyaline scales or glands with a tuft of hairs; anthers globose, ca 0.6 mm across. Female flowers: solitary in axils of bracts, arranged in short 3 - 8 cm long racemes; bracts ovate, 1 - 1.5 mm long; pedicels 0.5 - 1 mm long; calyx spathaceous, 4 or 5-lobed; lobes ovate-orbicular to triangular, 1 - 2 mm long; ovary subglobose, 3-loculed, 3 - 4 mm across, densely pubescent; styles 2, plumose, fimbriate-fringed, recurved, 1 - 1.5 mm long. Fruits tridymous, 1 - 1.5 cm across, contracted at base to a 3 - 5 mm long pedicel, smooth, ochraceous tomentellous; seeds globose to obovoid, 5 - 7 mm across.

*Fl. & Fr.* April - Dec.

*Distrib.* India: In dense evergreen primary or secondary forests, at low levels up to 500 m. Meghalaya, West Bengal and (?) Andaman & Nicobar Islands.

Myanmar, China, Cambodia, Laos, Vietnam, Thailand, Malesia to New Guinea.

*Uses.* In Malaysia and Philippines, the young shoots are used as vegetable.

**6. *Claoxylon longipetiolatum*** Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 244. 1873 & Forest Fl. Burma 2: 396. 1877; Hook.f., Fl. Brit. India 5: 413. 1887; Susila & N.P. Balakr. in Rheede 5(2): 124, f.4. 1995.

Shrubs or trees, (3 -) 5 - 10 m tall, finely pubescent throughout. Leaves broadly elliptic, oblong-ovate to oblong-lanceolate, acute, obtuse, rounded or subcordate at base, acuminate-cuspidate at apex, crenate and toothed with glands along margins, 20 - 40 x 9 - 18 cm, chartaceous, glabrous or pilose above, softly pubescent on nerves beneath; lateral nerves 6 - 10 pairs; petioles 4 - 12 (- 14) cm long. Male flowers: clustered in filiform 10 - 20 cm long spikes; bracts subulate, up to 1 mm long; flowers 4 - 6 mm across; pedicels 6 - 7 mm long; sepals 3, ovate-lanceolate, 2 - 3 mm across; stamens 35 - 60, intermixed with glands or scales with a tuft of up to 0.5 mm long hairs; filaments 0.5 - 2 mm long; anthers parallel, globose 0.3 - 0.5 mm across. Female flowers not seen. Fruits deeply 3-lobed, covered with soft hirsute prickles.

*Fl.* Feb. - May; *Fr.* May - July (-Dec.).

*Distrib.* India: Frequent in clearing and open places, chiefly along tropical forests. West Bengal, Meghalaya and (?) Andaman & Nicobar Islands.

Myanmar.

*Note.* Chromosome number:  $n = 54$ ,  $2n = 108$  (Mehra & Hans, Taxon 18: 310 - 315. 1969; Hans, Taxon 22: 591 - 636. 1973).

**7. *Claoxylon mercurialis*** (L.) Thwaites, Enum. Pl. Zeyl. 271. 1861; Hook.f., Fl. Brit. India 5: 412. 1887; Susila & N.P. Balakr. in Rheede 5(2): 131. 1995. *Tragia mercurialis* L., Sp. Pl. 980. 1753. *Micrococca mercurialis* (L.) Benth. in Hook., Niger Fl. 503. 1849; Haines, Bot. Bihar Orissa 2: 116. 1921; Gamble, Fl. Madras 2(7): 1328. 1921 (repr. ed. 2: 929. 1957); Govaerts et al., World Checkl. & Bibl. Euphorbiaceae 3: 1182. 2000. *Microstachys mercurialis* (L.) Dalzell & A. Gibson, Bombay Fl. 227. 1861.

Guj.: *Ardio-okharad*.

Herbs or subshrubs, annual or rarely perennial, 30 - 80 cm high, much-branched; branches minutely pubescent. Leaves ovate, rhombate-ovate, elliptic-ovate to elliptic-lanceolate, acute, obtuse, cuneate or truncate at base, shortly acuminate at apex, crenate-serrate along margins, 1.5 - 8 x 0.7 - 3 cm, coriaceous to membranous, pilose, puberulous or subglabrous or minutely pubescent on nerves; lateral nerves 5 - 7 pairs; petioles 1 - 6 cm long; stipules subulate, ca 0.2 mm long, finely hairy. Racemes bisexual, axillary or terminal, 2.5 - 10 cm long, hispid; bracts very remote; flowers short to long-pedicelled, few, in distant clusters. Male flowers: subsessile, 1 - 1.5 mm across; sepals 3, ovate, ca 1 mm across; stamens 3 - 10, mixed with ciliate scales or glands, up to 0.8 mm long; filaments up to 0.2 mm long; anther-locules parallel, linear, ca 0.4 mm wide. Female flowers: 2 - 4 mm across, solitary or sometimes 2 with many male flowers; pedicels 0.5 - 2 mm long; sepals 3 or 4, ovate-lanceolate, elliptic to suborbicular, 2 - 4 mm across, hirsute; scales 3, attached to ovary, alternate with sepals, ligulate, oblong, obtuse or subacute at apex, 1 - 2 mm long, hyaline. Fruits tridymous or rarely didymous, globose or subglobose, 0.7 - 1 cm across, depressed, glabrous or sparsely hairy; seeds globose, 3 - 4 mm across, pitted or verrucose.

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

*Distrib.* India: Generally in humid regions, a weed of cultivation, restricted to moist, shaded gravelly hill slopes, often found in fertile soils of plains, wastelands and in places where city wastes are heaped. Himachal Pradesh, Haryana, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Orissa, Madhya Pradesh, Andhra Pradesh, Maharashtra, Goa, Karnataka, Kerala, Lakshadweep, Tamil Nadu and Pondicherry.

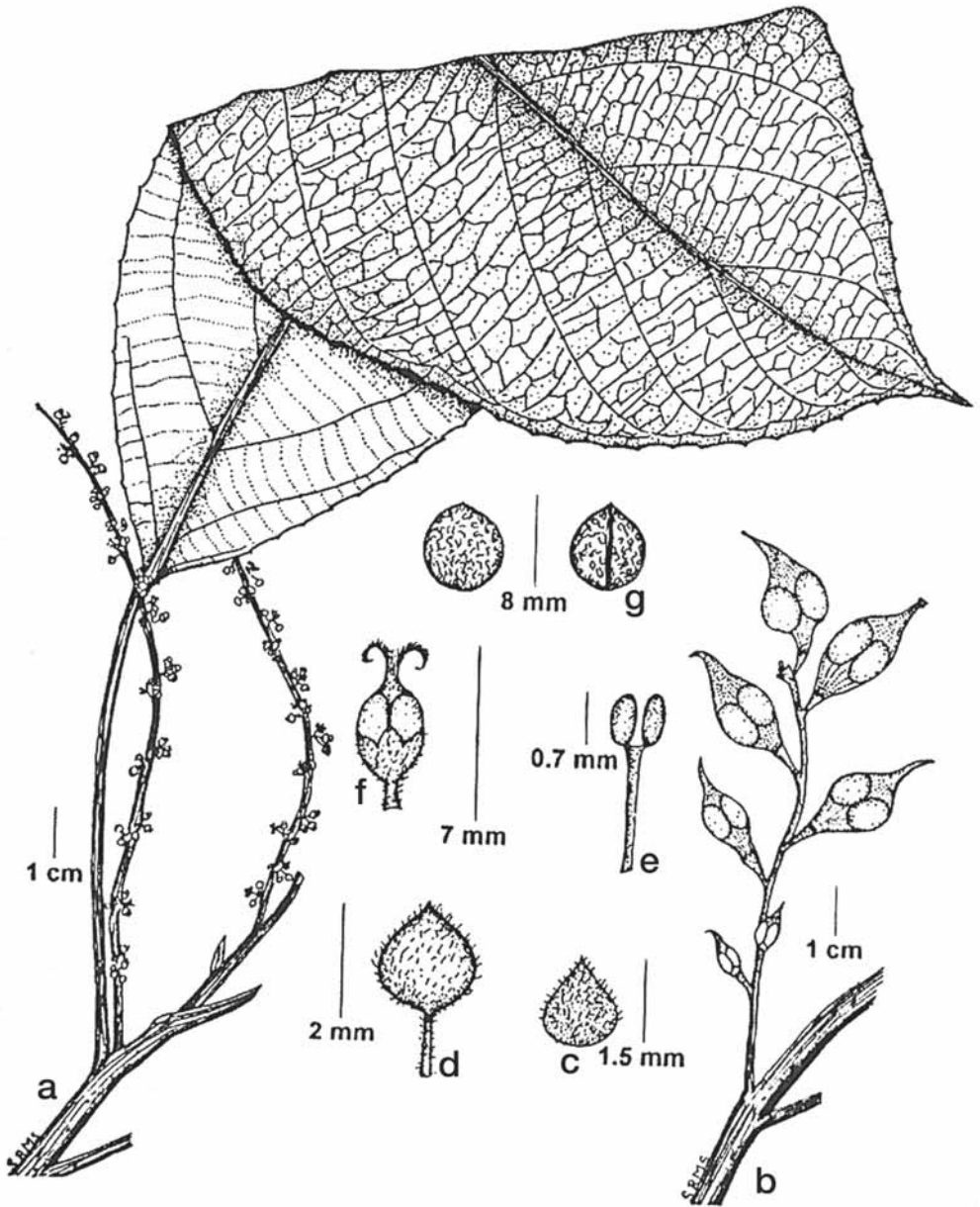
Tropical Africa, Arabia, Sri Lanka, Myanmar and Thailand.

*Uses.* Leaves said to be useful in jaundice. Ash of the plant mixed with oil used in skin diseases. Dye from the fruit used as an anti-oxidant for ghee and vegetable oils.

*Note.* Chromosome numbers:  $2n = 20$  (Datta, Taxon 16: 341 -350. 1967);  $2n = 20, 40, 60$  (Champault, Bull. Soc. Bot. France 117: 137 - 168. 1970);  $2n = 40$  (Brunel & Laplace, Taxon 26: 557 -565. 1977).

**8. *Claoxylon rostratum*** Airy Shaw in Kew Bull. 32: 389. 1978; Chakrab. in J. Econ. Taxon. Bot. 6: 451. 1985; Susila & N.P.Balakr. in Rheedeia 5(2): 138, f. 8. 1995. **Fig. 14**

Shrubs or trees, 2 - 12 m tall. Leaves narrowly to broadly elliptic, elliptic-lanceolate, obovate to oblanceolate, cuneate or rarely obtuse or truncate at base, subentire to obscurely sinuate-serrate along margins, acute to caudate-acuminate at apex, 9 - 37 x 3 - 17 cm, membranous to subcoriaceous, finely pubescent or pilose on nerves; lateral nerves 5 - 10 pairs; basal glands 2; petioles 1 - 14 cm long; stipules minute or obsolete. Male flowers: clustered in axillary or terminal racemes, 4 - 25 cm long; flowers in axils of bracts, 3 - 5 mm across; pedicels 2 - 4 mm long; sepals 3, ovate to orbicular, 1.5 - 2 mm across, tomentellous; stamens ca 40, clustered on a central receptacle mixed with a tuft of hyaline purplish scales or glands at apex; filaments 0.5 - 1.5 mm long; anthers globose, 0.5 - 0.7 mm across. Female flowers: solitary in axils of bracts, in axillary or terminal 3 - 12 cm long subumbellate racemes; rachis pubescent; bracts ovate-lanceolate or broadly triangular, 1 - 1.5 mm across; pedicels 1 - 5 mm long; sepals 3 - 5, spathaceous, triangular-ovate, 2 - 3 mm across, densely puberulous outside; disc shortly cupular, ca 1 mm



**Fig. 14.** *Claoxylon rostratum* Airy Shaw: a. twig with male inflorescences; b. twig with fruits; c. male bract; d. male bud; e. stamen; f. female flower; g. seeds – outer and inner views.

high; ovary broadly ovoid, 2 (or 3)-loculed, ca 4 mm across, densely appressed pubescent; styles 2 (or 3), recurved, 1 - 1.5 mm long. Fruits compressed, subpyriform or inflated-subglobose, bilobed, conspicuously stipitate at base and rostrate at apex, bilocular, 7 - 14 mm long (excluding apical beak and basal stipe), 10 - 15 mm across, appressed ochraceous-puberulous, greenish or dark purple when dry; stipe attenuate, 3.5 - 10 mm long; apical beak 3 - 18 mm long; recurved, fruiting pedicels 2 - 10 mm long; seeds globose, 5 - 8 mm across.

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

*Distrib.* India: In dense evergreen inland forests, along sides of streams, and also in scrub forests, on rocky or sandy loam or red soil, up to 700 m altitude. Andaman & Nicobar Islands.

Myanmar.

**9. *Claoxylon wightii*** Hook.f., *Fl. Brit. India* 5: 413. 1887; Susila & N.P.Balacr. in *J. Econ. Taxon. Bot.* 16: 733. 1992 & in *Rheedea* 5(2): 133. 1995. *Micrococca wightii* (Hook.f.) Prain in *Ann. Bot. (Usteri)* 25: 630. 1911; Gamble, *Fl. Madras* 2(7): 1328. 1921 (repr. ed. 2: 929. 1957); Govaerts et al., *World Checkl. & Bibl. Euphorbiaceae* 3: 1182. 2000.

Shrubs or undershrubs, up to 2 m high; branchlets and branchlets terete, glabrous, hirsute, or tomentose. Leaves alternate or subopposite, ovate or oblong-lanceolate, elliptic-lanceolate to linear-lanceolate, obtuse or subtruncate to cuneate at base, acute to acuminate at apex, subentire, crenate or serrate along margins, 3 - 10 x 0.5 - 3.5 cm, chartaceous, glabrous or sparsely white-hairy or silky on both sides or sparsely villous above, densely yellowish hirsute or tomentose beneath; lateral nerves 5 - 7 pairs; petioles 1.5 - 5.5 cm long, bearing 2 glands at apex; stipules subulate to linear-lanceolate, 0.5 - 1 mm long. Inflorescences axillary or terminal racemes, solitary or in clusters, 2 - 8 cm long; bracts linear-lanceolate, 1 - 3.5 x 1 - 1.5 mm. Male flowers: 2 - 3 mm across, mixed with 1 - 8 sterile male flowers in each cluster; pedicels 2 - 4 mm long; bracts 2 - 4 mm long, finely hairy; sepals 3, ovate, connate, 1 - 2 x ca 0.7 mm; stamens 6 - 10, subsessile, mixed with hyaline scales or filaments, 0.3 - 0.7 mm long; anthers oblong, ca 0.3 x 0.5 mm. Female flowers: solitary in axillary racemes, 3 - 4 mm long; scales 2, ovate, ca 2 mm long; sepals 3-lobed, up to 2 mm long; disc-scales 3, attached to ovary; ovary ca 2 mm long, hirsute; styles up to 1 mm long. Fruits 3-lobed, 7 - 10 mm across, hispid or densely hirsute.

#### KEY TO THE VARIETIES

- 1 a. Plants glabrous or subglabrous; leaves subglabrous; bracts linear-lanceolate; fertile male flowers mixed with 1 - 2 sterile male flowers 2
- b. Plants densely yellowish tomentose or hirsute; leaves densely hirsute on both sides; bracts ovate-lanceolate; fertile male flowers mixed with 3 - 8 sterile male flowers 3
- 2 a. Internodes 1 - 3 cm long; petioles 1 - 4 cm long **9.4. var. *wightii***
- b. Internodes 3 - 6 mm long; petioles up to 1 cm long **9.2. var. *glabratum***
- 3 a. Internodes 1.2 - 2 cm long; petioles up to 4 cm long; leaves ovate-lanceolate, usually more than 1.5 cm wide, sparsely glandular-serrate along margins; fertile male flowers 3 - 4 in each cluster, mixed with 3 - 4 sterile flowers; bracts dissected or toothed **9.3. var. *hirsutum***
- b. Internodes 3 - 6 mm long; petioles up to 1 cm long; leaves linear-lanceolate, usually less than 1.4 cm wide, closely glandular-serrate along margins; fertile male flowers solitary in each cluster, mixed with 6 - 8 sterile male flowers; bracts entire **9.1. var. *angustatum***

**9.1. var. *angustatum*** Susila & N.P.Balacr. in J. Econ. Taxon. Bot. 16: 736. 1992 & in Rheedea 5(2): 134, f. 6. 1995. *Microrocca wightii* var. *angustata* (Susila & N.P.Balacr.) Radcl.-Sm. & Govaerts in Kew Bull. 52: 480. 1997; Govaerts et al., World Checkl. & Bibl. Euphorbiaceae 3: 1182. 2000.

Branches and branchlets terete, woody; internodes 3 – 6 mm long.

*Fl. & Fr.* Oct. – Dec.

*Distrib.* India: Evergreen hill forests, up to 1000 m altitude. Tamil Nadu (Tirunelveli hills, Singampatti forests).

Endemic.

*Notes.* Differs from its allied varieties by the linear-lanceolate leaves with closely glandular serrate margins. Can be distinguished from var. *hirsutum* by its short internodes and petioles.

**9.2. var. *glabratum*** Susila & N.P.Balacr. in J. Econ. Taxon. Bot. 16: 735. 1992 & in Rheedea 5(2): 136. 1995. *Microrocca wightii* var. *glabrata* (Susila & N.P.Balacr.) Radcl.-Sm. & Govaerts in Kew Bull. 52: 480. 1997; Govaerts et al., World Checkl. & Bibl. Euphorbiaceae 3: 1183. 2000.

Branches and branchlets woody; internodes 3 – 6 mm long.

*Fl. & Fr.* June - Nov.

*Distrib.* India: Evergreen forests on hill slopes. Tamil Nadu (Coimbatore Dist.).

Endemic.

*Notes.* There are only two collections in MH: Ellis & Karthikeyan in 1968 and Viswanathan in 1979 from Kuridimalai hills of Coimbatore District. Obviously, it is a very rare variety and can be distinguished from its allied variety *wightii* in the very short internodes and the much-abbreviated petioles.

**9.3. var. *hirsutum*** (Hook.f.) Susila & N.P.Balacr. in J. Econ. Taxon. Bot. 16: 735. 1992 & in Rheedea 5(2): 136, f. 7. 1995. *Claoxylon hirsutum* Hook.f., Fl. Brit. India 5: 413. 1887. *Microrocca wightii* (Hook.f.) Prain var. *hirsuta* (Hook.f.) Prain in Ann. Bot. (Usteri) 25: 630. 1911; Govaerts et al., World Checkl. & Bibl. Euphorbiaceae 3: 1183. 2000.

Shrubs up to 2 m high; internodes 1.2 – 2 cm long.

*Fl. & Fr.* March - Nov.

*Distrib.* India: Evergreen hill forests, 800 - 1500 m. Tamil Nadu (Tirunelveli District).

Endemic.

*Notes.* Differs from var. *wightii* and var. *glabratum* by its densely yellowish tomentose or hirsute hairs on branchlets and leaves and the ovate-lanceolate bracts. Distinguished from var. *angustatum* by its long internodes and petioles and the dissected-toothed bracts.



**9.4. var. wightii**

Shrubs, up to 1 m high; internodes 1 – 4 cm long.

*Fl. & Fr.* June - Nov.

*Distrib.* India: Evergreen hill forests. Tamil Nadu (Tirunelveli dist. - Courtallam hills at ca 500 m altitude and Dindigul dist. – Kodaikanal hills at ca 2000 m altitude).

Endemic and rare.

*Notes.* Differs from var. *glabratum* by the long internodes and long petioles. A rare variety, only once collected since the type (*Wight* 2676 in the year 1835) from Thirukurungudi of Tirunelveli hills by V. S. Manickam in 1998 (field nos 16486, 16495 in XCH).

**3. Cleidion Blume**

Shrubs or small trees, monoecious or dioecious; indumentum of simple hairs or glabrous. Leaves alternate, rarely subopposite, usually sinuate-toothed or crenate, penninerved, shortly petioled with discoid glands near the base of lamina and at the top of petioles; stipules minute, fugacious. Male flowers: fascicled on long axillary racemes, sometimes elongated; flower buds globose to ovoid, pointed; calyx closed in bud, splitting into 3 or 4 valvate segments at anthesis; petals and disc absent; stamens ca 20 or 40 - 80, in a globose mass on a conical receptacle or arranged in regular ventral series; filaments free; anthers 4- or 2-loculed, transversely didymous, dorsifixed, introrse; connective broadened, short; thecae separated, transversely didymous; pistillode absent. Female flowers: axillary, solitary or pair wise on long peduncles; pedicels usually long, apically thickened; sepals 3 - 5, imbricate; petals, disc and staminodes absent; ovary subglobose, 4-grooved, 2 or 3-loculed; ovule 1 in each locule; styles 2 or 3, filiform, elongated, shortly connate below, deeply bifid or 3-fid above, minutely papillose on inner face. Fruits double-globose lobed capsules, 2 or 3-locular, schizocarpic, consisting 2 or rarely 3 two-valved cocci; seeds subglobose, ecarunculate; testa coriaceous, often mottled; endosperm fleshy; cotyledons broad and flat.

Tropical SE. Asia extending eastward to New Caledonia and Fiji Islands and westwards to Africa and America, ca 25 species; 2 species in India.

*Literature:* CHAKRABARTY, T., S. R. M. SUSILA RANI & N. P. BALAKRISHNAN (2004). Notes on the genus *Cleidion* Blume (Euphorbiaceae) in Indian Subcontinent. *J. Econ. Taxon. Bot.* 28: 517 – 520. 2004 (publ. 2005). KULJO, K. K. M. & P. C. VAN WELZEN (2005). Revision of the genus *Cleidion* (Euphorbiaceae) in Malesia. *Blumea* 50: 197 – 219.

**KEY TO THE SPECIES**

- 1 a. Leaves alternate or subopposite, shallowly repand-toothed or serrate all along the margins, dark green above and pale grey-green beneath and not shiny when dry; male spikes 5 - 20 cm long; female peduncles 5 - 7 cm long; female pedicels up to 18 cm long; fruits mostly didymous, 2 - 2.5 cm in diam.; seeds 10 - 15 mm in diam. **1. C. javanicum**
- b. Leaves alternate, entire along lower margins and coarsely repand-toothed or wavy-serrate at upper margins above the middle, dark reddish brown or blackish and shiny when dry; male spikes 10 - 35 cm long; female peduncles 4 - 5 cm long; female pedicels up to 5 cm long; fruits mostly tridymous, 1 - 1.5 cm in diam.; seeds 6 - 8 mm in diam. **2. C. nitidum**

**1. *Cleidion javanicum*** Blume, Bijdr. Fl. Ned. Ind. 613. 1826. Hook.f., Fl. Brit. India 5: 444. 1887. *Acalypha spiciflora* Burm.f., Fl. Indica 203, t. 61, f. 2. 1768, nom. confusum. *Cleidion spiciflorum* (auct. non Burm.f.) Merr., Interpr. Herb. Amboin. 322. 1917 (in obs.) & Enum. Philip. Fl. Pl. 2: 439. 1923; Govaerts et al., World Checkl. & Bibl. Euphorbiaceae 1: 358. 2000. *C. javanicum* var. *moniliflorum* (Airy Shaw) Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 12: 493. 1988 (publ. 1989) (non *Cleidion moniliflorum* Airy Shaw, 1980). *C. spiciflorum* var. *moniliflorum* (Airy Shaw) Radcl.-Sm. & Govaerts in Kew Bull. 52: 478. 1997; Chakrab & N.P.Balacr. in J. Econ. Taxon. Bot. 28: 520. 2005 (non *Cleidion moniliflorum* Airy Shaw, 1980).

Nep.: *Bepari, Hara-bepari*.

Trees or climbing shrubs, monoecious, evergreen, 8 - 12 m tall, all parts glabrous. Leaves alternate or subopposite, oblong-elliptic, narrowly elliptic to elliptic-oblong, acute, cuneate or narrowly rounded at base, repand-denticulate or crenate along margins, acuminate at apex, 7 - 25 x 2.5 - 9 cm, thinly coriaceous to chartaceous, glabrous, with 4 - 6 discoid scattered glands beneath near the base; lateral nerves 5 - 10 pairs; petioles 0.7 - 7.5 cm long, thickened towards apices, with 2 discoid glands at apex, pubescent; stipules triangular-subulate, 1 - 3 mm long, caducous. Male flowers: 5 - 8 mm across, in interrupted clusters on axillary, 5 - 20 cm long, simple or rarely branched racemes; pedicels absent or up to 5 mm long, articulate; bracts ovate-triangular, ca 1 mm long, 3 - 5-flowered; calyx lobes suborbicular to ovate-lanceolate, 2 - 3.5 mm long; stamens up to 70; filaments 1 - 2 mm long; anthers 4-loculed, ca 1 mm across. Female flowers: axillary or in axils of fallen leaves, solitary or sometimes in pairs, on 5 - 7 cm long peduncles; pedicels (0.5 -) 2 - 7 (- 18) cm long; bracts subulate, up to 1.5 mm long; sepals 4 or 5, ovate-triangular, 2 - 3 x 1.5 - 1.8 mm; ovary subglobose, 3 - 5 mm in diam., mostly bilocular, rarely 3-locular; styles 2 or 3, ca 14 mm long, connate below into 4 - 5 mm long column, bifid or quadrifid above, with papillose stigmatic surfaces. Capsules 2 (or 3) locular, deeply 2 (or 3)-lobed, mostly didymous, transversely oblong, flattened, broadened upwards, 2 - 2.5 cm across, 1 - 1.5 cm long, evanescently puberulous; fruiting pedicels 1 - 7 (-18) cm long, rigid; seeds 1 - 1.5 cm in diam., smooth, white or yellow, variegated with small brown patches.

*Notes.* The fruits and the fruiting pedicels are highly variable in this species.

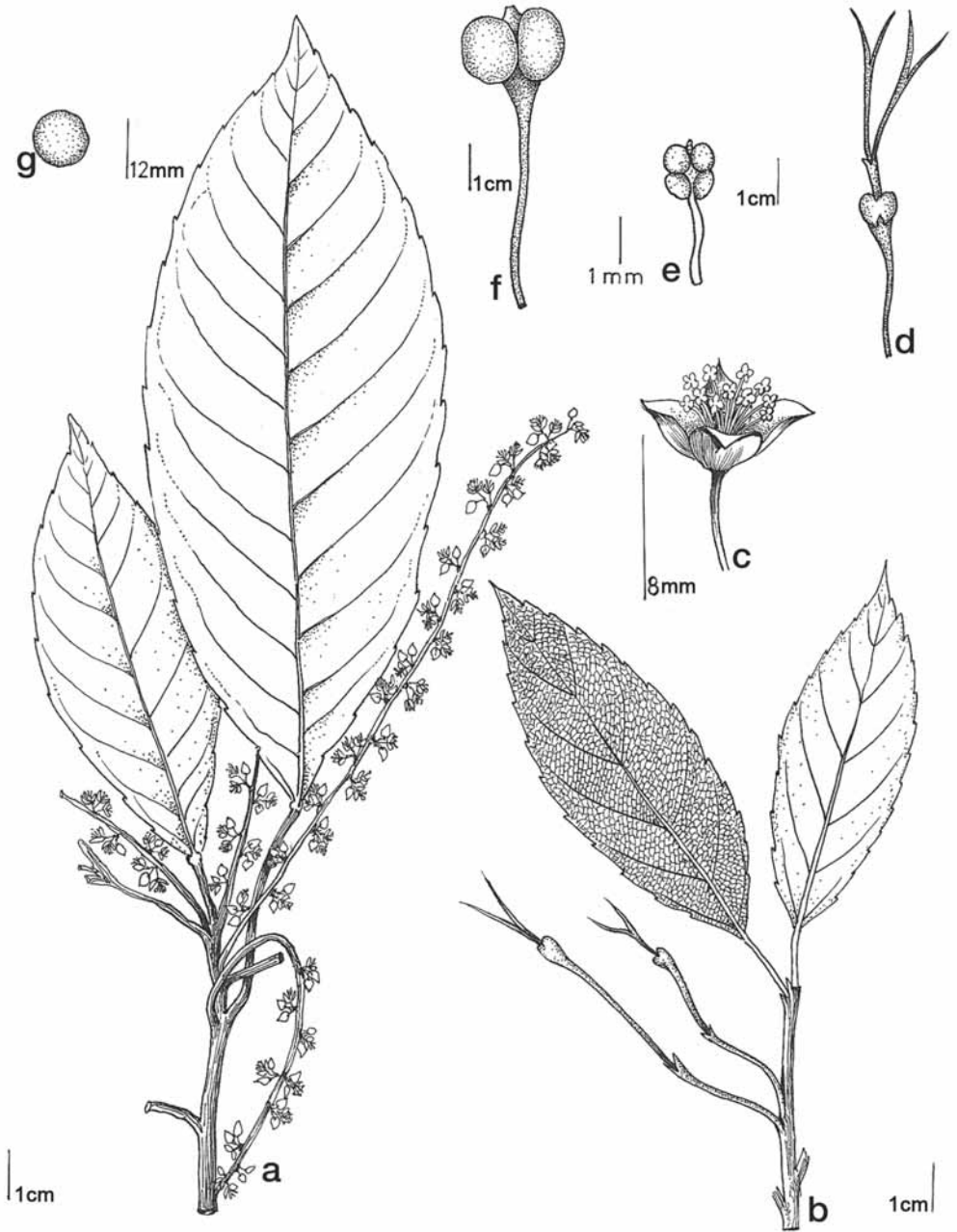
#### KEY TO THE VARIETIES

- |  |   |
|--|---|
| 1 a. Female pedicels less than 1 cm long | <b>1.1. var. <i>alongense</i></b>         |
| b. Female pedicels more than 2 cm long   | 2   |
| 2 a. Female pedicels 15 - 18 cm long     | <b>1.2. var. <i>longipedicellatum</i></b> |
| b. Female pedicels 2 - 7 cm long         | <b>1.3. var. <i>javanicum</i></b>         |

**1.1. var. *alongense*** (Bennet & Subh. Chandra) Chakrab. & N.P. Balacr., Fam. Euphorb. India 135. 2007. *Cleidion alongense* Bennet & Subh. Chandra in Indian Forester 111 (10): 846, f. 1. 1985; Govaerts et al., World Checkl. & Bibl. Euphorbiaceae 1: 356. 2000. *C. spiciflorum* var. *alongense* (Bennet & Subh. Chandra) Chakrab & N.P. Balacr. in J. Econ. Taxon. Bot. 28: 520. 2004 (publ. 2005).

Trees, ca 8 m tall.

*Fl.* Sept.



**Fig. 15.** *Cleidion javanicum* Blume var. *javanicum*: a. male plant; b. female plant; c. male flower; d. female flower; e. stamen; f. fruit; g. seed.

*Distrib.* India: Evergreen forests, on moist soil, up to 1200 m. Arunachal Pradesh (Along and Lohit Districts).

Endemic.

**1.2. var. javanicum**

**Fig. 15**

Asm.: *Theng-moite*; Mal.: *Yellari*.

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

*Distrib.* India: Tropical and subtropical evergreen, mixed or deciduous forests, swamp forests, edges of clearings, along banks of streams and rivers, up to 1000 m altitude. Bihar, Sikkim, Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, Maharashtra, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka, SE. Asia from S. China and Myanmar throughout Malesia to N. Australia.

**1.3. var. longipedicellatum** Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 12: 491. 1988 (publ. 1989). *Cleidion spiciflorum* var. *longipedicellatum* (Chakrab. & M. Gangop.) Susila & N.P.Balakr in J. Econ. Taxon. Bot. 28: 520. 2004 (publ. 2005).

*Fl. & Fr.* March - April.

*Distrib.* India: Subtropical evergreen forests, up to 1200 m. West Bengal and ? Sikkim.

Endemic.

**2. *Cleidion nitidum*** (Müll.Arg.) Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 245. 1873; Hook.f., Fl. Brit. India 5: 444. 1887. *Mallotus nitidus* Müll.Arg. in DC., Prodr. 15(2): 979. 1866.

Shrubs or trees, 3 - 10 m tall, entirely glabrous. Leaves ovate, elliptic, oblong-elliptic to obovate, cuneate, acute or rounded at base, distantly repand-denticulate or crenate along upper margins, acute to bluntly acuminate at apex, (4 -) 7 - 16 (- 22) x (1 -) 3 - 9 cm, thinly coriaceous, glossy, lateral nerves 5 - 8 (- 11) pairs; petioles 0.3 - 3.5 cm long; stipules ovate-triangular, up to 2 mm long, caducous. Male inflorescences axillary, glomerate-spicate, 10 - 36 cm long, simple or often few-branched towards base; flowers sessile; bracts ovate-triangular, acute, ca 1 mm long; calyx as in *C. javanicum*; stamens 75 - 80; filaments ca 1 mm long; anthers ca 1 mm across. Female flowers: axillary, solitary or sometimes paired or fasciculate-racemose, up to 8 cm long on 4 - 5 cm long peduncles; pedicels 1 - 5 cm long; sepals 4, ovate or triangular, 1.5 - 2.5 x 1 - 2 mm; ovary globose, 2 - 4 mm in diam., 2 or 3-loculed, fulvous tomentose; styles 3, connate at base into 1 - 2 mm long column, deeply bifid above. Capsules globose, somewhat depressed, mostly tridymous, up to 1.5 cm across; fruiting pedicels (2 -) 4 - 8 cm long; seeds subglobose, 6 - 8 mm across, smooth, white, variegated with brown patches.

*Fl. & Fr.* April - Dec.

*Distrib.* India: Tropical semi-deciduous or mixed forests, at low altitudes (up to 1450 m in Sri Lanka), often forming small patches where there is little undergrowth, rare in evergreen forests. Shows disjunct distribution in Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka.

#### 4. *Homonoia* Lour.

Shrubs or trees, usually dioecious, rheophytic. Leaves alternate, willow-like, entire or toothed, penninerved, densely and minutely glandular lepidote-scaly beneath, shortly petioled; stipules small, caducous. Inflorescences many or few-flowered axillary, unbranched spikes or racemes, often from old wood. Male flowers: calyx deeply 3-partite, splitting into 8 valvate segments; petals and disc absent; stamens numerous, largely connate into several paniculate or dendroid fascicles which are coherent at base in a dense globose head; anther-thecae subglobose, divaricate, sessile on the filament; connective obscure; pistillode absent. Female flowers: sepals 5 (or 6), unequal, imbricate, caducous; petals and disc absent; ovary 3-loculed, globose; ovule solitary in each locule; styles spreading, entire; stigmas 3, sessile, lacinate on inner surface. Fruits capsular rhegmas, flattened, 3-lobed, tricocous, smooth, puberulous, sometimes with soft prickles ending in rigid bristle; seeds covered by red arillode; testa crustaceous, hard with a thin fleshy coat; endosperm fleshy; cotyledons broad, flat.

India to S. China, Taiwan, Malesia and New Guinea, 3 species; all in India.

#### KEY TO THE SPECIES

- |   |                                |
|---|--------------------------------|
| 1 a. Leaves densely lepidote-scaly beneath; spikes 10 - 15 cm long                                    | <b>3. <i>H. riparia</i></b>    |
| b. Leaves not densely lepidote-scaly beneath; spikes not more than 5 cm long                          | 2                              |
| 2 a. Leaves sparsely lepidote-scaly beneath; male and female spikes 1 - 2 cm long                     | <b>2. <i>H. retusa</i></b>     |
| b. Leaves moderately lepidote-scaly beneath; male spikes up to 1 cm long; female spikes 3 - 5 cm long | <b>1. <i>H. intermedia</i></b> |

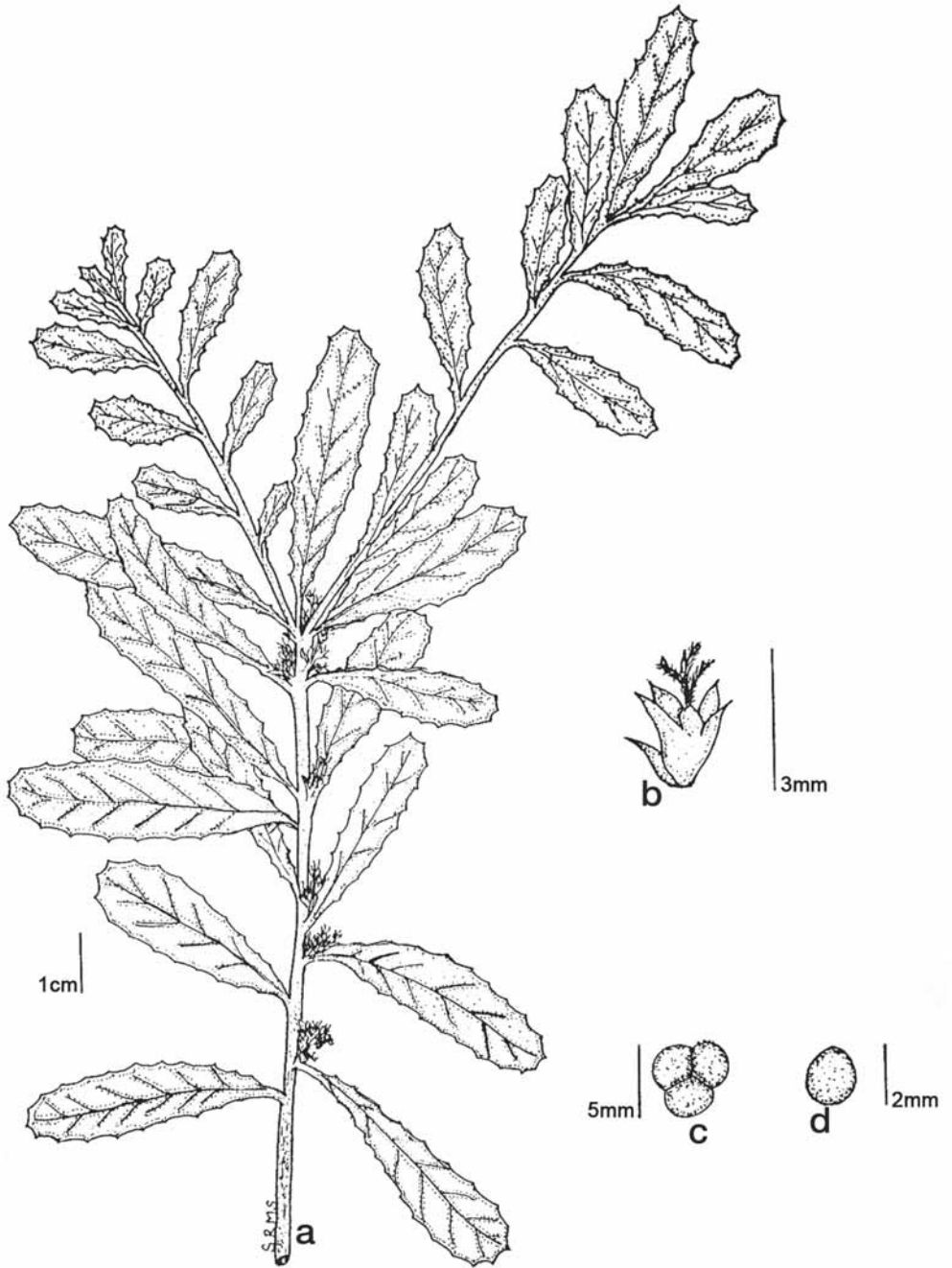
**1. *Homonoia intermedia*** Haines, Bot. Bihar Orissa 2: 111. 1921; S.K.Jain & R.R.Rao, Threatened Pl. India 88. 1983.

Shrubs, evergreen, 2 - 3 m high; branchlets minutely whitish pubescent. Leaves spatulate-lanceolate, oblong to obovate, narrowed downwards to a cuneate base, coarsely serrate or dentate with or without glands along margins, rounded-truncate or broadly acute at apex, 4 - 9.5 x 1 - 1.6 cm, coriaceous to chartaceous, subglabrous above, minutely pubescent on nerves beneath, covered with minute orbicular glands and few scales beneath; lateral nerves 5 - 10 pairs; petioles 2 - 5 mm long, pubescent; stipules subulate, ca 1 mm long, caducous. Inflorescences axillary, few-flowered spikes; male spikes up to 1 cm long; female spikes 3 - 5 cm long; bracts ovate-lanceolate, 1 - 1.5 x ca 1 mm; bracteoles 2, lanceolate, 1 - 1.5 x 0.5 - 0.8 mm. Male flowers: 7 - 10 mm across, clustered; sepals 3, ovate-lanceolate, concave, 4 - 6 x 3 - 5 mm; stamens numerous; anthers ca 0.5 mm long. Female flowers: sessile, 4 - 6 mm across; calyx segments 5 or 6, ovate-lanceolate, 0.8 - 1.3 x 0.5 - 0.9 mm; ovary globose, ca 2 mm across, appressed pubescent; styles 3, connate at base, 1 - 1.5 mm long, plumose, densely papillose and recurved at apex. Fruits globose, with 2 or 3-valved cocci, 2 - 4 mm across, smooth, puberulous, dark brown.

*Fl. & Fr.* March - Sept.

*Distrib.* India: Along river and stream banks at low levels. Bihar, Orissa, Madhya Pradesh, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu.

Endemic.



**Fig. 16. *Homonoia retusa* (J.Graham ex Wight) Müll.Arg.:** a. twig with female inflorescences; b. female flower; c. fruit; d. seed.

**2. *Homonoia retusa*** (J.Graham ex Wight) Müll.Arg. in *Linnaea* 34: 200. 1865 & in DC., *Prodr.* 15(2): 1022. 1866; Hook.f., *Fl. Brit. India* 5: 456. 1887. *Adelia retusa* J.Graham ex Wight, *Icon. Pl. Ind. Orient.* 5: t. 1869. 1852. **Fig. 16**

Tam.: *Aattuchendu*.

Shrubs, 2 - 3 m high; branchlets puberulous or glabrous. Leaves lanceolate to spatulate-lanceolate or obovate to oblanceolate, cuneate at base, serrate-dentate along margins towards upper portion, rarely entire, rounded, obtuse or retuse, 1.7 - 4.5 x 1 - 2.7 cm, coriaceous, glabrous above, sparsely glandular with minute orbicular glands and scales beneath; lateral nerves 5 - 10 pairs; petioles absent or 3 - 7 mm long, pubescent; stipules subulate, ca 1 mm long, caducous. Inflorescences axillary, few to many-flowered spikes, 1 - 2 cm long; bracts ovate, 1.5 - 2 mm long, pubescent; bracteoles 2, ovate-lanceolate, ca 5 mm across. Male flowers: sepals 3, ovate, concave, 4 - 6 mm long; stamens numerous; anthers red, with 2 divaricate subglobose thecae. Female flowers: calyx spathaceous, splitting into 5 - 8 lobes, minutely pubescent, caducous; ovary 2 - 3 mm across, appressed pubescent; styles 3, connate at base, recurved at apex, 1.5 - 2 mm long, densely papillose. Fruits globose, 2-valved, 2 - 5 mm across, dark brown, puberulous.

*Fl. & Fr.* Jan. - Nov.

*Distrib.* India: Riverbeds and rapids on rocky or stony beds, often seen associated with *Tamarix* sp. or *Polygonum* sp. Orissa, Madhya Pradesh, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Endemic.

**3. *Homonoia riparia*** Lour., *Fl. Cochinch.* 637. 1790; Müll.Arg. in DC., *Prodr.* 15(2): 1023. 1866; Hook.f., *Fl. Brit. India* 5: 455. 1887.

Asm.: *Hilhadam, Lari, Paniholos, Tabitasing, Tuipui-suhala*; Hindi: *Surra, Bersi*; Kan.: *Holenage, Nirganagile*; Lep.: *Mongthel-kung, Yetagyi*; Mal.: *Kaloor-vanchi, Kattalari*; Mar.: *Garahuru, Sarni, Sheran, Sherni*; Nep.: *Khola-ruis*; Or.: *Jambala*; Sans.: *Gurjor, Pashanabedaka, Sunukui*; Tam.: *Cheppunjerinjal, Kallalari*; Tel.: *Siridamani, Taniki*.

Shrubs or small trees, 1 - 3 m tall; branches sparsely pubescent. Leaves linear-lanceolate, narrowly lanceolate to oblanceolate, cuneate or obtuse at base, subentire or wavy, denticulate or serrulate towards tip and glandular along margins, obtuse, narrowly acute or acuminate and long-mucronate or apiculate at apex, (6 -) 10 - 20 x 1 - 3 (- 4) cm, coriaceous, glabrous or finely pubescent above, papillose on both sides with scattered lepidote scales beneath; lateral nerves 9 - 15 (- 30) pairs; petioles 4 - 12 mm long, puberulous; stipules subulate, 4 - 8 mm long, caducous. Inflorescences 4 - 10 (- 15) cm long, axillary, bracteate, dense-flowered unisexual spikes. Male flowers: sessile, 5 - 6 mm across; bracts linear-lanceolate, ca 1 mm long; calyx lobes oblong-ovate, concave, 4 - 5 x ca 3 mm; stamens numerous; anthers with 2 subglobose divaricate locules, 0.3 - 0.5 mm across. Female flowers: sessile, 5 - 6 mm across; bracts linear-lanceolate, 4 - 5 mm long; bracteoles 2; calyx 5 - 8-lobed; lobes oblong-ovate, 2 - 4 x 1 - 2 mm, caducous; ovary globose, 3-loculed, 2 - 3 mm across, appressed white tomentellous; styles 3, connate at base, spreading and recurved at tip, 4 - 5 mm long, plumose, densely papillose. Fruits globose, angular, shallowly 3-lobed, (4 -) 5 - 6 mm across, smooth, reddish brown.

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

*Distrib.* India: Rheophytic, on stony and gravelly banks and beds of rivers and streams, on sand bars, etc., up to 1500 m altitude. Often totally or partially submerged in rainy season. Almost in all States, in the plains and low hilly regions.

Sri Lanka, Myanmar, China, Cambodia, Laos, Vietnam, Thailand and throughout Malesia.

*Uses.* The root is laxative, diuretic and emetic. Decoction of root or powdered root mixed with honey or sugar given to cure piles, stone in bladder, chest pain, gonorrhoea and syphilis. Mashed leaves used as poultice against skin diseases.

*Note.* Chromosome number:  $2n = 22$  (Bedi et al., Taxon 29: 353. 1980).

### 5. *Lasiococca* Hook.f.

Small trees or shrubs, monoecious or dioecious, evergreen; indumentum of simple or often gland-tipped hairs. Leaves alternate, subopposite or often becoming subternately whorled or subverticillate towards branch-ends, entire, penninerved, shortly petioled; stipules caducous. Male flowers: in axillary racemes; calyx splitting into 3 valvate concave segments; petals and disc absent; stamens many, in dense globose heads or much-branched column of basally connate filaments; anther-thecae globose, divaricate; connectives arching over the top and sides of the thecae; pistillode absent. Female flowers: axillary or lateral, on slender solitary pedicels; sepals 5 or 7, unequal, imbricate, glandular, pubescent, persistent and enlarged in fruit; petals and disc absent; ovary 3-loculed, muricate; ovule solitary in each locule; styles 3, filiform, erect, united at base, free above. Fruits capsular, 2-seeded in 3 cocci, densely clothed with hispidly setose paleae, bristles or conical tubercles; seeds subglobose, smooth; testa crustaceous; endosperm fleshy; cotyledons thin, subcordate.

Tropical regions of India, Indo-china and Malesia, showing disjunct distribution, 5 species; 2 in India.

#### KEY TO THE SPECIES

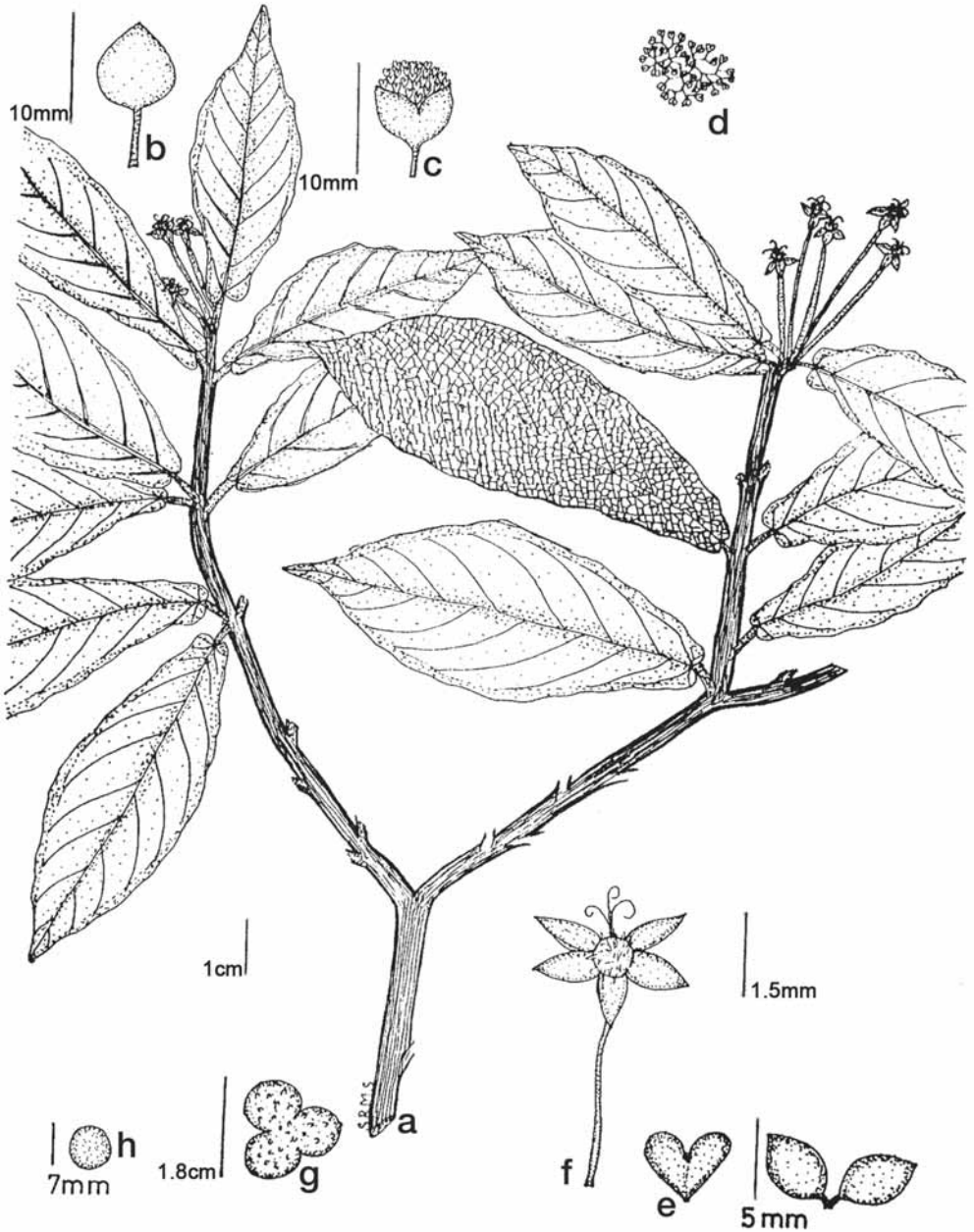
- 1 a. Calyx of female flowers eglandular; spines on the fruits bearing only one or rarely two terminal hairs at apex **1. *L. comberi***
- b. Calyx of female flowers densely glandular; spines on the fruits bearing dense hispid covering **2. *L. symphyllifolia***

**1. *Lasiococca comberi*** Haines in Bull. Misc. Inform. Kew 1920: 70. 1920 & Bot. Bihar Orissa 1: 114. 1961 (repr. ed.). *Homonoia comberi* (Haines) Merr. in Lignan Sci. J. 19: 188. 1940; T.Pullaiah & Moulali, Fl. Andhra Pradesh 2: 871. 1997. **Fig. 17**

Or.: *Kukri-hari*.

Trees, 3 - 5 m tall; branches and branchlets glabrous to pubescent. Leaves opposite to subverticillate, obovate, oblanceolate, elliptic-lanceolate or panduriform, narrowly rounded, cordate or subcordate at base, acute to caudate acuminate at apex, entire along margins, 6 - 14 x 2 - 4 cm, chartaceous or coriaceous, glabrous or finely scattered pubescent on nerves; lateral nerves 8 - 11 pairs; petioles 5 - 10 mm long; stipules minute, early caducous. Male flowers: 5 - 10 mm across, clustered on elongate racemes: bracts subsessile, 5 - 7 mm across, caducous; pedicels up to 2 mm long; sepals 3, ovate, 5 - 6 mm across, densely hirtellous; stamens highly





**Fig. 17.** *Lasiococca comberi* Haines: a. twig with female inflorescences; b. male bud; c. male flower; d. branched stamens (diagrammatic); e. anther; f. female flower; g. fruit; h. seed.

branched; anthers globose or ovoid, ca 0.5 mm across. Female flowers: solitary, axillary, 1 - 1.5 cm across, at axils of terminal leaves or subcorymbose in axils of bracts; peduncles 3 - 4 cm long; calyx-lobes 5 or 7, unequal, elliptic-lanceolate, 5 - 6 x 1 - 3 mm, persistent in fruit; ovary ovoid-conical, 5 - 6 mm high, tubercled; styles 3, filiform, connate at base, free above, 5 - 6 mm long. Fruits 3-lobed, 1.5 - 1.8 cm across; spines very short, hard, bearing one or two hairs at the tip; pedicels 1.5 - 2.5 cm long.

*Fl. & Fr.* June - Sept.

*Distrib.* India: Evergreen forests along rocky ravines and stream sides, as undergrowth in dense forests, rare. West Bengal, Orissa and Andhra Pradesh.

Thailand and var. *pseudoverticillata* (Merr.) H.S. Kiu in China.

**2. *Lasiococca symphyllifolia*** (Kurz) Hook.f. in Hooker's Icon. Pl. 16: t. 1587. 1887 & Fl. Brit. India 5: 456. 1887 (as *symphylliaefolia*). *Homonoia symphyllifolia* Kurz in Flora 58: 32. 1875; Gamble, Manual Indian Timbers 364. 1881.

Nep.: *Bajadanti, Jhankhri-kath.*

Trees; young shoots yellowish pubescent. Leaves alternate, opposite or subternately whorled, oblanceolate, elliptic-lanceolate or panduriform, narrowly cordate at base, contracted above and acuminate at apex, 6 - 14 x 2 - 4 cm, chartaceous to coriaceous, pilose on nerves; lateral nerves 8 - 10 pairs; petioles 5 - 10 mm long, pubescent; stipules minute, early caducous. Male flowers: 5 - 7 mm across, subsessile on pendulous 2 - 6 (- 8) cm long many-flowered racemes; bracts suborbicular, concave, 4 - 5 mm across; stamens highly branched; anthers globose, ca 0.5 mm across. Female flowers: on glandular-hispid 5 - 15 mm long pedicels; sepals irregularly placed, the inner 2 - 3 much smaller than the others, outermost ones broadly ovate, the others ovate-lanceolate, all glandular-pubescent outside; disc obscure or absent; ovary subglobose, pubescent, muricate; styles connate below into a stout column, with 3 slender erect arms. Fruits depressed-globose, 1.2 - 1.5 cm across, bearing densely hispid spines, seated on the enlarged persistent and spreading sepals.

*Fl. & Fr.* April - Aug.

*Distrib.* India: Evergreen forests at low levels, in damp places. Sikkim.

Endemic.

*Uses.* The wood is hard, tough and used as punting-pole by Tista (North Bengal) boatmen. Recommended as a substitute for boxwood.

## 6. *Macaranga* Thouars

Trees or shrubs, dioecious; twigs somewhat hollow. Leaves alternate, usually broad and often large, peltate or not, entire or sometimes 3 (- 5)-lobed, glandular beneath, 3 - 5-plinerved at base, sometimes with basal glands above, often gland-dotted beneath; petioles often long; stipules small and narrowly triangular, to very large and ovate to rounded. Flowers in axillary or terminal racemes or panicles, apetalous; bracts large, sometimes fimbriate or often patelliform-glandular. Male flowers: clustered along rachis or branches of inflorescences, sessile or very

shortly pedicelled, with a large, entire, toothed or fringed bract under each cluster; calyx closed in bud, opening into 3 or 4 valvate segments; stamens 1 - 30; filaments free; anthers 3 or 4-locular, almost peltately dorsifixed; connectives incomplete, shorter than thecae; disc rarely present; pistillode absent. Female flowers solitary, few or several in a cluster at each node; bracts often fringed or ciliate; calyx closed in bud, opening obliquely, truncate or shortly toothed; ovary 1 - 6-loculed; ovule solitary in each locule; styles 2 or 3, entire, linear-subulate, shortly united at base, unlobed. Fruits capsular or leathery to berry-like capsules, 2-valved with naked or armed cocci, often glandular or with a waxy coat, often muricate or tuberculate, loculicidally dehiscent into bivalved parts; seeds globose, ecarunculate; testa crustaceous or osseous; endosperm fleshy; cotyledons broad and flat.

Paleotropical, ca 289 species; 9 species in India.

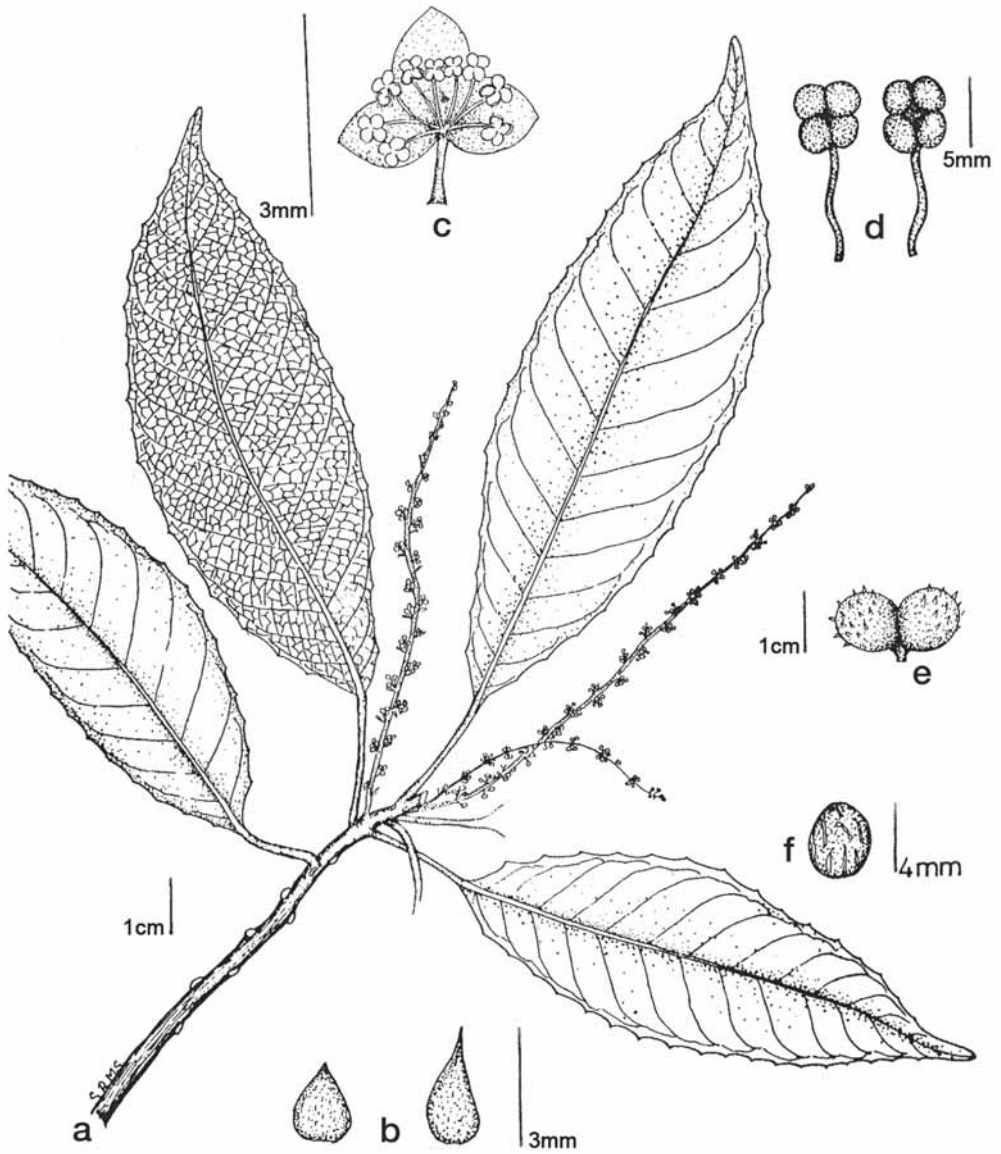
*Literature:* WHITMORE, T. C. (1978). Studies in *Macaranga* VII. The genus in "Greater India". Gard. Bull. Singapore 31: 51 - 56.

#### KEY TO THE SPECIES

- |      |   |  |
|------|---|--|
| 1 a. | Leaves nearly lanceolate, penninerved   | 2  |
| b.   | Leaves broadly ovate, rhombate or orbicular, palmately nerved   | 4  |
| 2 a. | Male flowers clustered on elongate pendulous simple spikes  | <b>1. <i>M. andamanica</i></b>                     |
| b.   | Male flowers clustered in panicles  | 3  |
| 3 a. | Stamens 16 - 22; fruits 2-lobed; seeds smooth   | <b>5. <i>M. lowii</i></b>                          |
| b.   | Stamens 15 - 20; fruits 3-lobed; seeds wrinkled   | <b>3. <i>M. gamblei</i></b>                        |
| 4 a. | Ovary 1-loculed and 1-ovuled  | 5  |
| b.   | Ovary more than 1-loculed and more than 1-ovuled  | 6  |
| 5 a. | Bracts sparsely dentate or entire, teeth often glandular inside; rarely eglandular                    | <b>7. <i>M. peltata</i></b>                        |
| b.   | Bracts entire, thick, 1-glandular outside, eglandular inside  | <b>4. <i>M. indica</i></b>                         |
| 6 a. | Ovary 2 or rarely 3-loculed; ovary and fruits smooth, unarmed   | <b>2. <i>M. denticulata</i></b>                    |
| b.   | Ovary 3 or more loculed, rarely 2-loculed; ovary and fruits echinate or armed with spines or spinules | 7  |
| 7 a. | Leaves large, more than 70 cm across  | <b>6. <i>M. nicobarica</i></b>                     |
| b.   | Leaves less than 70 cm across   | 8  |
| 8 a. | Leaves not trilobed; stamens 2 - 12; anthers 4-loculed; ovary 2 - 5-loculed                           | <b>8. <i>M. tanarius</i> var. <i>tomentosa</i></b> |
| b.   | Leaves trilobed at apex; stamen single; anthers 3-loculed; ovary 4 - 6-loculed                        | <b>9. <i>M. triloba</i></b>                        |

**1. *Macaranga andamanica*** Kurz, Forest Fl. Burma 2: 389. 1877; C.E. Parkinson, Forest Fl. Andaman Isl. 238. 1923. *M. brandisii* King ex Hook.f., Fl. Brit. India 5: 453. 1887. **Fig. 18**

Shrubs or trees, up to 3 m high; evergreen; branches and branchlets nearly glabrous; young parts puberulous. Leaves elliptic-lanceolate to oblong-lanceolate or narrowly oblong, with narrowed or cuneate base, repand to dentate with glandular teeth along margins, acute to cuspidate-acuminate at apex, 10 - 23 x 3.5 - 7 cm, coriaceous, glabrous above, glabrous or white-puberulous on lateral nerves and densely resinous gland-dotted beneath; lateral nerves 8 - 14 pairs; petioles 1.5 - 5 cm long, finely pubescent; stipules subulate, ca 1 mm long. Male flowers: clustered in lateral simple spikes (10 - 20 cm long), rusty pubescent; bracts ovate to ovate-lanceolate, concave, ca 2 x 3 mm, 5 or 6-flowered; sterile flowers 8 - 10, mixed with fertile flowers, flowers 2 - 3 mm across; sepals 2, ovate, entire, 1.5 - 2 mm across; stamens 12 - 15; filaments 0.5



**Fig. 18.** *Macaranga andamanica* Kurz: a. twig with male inflorescences; b. bracts; c. male flower; d. stamens; e. fruit; f. seed.

- 0.8 mm long; anthers 3 - 4-loculed. Female flowers: on lateral simple few-flowered spikes, somewhat umbellate; bracts ovate-cordate, 2 - 6 x 1.5 - 3.5 cm, foliaceous. Fruits capsular, didymous, subreniform, 5 - 6 x 10 - 12 mm, finely pubescent, densely yellow or white lepidote, sparsely echinate with short conical processes towards apex; calyx persistent.

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

*Distrib.* India: Tropical evergreen forests at low levels, on rocky loam or clayey soil along streams, up to 200 m altitude. Andaman & Nicobar Islands.

Myanmar, S. China, Indo-China, Thailand and Malaysia.

*Notes.* The processes on the fruits are of two types, triangular and filiform. Perhaps this species may ultimately have to be split into two varieties on this character.

**2. *Macaranga denticulata*** (Blume) Müll.Arg. in DC., Prodr. 15(2): 1000. 1866; Hook.f., Fl. Brit. India 5: 446. 1887. *Mapa denticulata* Blume, Bijdr. Fl. Ned. Ind. 625. 1826.

Trees, (3 -) 5 - 10 (- 15) m tall. Leaves broadly ovate-deltoid, often rhombate, rounded, truncate, cordate or broadly rounded and subpeltate at base, sinuate and glandular-denticulate or subentire along margins, shortly acuminate or cuspidate at apex, 7 - 30 x 5 - 24 cm, thinly coriaceous, subglabrous above, puberulous or rusty tomentose to glabrescent and dotted with numerous minute orbicular red or yellow glands on nerves beneath, biglandular at base, palmately (2 -) 9 - 11-nerved, with 5 - 11 sessile discoid glands on lowermost veins on upper surface; lateral nerves 10 - 12 pairs, arcuate to subparallel; petioles inserted at 1 - 2.5 cm above the base, (4 -) 8 - 17 (- 20) cm long, finely rusty pubescent; stipules ovate-lanceolate, ca 6 mm long. Male inflorescences 5 - 8-flowered clusters on axillary 5 - 12 cm long panicles; bracts broadly ovate, 1 - 2 mm long; flowers sessile; sepals (2 -) 3 or 4, ovate, ca 2 mm across, pubescent; stamens 8 - 30; filaments 1 - 2 mm long; anthers 4-loculed. Female inflorescences axillary or terminal panicles, 4 - 9 cm long; flowers solitary in each bract-axil, 3 - 4 mm across, rusty tomentose; bracts linear-lanceolate to ovate-lanceolate, 2 - 5 mm long; pedicels short; calyx cup-shaped, 3 or 4-lobed, spathaceous; lobes ovate, 2 - 3 mm across; ovary 2 or 3-loculed, deeply lobed, rusty pubescent; styles 2 - 3, 1 - 2 mm long. Fruits deeply or shallowly bilobed, grooved between the 2 cocci, 7 - 8 mm across, yellow-waxy gland-dotted, brown tomentose.

#### KEY TO THE VARIETIES

- 1 a. Branchlets densely ferruginous-tomentose; fruits deeply bilobed without any viscidly glandular patch at back **2.1. var. *denticulata***
- b. Branchlets tomentose but soon glabrescent; fruits not deeply bilobed, just grooved; cocci with large glabrous viscidly glandular patch at back **2.2. var. *pustulata***

#### **2.1. var. *denticulata***

Asm.: *Jaglo*, *Moralia*; Beng.: *Burno*, *Jagura*; Garo: *Bol-ajak*, *Chagru*; Kh.: *Dieng-lakhar*; Mani.: *Lakoi*; Naga.: *Kapu*; Nep.: *Malata*.

*Fl.* Feb. - April; *Fr.* May - Aug.

*Distrib.* India: Tropical and subtropical evergreen forests and secondary forests, up to 1200 m altitude. Uttarakhand, Bihar, West Bengal, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Tripura and Andaman & Nicobar Islands.

Nepal, Bhutan, Bangladesh, Myanmar, S. China, Laos, Vietnam, Thailand, Malaysia, Sumatra and Java.

*Uses.* Leaves eaten by cattle. Bark yields a good fibre. A fast-growing tree rapidly colonizing cleared forests used for reclaiming wastelands.

*Notes.* Chromosome number:  $2n = 22$  (Mehra & Hans, Taxon 18: 310 - 315. 1969; Hans, Taxon 22: 591 - 636. 1973).

**2.2. var. *pustulata*** (King ex Hook.f.) Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 13: 597. 1989. *Macaranga pustulata* King ex Hook.f., Fl. Brit. India 5: 445. 1887. *M. gmelinifolia* King ex Hook.f., l. c. 445. 1887.

Nep.: *Chilley-mallata*, *Malatta*.

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

*Distrib.* India: Subtropical evergreen forests, chiefly in old forest clearings, on landslips and abandoned plantations, 600 - 2000 m altitude. Uttarakhand (Garhwal Himalayas), West Bengal, Sikkim, Arunachal Pradesh, Meghalaya, Assam and Nagaland.

Nepal, Bhutan, Bangladesh, Myanmar and China.

*Notes.* Chromosome number:  $2n = 22$  (Mehra & Hans, J. Indian Bot. Soc. 51: 319 - 325. 1972; Hans, Taxon 22: 591 - 636. 1973).

**3. *Macaranga gamblei*** Hook.f., Fl. Brit. India 5: 445. 1887.

**Fig. 19**

Trees, 10 - 30 m high; young shoots puberulous. Leaves lanceolate to elliptic-lanceolate, cordate or rounded at base, subentire to shallowly crenate along margins, cuspidate-acuminate at apex, 7 - 17 x 3 - 6 cm, thinly coriaceous, subglabrous, gland-dotted beneath, obscurely 3-nerved with 2 discoid glands above base; secondary nerves 8 - 12 pairs; cross nervules prominent on both sides; petioles 1.5 - 4 cm long, with glands at apical part. Male inflorescences axillary or terminal, 4 - 10 cm long, yellowish stellate-tomentose; flowers 1 - 2 mm across, yellowish tomentose, in 2 - 4-flowered clusters in alternate or opposite bracts; bracts ovate-lanceolate, crenate to serrate with glands along margins, 7 - 9 x 1 - 2 mm, foliaceous; sepals 3 or 4, ovate, 1 - 1.5 x ca 1 mm; stamens 15 - 22; filaments ca 0.5 mm long; anthers 4-loculed, 0.2 - 0.3 mm long. Female flowers not seen. Fruits trilobed, 1 - 1.5 cm across; testa crustaceous, yellow-glandular, scattered echinate; spines conical, sharp or blunt, up to 1 mm long with one or a few hairs at apex; seeds globose, 5 - 6 mm across, dark brown, wrinkled.

*Fl. & Fr.* April - Dec.

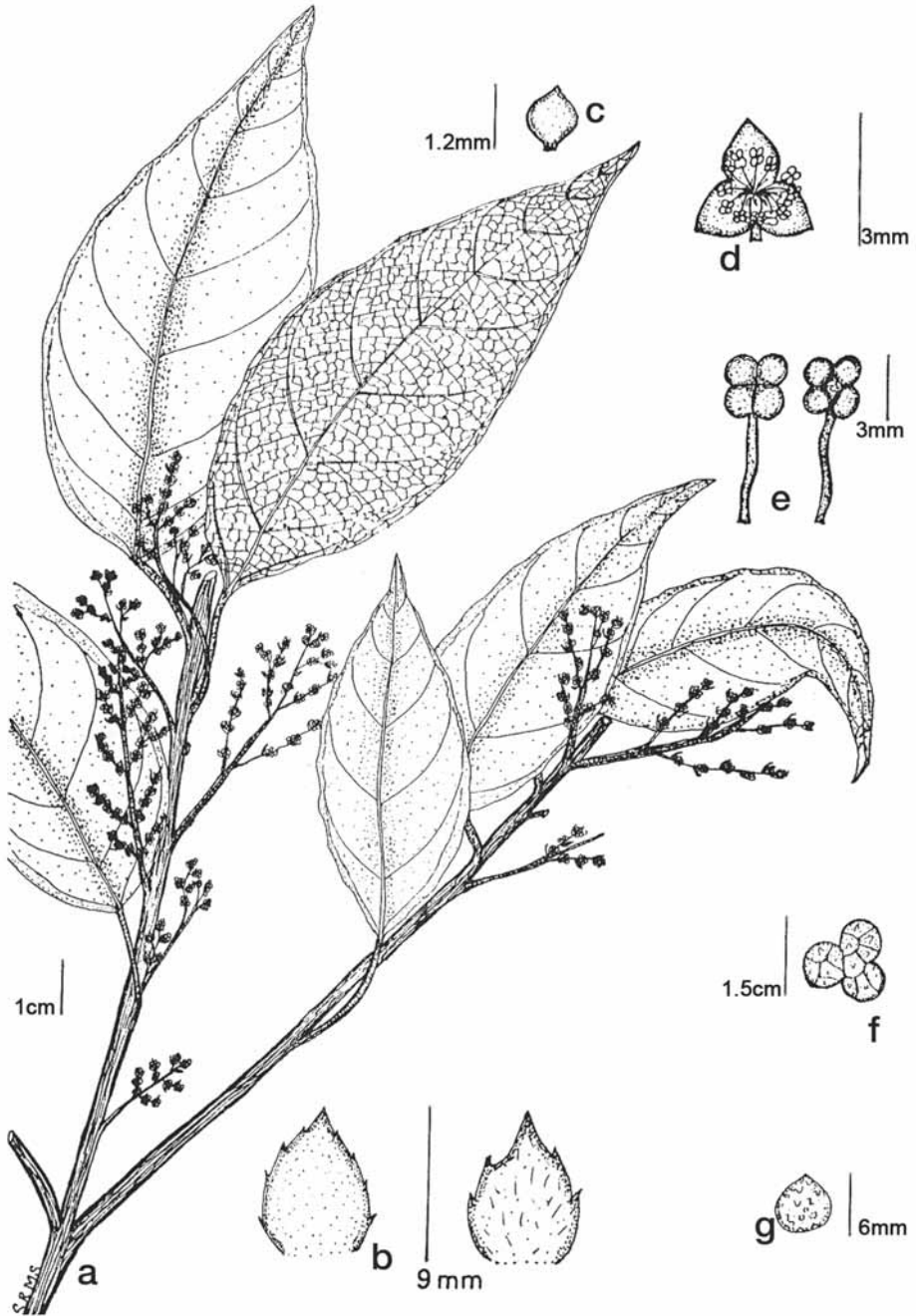
*Distrib.* India: Tropical evergreen forests, at low altitudes. West Bengal, Sikkim, Arunachal Pradesh and Assam.

Myanmar.

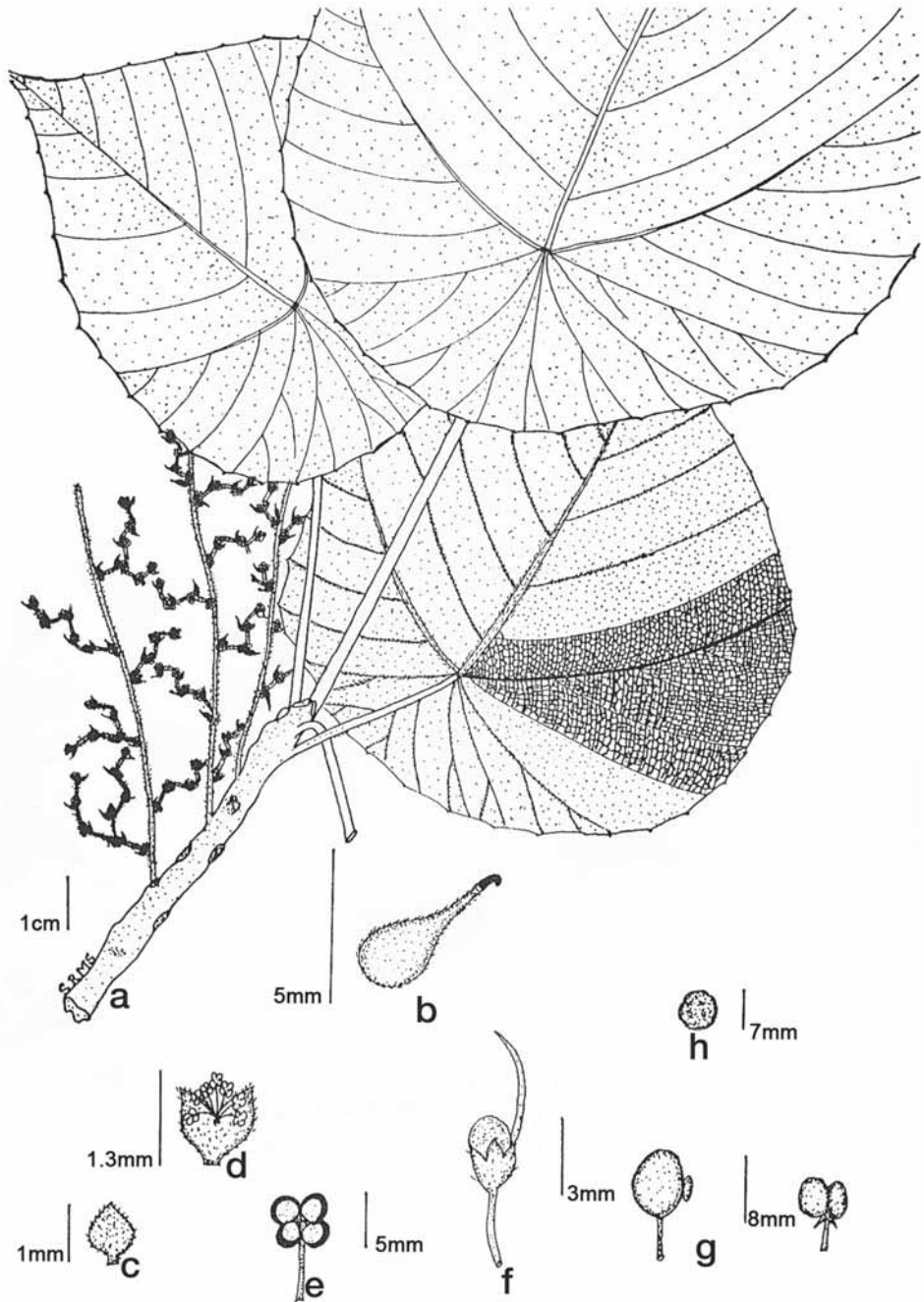
*Note.* Chromosome number:  $2n = 22$  (Mehra & Hans, Taxon 18: 310 - 315. 1969).

**4. *Macaranga indica*** Wight, Icon. Pl. Ind. Orient. 5: 23, t. 1883. 1852 & 6: t. 1949, f. 2. 1853; Hook.f., Fl. Brit. India 5: 446. 1887.

**Fig. 20**



**Fig. 19. *Macaranga gamblei* Hook.f.:** a. twig with male inflorescences; b. male bracts; c. male bud; d. male flower; e. stamens; f. fruit; g. seed.



**Fig. 20.** *Macaranga indica* Wight: a. twig with male inflorescences; b. bract; c. male bud; d. male flower; e. stamen; f. female flower; g. fruits; h. seed.



Mal.: *Bhoota-thamara*; Nep.: *Malata*.

Trees, (5- ) 10 - 20 m tall; young parts with tawny or rusty fugacious tomentum. Leaves broadly ovate-orbicular, peltate, rounded or subtruncate at base, entire or distantly glandular-dentate along margins, shortly cuspidate or acuminate at apex, 7 - 40 x 6 - 36 cm, thinly coriaceous, glabrous or sparsely pubescent and gland-dotted beneath, with 2 large discoid glands at base near the insertion of petioles; basal nerves 9 - 11, palmate; lateral nerves 8 - 12 pairs on midrib; cross nervules parallel; petioles 5 - 30 cm long; stipules oblong-ovate, up to 2 cm long. Male flowers: ca 1 mm across, in dense clusters in bract-axils, along 6 - 14 cm long subpyramidal panicles; bracts linear-spathulate, entire, 5 - 7 mm long, with a conspicuous discoid apical gland; pedicels up to 0.5 mm long; calyx 3 - 5-lobed; lobes ovate, acute, 1.5 - 2 mm across; stamens 3 - 8; anthers 4-loculed. Female flowers: in 5 - 7 cm long shortly peduncled panicles; bracts 1 to few-flowered, linear, with an apical gland; pedicels 2 - 4 mm long; calyx 4-lobed or 4-toothed, ca 2.5 x 1.5 mm; ovary 1-loculed, globose, ca 3 mm across, glandular-pubescent; style lateral, subulate, 4 - 5 mm long. Fruits unilocular or didymous, globose, 4 - 8 mm across, minutely echinate.

*Fl. & Fr.* Jan. - Dec. (Flowering peaks during Feb. - April and Aug. - Oct.; fruiting throughout the year).

*Distrib.* India: Tropical and subtropical evergreen forests, shola forests, preferring damp places, from sea level to 1600 m altitude. Uttar Pradesh, Bihar, West Bengal, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Orissa, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka, Bhutan, Bangladesh, Myanmar, China, Laos, Vietnam, Thailand, Malaysia and Sumatra.

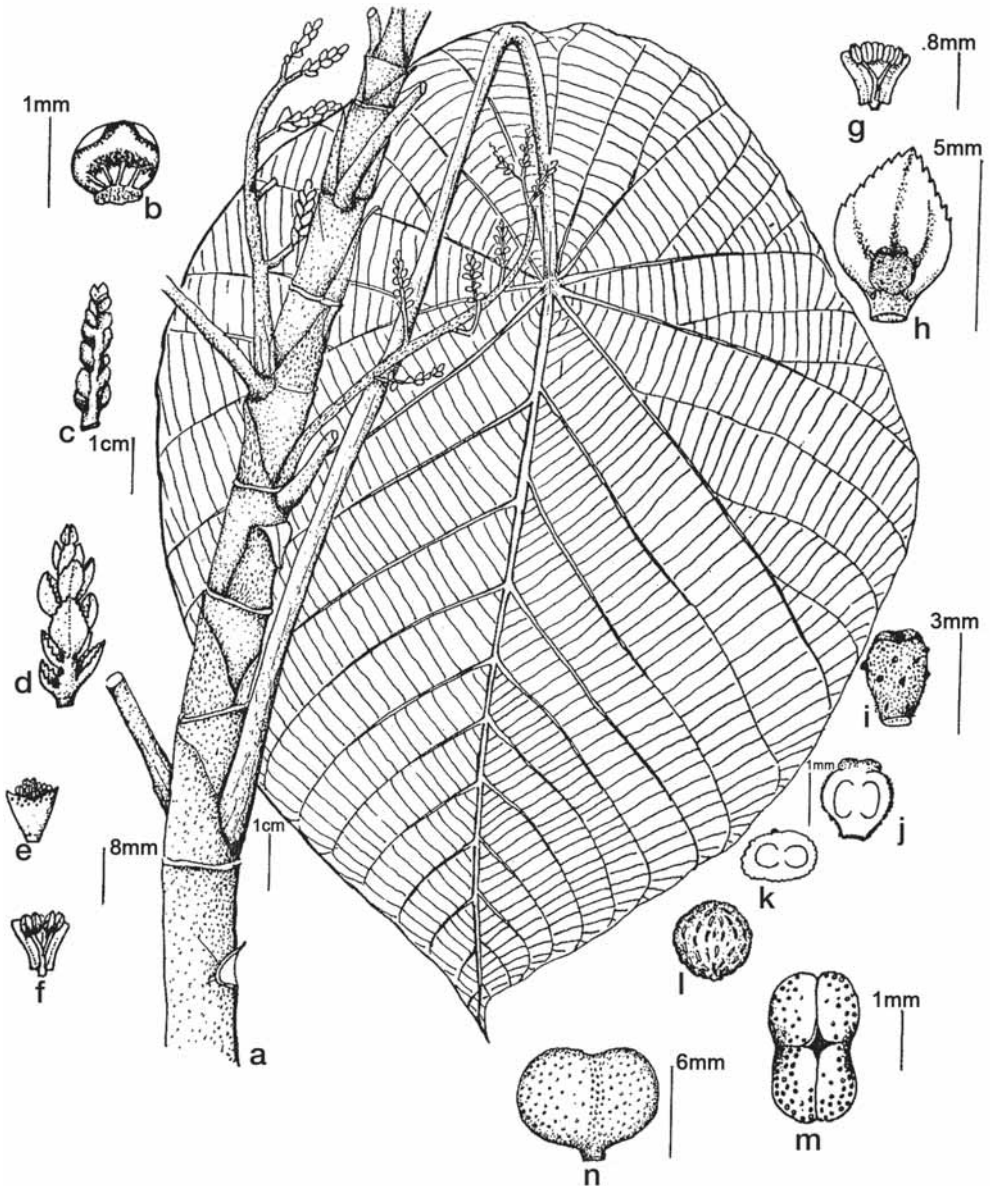
*Uses.* Red-coloured sap from the bark used medicinally to heal sores.

*Notes.* Chromosome number:  $2n = 22$  (Mehra & Hans, *Taxon* 18: 310 - 315. 1969 & *Nucleus* 15: 64 - 83. 1972; Kothari et al., *Taxon* 29: 703 - 730. 1980; Devar, *Indian J. Forest.* 5: 319 - 320. 1982). Devar (l. c) has done Karyo-morphological studies on this species.

**5. *Macaranga lowii*** King ex Hook.f., *Fl. Brit. India* 5: 453. 1887.

Asm.: *Noga-jegru*, *Phungi*.

Trees, 15 - 30 m tall; stem slightly fluted. Leaves oblong-elliptic to elliptic-lanceolate, truncate or narrowly cordate at base, subentire with distant obscure glands along margins, acuminate at apex, 5 - 15 x 2 - 6 cm, thinly coriaceous, glabrous above, hirsute on nerves and minutely gland-dotted with orbicular scales beneath, with 2 distinct glands at base near the petiole-apex; petioles 1 - 5 cm long; stipules subulate or linear-lanceolate, scale-like, 3 - 8 mm long. Male flowers: 2.5 - 3 mm across, sessile, clustered in bract-axils, arranged on slender 15 - 25 cm long racemes (sometimes branched); bracts triangular, concave, 3 - 4 x 1 - 1.5 mm; sepals 3, orbicular to ovate-orbicular, 1 - 2 mm across, glandular-hispidulous; stamens 15 - 20; filaments free, 0.5 - 0.6 mm long; anthers 4-lobed. Female flowers: 4 - 5 mm across, sessile, 1 - 9 together in each bract, arranged distantly on 10 - 15 cm long racemes or often branched panicles; peduncles 8 - 12 cm long, pubescent; bracts foliaceous; calyx-lobes 6, linear-lanceolate, 4 - 6 mm long,



**Fig. 21.** *Macaraga nicobarica* N.P.Balakr. & Chakra.: a. twig; b. male bract with flowers; c. male spike; d. female spike; e. male flower; f. two-stamened male flower; g. three-stamened male flower; h. female bract with flower; i. female flower; j. l. s. of ovary; k. t. s. of ovary; l. seed; m. fruit – top view; n. fruit – side view.

hirsute; ovary 2-loculed, 4 - 5 mm across, echinate; styles 2 or 3, filiform, 8 - 12 mm long, recurved. Fruits 2-lobed, 12 - 18 mm across, puberulous, echinate; seeds globose, 5 - 6 mm across, smooth.

*Fl.* Feb. - April; *Fr.* June - Dec.

*Distrib.* India: Evergreen primary forests, in disturbed Dipterocarp forests, at low altitudes. Assam.

Myanmar, Thailand, China, Malaysia, Indonesia and Philippines.

**6. *Macaranga nicobarica*** N.P.Balakr. & Chakr. in Gard. Bull. Singapore 31(1): 57. 1978; Whitmore in Gard. Bull. Singapore 31(1): 55. 1978. **Fig. 21**

Trees or shrubs, 3 - 10 m tall; branchlets densely pubescent. Leaves alternate to subopposite, broadly ovate, rounded and peltate for up to 17 cm inside the lamina at base, entire, short acuminate at apex, 50 - 100 x 40 - 75 cm, chartaceous to subcoriaceous; young leaves densely rufous tomentose; mature leaves subglabrous above, sparsely pilose and minutely red-lepidote or reddish glandular beneath, palmatinerved at base with 5 or 7 main nerves; lateral nerves 10 - 12 pairs form midrib; cross nervules scalariform-reticulate; petioles 30 - 75 cm long; stipules lanceolate, attached to half the circumference of stem by a broad base, 4 - 8 x 2 - 3 cm, densely villous outside. Male inflorescences lax panicles of racemes or spikes, 20 - 30 cm long, densely puberulous; branches 6 - 8 cm long; bracts of branches ovate, 3 - 5 mm long, persistent; floral bracts numerous, lax, sessile, suborbicular, ca 2.5 mm across, pubescent, lepidote-glandular; flowers many, sessile, fasciculate in each bract-axil; calyx campanulate, 3-lobed, ca 0.8 mm high; stamens 2 or 3, ca 0.7 mm long; filaments connate at base; anthers 3 - 4-loculed, oblong. Female inflorescences densely racemose paniculate, 10 - 15 cm long; branches 5 - 8 cm long; racemes strobiliform; bracts of branches sessile; floral bracts foliaceous, ovate, denticulate or pectinate; flowers solitary in each bract-axil, subsessile, ca 3 mm long; calyx highly reduced, cup-shaped, subtruncate, adherent to base of ovary, ca 0.8 mm long, densely pubescent; ovary 2-loculed, oblong-ovoid, dorso-ventrally compressed, tuberculate and densely yellow lepidote; stigma bilobed, sessile, densely papillose. Fruits transversely oblong or subreniform, 2-loculed, ca 1 cm across, ca 0.6 cm high, densely rufous lepidote.

*Fl. & Fr.* July - Oct.

*Distrib.* India: Lowland inland forests as lower storey in shade, or in mixed forests, on sandy or clayey loam, up to 100 m altitude. Andaman & Nicobar Islands (Nicobar Islands only).

Endemic.

*Note.* This species probably has the largest leaves in the genus.

**7. *Macaranga peltata*** (Roxb.) Müll.Arg. in DC., Prodr. 15(2): 1010. 1866. *Osyris peltata* Roxb., Fl. Ind., ed. Carey 3: 755. 1832. *M. roxburghii* Wight, Icon. Pl. Ind. Orient. 5(2): 23. 1852 & 6: t. 1949, f. 4. 1853; Hook.f., Fl. Brit. India 5: 448. 1887. *M. tomentosa* Wight, l. c. 5(2): 23. 1852 & 6: t. 1949, f. 1. 1853.

Kan.: Chandakanne, Chandkal, Chenthakanni, Chinthakanni. Kanchupranti, Uppaligi; Mal.: Oothoni, Pattavani, Uppila, Uppoothi, Vatta; Mar.: Chanda, Chandora,

*Chandwar*; Or.: *Gondaguria*, *Painia*; Tam.: *Vatta*, *Vatikanni*, *Vattitutti*; Tel.: *Boddi*, *Kondajaphara*, *Kondatamara*, *Pulichin-jalamu*.

Trees, (5- ) 8 - 15 m tall; branches ferruginous tomentose. Leaves deltoid, ovate, broadly ovate, rhombate-ovate to orbicular, rounded and peltate at base, entire or minutely glandular-denticulate along margins, subacute to acuminate at apex, 10 - 40 x 8 - 40 cm, chartaceous to thinly coriaceous, glabrous above, pale and gland-dotted with puberulous nerves beneath; basal nerves 9 - 11, palmate; lateral nerves 6 - 8 pairs; cross nervules parallel and prominent beneath; petioles 7 - 35 cm long; stipules ovate-lanceolate, 1 - 1.5 x ca 0.5 cm. Male flowers: ca 1.5 mm across, numerous, arranged in interrupted dense sessile 10 - 25-flowered heads on shortly branched 30 - 45 cm long axillary panicles of racemes; peduncles up to 15 cm long; bracts ovate, 3 - 6 x 4 - 7 mm, minutely glandular inside; bracteoles concave, foliaceous at base of flowering branches; sepals 3, obovate, 1 - 1.5 mm long; stamens 2 - 5, with free filaments and 4-loculed, 4-lobed anthers. Female flowers: in simple racemes, branched at base, 3 - 9 cm long, tomentose; bracts ovate, concave, denticulate along margins, 0.8 - 1 cm long, 1 or 2-flowered; pedicels 2 - 3 mm long; calyx-lobes 3, rounded, 2 - 3 mm long, densely glandular; ovary 1 - 2 mm across, glandular, 1-loculed; styles lateral, peltate, sessile, thickly papillose, 4 - 5 mm long. Fruits depressed-globose, 4 - 9 (- 12) mm across, grooved, echinate, hairy or nearly glabrous, with caducous waxy yellow resinous glands.

*Fl. & Fr.* Jan. - Dec. (Flowering in two peaks during Feb. - April and Sept. - Nov., but fruits can be seen throughout the year).

*Distrib.* India: Deciduous or evergreen forests along hills, roadsides, old forest clearings and secondary forests, up to 1000 m altitude; sometimes in beach forests, on sandy or clayey soil. Sikkim, West Bengal, Bihar, Orissa, Madhya Pradesh, Andhra Pradesh, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka and Myanmar.

*Uses.* The tree reproduces readily by seeds and makes rapid growth and hence suitable as pioneers in afforestation work.

A reddish gum, called 'kino' exudes from cut branches, base of petioles, young shoots and fruits, which is used as a substitute for gum-arabic. A paste of kino is used as application for venereal sores. A decoction of leaves and bark is used as a wash for ulcers.

The loppings of this tree used as green manure in paddy fields along West Coast. It is also useful as shade trees in coffee plantations. The leaves are rich in nitrogen and potassium.

The wood is suitable for matches and paper pulp.

*Notes.* The Megapode birds of Great Nicobar Island eat the fruits of this tree and a report in J. Bombay Nat. Hist. Soc. 102, 2005 says that the stomach of these birds is full of seeds of this tree.

Chromosome number:  $2n = 22$  (Mehra & Hans, Taxon 18: 310 - 315. 1969).

Pollen 3-colporate, sexine scabrate. P = 23im (20 to 28), E = 24 im (20 to 28). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery*, Pondicherry).

**8. *Macaranga tanarius*** (L.) Müll.Arg. var. ***tomentosa*** (Blume) Müll.Arg. in DC., Prodr. 15 (2): 997. 1866. *Mappa tomentosa* Blume, Bijdr. Fl. Ned. Ind. 624. 1826. *Macaranga molliuscula* Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 245. 1873.

Trees, 3 - 15 m tall; branches and branchlets softly pubescent. Leaves ovate, deltoid, orbicular to ovate-orbicular, rounded, truncate or cordate and broadly peltate at base, repand-denticulate or sinuate-toothed along margins, cuspidate-acuminate at apex, 10 - 40 x 6 - 33 cm, membranous to subcoriaceous, minutely puberulous above, densely ochraceous-velvety and yellow-glandular beneath, palmatinerved at base; lateral nerves 10 - 14 pairs; petioles 5 - 25 cm long; stipules oblong to lanceolate, 5 - 9 mm long. Male flowers: clustered in bract-axils along lax 15 - 27 cm long panicles; peduncles 4 - 16 cm long; bracts subfoliaceous; pedicels 1 - 2 mm long; calyx-lobes 3 or 4, broadly ovate, 1.5 - 2 mm across; stamens 4 - 6; filaments free, 0.7 - 1.4 mm long; anthers 4-loculed. Female flowers: 2 - 4 mm across, arranged singly along 7 - 20 cm long lax panicles of racemes; peduncles 5 - 10 cm long; bracts oblong, often 3-lobed at apex, serrate or fimbriate, 5 - 6 mm across, foliaceous; calyx-lobes 3 or 4, broadly ovate, 1.5 - 2 mm across, finely pubescent; ovary subovoid, 2 - 3-loculed, 2 - 3 mm across, shortly appressed hispid; styles 2 or 3, subulate, 2 - 3 mm long, densely plumose. Fruits didymous or tridymous, depressed at apex, 2 or 3-coccos, 1 - 2 cm across, 0.5 - 0.6 cm high, sparingly beset with 6 - 9 mm long subulate hairy soft prickles, yellowish waxy.

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

*Distrib.* India: Open places in primary and secondary forests, village groves, roadsides and forest clearings. Often seen along river and stream banks, beach forests and inland tidal creeks, on sandy loam or limestones, up to 500 m. Andaman & Nicobar Islands.

S. China, Taiwan, Indo-China, Japan, Myanmar, Thailand, throughout Malesia to N. Australia and Melanesia.

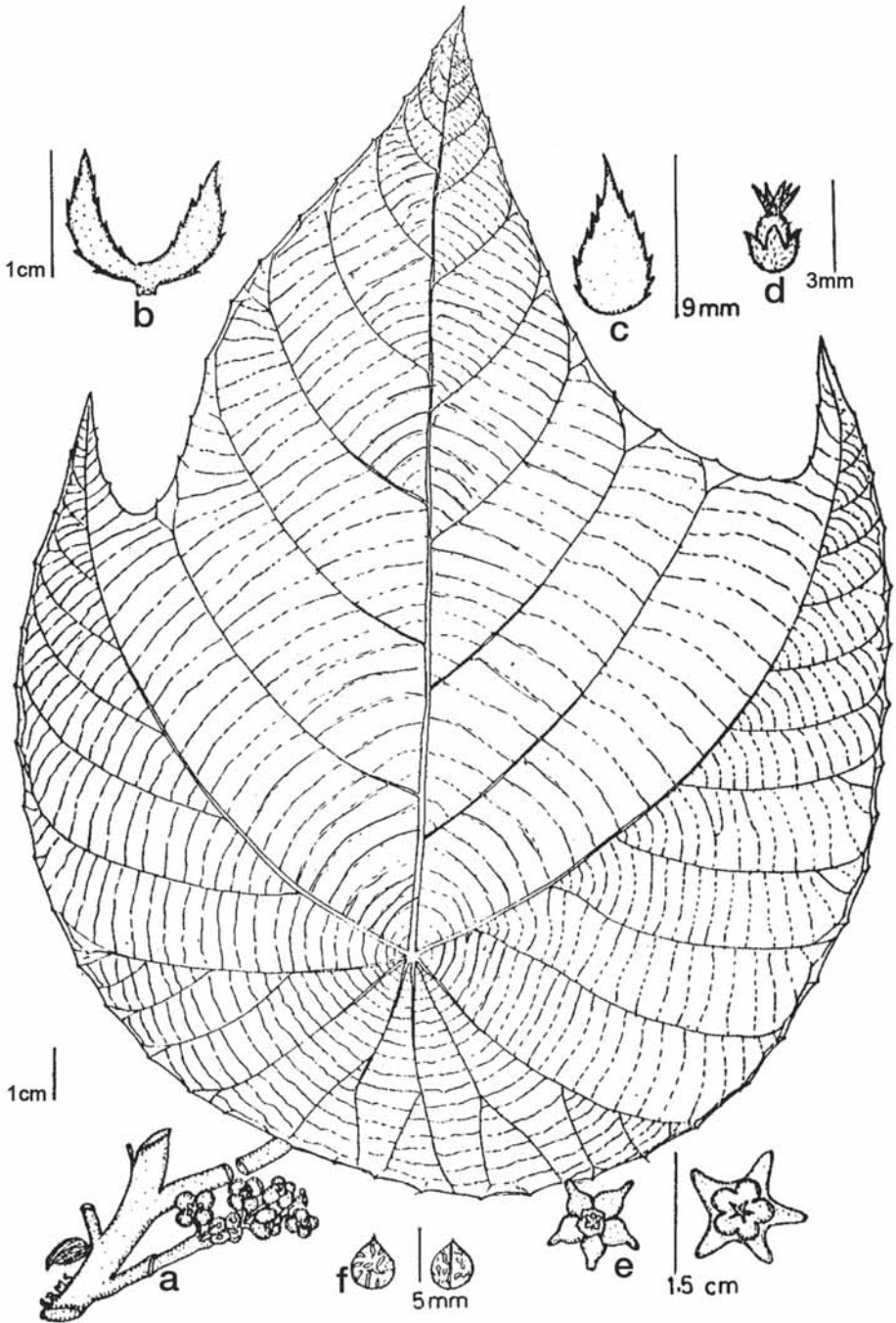
*Uses.* The bark contains 2.1 % tannin, used for toughening fishing nets. A decoction of the bark given in dysentery and a decoction of the root in fever. Powdered leaves used as poultice for wounds. In Philippines, the leaves used to stimulate fermentation of cane molasses by yeast. Pepper growers in Philippines use the wood for making temporary ladders.

*Notes.* Chromosome number:  $2n = 22$  (Chuang et al., Taiwania 1: 51 - 66. 1963; Whitmore et al., Taxon 19: 225 - 256. 1970).

**9. *Macaranga triloba*** (Thunb.) Müll.Arg. in DC., Prodr. 15(2): 989. 1866; Hook.f., Fl. Brit. India 5: 452. 1887. *Ricinus trilobus* Thunb., Diss. Ricin. 6. 1815; Blume, Bijdr. Fl. Ned. Ind. 626. 1826.

**Fig. 22**

Trees, 5 - 8 m tall; branches smooth, glabrous. Leaves broadly peltate, orbicular in outline, rounded at base, 3-lobed above, 18 - 30 x 15 - 26 cm, dentate along margins, chartaceous to subcoriaceous; basal nerves 3, palmate; secondary nerves 16 - 20 pairs in central lobe and 10 - 13 in lateral lobes; petioles 10 - 27 cm long; stipules ovate-lanceolate. Male inflorescences axillary, paniculate, 10 - 23 cm long, yellowish gland-dotted; bracts broadly lanceolate, 10 - 15 x 5 - 8 mm, yellowish glandular beneath; bracteoles ovate-lanceolate, irregularly serrate, 6 - 7 x 3 - 4 mm; pedicels 3 - 6 mm long; flowers ca 1 mm across, clustered in bracts; calyx-lobes 3 - 5, linear-lanceolate, 0.6 - 0.8 x 0.3 - 0.5 mm; stamen solitary in each flower, ca 0.5 mm long; filament



**Fig. 22.** *Macaranga triloba* (Thunb.) Müll.Arg.: a. twig with female inflorescence; b. bracteoles; c. bract; d. female flower; e. fruits; f. seeds.

attached to sepals; anther 4-loculed. Female flowers: few, capitate on short axillary 3 - 6 mm long puberulous peduncles; bracts 3 or 4-flowered; calyx spathaceous, 3 - 5-lobed; lobes ca 2 mm across; ovary 3-loculed, obconical, ca 2 mm across, nearly glabrous; styles 4 or 5, stout, connate into an ovoid mass, 1.5 - 2 mm long. Fruits subglobose, 4 - 6-lobed, 1 - 1.5 cm across; persistent calyx forms a stellate border, up to 7 x 5 mm.

*Fl. & Fr.* Feb. - Sept.

*Distrib.* India: Evergreen inland forests at low altitudes, often along watercourses, on clayey loam. Andaman & Nicobar Islands (Great Nicobar Island only).

Myanmar, Thailand, Malaysia, Indonesia and Philippines.

#### EXCLUDED SPECIES

*Macaranga balakrishnanii* B.Mitra & Chakrab. (in J. Econ. Taxon. Bot. 15: 465. 1991) described from Sikkim and North Bengal is *Tetrameles nudiflora* R.Br. (Tetramelaceae). See Chakrabarty & Chauhan in J. Econ. Taxon. Bot. 28(1): 128. 2004.

### 7. *Mallotus* Lour.

Trees or shrubs, evergreen or deciduous, monoecious or dioecious; indumentum of stellate and sometimes simple hairs, usually mixed with sessile granular yellow, orange or red gland dots. Leaves alternate, subopposite or opposite, decussate, often unequal in size and shape at each node, entire or sometimes palmately lobed or toothed, penninerved or palmately 3 - 9-nerved and sometimes peltate at base, sometimes with hairy domatia, usually with discoid almost immersed glands near the base on upper surface; stipules minute, often caducous. Inflorescences terminal or axillary, simple or branched racemes or spikes. Male flowers: 1 - 9 per node; sepals 3 or 4, valvate; petals and disc absent; stamens 20 - 50 (- 150), free, crowded on a central flat or convex receptacle; anthers globose to oblong, basi- to dorsifixed; thecae parallel, often separated by wide thickened and widened connective; disc rarely present; pistillode minute or absent. Female flowers: solitary or rarely paired at nodes along the rachis; calyx spathaceous, deeply 3 - 6-lobed or minutely toothed at length; ovary (2 -) 3 (- 4)-loculed, rarely up to 5-loculed, usually echinate, muricate or tubercled; styles 2 or 3, simple, free or shortly connate at base, erecto-patent, spreading or recurved, papillose or lacinate. Fruits capsular, (2 -) 3 (- 4)-loculed, dehiscent into bivalved parts, tubercled, muricate or echinate; seeds usually 3, rarely 2, ovoid to oblong or globose, black to red, ecarunculate; testa crustaceous; endosperm fleshy; cotyledons broader than radicles.

Paleotropical, ca 135 species, of which only two are in Africa, the rest in Asia; 17 species in India.

#### KEY TO THE SPECIES

- |   |   |
|---|---|
| 1 a. Leaves penninerved, not palmately nerved at base       | 2 |
| b. Leaves palmately 3 - 9-nerved at base, penninerved above | 7 |
| 2 a. Leaves strictly opposite                               | 3 |
| b. Leaves alternate or opposite in young shoots             | 4 |

- 3 a. Branchlets terete; leaves of each pair at each node unequal in size, one being of normal size and the other stipuliform **12. M. penangensis**  
 b. Branchlets flattened; leaves of each pair at each node equal and normal in size and shape **15. M. resinusus**
- 4 a. Leaves glandular or glands appressed on both surfaces; fruits smooth, neither echinate nor tubercled **1. M. atrovirens**  
 b. Leaves eglandular above; fruits echinate or tubercled 5
- 5 a. Anther-connective broad; mature fruits with hard conical spines **2. M. aureo-punctatus**  
 b. Anther-connective linear; mature fruits with soft spines 6
- 6 a. Fruits glandular **4. M. beddomei**  
 b. Fruits eglandular **7. M. khasianus**
- 7 a. Leaves opposite, epeltate 8  
 b. Leaves alternate, usually peltate, rarely epeltate 9
- 8 a. Leaves 5 - 25 x 3.5 - 15 cm; petioles 2 - 9 cm long; ovary and fruits smooth, not echinate **5. M. distans**  
 b. Leaves 18 - 30 x 15 - 25 cm; petioles 8 - 20 cm long; ovary and fruits echinate **8. M. leucocarpus**
- 9 a. Fruits smooth, not echinate or tubercled 10  
 b. Fruits echinate or tubercled 12
- 10a. Leaves opposite and alternate, subglabrous beneath; male receptacle central; fruits minutely pale brown stellate tomentose; seeds brown **16. M. rhamnifolius**  
 b. Leaves alternate, tomentose beneath; male receptacle not central; fruits densely fulvous tomentose; seeds black 11
- 11a. Leaves narrowly oblong-ovate, mostly twice as long as broad, with red granules beneath; stamens 15 - 30; styles 2; fruits 3 or 4-loculed, densely clothed with crimson-red resinous powder **13. M. philippensis**  
 b. Leaves broadly ovate-deltoid, mostly as long as broad, yellow tomentose and glandular beneath; stamens 40 - 80; styles 2; fruits 2-loculed, densely fulvous tomentose, not with red resinous powdery glands **14. M. repandus**
- 12a. Stamens 45 - 100; female calyx persistent in fruit 13  
 b. Stamens 17 - 42; female calyx caducous 16
- 13a. Leaves shortly 3-lobed; basal nerves 9 or 11; spine-layer on fruits continuous **3. M. barbatus**  
 b. Leaves not 3-lobed; basal nerves 3 or 5 (rarely 9); spine-layer on fruits not continuous 14
- 14a. Spikes simple **10. M. nepalensis**  
 b. Spikes branched 15
- 15a. Inflorescences simple or compound spikes; rachis of spikes stout, 5 - 8 mm thick; male bracts linear to linear-lanceolate or subulate **9. M. mollissimus**  
 b. Inflorescences axillary or terminal pyramidal panicles; rachis of spikes less than 2 mm thick; male bracts ovate to ovate-triangular **6. M. ferrugineus**
- 16a. Leaves nearly oblong to elliptic or ovate-elliptic, 10 - 35 cm long; lateral nerves 5 - 10 pairs; racemes 6 - 22 cm long, much shorter than the leaves **11. M. peltatus**  
 b. Leaves orbicular or triangular-ovate, 8 - 20 cm long; lateral nerves 4 - 5 pairs; racemes 6 - 30 cm long, as long as or much longer than the leaves **17. M. roxburghianus**



**1. *Mallotus atrovirens*** Wall. ex Müll.Arg. in *Linnaea* 34: 195. 1865 & in DC., *Prodr.* 15(2): 978. 1866; Hook.f., *Fl. Brit. India* 5: 440. 1887.

Shrubs or small trees, 3 - 8 m tall; branchlets puberulous. Leaves alternate or opposite in young shoots, obovate-elliptic or elliptic-lanceolate, cuneate or broadly acute and epeltate at base, acute, acuminate to cuspidate at apex, 6 - 18 x 2.5 - 7 cm, coriaceous to chartaceous, glabrous above, yellow-glandular and pubescent on nerves beneath, penninerved; lateral nerves 5 - 8 pairs; petioles 0.5 - 3.5 cm long; stipules linear-lanceolate, ca 2 mm long. Male flowers: in axillary 8 - 15 cm long simple racemes; pedicels 1 - 2 mm long; bracts ovate-lanceolate, ca 2 mm long; sepals 3, ovate, ca 2 mm long, glandular-hairy; stamens 20 - 40; filaments 2 - 3 mm long; anthers subglobose to oblong. Female flowers: 2 - 4 mm across, on 6 - 8 cm long racemes; pedicels 2 - 3 mm long; calyx spathaceous, 4 - 6-fid; lobes narrowly ovate to linear-lanceolate, 1 - 1.5 x ca 0.5 mm, glandular scurfy; ovary 2-loculed, ca 2 mm across, rusty pubescent, scaly and densely glandular; styles 2, 1.5 - 2.5 mm long, densely plumose or papillose. Fruits ovoid or obovoid, 3 - 4 x 2 - 2.5 cm, faintly 2 - 5-ribbed, glandular, with dense short tomentum and whitish powdery surface; seeds ovoid to globose, angular on inner face, 1.5 - 1.8 cm long, glandular on outer surface.

*Fl. & Fr.* March - Sept.

*Distrib.* India: Evergreen forests and dense hill slopes in dense secondary mixed forests, along hill slopes, up to 500 m altitude. Kerala, Tamil Nadu and Maharashtra.

Endemic.

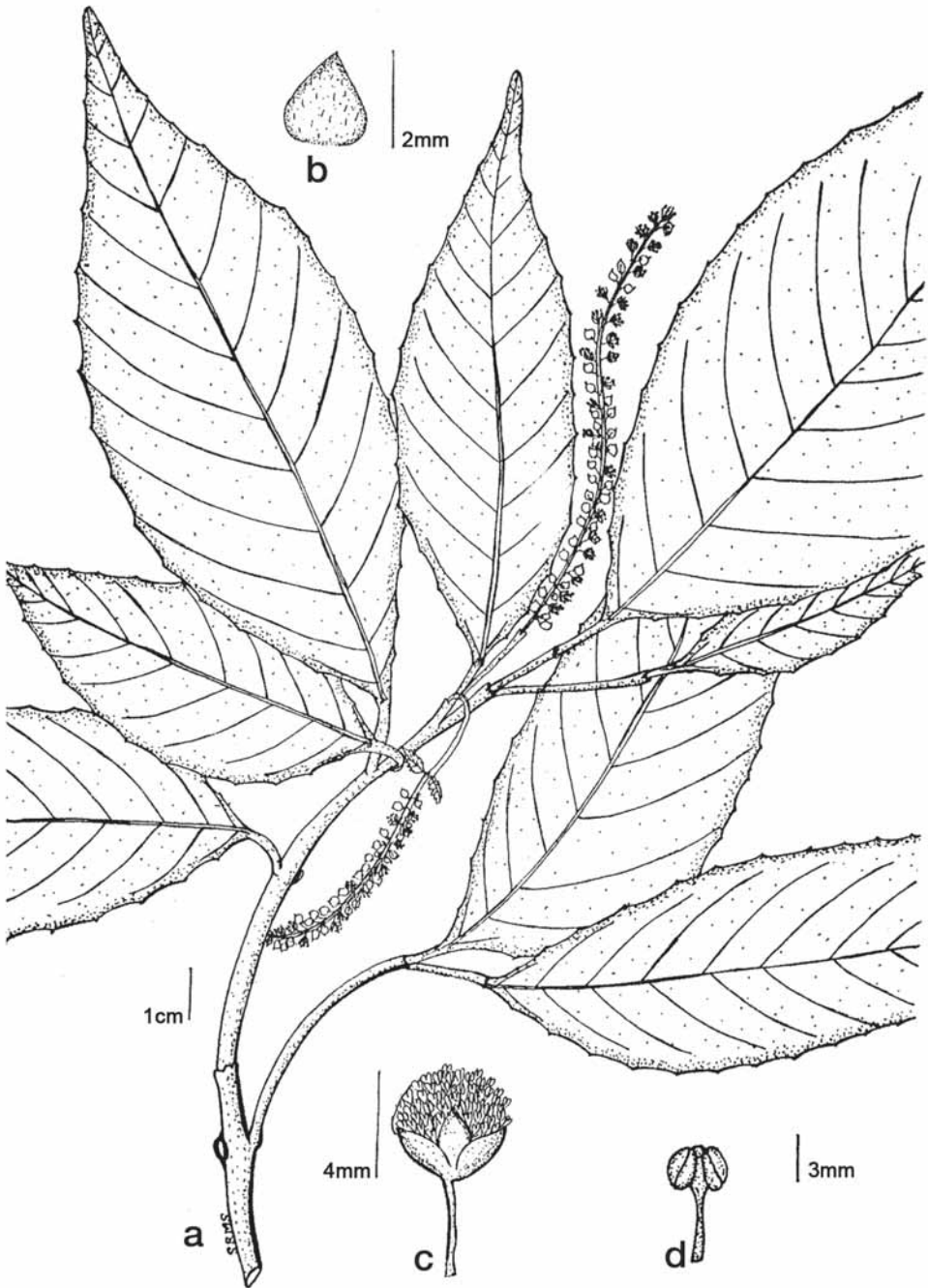
**2. *Mallotus aureo-punctatus*** (Dalzell) Müll.Arg. in DC., *Prodr.* 15(2): 973. 1866. *Rottlera aureo-punctata* Dalzell in Hooker's *J. Bot. Kew Gard. Misc.* 3: 122. 1851; Dalzell & A. Gibson, *Bombay Fl.* 230. 1861. *Mallotus lawii* Müll.Arg. in *Linnaea* 34: 192. 1865 & in DC., *Prodr.* 15(2): 975. 1866; Hook.f., *Fl. Brit. India* 5: 438. 1887. **Figs. 23 A - B**

Trees or shrubs, 2 - 10 m tall; branchlets compressed. Leaves opposite, lanceolate, oblong-ovate, rhombate-lanceolate to ovate-lanceolate, cuneate or attenuate to subtruncate at base, sinuate-toothed to entire along margins, subacute or acuminate to cuspidate at apex, 4 - 20 x 2 - 7 cm, membranous to chartaceous, glabrous above, softly pubescent on nerves and resinous glands beneath, penninerved; lateral nerves 5 - 10 pairs; petioles 1 - 5 cm long; stipules linear-lanceolate, up to 2 mm long, caducous. Male flowers: clustered in axillary or terminal racemes, 4 - 10 cm long; pedicels 5 - 7 mm long; bracts triangular-orbicular, acute, 1 - 2 mm across; sepals 3, elliptic to broadly ovate, 3 - 4 mm across, sparsely glandular; stamens 50 - 64; filaments 2 - 3 mm long; anthers oblong. Female flowers: 5 - 7 mm across, in few-flowered axillary or terminal, 3.5 - 10 cm long finely pubescent racemes; pedicels up to 1 mm long; bracts ovate, 1 - 3 mm long; calyx spathaceous, splitting into 4 - 6 lobes; each lobe linear-lanceolate, 4 - 5 mm long; ovary 3-loculed, 3 - 4 mm across, covered with dense conical tubercles, hirsute; styles 3, 3 - 5 mm long, plumose. Fruits tridymous, 1.5 - 1.8 cm across, with villous-hairy up to 1.5 mm long bristles; seeds subglobose, 7 - 8 mm across, shiny, smooth.

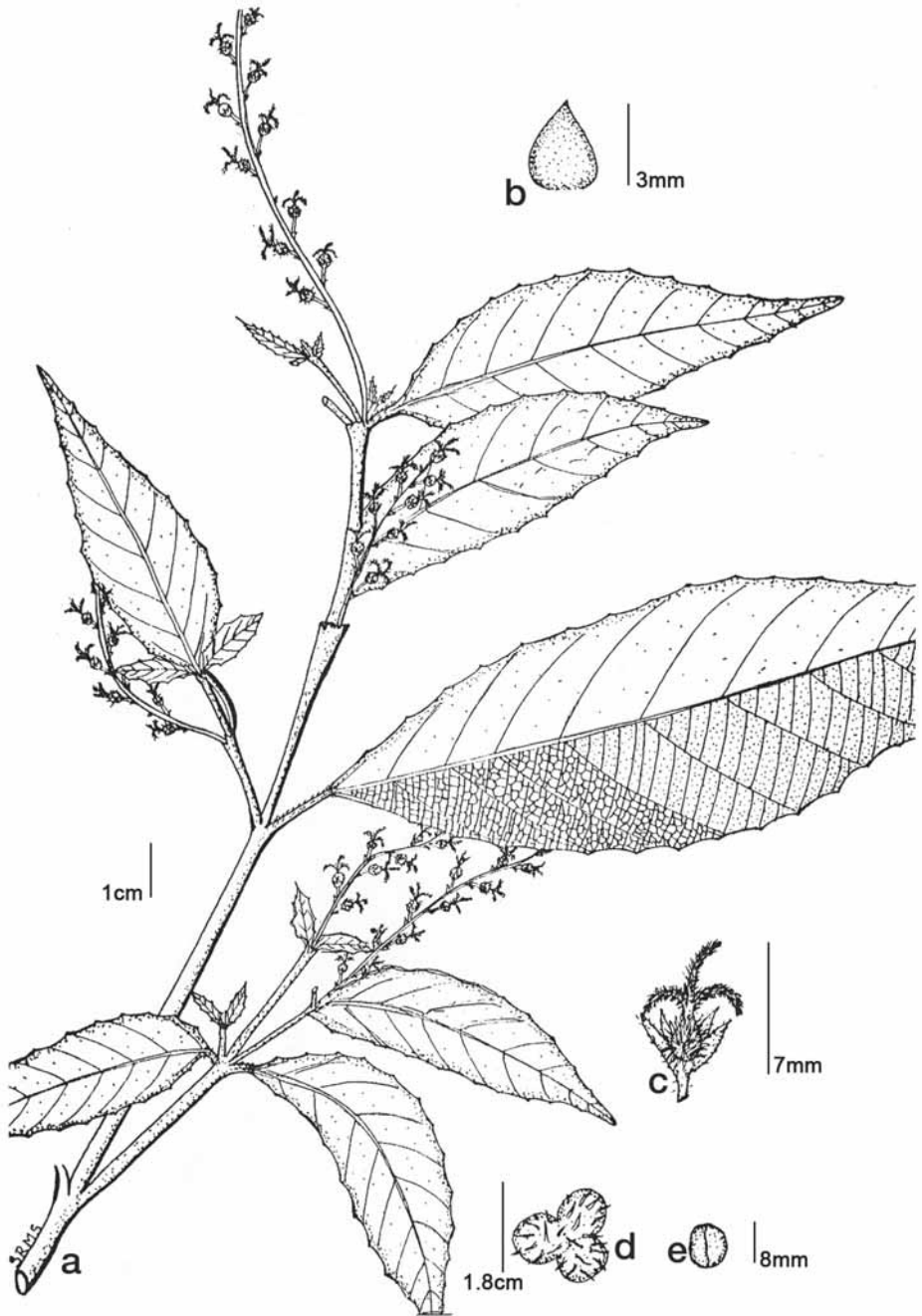
*Fl. & Fr.* Nov. - July.

*Distrib.* India: Evergreen forests of Western Ghats, up to 1000 m altitude. Maharashtra, Karnataka, Kerala and Tamil Nadu.

Endemic.



**Fig. 23 A.** *Mallotus aureo-punctatus* (Dalzell) Müll.Arg.: a. twig with male inflorescences; b. bract; c. male flower; d. stamen.



**Fig. 23 B. *Mallotus aureo-punctatus* (Dalzell) Müll.Arg.:** a. twig with female inflorescences; b. bract; c. female flower; d. fruit; E. seed.

**3. *Mallotus barbatus*** Müll.Arg. in *Linnaea* 34: 184. 1865 & in DC., *Prodr.* 15(2): 957. 1866; Hook.f., *Fl. Brit. India* 5: 428. 1887. *Rottlera barbata* Wall. [Cat. No. 7822. 1828; Baill., *Etude. Euphorb.* 423. 1858, nom. nud.]. **Figs. 24 A - B**

Shrubs or trees, 2 - 5 m tall; branchlets and young leaves covered with soft dense floccose tomentum mixed with stellate hairs. Leaves alternate, suborbicular to broadly ovate, rounded and broadly (2 - 6 cm) peltate at base, shortly 3-lobed with acute lobes at apex, shallowly dentate along margins, 10 - 25 x 15 - 30 cm, subcoriaceous, glabrescent above, stellate tomentose beneath; basal nerves 9 or 11, palmate, with 2 large maculate glands at base beneath; lateral nerves 6 - 8 pairs; petioles 5 - 17 cm long; stipules linear, 6 - 10 x 0.5 - 1 mm. Inflorescences axillary or terminal, simple or sometimes paniced racemes; male inflorescences erect, up to 25 cm long; flowers in groups of 3 at each node; peduncles and rachis 5 - 7 mm thick, densely stellate hairy; female inflorescences pendent, up to 40 cm long. Male flowers: 6 - 8 mm across; pedicels 3.5 - 5.5 mm long; calyx 3 - 4 x ca 2 mm, unequally 4 or 5-lobed; lobes ovate to elliptic, 3.5 - 5 x 1.5 - 3 mm; stamens 40 - 50; filaments 3 - 4 mm long; anthers globose, ca 1 mm long. Female flowers: 5 - 7 mm across, solitary in bract-axils; bracts subulate-triangular, ca 5 mm across; calyx spatheaceous, 3 - 5-lobed, 5 - 6 mm across; lobes ovate-lanceolate, ca 2.5 mm long, densely stellate-hairy; ovary 3-loculed, 3 - 4 mm across, densely stellate hairy; styles 3 or 4, up to 5 mm long. Fruits 3-lobed, 1.5 - 2 cm across, enclosed in a globose mass of numerous scattered continuous villous conical spines and dense layers of stellate hairs.

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

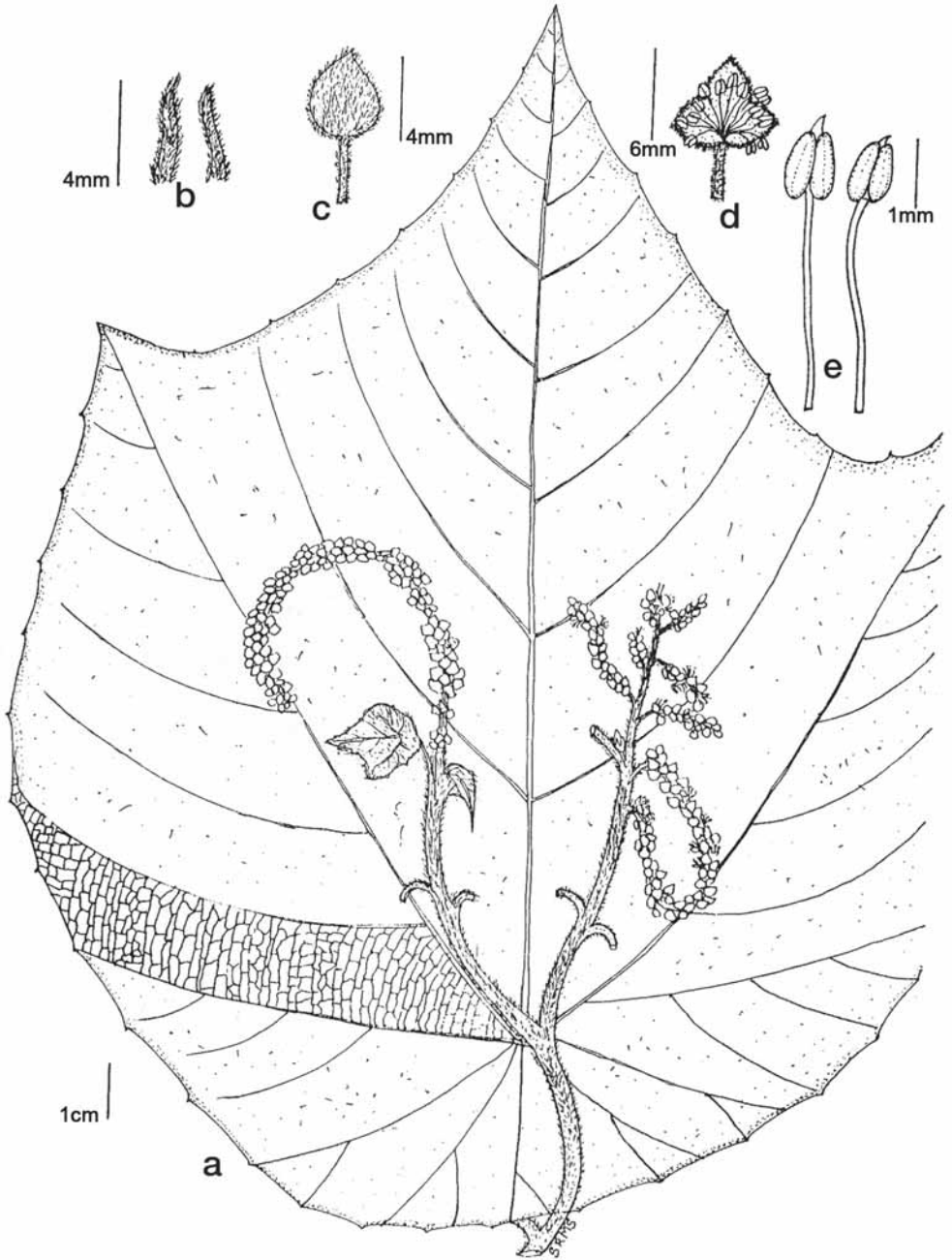
*Distrib.* India: Dense evergreen subtropical forests, disturbed deciduous forests and in mixed evergreen forests, 800 - 2000 m altitude. Maharashtra.

Myanmar, China, Vietnam, Thailand and Malaysia.

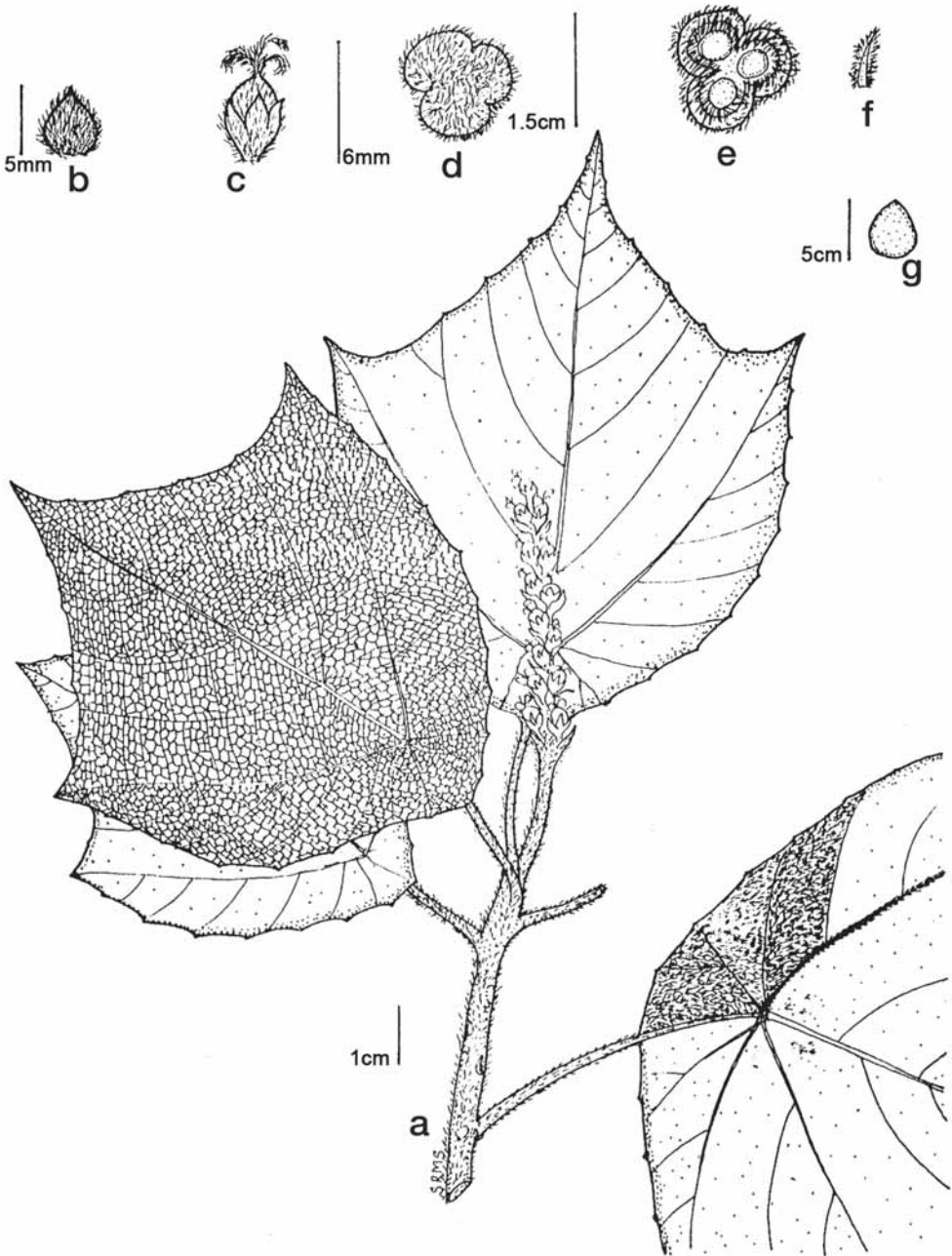
*Uses.* The fatty oil extracted from seeds is often used illumination lamps and for making candles.

**4. *Mallotus beddomei*** Hook.f., *Fl. Brit. India* 5: 438. 1887; R. V. Kammathy et al. in *Bull. Bot. Surv. India* 9: 227. 1968; C.J. Saldanha, *Fl. Karnataka* 2: 151. 1996. **Figs. 25 A - B**

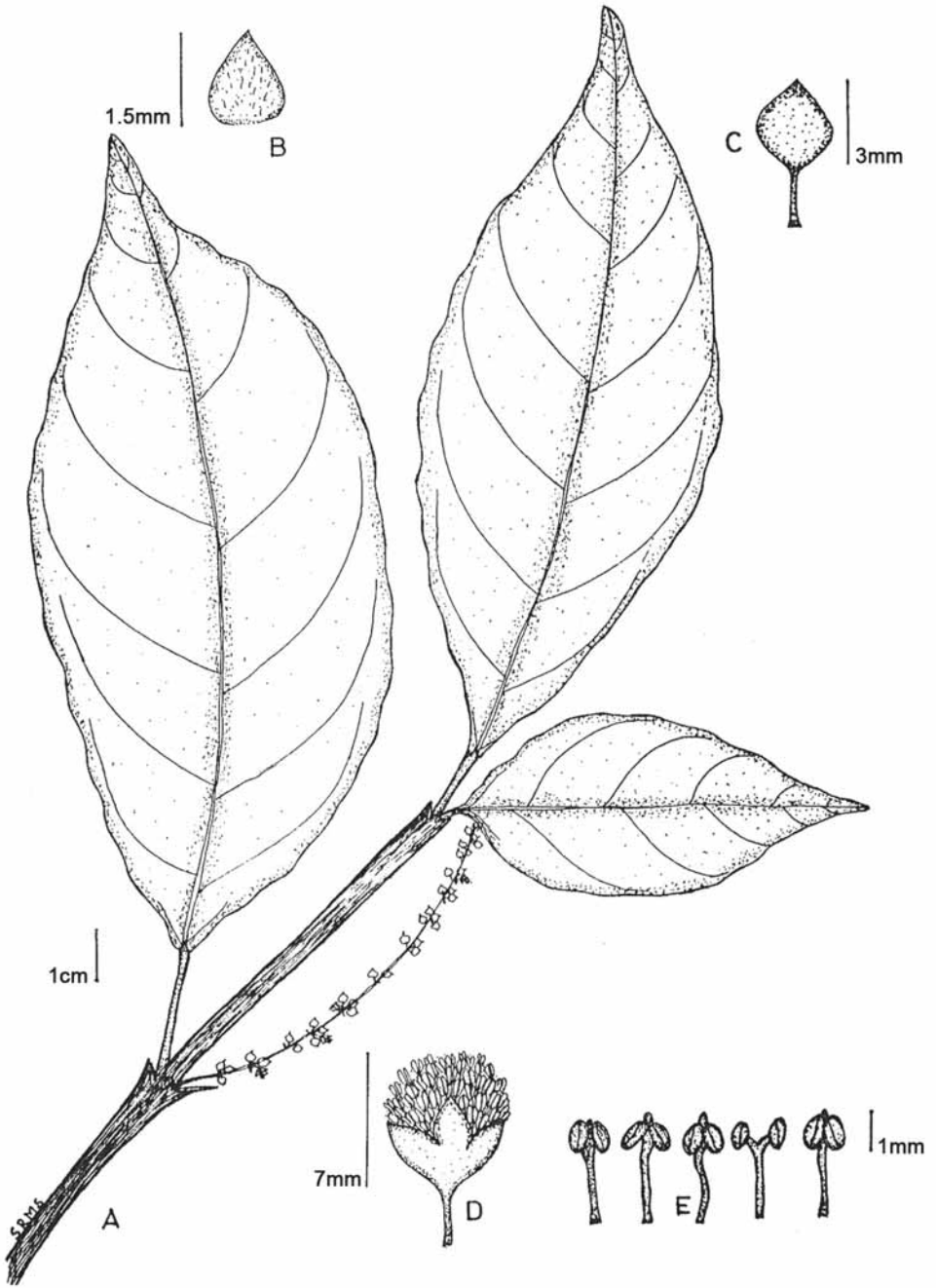
Shrubs or small trees, 1 - 3 m tall; branchlets densely woolly. Leaves opposite, ovate, oblong, to lanceolate, obtuse, truncate or rounded at base, entire or sinuate-dentate along margins, cuspidate or caudate-acuminate at apex, 6 - 30 x 2 - 12 cm, thinly coriaceous, glabrous except nerves beneath, minutely yellow-glandular beneath, penninerved; lateral nerves 5 - 10 pairs; glands 2 - 5 at base on both sides of the midrib; petioles 0.5 - 5 cm long, the pair at each node of unequal length, 0.5 - 1 and 2 - 5 cm; stipules linear, ca 2 mm long. Male flowers: in terminal or axillary, 5 - 8 cm long spikes; flowers sessile; bracts caducous; pedicels 2 - 4 mm long; sepals 3, oblong-ovate, 2 - 4 x 1.5 - 1.7 mm; stamens 25 - 45; filaments free, 1 - 2 mm long; anthers oblong to subglobose. Female flowers: 7 - 9 mm across, few distantly clustered on 8 - 10 cm long spikes; pedicels ca 5 mm long; sepals 5 or 6, linear-lanceolate, 4 - 8 x 1.8 - 2.5 mm; ovary 3-loculed, globose, 3 - 4 mm across, echinate, each spine stellate-pubescent; style 3-fid, connate at base, 5 - 8 mm long. Fruits globose, tridymous, 1 - 1.5 cm across, echinate, glandular, stellate pubescent; spines soft, 1 - 3 mm long.



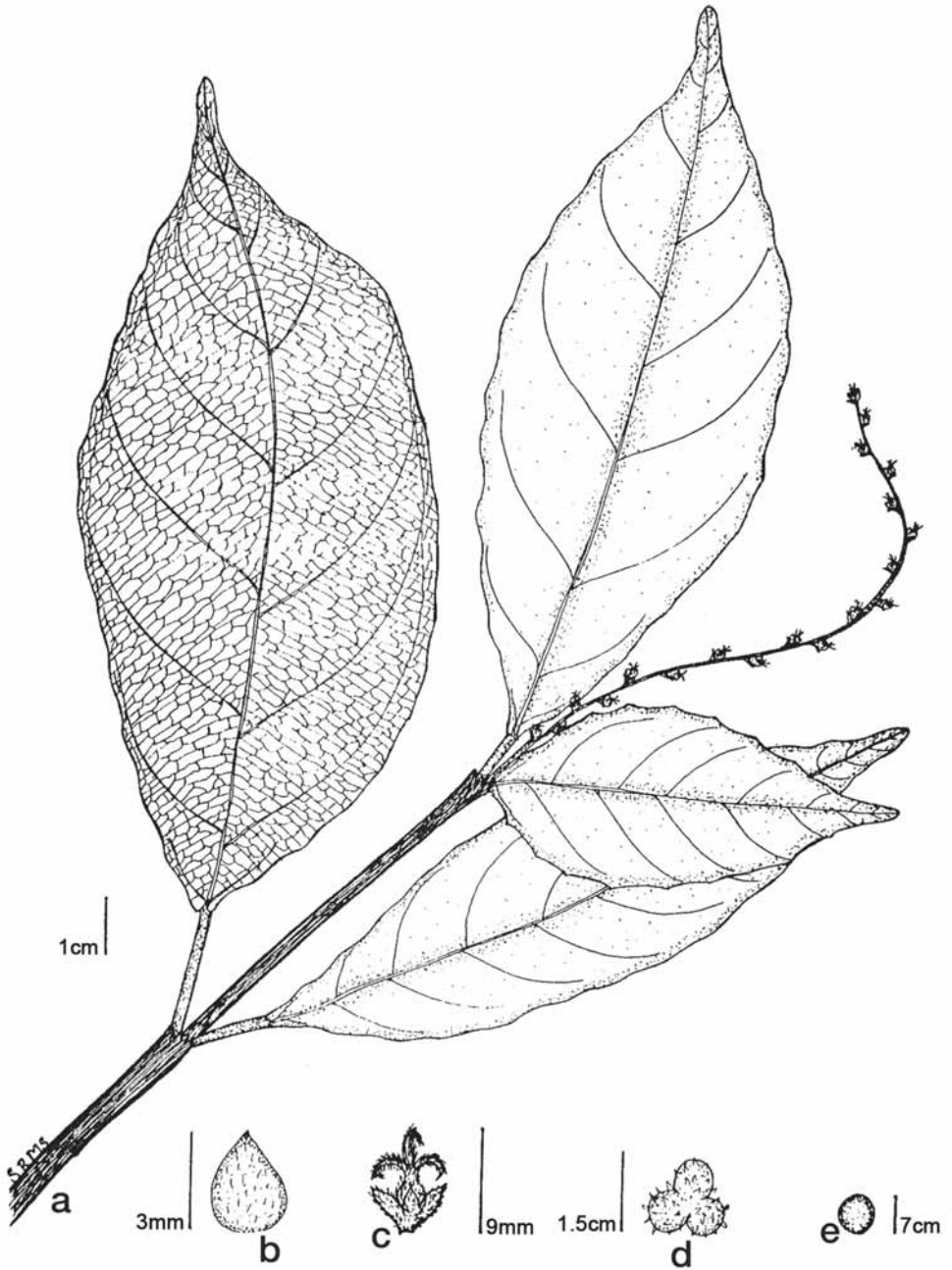
**Fig. 24 A.** *Mallotus barbatus* Müll.Arg.: a. twig with male inflorescences; b. bracts; c. male bud; d. male flower; e. Stamens.



**Fig. 24 B. *Mallotus barbatus* Müll. Arg.:** a. twig with female inflorescence; b. bract; c. female flower; d. fruit; e. t. s. of fruit; f. spine; g. seed.



**Fig. 25 A. *Mallotus beddomei* Hook.f.:** a. twig with male inflorescence; b. bract; c. male bud; d. male flower; e. stamens.



**Fig. 25 B. *Mallotus beddomei* Hook.f.:** a. twig with female inflorescence; b. bract; c. female flower; d. fruit; e. seed.



*Fl. & Fr.* July - Dec.

*Distrib.* India: Evergreen forests of Western Ghats, up to 1500 m altitude. Karnataka, Kerala and Tamil Nadu.

Endemic.

*Note.* Pollen grains 3-colporate, sexine scabrate. P = 27  $\mu\text{m}$  (22 to 30), E = 24  $\mu\text{m}$  (20 to 28). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery*, Pondicherry).

**5. *Mallotus distans*** Müll.Arg. in *Linnaea* 34: 194. 1865 & in DC., *Prodr.* 15(2) 976. 1886; Hook.f., *Fl. Brit. India* 5: 441. 1887.

Trees, 7 - 8 m tall; branchlets, petioles, leaves beneath and inflorescences scurfy yellowish or brownish stellate pubescent. Leaves opposite, in distant pairs, ovate, orbicular-ovate to elliptic-ovate, narrowly cuneate or acute and non-peltate at base, serrate or obscurely denticulate along margins, subacuminate or obtuse-cuspidate at apex, 5 - 25 x 3.5 - 15 cm, thinly coriaceous, subglabrous above, densely brown stellate tomentose beneath, glandular above, palmately 3-nerved with 4 - 8 large red glands at base; lateral nerves 3 - 5 pairs; petioles 2 - 9 cm long. Male flowers: on 8 - 15 cm long axillary racemes; sepals 3 - 5, ovate to orbicular, 2.5 - 3 mm across; stamens many; filaments free, 1.5 - 2.5 mm long; anther-thecae oblong-linear, ca 0.5 mm long. Female flowers: on 7 - 14 cm long axillary racemes; pedicels 2 - 6 mm long; calyx spathaceous, 4 or 5-lobed; lobes lanceolate, 3 - 4 x 1.5 cm; ovary 3-loculed, 3 - 4 mm across, densely yellowish tomentose, glandular; styles 3 - 5, 4 - 5 mm long. Fruits tridymous, ca 1 cm across, densely fulvous stellate tomentose, glandular.

*Fl. & Fr.* March - Nov.

*Distrib.* India: Evergreen forests along hill slopes and near estates, up to 800 m altitude. Kerala and Tamil Nadu.

Sri Lanka.

*Note.* Pollen 3-colporate, sexine scabrate. P = 24  $\mu\text{m}$  (20 to 26), E = 24  $\mu\text{m}$  (21 to 27). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery*, Pondicherry).

**6. *Mallotus ferrugineus*** (Roxb.) Müll.Arg. in *Linnaea* 34: 188. 1865 & in DC., *Prodr.* 15(2): 982. 1866. *Rottlera ferruginea* Roxb., *Fl. Ind.*, ed. Carey 3: 828. 1832. *R. tetracocca* Roxb. [*Hort. Bengal.* 73. 1814, nom. nud.] & l. c. 826. 1832. *Mallotus tetracoccus* (Roxb.) Kurz in *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 41(2): 245. 1873 & *Forest Fl. Burma* 2: 382. 1877. *M. albus* sensu Müll.Arg. in *Linnaea* 34: 188. 1865; Bedd., *Fl. Sylv. S. India* 208. 1872; Hook.f., *Fl. Brit. India* 5: 429. 1887, non *Rottlera alba* Roxb. ex Jack, 1820.

*Asm.:* *Lauri-bandha*, *Moralia*; *Beng.:* *Marleya*; *Kh.:* *Dieng-paklia*, *Dieng-tha-rong*; *Mal.:* *Adukanni*, *Vattakumbil*; *Naga:* *Teng-num-ching*; *Nep.:* *Jogi-malata*, *Kasre-malata*; *Tam.:* *Mullu-polavu*.

Shrubs or small trees, 3 - 15 m tall; young parts and inflorescences stellate or scurfy white or rusty tomentose. Leaves mostly alternate, broadly ovate to suborbicular, sometimes trilobed,

rounded or shallowly cordate and sometimes narrowly peltate at base, entire or sometimes angled, sinuate or repand-denticulate with glands along margins, obtuse, acute or obtusely acuminate at apex, 10 - 35 x 5 - 30 cm, coriaceous, glabrous and sparsely gland-dotted above, stellate-tomentose and densely gland-dotted beneath, 3 - 5-nerved at base; lateral nerves 3 - 6 pairs; petioles 3 - 18 cm long; stipules triangular-ovate, ca 2 mm long, caducous. Inflorescences axillary or terminal, pyramidal panicles of spikes or racemes, 10 - 40 cm long. Male flowers: clustered along nodes; pedicels ca 4 mm long; bracts ovate, ca 1 mm long, 3-flowered; sepals 3 or 4, ovate to elliptic-lanceolate, 3 - 4 mm long, densely scurfy tomentose; stamens 60 - 80; filaments free, 4 - 5 mm long; anthers globose to oblong, 2-loculed. Female flowers: solitary along rachis; pedicels 2 - 5 mm long; bracts triangular-ovate, ca 1 mm long; calyx spathaceous, deeply 4 or 5-partite; lobes oblong-lanceolate, 3 - 4 mm long; ovary 3 or 4-loculed, 3 - 4 mm long, densely stellate-hairy; styles 3 or 4, connate at base, free above, papillose. Fruits subglobose, 3 - 4-lobed, 12 - 17 x 8 - 10 mm, muricate with soft white-tomentose spinules; seeds ovoid, rounded on back, angular on inner face, 4 - 5 x ca 3.5 mm, minutely tubercled.

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

*Distrib.* India: Tropical and subtropical evergreen forests, up to 1600 m altitude. West Bengal, Arunachal Pradesh, Assam, Meghalaya, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu.

Sri Lanka, Bangladesh, Myanmar, China and Thailand.

*Notes.* *Rottlera tetraococca* Roxb. is same as *R. ferruginea* Roxb. Miquel (1860) was the first to unite the two species and selected *R. ferruginea* Roxb. as the name for the combined species and hence, the correct name.

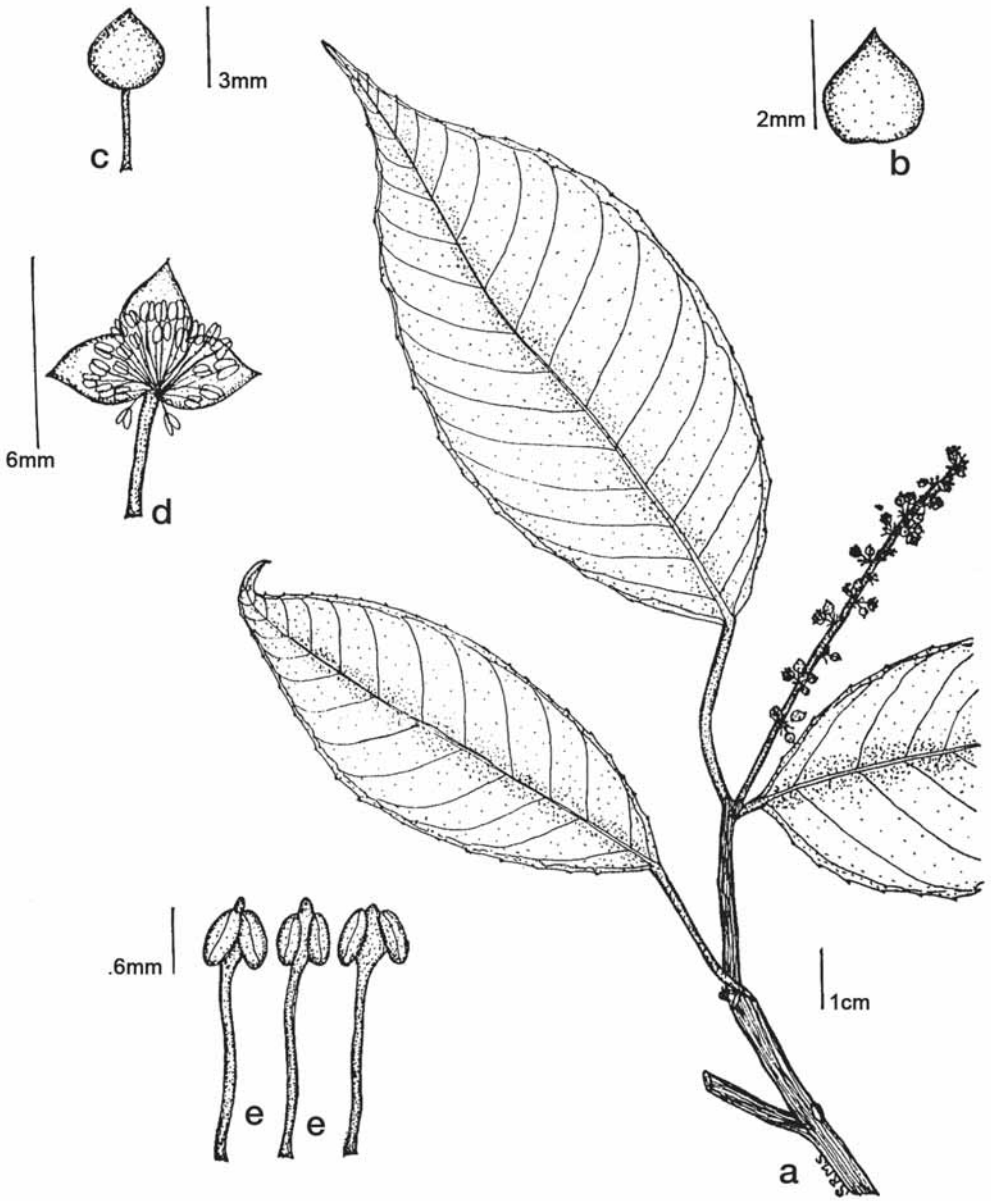
Chromosome number:  $2n = 66$  (Mehra, Nucleus 15: 64 - 83. 1972; Hans, Taxon 22: 591 - 636. 1973).

**7. *Mallotus khasianus*** Hook.f., Fl. Brit. India 5: 438. 1887. *M. filiformis* Hook.f., l. c. 435. 1887. *M. polyneurus* Hook.f., l. c. 439. 1887. **Figs. 26 A - B**

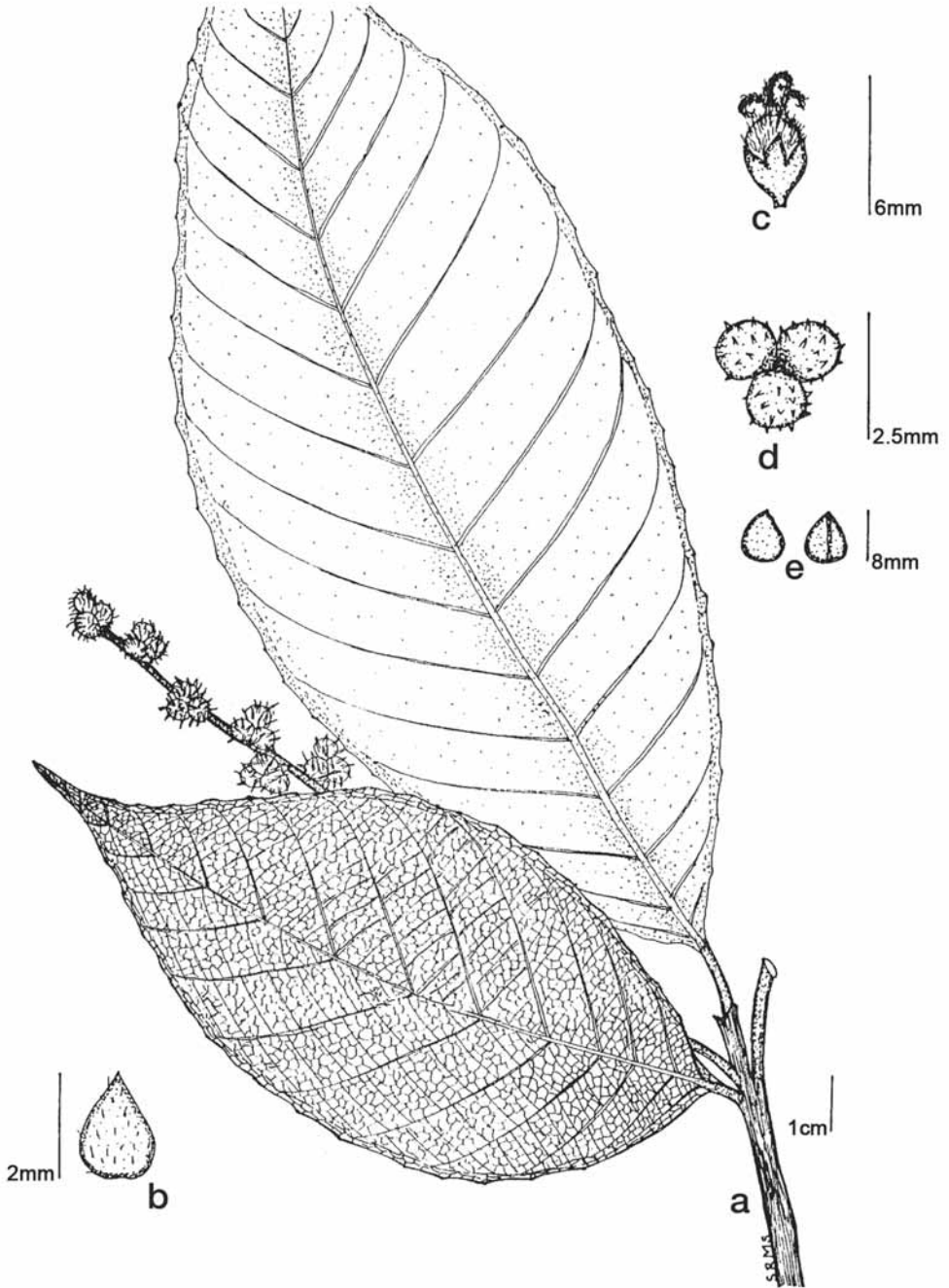
Trees or shrubs, 2 - 9 m tall. Leaves opposite, oblong to elliptic-ovate, rounded to broadly cuneate at base, entire or shallowly dentate along margins, caudate at apex, 10 - 25 x 4 - 11 cm, chartaceous, pilose on both sides, penninerved, with 2 or 3 large glands at base on both sides of midrib; lateral nerves 6 - 10 pairs; petioles 1 - 6 cm long; stipules subulate, ca 1 mm long. Male flowers: sessile or on 2 - 4 mm long pedicels, along simple or panicked, 8 - 15 cm long racemes; bracts ovate-lanceolate, ca 2 mm across; sepals 3, ovate-lanceolate, 3 - 4 x ca 2 mm; stamens 40 - 50; filaments free, 1.5 - 3 mm long; anthers reniform. Female flowers: along 12 - 20 cm long slender racemes; calyx spathaceous, 4 - 5-lobed, lobes ovate-lanceolate, 3 - 4 mm long; ovary 3-loculed, 4 - 5 mm across, pubescent, with soft spines; styles 3, connate at base, free above, 3 - 5 mm long. Fruits with 1 - 2.5 cm long pedicels, tridymous, 2 - 3 cm across, pubescent, with yellow scattered conical ca 0.5 mm long spines or prickles; seeds subglobose, 5 - 8 mm across, smooth, pitted, shiny dark brown.

*Fl. & Fr.* Not known.

*Distrib.* India: Dense deciduous subtropical forests, at 800 - 1500 m altitudes. Rare, found only in Meghalaya.



**Fig. 26 A. *Mallotus khasianus* Hook.f.:** a. twig with male inflorescence; b. bract; c. male bud; d. male flower; e. stamens.



**Fig. 26 B. *Mallotus khasianus* Hook.f.:** a. twig with female inflorescence; b. bract; c. female flower; d. fruit; e. seeds.

Myanmar and Thailand.

**8. *Mallotus leucocarpus*** (Kurz) Airy Shaw in Kew Bull. 16: 352. 1963. *Claoxylon leucocarpum* Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 244. 1873 & Forest Fl. Burma 2: 396. 1877; Hook.f., Fl. Brit. India 5: 413. 1887.

Shrubs, 2 - 4 m high; young branchlets densely yellowish stellate-pubescent. Leaves broadly ovate, rounded or almost subcordate at base, repand-dentate with glands along margins, acute to acuminate at apex, 18 - 30 x 15 - 25 cm, subcoriaceous, shortly hirsute above, stellate pubescent beneath (more so on nerves), strongly 3-nerved at base with 2 large red glands; lateral nerves 5 - 9 pairs; petioles 8 - 20 cm long, puberulous; stipules ovate-lanceolate, 2 - 3 mm long, densely yellow-pubescent. Male flowers: not seen. Female flowers: clustered along 5 - 10 cm long stellate-pubescent racemes; ovary 3-loculed, ovoid, and densely covered with soft spinules; styles 3, connate at base, 3 - 4 mm long. Fruits on 3 - 5 mm long stalks, 2 - 4-lobed, 1 - 1.5 cm across, white, covered with soft appressed, up to 0.7 mm long spines, and yellowish stellate pubescence; seeds globose to ovoid, 5 - 6 mm across, enveloped in white sappy caruncle.

*Fl.* Not known; *Fr.* Jan.

*Distrib.* India: Mixed subtropical evergreen forests, 1400 - 1600 m altitudes. Rare. Meghalaya.

Myanmar.

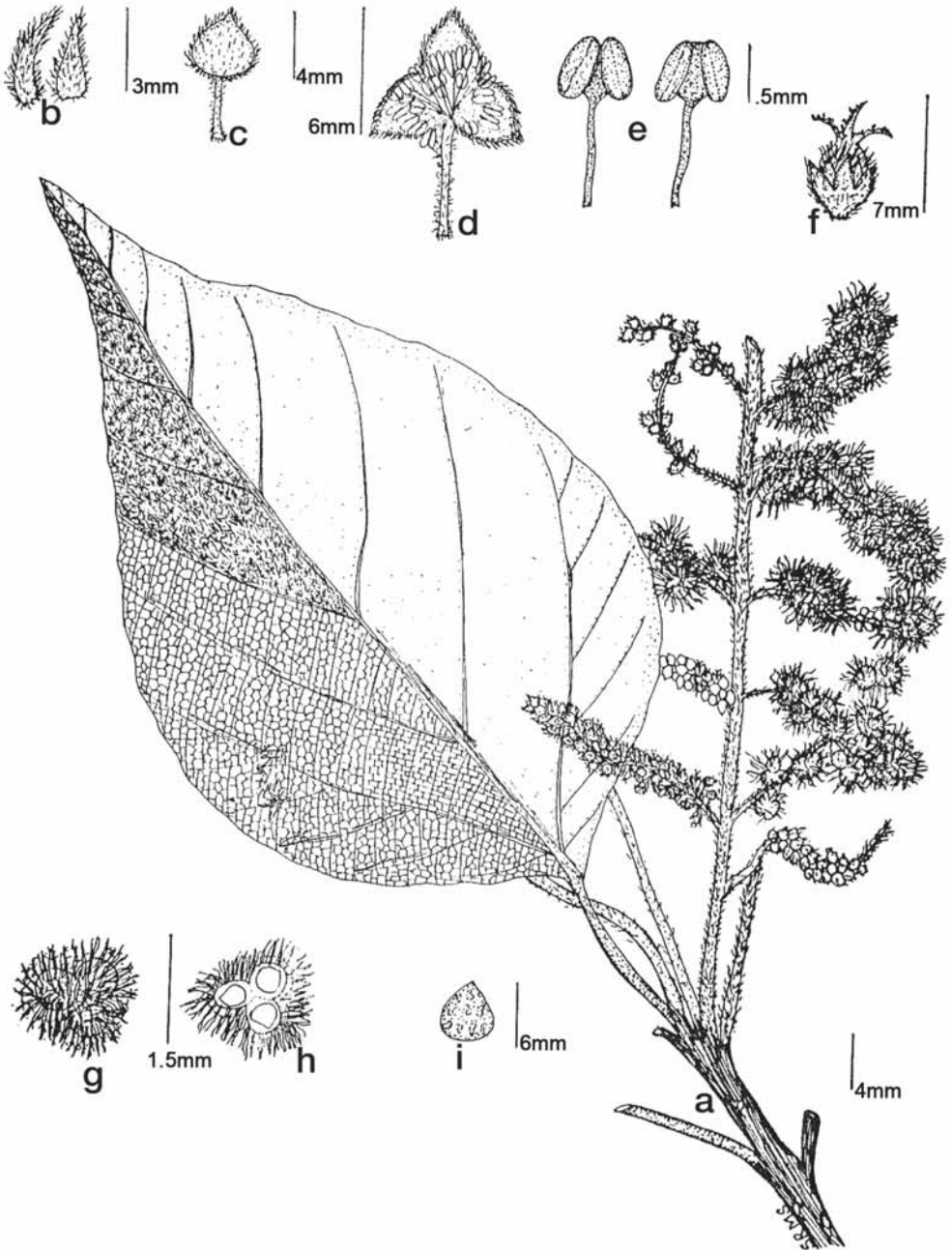
**9. *Mallotus mollissimus*** (Geiseler) Airy Shaw in Kew Bull. 26: 297. 1972. *Croton mollissimus* Geiseler, Croton. Monogr. 73. Mar. 1807. *C. ricinoides* Pers., Syn. Pl. 2: 586. Sep. 1807. *Mallotus ricinoides* (Pers.) Müll.Arg. in Linnaea 34: 187. 1865 & in DC., Prodr. 15(2): 963. 1866; Hook.f., Fl. Brit. India 5: 430. 1873. **Fig. 27**

Shrubs or trees, 5 - 15 m tall; branchlets and young parts yellowish floccose. Leaves alternate, ovate to orbicular-ovate or deltoid or rhombate, broadly rounded to cordate and peltate or subpeltate at base, acute to cuspidate-acuminate at apex, entire or remotely toothed along margins, 10 - 26 x 7 - 20 cm, membranous, stellate tomentellous on nerves above, tomentose and glandular beneath, palmately 3 - 5-nerved at base; lateral nerves 6 - 8 pairs; petioles 4 - 15 cm long; stipules subulate, 3 - 4 mm long. Inflorescences simple or compound spikes. Male flowers: on axillary or terminal, branched, densely floccose-tomentose 10 - 28 cm long panicles; pedicels 2 - 4 mm long; sepals 3, ovate, 2 - 3 mm across; stamens 45 - 65; filaments free, 0.7 - 2 mm long; anthers globose. Female flowers: 5 - 7 mm across, subsessile, solitary at bract-axils along with the cluster of male flowers; pedicels very short; calyx spathaceous, 4 - 5-cleft; lobes triangular-lanceolate, 3 - 4 x 1.8 - 2 mm; ovary 3-loculed, globose, ca 3 mm across, greyish villous, echinate; styles 3, 1 - 3 mm long, densely plumose. Fruits subglobose, 3-lobed, 1 - 1.5 cm across, with long subulate soft bristles, densely stellate scurfy hairy; seeds globose, 3 - 6 mm across, brown or black, shiny, faintly tubercles, pitted.

*Fl.* & *Fr.* Jan. - Nov.

*Distrib.* India: Secondary forests, tea or coffee gardens and also along edges of forests amidst bushes. West Bengal, Assam and Nagaland.

Nepal, Myanmar, China, Malaysia, Indonesia, Philippines and N. Australia.



**Fig. 27. *Mallotus mollissimus* (Geiseler) Airy Shaw:** a. twig with dioecious inflorescence; b. bracts; c. male bud; d. male flower; e. stamens; f. female flower; g. fruit; h. t. s. of fruit; i. seed.

**10. Mallotus nepalensis** Müll.Arg. in Linnaea 34: 188. 1865 & in DC., Prodr. 15(2): 965. 1866; Hook.f., Fl. Brit. India 5: 428. 1887. *M. oreophilus* Wall. [Cat. No. 7324. 1847, nom. nud.] ex Müll.Arg. in Linnaea 34: 188. 1865 & in DC., Prodr. 15(2): 964. 1866 (incl. var. *floccosus*).

Kh.: *Dieng-lakhar*; Nep.: *Malata*.

Trees, 5 - 10 m tall; branchlets, young parts, leaves beneath, petioles and inflorescences white or rusty tomentellous or stellate pubescent. Leaves opposite or alternate, broadly ovate, orbicular-ovate to triangular-ovate, truncate or rounded at base, rarely subpeltate, entire or repand-denticulate along margins, caudately acuminate at apex, 10 - 30 x 5 - 20 cm, chartaceous to subcoriaceous, minutely glandular above, palmately 3-nerved at base; lateral nerves 5 - 10 pairs; petioles 4 - 15 cm long. Male flowers: clustered along 10 - 20 cm long stout racemes; bracts linear-lanceolate, 3 - 4 mm long; pedicels 4 - 6 mm long; sepals 3 or 4, ovate, 4 - 5 x ca 3 mm; stamens up to 100 or more; filaments free, 3 - 4 mm long; anthers globose, 0.5 - 0.7 mm across. Female flowers: on short stout racemes; pedicels 2 - 3 mm long; calyx splitting into 5 or 6 segments; lobes lanceolate, 3 - 5 x 1 - 2 mm; ovary 3-loculed, 3 - 4 mm across, densely stellate hairy, echinate; styles 3 - 5 mm long, densely plumose. Fruits trilobed, subglobose, 1 - 1.5 cm across, clothed with soft, 5 - 7 mm long spines, densely stellate or simple hairy; seeds globose or ovoid, 5 - 6 mm across, smooth, angular at inner face, black.

#### KEY TO THE VARIETIES

- 1 a. Leaves scabrid on lower surface with sparse or scattered stellate hairs **10.1. var. nepalensis**  
 b. Leaves densely and softly appressed matty stellate tomentose on lower surface  
**10.2. var. ochraceo-albidus**

#### **10.1. var. nepalensis**

*Fl. & Fr.* May - Nov.

*Distrib.* India: Chiefly in secondary subtropical forests, occasionally in temperate forests, along moist hill slopes, at 500 to 3400 m altitudes. West Bengal, Sikkim, Nagaland and Meghalaya.

Nepal, Myanmar and S. China (Yunnan).

*Uses.* In Darjeeling (West Bengal), the wood is used for huts, fencing and for making charcoal.

*Notes.* Chromosome numbers:  $2n = 44$  (Mehra & Hans, Taxon 18: 310 - 315. 1969 & in J. Indian Bot. Soc. 51: 319 - 325. 1972);  $n = 44$  (Bedi, Taxon 29: 353. 1980).

**10.2. var. ochraceo-albidus** (Müll.Arg.) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.vii (heft 63): 165. 1914. *Mallotus oreophilus* var *ochraceo-albidus* Müll.Arg. ll. cc. 188. 1865 & 964. 1866; D.G. Long in Grierson & D.G.Long, Fl. Bhutan 1(3): 84. 1987.

*Fl. & Fr.* July.

*Distrib.* India: Warm broad-leaved forests. Sikkim and West Bengal.

Nepal.

**11. *Mallotus peltatus*** (Geiseler) Müll.Arg. in *Linnaea* 34: 187. 1865 & in DC., *Prodr.* 15(2): 967. 1866. *Aleurites peltata* Geiseler, *Croton. Monogr.* 81. 1807. *Adisca acuminata* Blume, *Bijdr. Fl. Ned. Ind.* 610. 1826. *Mallotus acuminatus* (Blume) Müll.Arg. in *Linnaea* 34. 117. 1865 & in DC., *Prodr.* 15(2): 966. 1866; Hook.f., *Fl. Brit. Ind.* 5: 431. 1887. *M. floribundus* sensu Chakrab. in *J. Econ. Taxon. Bot.* 6: 495. 1985, non (Blume) Müll.Arg., 1865. *M. oblongifolius* (Miq.) Müll.Arg. in *Linnaea* 34: 192. 1865 & in DC., *Prodr.* 15(2): 973. 1866. *Rottlera oblongifolia* Miq., *Fl. Ned. Ind.* 1(2): 396. 1859. *Mallotus helferi* Müll.Arg. in *Linnaea* 34: 190. 1865 & in DC., *Prodr.* 15(2): 968. 1866; Hook. f., l. c. 431. 1887. *M. floribundus* (Blume) Müll.Arg. var. *cordifolius* Chakrab. in *J. Econ. Taxon. Bot.* 6: 496. 1985.

Shrubs or trees, 2 - 8 m tall. Leaves alternate or opposite towards tips of branchlets, epeltate or peltate, oblong to elliptic, narrowly cordate or rounded at base, glandular-serrate to subentire along margins, caudate-acuminate at apex, 10 - 35 x 4 - 15 cm, chartaceous, glabrous above, glabrous to scattered pubescent beneath on nerves, penninerved or often weakly trinerved with 1 - 3 pairs of large red glands at base; lateral nerves 5 - 10 pairs; petioles 1 - 12 cm long; stipules subulate, 1 - 4 mm long, caducous. Male inflorescences terminal, racemose, 6 - 22 cm long; bracts rounded to ovate, concave, 0.7 - 2 mm long; pedicels 1 - 4 mm long; calyx lobes 3 or 4, ovate-lanceolate, 2 - 2.5 x 1 - 1.5 mm; stamens 17 - 30, 2 - 3 mm long; anthers globose, ca 0.5 mm across. Female inflorescences racemose spikes, 10 - 25 cm long; bracts oblong-ovate, 1 - 2 x 2 - 3 mm; pedicels (1 -) 3 - 6 mm long; flowers 4 - 6 mm across; calyx spathaceous, split on one side, 4 - 5 x 3 - 4 mm, minutely stellate-hairy, caducous; ovary 3-locular, globose or ovoid, ca 1.5 mm in diam., echinate; stylar column 4 - 5 mm long; branches 3, 4 - 6 mm long. Fruits depressed-subglobose, 10 - 12 mm in diam., deeply 3-lobed, sparsely echinate with soft 3 - 4 mm long spines with a few apical setae, often yellow-brown glandular; seeds subglobose, to ovoid, 5 - 7 x 4 - 5 mm, angular on inner face, smooth, white or dark brown variegated, minutely gland-dotted.

#### KEY TO THE VARIETIES

- 1 a. Ovary, style and fruits green, turning brownish when dry **11.1. var. peltatus**  
 b. Ovary, style and fruits deep red, turning blackish-red when dry **11.2. var. rubriflorus**

#### **11.1. var. peltatus**

Chakrab. & N.P.Balakr. in *J. Econ. Taxon. Bot.*, *Addit. Ser.* 9: 85. 1992.

Shrubs or trees, 2 - 8 m tall.

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

*Distrib.* India: One of the commonest species, from littoral forests to edges of evergreen forests on sandstone or clayey soil, ascending to 500 m altitude on the Saddle Peak. Andaman & Nicobar Islands.

Thailand, China, Vietnam, Malaya, Sumatra, Java to New Guinea and N. Australia.

*Note.* Recently recorded that the seeds of *M. peltatus* are among the primary food items of the Megapode birds of Great Nicobar Island (Sivakumar & Sankaran, *J. Bombay Nat. Hist. Soc.* 102: 105 - 106. 2005).



**11.2. var. rubriflorus** Chakrab. in J. Econ. Taxon. Bot. 6: 497. 1985. *Mallotus oblongifolius* var. *rubriflorus* Chakrab. in J. Econ. Taxon. Bot. 6: 496. 1985.

Shrubs or trees, up to 5 m tall, distinguished from var. *peltatus* by the deep red colour on ovary, styles and fruits (often on spines only).

*Fl. & Fr.*: April – December.

*Distrib.*: India: Coastal and inland evergreen forests on rocky or clayey soil, up to 100 m altitude. Andaman & Nicobar Islands (South Andamans and Great Nicobar Island).

Endemic.

**12. Mallotus penangensis** Müll.Arg. in Linnaea 34: 186. 1865 & in DC., Prodr. 15(2): 961. 1866; Hook.f., Fl. Brit. India 5: 440. 1887; Chakrab. in J. Econ. Taxon. Bot. 5: 217. 1984. *Cordemoya penangensis* (Müll.Arg.) Sierra, Kulju & Welzen in Blumea 51(3): 534. 2006.

Trees, 3 - 20 m tall. Leaves opposite, exceedingly unequal, (one of each pair at a node normal in size and shape, the other being very small, stipuliform and subtending an inflorescence), narrowly oblong, acute, obtuse to rounded or truncate at base, cuspidate-acuminate at apex, entire along margins, 5.5 - 25 x 1.5 - 8 cm, subcoriaceous, glabrous, penninerved (stipuliform leaves narrowly triangular to ovate, 1.5 - 4 x 1 - 2 mm); lateral nerves 5 - 9 pairs; petioles 1 - 4 cm long. Inflorescences in axils of stipuliform leaves, simple. Male flowers: many, clustered on 3 - 7 cm long racemes; bracts deltoid or triangular, ca 1 mm long; pedicels 2 - 3 mm long; sepals 3, elliptic, 3 - 4.5 mm long; stamens ca 50; filaments free, 3 - 4 mm long; anthers globose, 0.5 - 0.7 mm across. Female flowers: few on 3 - 11 cm long racemes; bracts deltoid, ca 1.5 x 1 mm; pedicels 3 - 8 mm long; sepals 4 - 6, oblong, 2 - 6 x 0.5 - 1.5 mm; ovary 3-locular, 4 - 5 mm across, densely woolly, echinate with narrow conical up to 2 mm long spines; styles 3, shortly connate at base, free above, 5 - 10 mm long. Fruits trilobed, 1.4 - 1.5 cm across, flattened or depressed on top, densely covered with short sharp up to 5 mm long spines and setae, fulvous tomentellous; seeds subglobose, 7 - 8 mm across.

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

*Distrib.* India: Inland tropical evergreen or mixed forests, moist hill slopes, often near riverbanks and occasionally in swampy areas on sandy clay, up to 200 m altitude. Andaman & Nicobar Islands (Great Nicobar Island).

Thailand, Vietnam, Peninsular Malaysia, Sumatra, Philippines, Sulawesi, Molluccas and New Guinea.

**13. Mallotus philippensis** (Lam.) Müll.Arg. in Linnaea 34: 196. 1865 & in DC., Prodr. 15(2): 981. 1866; Hook.f., Fl. Brit. India 5: 442. 1887. *Croton philippensis* Lam., Encycl. 2: 206. 1786. *Rottlera tinctoria* Roxb., Pl. Coromandel 2: 36, t. 168. 1802 & Fl. Ind., ed. Carey 3: 827. 1832.

Asm.: *Gangai, Jorat, Losan, Puddum*; Beng.: *Kamala, Kishur, Pung-tung*; Guj.: *Kapilo*; Hindi: *Kamala, Raini, Rohini, Roli, Ruina, Sindur*; Kan.: *Kumkumadamara*; Kash.: *Kaimlar, Kamila*; Mal.: *Chenkolli, Kapila, Kuramadakku, Manchana, Mannana, Ponnagam*; Mar.: *Kapila, Roem, Shendri*; Nep.: *Sindure*; Or.: *Kapilgundi, Kumala, Sinduri, Sundaragundi*; Punj.: *Kamal, Kambal, Kamela, Kumila*; Tam.: *Avam, Curangicari, Kabilam, Kaisalppodi, Kapli, Kungumam*; Tel.: *Chendra, Kumkuma, Sinduri, Vasunthagunda*; Urdu: *Sinduri*.

Trees, 5 - 25 m tall; young shoots and inflorescences densely tawny or fulvous stellate pubescent or rusty pubescent. Leaves alternate, rarely subopposite, ovate, oblong-ovate, to lanceolate, rounded, cuneate, acute to truncate at base, entire, acuminate at apex, 5 - 27 x 2 - 16 cm, coriaceous to chartaceous, subglabrous above, subglaucous, minutely puberulous or stellate tomentose and mixed with numerous orbicular crimson-red glands beneath, strongly trinerved and with 2 large red sessile glands beneath at base; lateral nerves 4 - 11 pairs; petioles 1 - 12 cm long; stipules obsolete. Male flowers: clustered along terminal or axillary solitary or fascicled 4 - 15 cm long racemes or panicles; pedicels 0 - 3 mm long; bracts triangular, ca 1 mm long, 1 - 3-flowered; sepals 3 or 4, ovate to elliptic-lanceolate, 1.5 - 2.5 mm long; stamens 18 - 32; filaments free. Female flowers: sessile, arranged singly along terminal or axillary simple 3 - 15 cm long racemes or spikes; bracts triangular, ca 1 mm long, 1-flowered; pedicels 0.5 - 1 mm long; sepals 3 - 5, connate at base, ovate-lanceolate, 1.5 - 3 mm long, granular-glandular outside; ovary 2 - 3 mm across, densely crimson-red glandular; styles 3, free above, 2 - 5 mm long. Fruits 3-lobed, 1 - 1.3 cm across, stellate hairy, densely covered with bright red indurate glandular powder; seeds subglobose to ovoid, 4 - 5 mm across, black, smooth.

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

*Distrib.* India: Tropical primary and secondary forests, deciduous forests, scrub jungles, grasslands and rarely near mangrove forests, up to 900 m altitude. Throughout the country in tropical areas of all states.

Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, China, Indo-China, Thailand and throughout Malesia up to N. Australia.

*Uses.* The tree has long been valued as a source of dyeing material known in trade as *Kamala*, *Kamalam* powder or *Kamala* dye used in dyeing silk and wool. The colouring matter is present in the red granular powder covering the fruits. *Kamala* powder contains 4 - 5 % ash, traces of volatile oil, tannins, gum, citric acid and oxalic acids and sometimes employed as an anti-oxidant for ghee and vegetable oils, preventing development of rancidity and loss of Vitamin A. Also finds use as a colouring stuff for food and beverages. Women in India use the crimson powder as *sindhur* or *kumkum*.

The crimson powder from the surface of the fruits inhibits action of tapeworms and is considered as an effective taenifuge. The powders as well as paste of fruits are used externally for parasitic infections of skin, such as scabies, ringworms and herpes.

Recently an oil extracted from the seeds have attracted attention as a substitute for Tung oil (*Aleurites* sp.), in the formulation of quick drying paints and varnishes. The oil finds use in the formulation of hair fixers and ointments.

*Notes.* Chromosome number:  $2n = 22$  (Datta, Taxon 16: 341 - 350. 1967; Mehra & Hans, Taxon 18: 310 - 315, 1969).

Pollen 3-colporate, sometimes 4-colporate, sexine scabrate.  $P = 20 \mu\text{m}$  (18 to 24),  $E = 24 \mu\text{m}$  (20 to 29). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francis de Pondicherry*, Pondicherry).

**14. Mallotus repandus** (Rottler ex Willd.) Müll.Arg. in *Linnaea* 34: 197. 1865 & in DC., *Prodr.* 981. 1866; Hook.f., *Fl. Brit. India* 5: 442. 1887. *Croton repandus* Rottler ex Willd., *Ges. Naturf. Freunde Berlin Neue Schriften* 4: 206. 1803.

Asm.: *Dudloti, Konibih*; Beng.: *Akus, Nanbhantur*; Hindi: *Akus*; Kan.: *Kumati*; Mal.: *Thavatti*; Tel.: *Kanda-veltu*.

Trees or scandent shrubs with prominent large thorns on the trunks and stems, 5 - 20 m tall. Leaves alternate, ovate, cordate to broadly deltoid, rounded, truncate or broadly cuneate (often narrowly peltate) at base, coarsely dentate to repand-denticulate along margins, acute to acuminate at apex, 3 - 14 x 2 - 10 cm, subcoriaceous, glabrescent or thinly velvety with scattered scales on nerves above, stellate-pubescent and whitish beneath, minutely yellow-glandular dotted on both sides, palmately 3-nerved, with 4 - 8 large red sessile glands at base near margin; lateral nerves 4 or 5 pairs; petioles 1 - 6 cm long; stipules triangular, ca 1 mm long. Male flowers: clustered in terminal or axillary, lax-panicked 6 - 14 cm long racemes; bracts ovate or triangular, ca 1 mm long, 1 - 3-flowered; pedicels 5 - 7 mm long; sepals 3 - 5, oblong-ovate to lanceolate, 4 - 5 x 2.5 - 3.5 mm; stamens 70 - 75. Female flowers: in simple or branched 4 - 10 cm long racemes; bracts linear-lanceolate, 2 - 5 mm long, 1-flowered; pedicels 1.5 - 3 mm long; calyx campanulate, 5-lobed, glandular tomentose outside; lobes linear-lanceolate to oblong, 3 - 4 mm long; ovary 2-loculed, globose, 2 - 3 mm across; styles 2, shortly connate at base, 3 - 4 mm long. Fruits on 5 - 7 mm long stalk, globose to ovoid, deeply bilobed, 5 - 7 x 10 - 12 mm, stellate pubescent and densely velvety tomentose and glandular; seeds subglobose, 4 - 5 mm across, rugose, glossy black.

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

*Distrib.* India: Tropical and subtropical, in secondary or rarely primary forests, often in thickets and cleared forests, up to 850 m altitude. Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Tripura, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka, Bhutan, Myanmar, S. China, Thailand, through Malesia to N. Australia and New Caledonia.

*Note.* Chromosome number:  $2n = 22$  (Datta, *Taxon* 16: 341 - 350. 1967).

**15. Mallotus resinus** (Blanco) Merr., *Sp. Blancoan.* 222. 1918 & *Enum. Philip. Fl. Pl.* 2: 432. 1924. *Adelia resinosa* Blanco, *Fl. Philip.*, ed. 2: 562. 1845. *Axenfeldia intermedia* Baill., *Etude Euphorb.* 419. 1858. *M. walkerae* Hook.f., l. c. 437. 1887. *M. muricatus* (Wight) Müll.Arg. var. *walkerae* (Hook.f.) Pax & K.Hoffm. in *Engl., Pflanzenr.* IV. 147. vii: 190. 1914. *M. andamanicus* Hook.f., l. c. 439. 1887. *M. intermedius* (Baill.) N.P.Balakr. in *Bull. Bot. Surv. India* 10: 245. 1968.

Trees or shrubs, 4 - 10 m tall; branchlets compressed, puberulous. Leaves opposite, unequal, lanceolate, elliptic-lanceolate or rhombate-lanceolate, narrowly cuneate or obtuse-oblique at base, entire or repand-dentate along margins, acuminate to cuspidate at apex, 3.5 - 27 x 1.5 - 12 cm, membranous, finely pubescent and lepidote-glandular beneath, with 3 or 4 dark red glands at base, penninerved; lateral nerves 5 - 15 pairs; petioles 0.5 - 6 cm long; stipules linear to oblong, up to 3 mm long, caducous. Male flowers: clustered in axillary or terminal, 3 - 16 cm long racemes or spikes; bracts ovate or triangular, 1.5 - 2 mm long, 3 - 5-flowered; pedicels 1 - 3 mm long; sepals 3 or 4, ovate, ca 3 x 1.5 mm; stamens 18 - 40. Female flowers: 5 - 10 mm long,

solitary in axils of bracts along 5 - 15 cm long racemes; bracts ovate-orbicular, ca 2 mm across; sepals 3 - 6, connate at base, linear-lanceolate or oblanceolate, 2 - 5 x ca 1 mm; ovary 3-loculed, globose, 2 - 4 mm long, covered with conical tubercles; styles 3, 3 - 5 mm long. Fruits tridymous, 1 - 1.5 cm across, sparsely or densely yellow-glandular; spines scattered or in 2 or 3 rows, hard, 1 - 3 mm long; seeds ovoid, angular along faces, 3 - 9 mm across, smooth, shiny dark brown.

#### KEY TO THE VARIETIES

- 1 a. Styler column 2 - 3 mm long; fruits densely yellow glandular with few and scattered spines **15.3. var. stenanthus**
- b. Styler column less than 2 mm long; fruits sparsely yellow glandular, with spines in 2 - 3 linear rows or scattered 2
- 2 a. Spines on fruits long and slender, scattered **15.2. var. resinosus**
- b. Spines on fruits short, conical and thick at base, in 2 or 3 linear rows **15.1. var. muricatus**

**15.1. var. muricatus** (Wight) N.P.Balacr. & Chakrab. in Rheedeia 1: 39. 1991. *Claoxylon muricatum* Wight, Icon. Pl. Ind. Orient. 5: 24, t. 1886. 1852. *Mallotus muricatus* (Wight) Müll.Arg. in Linnaea 34: 191. 1865; & in DC., Prodr. 15(2): 992. 1866; Hook.f., Fl. Brit. India 5: 436. 1887. *M. muricatus* var. *muricatus* (excl. var. *walkerae*) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.vii (heft 63): 190. 1914. *M. subramanyamii* J.L.Ellis in Bull. Bot. Surv. India 25: 199. 1983 (publ. 1985), sphalm. *subramanyamili*. *M. resinosus* var. *subramanyamii* (J.L.Ellis) Chakrab. in J. Econ. Taxon. Bot. 6: 704. 1985.

Shrubs or trees, up to 8 m tall, differing from var. *resinosus* in the short 2 - 3 linear rows of conical spines on the capsules.

*Fl. & Fr.* Jan. - Dec. (differs from place to place).

*Distrib.* India: Tropical and subtropical evergreen mixed forests, up to 2400 m altitude. Andhra Pradesh, Tamil Nadu and Kerala.

Endemic.

*Note.* Chromosome number:  $2n = 22$  (Krishnappa & Reshme in Taxon 29: 533 - 547. 1980).

#### **15.2. var. resinosus**

*Mallotus walkerae* Hook.f., Fl. Brit. India 5: 437. 1887. *M. muricatus* var. *walkerae* (Hook.f.) Pax & K.Hoffm., l. c. 190. 1914.

Shrubs or trees, up to 8 m tall. Recognizable by the distinctly flattened branchlets, the opposite and unequal short petioled leaves with conspicuous macular glands near the base and echinate fruits with slender spines and devoid of any pubescence.

*Fl. & Fr.* Jan. - Aug.

*Distrib.* India: Mixed tropical forests, mangrove swamps or inland hill forests, up to 400 m altitude. Karnataka and Andaman & Nicobar Islands.

Sri Lanka, Myanmar, China, Thailand, Malesia to New Guinea and N. Australia.

**15.3. var. *stenanthus*** (Müll.Arg.) Susila & N.P.Balacr. in N.P. Balacr. & Chakrab., Fam. Euphorb. India 151. 2007. *Mallotus stenanthus* Müll.Arg. in Linnaea 34: 191. 1865 & in DC., Prodr. 15(2): 992. 1866; Hook.f., Fl. Brit. India 5: 437. 1887.

Tam.: *Karevalichedi, Kattupulasai, Solai-karupuchedi.*

Shrubs or small trees, 3 - 8 m tall.

*Fl.* Feb. - Aug.; *Fr.* Jan. - Dec.

*Distrib.* India: Evergreen tropical and subtropical forests as undergrowth, up to 1800 m altitude. Maharashtra, Karnataka, Kerala and Tamil Nadu.

Endemic.

*Note.* Pollen 3-colporate, sometimes 4-colporate, sexine scabrate. P = 20 µm (18 to 24), E = 24 µm (20 to 28). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondicherry, Pondicherry*).

**16. *Mallotus rhamnifolius*** (Rottler ex Willd.) Müll.Arg. in Linnaea 34: 196. 1865 & in DC., Prodr. 15(2): 979. 1866; Hook.f., Fl. Brit. India 5: 440. 1887. *Croton rhamnifolius* Rottler ex Willd., Neue Schriften Ges. Naturf. Freunde Berlin 4: 190. 1803. *Mallotus micranthus* Müll.Arg. in Linnaea 34: 191. 1865. *M. zeylanicus* Müll.Arg., l. c. 195. 1865.

Shrubs, 1 - 3 m high; branches, petioles and inflorescences densely pubescent. Leaves opposite or alternate, ovate-lanceolate or elliptic-lanceolate, cuneate, obtuse truncate or rounded at base, sinuate to crenulate along margins, cuspidate to caudate at apex, 5 - 30 x 2 - 12 cm, chartaceous, puberulous on nerves above, minutely yellow-glandular beneath, strongly trinerved, with 2 large maculate glands at base; lateral nerves 5 - 7 pairs; petioles 0.5 - 6 cm long. Male flowers: clustered along axillary or terminal 10 - 20 cm long spikes; bracts linear-lanceolate, 1.5 - 2 mm long, 3 - 5-flowered; pedicels 1 - 1.5 mm long; sepals 3 or 4, ovate, 2 - 3 mm long; stamens 45 - 50; filaments 2 - 3 mm long. Female flowers: clustered along 5 - 15 cm long spikes; bracts ovate to linear-lanceolate, 2 - 3 mm long; calyx sub-spathaceous, 5 or 6-lobed; lobes linear-lanceolate, 3 - 4 mm long; ovary 3-loculed, minutely dark reddish glandular, finely pubescent; styles 3, 2 - 3 mm long. Fruits tridymous, ca 1 cm long, stellate tomentose, minutely yellow glandular, with scattered spine-like projections; seeds globose to ovoid, ca 5 mm across, angular at inner face, with faint reticulate pittings, shiny red..

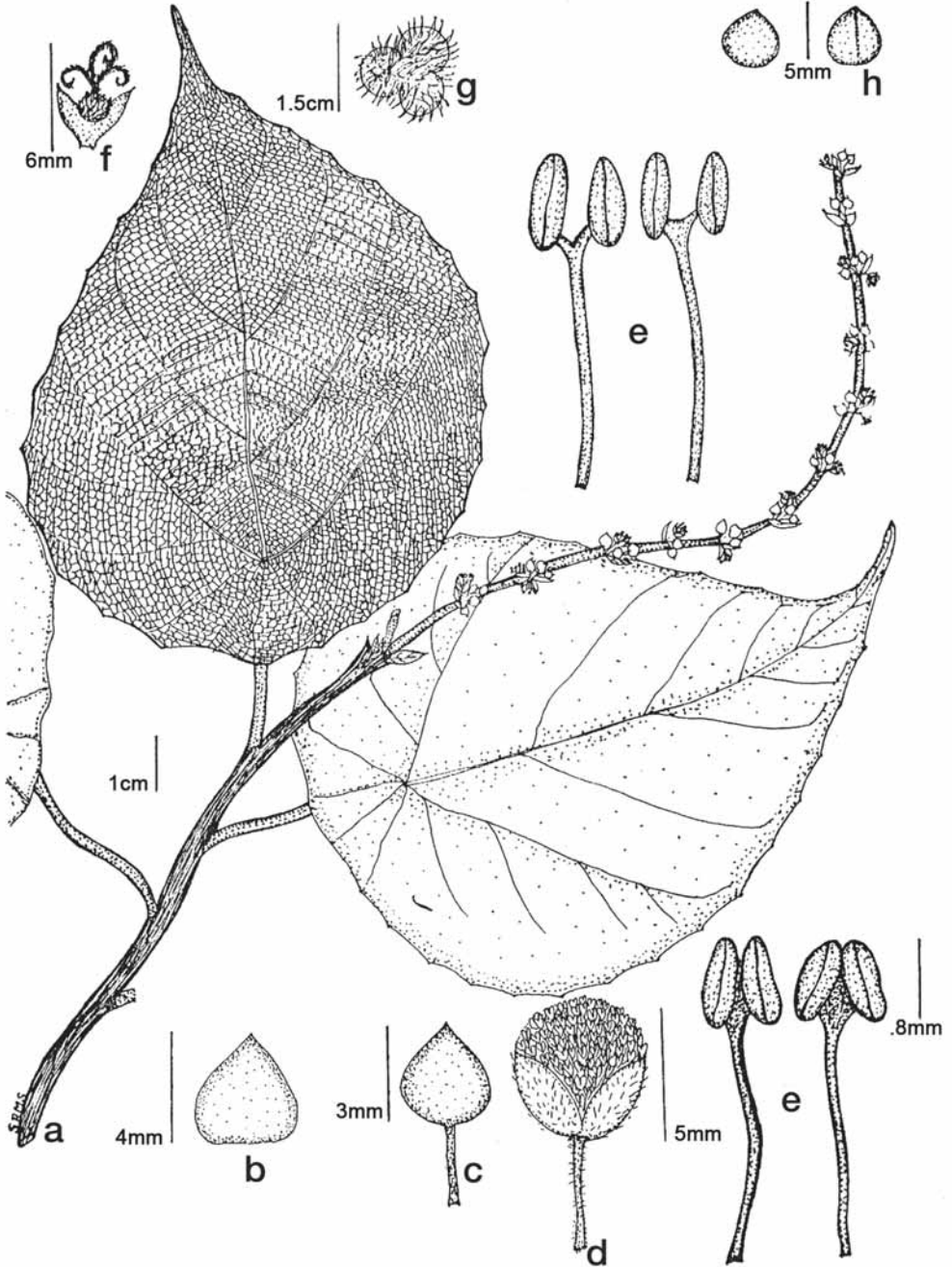
*Fl. & Fr.* March - Nov.

*Distrib.* India: Tropical evergreen or semideciduous forests, up to 1000 m altitude. Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

**17. *Mallotus roxburghianus*** Müll.Arg. in Linnaea 34: 186. 1865 & in DC., Prodr. 15(2): 962. 1866; Hook.f., Fl. Brit. India 5: 428. 1887; Kanjilal et al., Fl. Assam 4: 214. 1940. **Fig. 28**

Asm.: *Buri-tokon*; Beng.: *Nim-puteli*; Kh.: *Dieng-long-kharai*; Mani.: *Khabi-loboi*; Naga: *Tamlai*; Nep.: *Kamli, Mallatta, Phusri-malata*.



**Fig. 28. *Mallotus roxburghianus* Müll.Arg.:** a. twig with male inflorescence; b. male bract; c. male bud; d. male flower; e. stamens; f. female flower; g. fruit; h. seeds.

Trees or shrubs, 4 - 13 m tall. Leaves alternate, distant, orbicular or triangular-ovate to broadly ovate, rounded and distinctly peltate at 1 - 3 cm above base, repand-denticulate and glandular-toothed along margins, caudate-acuminate at apex, 8 - 20 x 5 - 18 cm, subcoriaceous, densely pubescent with simple hairs and yellow glands above, densely pubescent with stellate hairs and glandular yellow dots beneath, palmately 5 - 9-nerved at base with 3 - 5 sessile discoid glands on veins near the base; lateral nerves 4 or 5 pairs on midrib; petioles 3 - 15 cm long; stipules linear-lanceolate, 6 - 7 x ca 2 mm. Male flowers: clustered in axillary or terminal 10 - 30 cm long simple racemes; pedicels 4 - 5 mm long; bracts ovate, 2 - 4 mm long, 3 - 5-flowered; sepals 4 or 5, ovate to oblong-ovate, 2 - 3 mm across; stamens 30 - 40; filaments 2 - 3 mm long. Female flowers: arranged singly along 6 - 12 cm long simple racemes; pedicels 2 - 3 mm long; calyx lobes 5 or 6, lanceolate, 3 - 4 mm long; ovary 3-locular, 2 - 3 mm across, stellate-bristly and warty, with dense soft spines; styles 3, 3 - 5 mm long. Fruits on 8 - 12 mm long stalks, subglobose, deeply 3-lobed, 1 - 1.5 cm across, hirsute, densely clothed with soft spinules and yellow resinous glands; spines 2 - 3 mm long, stellate hairy; seeds subglobose, ca 5 mm across, angular at inner face, smooth, rugulose.

*Fl. & Fr.* Feb. - Aug.

*Distrib.* India: Tropical and subtropical evergreen primary forests, as undergrowth in damp places, up to 1500 m altitude. West Bengal, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Tripura, Manipur and Mizoram.

Bhutan, Bangladesh, Myanmar and China.

*Notes.* Chromosome number:  $2n = 22$  (Hans, Taxon 25: 591 - 636. 1967).

## 8. *Mercurialis* L.

Herbs, annual or perennial, dioecious rarely monoecious, with watery sap. Leaves opposite, dentate, penninerved, bistipulate. Flowers: in interrupted spikes. Male flowers: sessile to subsessile, clustered on spikes; calyx 3-partite with obtuse to acute lobes; petals and disc absent; stamens 8 - 12 (- 20), free; anthers 2-loculed, ovoid, divaricate, sub-pendulous, longitudinally dehiscent; pistillode absent. Female flowers: solitary in axils of leaves; calyx-lobes 3, imbricate, enlarging on maturity in fruits; disc absent or rarely present, hypogynous, glandular; ovary 2-locular; styles 2, connate at base, free and divaricate above, papillose inside. Fruits capsular, strongly 2-lobed, 2-valved, 2-seeded; endocarp crustaceous; seeds ovoid, globose, carunculate; endosperm thick; cotyledons broad, flat.

Eurasian, 8 species; one in India.

*Mercurialis leiocarpa* Siebold & Zucc., Fl. Jap. Fam. Nat. 1: 37. 1845 & Abh. Math.-Phys. Cl. Konigl. Bayer. Akad. Wiss. 4(2): 145. 1845; Müll. Arg. in DC., Prodr. 15(2): 795. 1866; Kanjilal et al., Fl. Assam 4: 210. 1940.

Herbs, annual, 30 - 100 cm high; stems rhizomatous at base, sparsely hairy. Leaves ovate-lanceolate, broadly cuneate or truncate at base, crenate along margins, acute to acuminate at apex, 5 - 12 x 2 - 4 cm, membranous, hairy on nerves beneath, biglandular at base with a tuft of short hairs; lateral nerves 8 - 10 pairs; petioles 2 - 5 cm long; stipules ovate-lanceolate, 2 - 3 mm long. Male flowers: on 6 - 10 cm long spikes; sepals 3; stamens 10 - 15. Female flowers: solitary, axillary or in terminal 2 - 6 cm long finely pubescent spikes; pedicels 2 - 3 mm long, elongating in

fruits; bracts ovate-lanceolate, ca 2 x 1.5 mm; sepals 3, ovate-lanceolate, 1 - 2 x ca 1.5 mm, minutely glandular, with 2 narrow 2 - 2.5 mm long scale-like structures alternating with each sepal; ovary 2 - 3 mm long; styles 2, connate at base, free and papillose-laciniate above, 2 - 2.5 mm long. Fruits deeply 2-lobed, (3 -) 4 - 6 (- 9) mm across, sparsely puberulous.

*Fl. & Fr.* April - Aug.

*Distrib.* India: In temperate broad-leaved forests along shaded places, at 2200 to 2800 m altitudes. Sikkim, Arunachal Pradesh and Nagaland.

Bhutan, Myanmar, China, Taiwan, Thailand, Korea and Japan.

*Notes.* *Chromosome* number:  $2n = 48$  (Morinaga, *Cytologia* 1: 16 - 27. 1929; Chuang et al., *Taiwania* 1: 51 - 66. 1963).

## 9. *Ricinus* L.

Monotypic genus, probably native of NE. Africa, now widely cultivated and naturalised in many tropical and subtropical areas around the World.

***Ricinus communis* L.**, Sp. Pl. 1007. 1753; Hook.f., Fl. Brit. India 5: 457. 1887.

Beng.: *Bherenda, Redi, Rerri*; Eng.: Castor-oil plant, Castor-bean plant, Palma-Christi; Guj.: *Divelo, Erado*; Hindi: *Andi, Arendi, Arendu, Eldi, Jaronda, Randi, Rehri*; Kan.: *Haralu*; Mal.: *Amanakku, Avanakku, Chittavanakku*; Mar.: *Arand, Nironda, Rand*; Nep.: *Reri, Orer*; Sans.: *Deerghadanda, Erandam, Gandharya, Hasta, Kumbhi, Panjangulum, Thambugam, Tharuna, Vardhamanam*; Tam.: *Aimugi, Amanakku, Sittamanakku*; Tel.: *Amadam, Amudam, Amudapu, Amanamuchattu, Eramundapu*.

Shrubs or small trees, monoecious, 1 - 6 m tall, glabrous with glaucous young parts. Leaves alternate to opposite, narrowly peltate at base, suborbicular in outline, 10 - 60 x 10 - 70 cm, palmately divided beyond the middle into 5 - 10 oblong-ovate to lanceolate, acute to acuminate lobes with coarse teeth along margins, thinly coriaceous, pale glaucous green beneath, often suffused with purplish red, minutely puberulous on both sides, bearing many glandular cells on epidermis; petioles (7 -) 10 - 40 cm long, bearing at apex 1 - 3 scattered nectaries on upper side adjoining the blade; stipules ovate-lanceolate, 1 - 3.5 cm long, early caducous. Inflorescences terminal or leaf-opposed, paniculate, 8 - 25 (- 40) cm long, with 3 - 25-flowered male cymes below and 1 - 7-flowered female cymes above; peduncles ca 10 cm long, later becoming elongated up to 50 cm in length. Male flowers: pedicels 8 - 15 mm long; calyx spatheaceous, splitting into 3 - 5 lobes; lobes ovate-lanceolate, 5 - 9 mm long, yellowish green to pale yellow; petals and disc absent; stamens numerous (up to 1000), crowded and connate into ca 8 mm long cluster of stipitate phalanges; anthers globose to ovoid. Female flowers: 8 - 9 mm across, green; pedicels 2.5 - 4 mm long, elongating in fruit; calyx spatheaceous, split into 5 - 7 unequal lobes; lobes lanceolate, 5 - 6 mm long, green to reddish, caducous; ovary globose, ca 4 mm across, densely echinate with soft spines, each ending in a translucent stinging hair at apex; styles 3, entire or bifid; stigmas 4 - 6 mm long, papillose-plumose on inner surface. Fruits schizocarpic, trilobed, ellipsoid to subglobose, 1.2 - 2.5 x 1.5 - 2 cm, reddish brown to blackish purple, marked with various shades of white, grey or brown, covered with 3 - 6 mm long brown or dark brown soft spines; seeds ellipsoid, to ovoid, 9 - 14 x 5 - 6 mm, shiny dark brown and white or mottled grey and brown along margins, with a large caruncle.



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

*Distrib.* India: Cultivated near villages, often as an escape in wastelands with rich soil, usually in plains but often ascending to 2000 m altitude. Throughout the country.

Pantropical, probably native of N. Africa.

*Uses.* The seeds yield 'Castor Oil', which is used for lamps, soap making, as lubricant and sometimes as purgative. It is used in rheumatism, as a hair tonic, for asthma and certain eye ailments. A paste of the seeds cures rheumatic swellings. In Assam, the plants are used as food plants for silk worms. The oil is useful for manufacture of plastic and synthetic fibres. Castor seeds contain an effective fat-splitting enzyme and commercially used for catalyzing hydrolysis of fats and glycerides. In Uttar Pradesh, an aqueous extract of castor seeds finds use as clarifying agent in preparation of *gur* from sugar cane juice. Castor cakes, the residue after extraction of oil, are used as manure but are unsuitable for feeding to cattle, as it contains toxic constituents. The seeds have a large number of industrial uses. Tribals of Uttarakhand use leaves to cure arthritis and diabetes and the seed oil for spondylitis and joint pain (Arya, Indian J. Trad. Knowledge 1: 84, 2002). Leaves are rubbed on joints to relieve pain and young leaves mashed and taken as purgative (Jain, Econ. Bot. 19: 245, 1965). Castor oil seasoned with paste of *Eclipta alba* and *Sassaurea lappa* is used for healthy and luxuriant hair and cools brain.

The green variety of this species is an effective cure for various types of jaundice. Equal quantity of tender leaves of this variety and cumin seeds are ground together into a paste and one gooseberry-size globule is taken early in the morning in empty stomach for three days. In the alternative, the tender leaves of green variety and the whole plant with roots of *Phyllanthus amarus* are ground together into a paste and one lemon-sized globule is taken early in the morning in empty stomach for three days, avoiding fatty foods.

*Notes.* There are two distinct varieties in India. The most common one occurring throughout India is a large shrub or small tree up to 6 m tall with young stems, branches, petioles, nerves on leaves, inflorescence peduncles and pedicels being purplish green. The other (not so common, confined to Kerala and Tamil Nadu) is a small or medium-sized shrub up to 2 m tall, with the entire plant being completely green. The green variety often grows along with the purple variety in wet humid places. Even though they occur side by side, they do not seem to hybridize.

Morphologically this species is highly variable, probably due to centuries of cultivation and escapes from cultivation. Seeds of this species were known from graves of Egyptian Pharaohs dating back to 4000 BC. Various workers, based on characteristics of capsule, seeds and inflorescences, often divide this species into a number of varieties and forms. Pax & K. Hoffmann (Engler, Pflanzner. IV.147.xi: 199, 1919) enumerated 17 varieties, mainly based on foliage colour, and mostly cultivated for ornamental purposes. Various workers have reported hundreds of more forms and cultivars. However, intermediate forms interconnect them all and they do hybridize freely when brought together. Therefore, it is not practical to consider them as distinct infra-specific taxa.

Chromosome numbers:  $n = 10$  (Narain & Singh, J. Hered. 59: 287 - 288, 1968;  $2n = 20$  (Hans, Taxon 22: 591 - 636, 1973).

## 10. *Trevis* L.

Monotypic, from India to China and Indonesia.

*Note.* Based on molecular studies, Kulju, Sierra & Welzen (Blumea 52: 124. 2007) merge this genus with *Mallotus*. The generic name *Trevis* L. (1753) has priority over *Mallotus* Lour. (1790). Kulju & Welzen (Taxon 57: 1358. 2008), has made a formal proposal for conservation of the generic name *Mallotus* against *Trevis* and it is still pending a decision.

The original spelling used by Linnaeus (Sp. Pl. ed. 1, 2: 1193. 1753) is '*Trevis*', but later he inconsistently used both '*Trevis*' and '*Trewia*'. All subsequent authors have adopted the spelling '*Trewia*'. However, Art. 13.4 of the present Code (2006) gives protection to the original spelling given in *Species Plantarum*, ed. 1 (1753) and therefore '*Trevis*' cannot be altered.

*Literature.* KULJU, K. K. M., S. E. C. SIERRA & P. C. VAN WELZEN (2007). Re-shaping *Mallotus* (Part 2): Inclusion of *Neotrewia*, *Octospermum* and *Trewia* in *Mallotus* s. s. (Euphorbiaceae s. s.). Blumea 52: 115 – 136. SUSILA RANI, S. R. M. & N. P. BALAKRISHNAN (1998). Notes on *Trewia nudiflora* L. (Euphorbiaceae) and its varieties. J. Econ. Taxon. Bot. 22: 345 - 352, ff. 1 - 4.

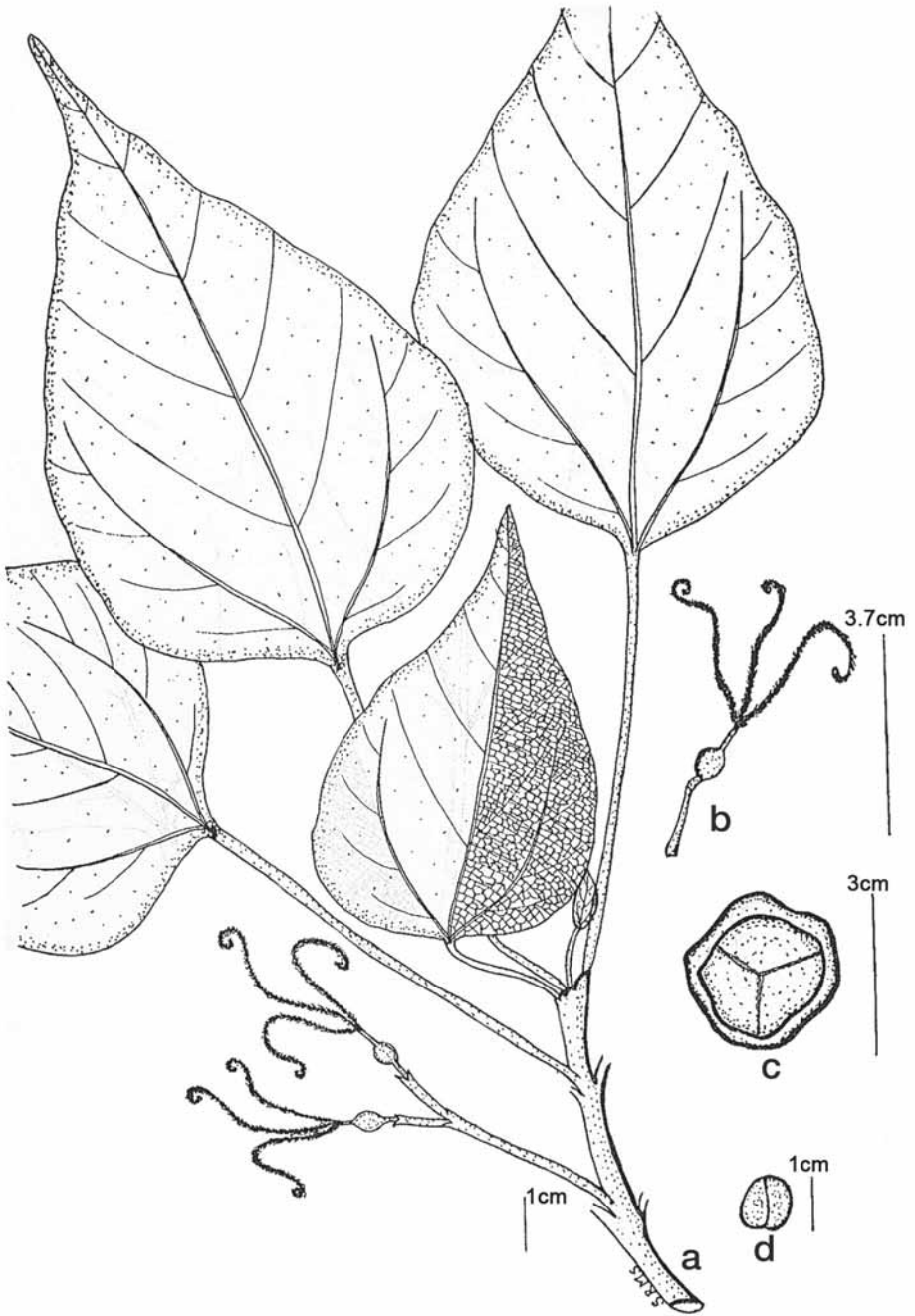
***Trevis nudiflora* L.**, Sp. Pl. 1193. 1753; Müll.Arg. in DC., Prodr. 15(2): 953. 1866; Hook.f., Fl. Brit. India 423. 1887. *Mallotus nudiflorus* (L.) Kulju & Welzen, Blumea 52: 124. 2007

Asm.: *Bhel-kol*, *Kenlo*, *Pithakuma-kendlow*; Beng.: *Paringambhar*, *Pitali*; Garo: *Arurong*, *Boinokhap*, *Bol-diktak*, *Joingheia*; Hindi: *Bhillar*, *Gambhar*, *Pindara*, *Tumri*; Kan.: *Kaadukayi*, *Katkumbala*; Kh.: *Dieng-soh-lyndot*; Lep.: *Thungplam*; Mal.: *Kattu-kumi*, *Mala-kumi*, *Pambara-kumbil*; Mar.: *Petari*; Nep.: *Aule-kapase*, *Belar*, *Gamari*, *Garum*, *Kurong*, *Pitali*, *Ramrita*; Or.: *Monda*, *Pithaliya-panijambhar*; Tam.: *Annathuvarei*, *Attarasu*, *Attuvarasu*, *Raypkunul*; Tel.: *Eruponaku*; Urdu: *Mundu*.

Trees, dioecious, deciduous, 7 - 20 m tall. Leaves opposite, broadly ovate to deltoid, truncate or cordate at base, entire or dentate along margins, acuminate to cuspidate at apex, 6 - 20 x 3 - 15 cm, chartaceous, glabrous above, velutinous beneath; basal nerves 3; lateral nerves 3 - 6 pairs; petioles of each node unequal, 3 - 10 cm long; stipules linear, 2 - 4 x 1 - 2 mm, caducous. Inflorescences precocious. Male flowers: greenish, in 2 or 3-flowered clusters on axillary or terminal lax pendulous 8 - 16 cm long racemes; bracts ovate-lanceolate, ca 3 mm across; pedicels 3 - 5 mm long; sepals 3 or 4, ovate, concave, 3.5 - 6 x 2 - 4 mm; stamens 20 - 25; filaments free, 1.5 - 2.5 mm long; anthers oblong, 1 - 1.5 x 0.5 - 0.7 mm. Female flowers: axillary, solitary or in 5 - 15 cm long stout racemes; pedicels 5 - 9 mm long; sepals 3 - 5, broadly ovate, 4 - 5 mm long, densely woolly tomentose outside, caducous; ovary 3 - 5-loculed, 3 - 4 mm across, tomentose; styles 3 - 5, shortly connate at base, 1.5 - 3 cm long. Fruits 2 - 5-loculed, ovoid to subglobose, 1 - 3.5 cm across, shallowly lobed, dehiscent or apparently indehiscent, fleshy, becoming woody with thick or thin pericarp, densely pubescent to glabrous; seeds 3 - 5, globose to ovoid, 0.5 - 1.3 cm across.

### KEY TO THE VARIETIES

- |   |                            |
|---|----------------------------|
| 1 a. Leaves, inflorescences and fruits glabrous             | 2                          |
| b. Leaves, inflorescences and fruits tomentose or pubescent | 3                          |
| 2 a. Fruits 2 - 3.5 cm across, with very thick pericarp     | <b>1.2. var. nudiflora</b> |
| b. Fruits 1 - 1.5 cm across, with very thin pericarp        | <b>1.3. var. polycarpa</b> |



**Fig. 29.** *Trevia nudiflora* L. var. *nudiflora*: a. twig with female inflorescence; b. female flower; c. t. s. of fruit showing thick pericarp; d. seed.

- 3 a. Branchlets densely flocculent-cottony or woolly-tomentose; leaves entire along margins; fruits 2 - 3 cm across, densely white-cottony tomentose **1.4. var. tomentosa**  
 b. Branchlets softly pubescent; leaves dentate along margins; fruits 1.5 - 1.8 cm across, yellow pubescent **1.1. var. dentata**

**1.1. var. dentata** Susila & N.P.Balakr. in J. Econ. Taxon. Bot. 22: 352, f. 4. 1998.

*Fl. & Fr.* March - Sept.

*Distrib.* India: Evergreen florets, along riverbanks and stream sides, up to 1200 m altitude. Maharashtra.

Endemic.

**1.2. var. nudiflora**

**Fig. 29**

*Fl. & Fr.* Feb. - Aug.

*Distrib.* India: Tropical and subtropical forests, often along riverbanks and stream sides, up to 1000 m altitude. Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Tripura, Meghalaya, Orissa, Madhya Pradesh, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka, Nepal, Bhutan. Bangladesh, Myanmar, S. China, Indo-china, Thailand to Malesia.

*Uses.* Leaves are used as cattle fodder. Wood soft, used for carving, planking, in match industry, packing cases and plywood.

The fruit pulp is sweet and edible.

*Notes.* Chromosome number:  $2n = 22$  (Bhaduri & Kar, Proc. Indian Sci. Congr. 36th Session, Part 3: 140. 1949; Datta, Taxon 16: 341 - 350. 1967; Hans, Taxon 22: 591 - 636. 1973).

The leaves are similar to those of *Gmelina arborea*.

**1.3. var. polycarpa** (Benth.) Susila & N.P.Balakr. in J. Econ. Taxon. Bot. 22: 351, f. 2. 1998. *Trevia polycarpa* Benth. in Benth. & Hook.f., Gen. Pl. 3: 318. 1880; Hook.f., Fl. Brit. India 5: 424. 1887, p. p. *Mallotus polycarpus* (Benth.) Kulju & Welzen, Blumea 52: 130. 2007.

Kan.: *Bomvaro, Tumri*; Mal.: *Pambarakumbil*; Mar.: *Petari*; Tam.: *Anathuvarei, Kaanji, Raajni*.

*Fl. & Fr.* Mar. - Oct.

*Distrib.* India: In evergreen forests, along hill slopes and river and stream banks, up to 1200 m altitude. Madhya Pradesh, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu. Very common in N. Kanara in Karnataka and Goa.

Endemic.

**1.4. var. tomentosa** Susila & N.P.Balakr. in J. Econ. Taxon. Bot. 22: 351, f.3. 1998.

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

*Distrib.* India: Evergreen or semievergreen forests, up to 1200 m altitude. Sikkim, West Bengal, Tripura, Orissa, Andhra Pradesh, Maharashtra and Gujarat.

Bangladesh, Myanmar, Indo-china and Thailand.

Tribe 2. **AGROSTISTACHYDEAE** (Müll.Arg.) G.L.Webster  
(N. P. Balakrishnan)

Trees or shrubs, dioecious or rarely monoecious; indumentum simple or absent. Leaves alternate, simple, entire or denticulate; stipules persistent or caducous. Inflorescences axillary, racemose or spicate, sometimes with scarious imbricate bracts. Male flowers: calyx closed in bud, splitting into 2 - 5 valvate lobes; petals 3 - 8; disc receptacular or extrastaminal and dissected; stamens 10 - 50; filaments free or partly so; anthers introrse, with somewhat enlarged connective; anther-thecae often pendulous; pollen grains subglobose, 3-colporate; colpi inoperculate, not distinctly marginate; sexine coarsely reticulate; pistillode present or absent. Female flowers: sepals 4 or 5, open or valvate; petals 5, small and caducous or absent; disc lobed, pitted or dissected; ovary 3-locular, often tomentose; styles bifid. Fruits capsular; seeds smooth or granulose, ecarunculate; testa sometimes fleshy.

Tropical Africa with 2 genera and tropical Asia with 2 genera; one in India.

**11. Agrostistachys Dalzell**

Shrubs or trees, dioecious, evergreen. Leaves shortly petioled or sessile, pinnately nerved. Flowers: in axillary or supra-axillary bracteate racemose spikes; bracts concave. Male flowers: small, few or many within each bract, sessile or shortly pedicelled; calyx globose; petals 5, rarely 6 - 8, shorter than calyx lobes or equal; disc 5-glandular, episepalous; stamens 8 - 13, on a convex receptacle, biseriate, rarely fewer, outer ones epipetalous; connective subulate at apex; anthers versatile; anther-thecae pendulous from the glanduliferous thick connective, free below, longitudinally dehiscent; pistillode usually large or absent. Female flowers: solitary in each bract, on long pedicels; calyx 5- or rarely 4-fid; lobes lanceolate; petals longer than calyx-lobes, caducous; disc of 5 glands, thick; staminodes absent; ovary 3-loculed; styles bifid, spreading; ovule one in each locule. Fruits consisting of three 2-valved dehiscent cocci, crustaceous or subfleshy; seeds subglobose; testa shiny, ecarunculate; endosperm fleshy; cotyledons broad, laterally flat.

India, Sri Lanka and Myanmar, through Malesia to New Guinea, ca 10 species; 2 species in India.

*Literature.* BALAKRISHNAN, N. P. (1970). Studies in Indian Euphorbiaceae - IV. The genus *Agrostistachys* Dalz. in India. J. Bombay Nat. Hist. Soc. 67: 299 - 306, ff. 1 - 2. SEVILLA, S. & P. C. van WELZEN (2001). Revision and phylogeny of *Agrostistachys* and *Chondrostylis* (Euphorbiaceae). Blumea 46: 71 - 97.

KEY TO THE SPECIES

- 1 a. Stipules ca 10 mm long; spikes short, 7 - 15 mm long; bracts closely imbricate; male bracts 1-flowered **1. A. indica**
- b. Stipules ca 2 mm long; spikes elongate, 8 - 14 cm long; bracts distantly placed; male bracts many-flowered **2. A. meeboldii**

**1. *Agrostistachys indica*** Dalzell in Hooker's J. Bot. Kew Gard. Misc. 2: 41. 1850; Hook.f., Fl. Brit. India 5: 406. 1887.

Shrubs, 1 - 2 (- 3) m high, glabrous except flowers. Leaves crowded, alternate, elliptic-oblong or oblong-lanceolate to spatulate, narrowed or cuneate at base, acute to caudate-acuminate at apex, distantly serrate with incurved spinulose teeth or minutely denticulate along margins, 12 - 48 x 4 - 15 cm, coriaceous; lateral nerves 8 - 18 pairs; petioles 2 - 6 cm long; stipules caducous. Spikes of both sexes axillary or supra-axillary, glomerate, clustered together in leaf-axils, 7 - 15 mm long; bracts distichous, ovate-acute, ca 4 x 3 mm; flowers solitary in axil of each bract, shortly pedicellate. Male flowers: sepals 5, ovate-lanceolate; petals 5 - 8, rounded or subquadrate, lanceolate or obovate, white; disc glandular, 5-lobed; stamens 8 - 13; anthers apiculate; pistillode simple, undivided. Female flowers: solitary in each spike; pedicels with 3 - 5 scale-like sterile bracts at base; calyx 5-fid with lobes narrower and more rigid than in male; petals 5, oblong, longer than calyx-lobes; disc cupular, of 5 thick glands covering the base of ovary; ovary glabrous or minutely puberulous; styles 3, each bifid. Fruits subglobose, 3-lobed, ca 1 cm in diam., glabrous, reddish brown; seeds globose, ca 6 mm in diam., smooth.

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

*Distrib.* India: Subtropical evergreen forests of Western Ghats, at 1200 - 2500 m altitudes. Karnataka, Kerala and Tamil Nadu.

Sri Lanka, Myanmar, Laos, Thailand, Vietnam, Borneo, Philippines and New Guinea.

*Note.* Pollen 3-colporate, sexine reticulate. P = 33  $\mu$ m (29 to 38), E = 28  $\mu$ m (27 to 332). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery*, Pondichery).

**2. *Agrostistachys meeboldii*** Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.vi (heft 57): 100. 1912; Gamble, Fl. Madras 2(7): 1318. 1925 (repr. ed. 2: 922. 1957); N.P.Balakr. in J. Bombay Nat. Hist. Soc. 67: 301. 1970. *Sarcoclinium longifolium* Wight, Icon. Pl. Ind. Orient. 5: 24, t. 1887-88. 1852, non *A. longifolia* Kurz, 1875. *Agrostistachys longifolia* (Wight) Benth. ex Hook.f., Fl. Brit. India 5: 407. 1887, excl. var. *malayana* and var. *latifolia* (non Kurz, 1875). *A. borneensis* auct. non Becc. 1904: sensu K.M.Matthew & Rani in Matthew, Fl. Tamil Nadu Carnatic 3: 1409. 1983.

Mal.: *Mulimpala*, Tam.: *Mancherai*.

Shrubs or trees, 3 - 6 (- 10) m tall; branches glabrous. Leaves crowded at ends of branches, obovate, oblanceolate to spatulate, narrowed and gradually tapering to the petiole, shortly acuminate at apex, 14 - 30 x 3 - 9 cm, coriaceous to chartaceous, glabrous; lateral nerves 10 - 15 pairs; petioles 5 - 15 mm long; stipules caducous. Inflorescences racemose spikes, axillary, solitary, 8 - 14 cm long; bracts distantly placed, ovate, denticulate-margined, ca 2 mm long. Male flowers: 3 - 5 in each bract; pedicels 2 - 3 mm long; sepals 2 or 3; petals 5, ovate, denticulate along margins; disc 5-glandular; stamens 10, 5 situated within the disc and the other 5 outside; anthers apiculate; pistillode 2-cleft. Female flowers: solitary in each bract; sepals 5, free, ovate-acute to lanceolate-acuminate; petals 5, ovate; staminodes 5, subulate; disc cupular, covering the base of the ovary; ovary puberulous; styles 3, each bifid. Fruits shortly pedicelled, depressed-globose, trigonous, 6 - 8 mm long, 8 - 13 mm across, rugulose, minutely pilose or subglabrous; seeds oblong, subglobose, 5 - 6 mm in diam.

*Fl.* May - Aug.; *Fr.* July - Feb.

*Distrib.* India: Subtropical evergreen forests of Western Ghats, at 1000 - 2500 m altitudes. Karnataka, Kerala and Tamil Nadu.

Endemic.

*Notes.* Several recent regional floras have treated this species as *A. borneensis* Becc., which is different from Wight's *Sarcoclinium longifolium* and distributed only from Myanmar onwards to Malesia and not extending to peninsular India. *A. longifolia* var. *malayana* and var. *latifolia* given by Hook.f. (l. c.) are their synonyms, but not *A. longifolia* var. *longifolia*.

Pollen 3-colporate, sexine reticulate. P = 31  $\mu\text{m}$  (28 to 35), E = 29  $\mu\text{m}$  (27 to 32). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery*, Pondicherry).

### Tribe 3. ALCHORNEAE (Hurus.) Hutch. (N. P. Balakrishnan)

Trees or shrubs, monoecious or dioecious; indumentum simple or stellate. Leaves alternate, entire or dentate, pinnately or palmately veined, sometimes stipellate or with laminar glands; stipules mostly caducous, sometimes obsolete. Inflorescences terminal or axillary, spicate or paniculate (compounded spikes); bracts glandular or eglandular. Male flowers: calyx splitting into 2 - 5 valvate lobes; petals absent; disc intrastaminal or absent; stamens (2 -) 4 - 60, free; anthers introrse, muticous or apiculate; pollen grains 3-colporate; colpi operculate; sexine rugulose to vermiculate; pistillode rudimentary or absent. Female flowers: sepals 3 - 8, imbricate, usually persistent, sometimes glandular; disc mostly rudimentary or absent; ovary 2 or 3 (- 4)-locular; styles entire, bifid or multifid. Fruits schizocarpic capsules; seeds smooth or tuberculate; testa not fleshy.

Tropical America, Africa, Asia and Australia, 9 genera; one in India.

## 12. Alchornea Sw.

Trees or shrubs. Leaves alternate or subopposite, palmately 3 - 5-nerved at base or penninerved, with sessile glands in between veins at base and stipels at top of petioles; stipules subulate, caducous or semipersistent. Inflorescences simple or paniced spikes or racemes. Male flowers: small, clustered; calyx globose and closed in bud; petals and disc absent; stamens (3 -) 6 - 8; filaments shortly coherent at base. Female flowers: solitary to a bract, on glandular thickening on the rachis; sepals (3 -) 4 (- 8), imbricate in bud, sometimes glandular, persistent; petals, disc and staminodes absent; ovary 3-loculed; ovule 1 in each locule; styles 3, free, simple or lobed, recurved, often elongate. Fruits 3-lobed, 3-valved, 3-seeded; seeds subglobose; testa crustaceous; endosperm fleshy; cotyledons flat.

Tropics of both and Old and New World, ca 62 species; 3 species in India.

### KEY TO THE SPECIES

- 1 a. Plants glabrescent; leaves cuneate-obovate or subpanduriform to elliptic, penninerved, estipellate; petioles 2 - 7 mm long; male inflorescences terminal, compound; fruits subglobose, deeply 3-lobed, smooth, 8 - 10 mm in diam. **2. A. rugosa**

- b. Plants pubescent; leaves ovate to orbicular, trinerved at base, stipellate at base; petioles longer, 5 - 60 mm long; male inflorescences axillary or sometimes cauliflorous, simple; fruits globose or ellipsoid, shallowly 3-lobed, smooth or strongly muricate, 12 - 16 mm in diam. 2
- 2a. Leaves softly pubescent beneath; stipels 4 - 6 mm long; fruits globose, smooth, pubescent
- 1. A. mollis**
- b. Leaves pubescent only on nerves beneath; stipels 1.5 - 2 mm long; fruits ellipsoid, tuberculate, warty, not pubescent
- 3. A. tiliifolia**

**1. Alchornea mollis** Müll.Arg. in *Linnaea* 34: 168. 1865 & in DC., *Prodr.* 15(2): 902. 1866; Hook.f., *Fl. Brit. India* 5: 420. 1887. *Stipellaria mollis* Benth. in Hooker's *J. Bot. Kew Gard. Misc.* 6: 3. 1854, non Klotzsch, 1849.

Tel.: *Badeki*.

Shrubs or small trees, monoecious. Leaves broadly ovate or suborbicular, rounded, truncate or shallowly cordate at base, crenate-serrate to cuspidate-dentate along margins, cuspidate-acuminate at apex, 8 - 13 x 4 - 8 cm, pellucid-dotted, softly pubescent beneath, palmately 3-nerved with usually large glands at base; stipels lanceolate, 4 - 6 mm long; petioles stout, 5 - 15 mm long; stipules subulate, small. Male flowers: with short 2 - 2.5 mm long pedicels on 10 - 15 cm long racemes; calyx glabrous, usually splitting irregularly. Female flowers: on 10 - 15 cm long racemes; sepals lanceolate, ca 4 mm long, glandular at base; ovary tomentose; styles free nearly to base. Fruits globose, faintly 3-lobed, 12 - 14 mm in diam., softly grey-pubescent; seeds subglobose, dorsally compressed, rugose.

*Fl.* July.

*Distrib.* India: Tropical and subtropical forests of C. & E. Himalayas, up to 1100 m altitude. West Bengal, Sikkim and Assam.

Nepal, Bhutan and China.

**2. Alchornea rugosa** (Lour.) Müll.Arg. in *Linnaea* 34: 170. 1865 & in DC., *Prodr.* 15(2): 905. 1866; Hook.f., *Fl. Brit. India* 5: 422. 1887. *Cladodes rugosa* Lour., *Fl. Cochinch.* 574. 1790. *Conceveiba javanensis* ('*Conceveibum javanense*') Blume, *Bijdr. Fl. Ned. Ind.* 614. 1826. *Aparisthmium javense* (Blume) Endl. ex Hassk., *Cat. Hort. Bot. Bogor.* 235. 1844 (as *javensis*). *Alchornea javensis* (Blume) Müll.Arg. in *Linnaea* 34: 170. 1865 & in DC., *Prodr.* 15(2): 905. 1866; Thoht, in *Bull. Bot. Surv. India* 2: 346. 1960.

Nicobar.: *Tamfathu*.

Shrubs or trees, dioecious, 1 - 10 m tall. Leaves obovate or subpanduriform to elliptic, cuneate or attenuate at base and narrowly cordate to rounded at extreme base, shallowly serrate to crenate along margins, caudate-acuminate at apex, 9 - 28 x 2.5 - 10 cm, chartaceous to membranous, glabrous except the puberulous midrib beneath; lateral nerves 5 - 10 pairs; petioles 2 - 7 (- 30) mm long; stipules subulate, 3 - 4 mm long. Male inflorescences terminal, paniculate racemes, 10 - 25 cm long; flowers dark crimson; calyx segments 2 - 5; stamens 4, ca 2 mm long; filaments shortly connate. Female inflorescences terminal, simple racemes or spikes, often with a few branches, 9 - 15 cm long; flowers sessile to subsessile; sepals ovate or oblong, 2 - 3 x 1 - 2 mm; ovary 2 - 3 mm in diam.; styles simple, 3 - 4 mm long. Fruits subglobose, 8 - 10 mm in diam., strongly 3-lobed, glabrous.



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

*Distrib.* India: Coastal forests, mixed or primary inland forests, on sandy or clayey soil at low altitudes, often on roadsides in Car Nicobar Island. Andaman & Nicobar Islands.

Myanmar, S. China, throughout Malesia to New Guinea and N. Australia.

*Uses.* The Nicobar tribes use it medicinally for children's diseases. (Thothathri, l. c.).

**3. *Alchornea tiliifolia*** (Benth.) Müll.Arg. in *Linnaea* 34: 168. 1865 & in DC., *Prodr.* 15(2): 903. 1866; Hook.f., *Fl. Brit. India* 5: 421. 1887. *Stipellaria tiliifolia* Benth. in Hooker's *J. Bot. Kew Gard. Misc.* 6: 4. 1854 (as *tiliaefolia*).

Nep.: *Sanu-malata*.

Shrubs or trees, 1 - 5 m tall. Leaves orbicular or broadly ovate to rhombate-ovate, broadly cuneate to rounded or narrowly subcordate at base, glandular-dentate along margins, acute to shortly caudate-acuminate at apex, 6 - 22 x 3 - 18 cm, chartaceous to membranous, gland-dotted, sparsely pubescent above, puberulous on nerves beneath, trinerved at base; lateral nerves 4 - 6 pairs, with discoid glands between veins; petioles (5-) 8 - 15 mm long, reddish hairy, with 2 subulate 1.5 - 2 mm long stipels at apex; stipules filiform, 4 - 6 mm long, subsistent. Inflorescences simple or rarely branched racemes, terminal or axillary, or 2 - 4 clustered in axils of fallen leaves, 3 - 12 cm long; bracts minute; pedicels 1 - 3 mm long. Male flowers: subsessile, clustered on rachis; calyx lobes 2 - 4, ca 1 mm long; stamens 5 - 8, connate at base. Female flowers: arranged singly on simple terminal 6 - 8 cm long racemes; pedicels 1 - 2 mm long; sepals 5 - 8, subulate-lanceolate, 4 - 5 mm long; ovary globose, tubercled, 3-loculed, 2 - 3 mm long; styles free. Fruits subsessile, ellipsoid, flattened, 3-loculed, 3-lobed, 12 - 16 mm long, minutely purplish tuberculate; seeds obovoid, nearly smooth.

*Fl. & Fr.* April - Oct.

*Distrib.* India: Subtropical evergreen forests at 500 - 1500 m altitudes. West Bengal, Sikkim, Arunachal Pradesh, Assam, Meghalaya and Andaman & Nicobar Islands.

Bangladesh, Bhutan, Myanmar, China, Laos, Vietnam, Thailand, Sumatra, Java and Borneo.

*Note.* Chromosome number:  $2n = 18$  (Mehra & Hans, *Taxon* 18: 310 - 315. 1969).

#### Tribe 4. **CHAETOCARPEAE** (Müll.Arg.) G.L.Webster (N. P. Balakrishnan)

Trees or shrubs; indumentum simple or absent. Leaves alternate, simple, entire, distichous, penninerved, eglandular; stipules caducous. Inflorescences axillary bracteate glomerules. Male flowers: sepals 4 or 5, broadly imbricate, free or connate; petals present or absent; disc dissected; stamens 5 - 15; filaments connate below, hirsute; anthers basifixed, dehiscing longitudinally; pollen grains globose, 3-colporate; colpi with irregular margins; exine rugulose and micropunctate; pistillode prominent, hirsute. Female flowers: sepals 4 - 8, imbricate; petals present or absent; disc urceolate; ovary 3-locular; styles bipartite, papillose. Fruits capsular; seeds carunculate, smooth, blackish; endosperm copious; cotyledons much longer and broader than radicle.

Tropical America, Africa and Asia, 2 genera; one in India.

### 13. *Chaetocarpus* Thwaites, nom. cons.

Trees or shrubs, dioecious, evergreen; indumentum simple. Leaves attenuate at base, entire or laxly sinuate along margins, acuminate to cuspidate at apex, coriaceous; petioles slightly pulvinate; stipules asymmetric, early caducous. Inflorescences axillary clusters of reduced thyrses; bracts 4, surrounding each flower; pedicels jointed at middle in male flowers, elongating in female flowers. Male flowers: sepals 4 (or 5), outer 2 sericeous, innermost one petal-like; petals absent; stamens 8 - 15, with an androphore from which filaments branch alternately, each with an anther, except the lower branches often with 2 or 3 anthers; anthers laterosely dehiscent by slit; pistillode pilose, 3-lobed. Female flowers: sepals as in male; staminodes absent; ovary on short gynophore; ovule one in each locule, attached half-way on the column; styles 3, hirsute; stigmas divided up to the style. Fruits subglobose, densely echinate with glochidiate hairs, dehiscent septically into 3 (or 4) segments; wall thin, woody; seeds ovoid, flattened, 1 - 3 per fruit, black, glossy, covered in upper third by a thin aril.

Pantropical, showing disjunct distribution in West Indies, South America, West Africa, Madagascar and tropical Asia, ca 15 species; one in India.

*Literature.* VAN WELZEN, P. C. (1994). A taxonomic revision of S.E. Asian *Chaetocarpus* Thwaites (Euphorbiaceae). *Rheedea* 4: 93 - 101, f. 1, map.

***Chaetocarpus castanocarpus*** (Roxb.) Thwaites, Enum. Pl. Zeyl. 275. 1861; Müll.Arg. in DC., Prodr. 15(2): 1122. 1866; Hook.f., Fl. Brit. India 5: 460. 1887. *Adelia castanicarpa* Roxb., Fl. Ind., ed. Carey 3: 848. 1832.

Trees or large shrubs, 5 - 25 m tall. Leaves ovate-elliptic to ovate-lanceolate, rounded to acute at base, narrowly rounded to acute or acuminate and mucronulate at apex, 3.5 - 18.5 x 1.5 - 8 cm, coriaceous, glabrous; lateral nerves 7 - 12 pairs; petioles (3-) 8 - 17 mm long; stipules obliquely lanceolate to falcate, 3 - 6.5 x 0.6 - 2.2 mm. Inflorescences axillary, clustered. Male flowers: pedicels 3.8 - 4.5 mm long; calyx 4-lobed, pubescent outside; lobes ovate to rounded, 1.5 - 3 x 1.5 - 3.5 mm; disc lobed; stamens 8, 2.8 - 5 mm long; filaments connate into 3 - 5 mm long white hairy androphore at base; free upper portion 0.4 - 1 mm long; anthers oblong-triangular, 0.5 - 1.2 x 0.4 - 0.6 mm; pistillode 3-lobed, villous. Female flowers: pedicels 3.3 - 5 mm long; calyx as in male; disc urceolate; gynophore up to 0.5 mm long; ovary ovoid, 1 - 1.3 mm long, densely hispid; styles 0.3 - 1.2 mm long, densely ciliate; stigmatic lobes 1 - 2 mm long. Fruits ovoid or subglobose, 10 - 18 mm across, densely echinate with ca 3 mm long glochidiate tawny-brittle spines, yellow, turning reddish brown; seeds ca 5 x 3 mm, with red aril.

*Fl. & Fr.* Nov. - April.

*Distrib.* India: Primary and secondary lowland forests, coastal swampy forests, in mixed dipterocarp forests, along river banks and submontane forests, on sandy loam, clayey loam or rocky soil, from sea level to 500 m altitude. Assam, Meghalaya and (?) Andaman & Nicobar Islands.

Sri Lanka, Bangladesh, Myanmar, China, Cambodia, Vietnam, Thailand, Malaysia, Sumatra and Borneo.

*Uses.* The wood is useful as light duty timber for building purposes and poles. In NE. Malesia the young leaves are cooked and eaten as spinach or chopped up with rice (Corner, Ways. Trees Malaya 1: 244. 1940).

**Tribe 5. CHEILOSEAE (Müll.Arg.) Airy Shaw**  
**(N. P. Balakrishnan & T. Chakrabarty)**

Trees, dioecious; indumentum simple hairs and bundles of stellate hairs, or nearly absent. Leaves alternate, simple, entire or crenulate, penninerved, glandular or eglandular; stipules caducous. Inflorescences axillary or sometimes terminal, paniculate; bracts eglandular. Male flowers: sepals 4 or 5, imbricate; petals absent; disc dissected, intrastaminal or extrastaminal; stamens 4 - 10, free; anthers muticous, introrse; pollen grains globose, 3-colporate; colpi inoperculate; exine echinate; pistillode absent. Female flowers: sepals as in male; petals absent; disc annular or absent; ovary 2 or 3-locular; styles bifid. Fruits capsular; seeds ecarunculate; testa fleshy; cotyledons longer and broader than radicle.

Tropical South and Southeast Asia, 2 genera; one in India.

**14. Neoscortechinia Hook.f. ex Pax**

Trees; Leaves serrate or entire, pinnately nerved, usually bearing 2 glands at base. Inflorescences axillary or terminal, lax panicles; pedicels elongating in fruits. Male flowers: calyx split into 4 or rarely 5 imbricate suborbicular lobes, with 2 smaller outer ones overlapping the inner ones; disc consisting of 4 (or 5) glands, very small, alternating with calyx-lobes; stamens (4-) 5 - 9, minute; filaments free, thick, flat; anthers 2-locular, basifixed, broad, introrse; pistillode reduced to small scales. Female flowers: calyx as in male, persistent in fruits; ovary 2 (or 3)-locular, each locule 1-ovuled; stigmas 2, small, bifid. Fruits rhegma, oblong-ellipsoid, 4-valved, densely white hairy; seeds 1 (or 2) per fruit, ovoid, smooth, glabrous, covered by a thin red fleshy aril; embryo flat, surrounded by 1 - 1.5 mm thick endosperm; cotyledons laterally beside each other; radicle apical on the embryo.

Tropical Malesia, from Myanmar to Philippines and Solomon Islands, 6 species; one in India.

*Literature.* VAN WELZEN, P. C. (1994). Taxonomy, Phylogeny, and Geography of *Neoscortechinia* Hook.f. ex Pax (Euphorbiaceae). *Blumea* 39: 301 - 318.

***Neoscortechinia nicobarica* (Hook.f.) Pax & K.Hoffm.** in Engl., *Pflanzenr.* IV.147.xiv (Euph. addit. VI, heft 68): 53. 1919; Chakr. in *Bull. Bot. Surv. India* 21: 14. 1979. *Scortechinia nicobarica* Hook.f. in Hooker's *Icon. Pl.* 18, sub. t. 1706. 1887 & *Fl. Brit. India* 5: 367. 1887.

Trees, 15 - 30 m tall, often with buttresses; bark smooth to scaly, whitish grey brown to black brown with lenticels; flowering branches 4 - 6 mm thick; young branches pilose. Leaves ovate to oblong or elliptic to obovate, acute to rounded at base, crenate to subentire or glandular-dentate along margins, acute, obtuse to rounded at apex, (5 -) 8 - 18 (- 25) x 3 - 8 (- 12.5) cm, thinly coriaceous, glabrous; lateral nerves 6 - 8 (- 12) pairs; petioles 1.5 - 5 cm long, biglandular at apex; stipules triangular, 1.5 - 2.2 x 0.5 - 0.8 mm. Inflorescences pilose, main branch up to 23 cm long; bracts of inflorescences triangular, 2 - 4.5 x 0.6 - 1 mm; bracts of cymules with bracteoles or with glands; bracts of flowers triangular, 0.7 - 1.2 mm across, pilose outside, with glands; pedicels

0.5 - 1.6 mm long. Male flowers: 2–2.5 mm in diam; sepals 4 or 5, ovate, 1.5 - 2.5 x 1.4 - 2.5 mm; stamens 6 - 9, filaments 0.4 - 0.7 mm long; anthers orbicular, ca 0.3 mm across. Female flowers ca 4 mm in diam.; sepals as in male; ovary ca 2.5 x 2.8 mm; stigmatic lobes ca 0.8 mm long, slightly split at apex. Infructescences thyrsoid, up to 8 cm long. Fruits oblong-ellipsoid to obovoid, 2.5 – 3 x 1.5 – 2 (- 2.7) cm, densely and shortly felted, 1 or 2-seeded, tardily dehiscent, yellowish when dry; seeds ca 2.4 x 1.2 mm.

*Fl.* March - Nov.; *Fr.* June - Jan.

*Distrib.* India: Inland evergreen primary forests up to 500 m altitude. Andaman & Nicobar Islands (seen in Nicobar Islands only).

Myanmar, Malaysia, Sumatra, Java, Borneo, Philippines and Sulawesi.

*Uses.* The wood is not durable, but easy to work with for production of planks and beams. Orang-utans of Indonesia eat the fruits.

Tribe **6. CHROZOPHOREAE** (Müll.Arg.) Pax & K. Hoffm.  
(N. P. Balakrishnan)

Trees, shrubs or herbs, monoecious or dioecious; indumentum usually stellate, lepidote or malpighiaceus (at least in part), rarely entirely simple. Leaves alternate, unlobed or lobed, pinnately or palmately veined, sometimes with laminar glands; stipules persistent or caducous, sometimes obsolete. Inflorescences axillary or terminal, mostly racemose or spicate. Male flowers: sepals 3 - 5, valvate; petals 4 or 5, rarely 10, or absent; stamens 5 to many; filaments free or connate; anthers introrse, muticous; pollen grains subglobose to oblate, mostly 3 - 6-colporate, colpi sometimes operculate, not distinctly marginate, sexine reticulate and often distinctly heterobrochate; pistillode present or absent. Female flowers: sepals 5 or 6, imbricate or valvate; petals 5, sometimes reduced or absent; disc annular or dissected, rarely absent; ovary (2 or) 3-locular, smooth or muricate; styles unlobed to bifid or twice bifid, sometimes lacerate. Fruits capsular or rarely fleshy; seeds dry or fleshy; sarcotesta smooth or rough to pitted, ecarunculate.

Tropical America, Africa, Asia and rarely in Europe, 11 genera; 2 genera in India.

KEY TO THE GENERA

- 1 a. Herbs; leaves with 2 abaxial glands near the petiole insertion; stamens 3 - 16; filaments connate at base; pollen grains stephano-colporate; female flowers with petals; seeds not fleshy, covered by thin incomplete sarcotesta **15. Chrozophora**
- b. Trees or large shrubs; leaves without abaxial glands near the petiole insertion; stamens 75 - 130; filaments free; pollen grains 3-colporate; female flowers without petals; seeds fleshy, covered by fleshy sarcotesta **16. Doryxylon**

**15. Chrozophora** Neck. ex A.Juss., nom. & typ. cons.

Herbs or undershrubs, annual or perennial, monoecious, usually clothed with stellate tomentose hairs. Leaves spirally arranged, petiolate, simple, entire or lobed, often plicate-rugose or plicate-bullate, rarely glabrous, often with 2 glands near petiole-apex beneath the base of leaf-blade; stipules caducous. Inflorescences short, dense, stalked or sessile racemes, axillary or terminal, bisexual with male flowers towards base and female flowers towards upper

part. Male flowers: calyx closely adherent in bud, splitting into 5 lobes; petals 5, usually equal to sepals; disc inconspicuous, divided into small glands, united with petals and slightly adnate to the staminal column; stamens 4 - 15; filaments connate into a central column and branching off in 1 - 3 verticillate layers; anthers oblique, basi-dorsifixed, introrse; thecae parallel, contiguous, longitudinally dehiscent; pistillode absent. Female flowers: calyx campanulate, 5-lobed, valvate, persistent; petals 5, similar to sepals, usually much smaller than in male, sometimes setaceous, rarely obsolete; disc annular with 5 short wide prominent glands alternating with the petals; ovary on short gynophore, 3-locular; styles 3, erect, bifid; branches entire, spreading, red, rarely purplish red or orange; ovules solitary in each locule. Fruits at first fleshy, later capsular, 3-loculed, dehiscent septicidally and partly loculicidally into 3 bivalved cocci, usually tinctorial and red, purple or purplish white when ripe, tuberculate, clothed with stellate hairs or with flat pectinate or subentire scales; seeds 3, obovoid, angular, carunculate, often tuberculate; sarcotesta incomplete, thin, smooth or somewhat rugose; embryo flat; endosperm copious, fleshy; cotyledons broad, flat.

NE. tropical Africa, Mediterranean region, West Asia to India, Thailand, Indo-China and Java, ca 12 species; 4 species in India.

*Literature.* BALAKRISHNAN, N. P. (1973). Studies in Indian Euphorbiaceae - V: The genus *Chrozophora* Neck. Bull. Bot. Surv. India 15: 1 - 7. PRAIN, D. (1918). The genus *Chrozophora*. Bull. Misc. Inform. Kew 1918: 49 - 120. PAX, F. & K. HOFFMANN (1912) Euphorbiaceae - Acalyphaeae-Chrozophorineae. In Engl., Das Pflanzenreich IV.147.VI (heft 57): 1 - 142. VAN WELZEN, P. (1999). Revision and phylogeny of subtribes Chrozophorinae and Doryxylinae (Euphorbiaceae) in Malesia and Thailand. Blumea 44: 411 - 436.

#### KEY TO THE SPECIES

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|--|------------------------------|
| 1 a. Ovary and fruits lepidote, never stellate-pubescent   | 2                            |
| b. Ovary and fruits stellate-pubescent, never lepidote   | 3                            |
| 2 a. Leaves not much longer than broad; ripe carpels reddish purple  | <b>1. C. hierosolymitana</b> |
| b. Leaves twice as long as broad; ripe carpels bluish purple   | <b>2. C. oblongifolia</b>    |
| 3 a. Leaves both radical and cauline, eglandular at base; stigmas orange; fruits grey or black, non-tinctorial when wetted | <b>3. C. prostrata</b>       |
| b. Leaves cauline only, 2-glandular at base; stigmas red; fruits purple, tinctorial when wetted                            | <b>4. C. rottleri</b>        |

**1. *Chrozophora hierosolymitana*** Spreng., Syst. Veg. 3: 850. 1826. *C. tinctoria* auct. non A.Juss., 1824: sensu Hook.f., Fl. Brit. India 5: 408. 1887, p. p., quoad specim. capsulis lepidotis tantum. *C. tinctoria* var. *hierosolymitana* (Spreng.) Müll.Arg. in DC., Prodr. 15(2): 749. 1866, p. p. *C. obliqua* auct. non (Vahl) A.Juss. ex Spreng., 1826: sensu Hook.f., l. c. 5: 409. 1887, p. p., excl. specim. Sind. *C. obliqua* var. *hierosolymitana* (Spreng.) Duthie, Fl. Gangetic Plain 3: 105. 1915.

Herbs, annual. Leaves ovate or subrhombate, truncate, rounded or broadly cuneate at base, obtuse or subobtuse at apex, subentire, wavy, undulate or distantly dentate along margins, 2 - 6.4 x 1.5 - 5 cm, tomentose on both sides; petioles 1.5 - 5.5 cm long. Male flowers: sessile; calyx subglobose, 5-lobed; lobes ca 3 mm long; petals 5, linear, ca 2.5 mm long, densely lepidote; stamens 4 or 5, rarely 6 - 8, connate below. Female flowers: solitary, scattered at the lower part of the raceme, pedicelled; calyx lobes 5, linear-lanceolate, ca 3 mm long; petals narrow or obsolete; disc glands short, broad. Fruits subglobose, 6 - 8 mm in diam., reddish purple, muricate when mature, covered with silvery scales.

*Fl. & Fr.* Feb. - May.

*Distrib.* India: Plains, in dry alluvial soil, rare. Punjab, Haryana and Rajasthan.

Pakistan and westwards to Egypt and Turkey.

*Note.* Chromosome number:  $2n = 44$  (Kliphuis & Wieffering, *Taxon* 28: 398. 1979).

**2. *Chrozophora oblongifolia*** (Delile) A. Juss. ex Spreng., *Syst. Veg.* 3: 850. 1826. *Croton oblongifolius* Delile, *Fl. Egypte* 283, t. 51, f. 1. 1812. *Chrozophora obliqua* non Spreng., 1826: sensu Müll. Arg. in DC., *Prodr.* 15(2): 749. 1886, excl. Wall. *Cat.* 7716 G; Hook. f., *Fl. Brit. India* 5: 409. 1889, p. p.

Shrubs or woody herbs, up to 1 m high, densely white or tawny stellate tomentose. Leaves ovate or triangular-lanceolate, more or less lobed or incised, subentire or sinuate-toothed along margins, rounded or cuneate at base, subobtuse at apex, 3 - 5 x 1 - 2 cm, usually with 2 glands beneath near the base of midrib; main nerves few; petioles 1 - 2.5 cm long; stipules linear, soon caducous. Inflorescences axillary bracteate racemes, the males towards upper part, sessile, the females towards lower part, pedicellate. Male flowers: subsessile; sepals ca 3 mm long; petals lanceolate to ovate-lanceolate, 3 - 4 mm long yellowish; stamens 4 - 7 (- 12), united below. Female flowers: pedicels ca 5 mm long; sepals triangular to linear-lanceolate, ca 2.5 x 1 mm; ovary clothed with silvery lepidote scales; styles ca 3 mm long, 2-fid to about half way down. Fruits subglobose, ca 7 mm in diam., bluish purple, covered with silvery lepidote scales, with fringed margins; seeds triangular-ovoid, 4 - 5 mm long, coarsely tuberculate.

*Fl. & Fr.* Jan. - April.

*Distrib.* India: Arid zones in sandy soil, often in sublittoral zones. Rajasthan.

Pakistan to coastal NE. Africa.

*Notes.* Chromosome numbers: *C. obliqua*:  $2n = 22$  (Gill et al., *Cytologia* 38: 393 - 401. 1973);  $2n = 44$  (Malik, *Sci. & Cult.* 25: 437. 1960; Choda & Mehra, *Curr. Sci.* 41: 76. 1972).

**3. *Chrozophora prostrata*** Dalzell in Dalzell & A. Gibson, *Bombay Fl.* 233. 1861. *C. plicata* var. 2 & 3. Hook. f., *Fl. Brit. India* 5: 410. 1887.

Herbs, stellately pubescent; branches erect to prostrate, spreading from rootstock, 30 - 45 cm long, woolly tomentose. Leaves both radical and cauline, broadly ovate, suborbicular, oblong or oblong-lanceolate, cordate or truncate at base, obtuse or subacute at apex, crenate along margins, 1 - 5 x 0.5 - 3.5 cm, sometimes with 2 glands at base near the petioles on either side of the midrib, usually deeply bullate, plicate-rugose or rarely smooth, finely pubescent and mixed with stipitate hairs above, densely stellate woolly beneath; petioles 3 - 6 cm long on radical leaves, 1 - 3 cm long on cauline leaves, woolly tomentose. Inflorescences short few-flowered, axillary 2 - 3 cm long racemes; bracts linear, ca 5 mm long. Male flowers: sepals ovate, ca 3 mm long; petals ovate to elliptic-lanceolate, ca 2.5 mm long; stamens 15 in 2 whorls. Female flowers: sepals linear, ca 2 mm long; petals linear, small; styles slightly connate at base, ca 2.5 mm long; stigma orange-coloured. Fruits subglobose, 5 - 7 mm in diam., densely stellate-woolly, non-tinctorial.

## KEY TO THE VARIETIES

- 1 a. Branches erect or decumbent, woody; leaves oblong-lanceolate to elliptic, sub acute, always with 2 glands at base beneath, near the midrib **3.1. var. parvifolia**  
 b. Branches prostrate to procumbent, less woody; leaves oblong-ovate to suborbicular, obtuse, usually eglandular, but sometimes with 2 glands at base near the midrib **3.2. var. prostrata**

**3.1. var. parvifolia** (Klotzsch ex Schweinf.) N.P.Balacr. in Bull. Bot. Surv. India 15: 7. 1973 (1976). *Chrozophora parvifolia* Klotzsch. ex Schweinf., Pl. Quaed. Nilot. 10 - 11. 1862; Gamble, Fl. Madras 2(7): 1316. 1925 (repr. ed. 921. 1957).

*Fl. & Fr.* Jan. - Nov.

*Distrib.* India: Wastelands and scrub forests, plains and coastal areas on sandy soil. Rajasthan, Delhi, Uttar Pradesh, Madhya Pradesh, Orissa, Andhra Pradesh and Tamil Nadu.

Endemic.

**3.2. var. prostrata**

Guj.: *Beto-okharad*.

*Fl. & Fr.* Feb. - Sept.

*Distrib.* India: Wastelands and scrubs in plains and coastal areas up to 400 m, on sandy soil. Punjab, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Orissa, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu; absent in Kerala and NE. India.

Pakistan to N. Africa.

*Uses.* The ash of the roots is given to children for cough in Gujarat (Saurashtra).

*Notes.* Chromosome number:  $2n = 22$  (Abraham, Sci. & Cult. 30: 343 - 344. 1964).

**4. Chrozophora rottleri** (Geiseler) A.Juss. ex Spreng., Syst. Veg. 3: 850. 1826. *Croton rottleri* Geiseler, Croton. Monogr. 54. 1807. *Chrozophora plicata* auct. non (Vahl) A.Juss. ex Spreng., 1826: Voigt, Hort. Suburb. Calcutt. 156. 1846; Prain, Bengal Pl. 994. 1903. *C. plicata* (Vahl) A.Juss. ex Spreng. var. *rottileri* (Geiseler) Müll.Arg. in DC., Prodr. 15(2): 747. 1866. *C. tinctoria* auct. non (L.) A.Juss., 1824: Hook.f., Fl. Brit. India 5: 408. 1887, p. p.

Guj.: *Alchhiyo, Kalo-ochrad*; Hindi: *Shadevi*; Kan.: *Angamenasu, Gurugu*; Kon.: *Suravalli*; Mar.: *Suryavarti*.

Herbs or undershrubs, erect, up to 60 cm high, densely hispid or stellate-tomentose. Leaves cauline, broadly ovate-orbicular to oblong or elliptic-lanceolate, truncate or cuneate at base, sinuate-toothed or undulate-crenate along margins, often trilobed, rounded or subacute at apex of lobes, 2.5 - 7.5 (- 10) x 2 - 6 (- 9) cm, densely tomentose on both sides, 2-glandular beneath at the base of the midrib; petioles 1 - 10 cm long. Inflorescences axillary or terminal bracteate racemes, 2.5 - 9 cm long; bracts linear, ca 3 mm long, caducous. Male flowers: subsessile, crowded at upper part of racemes; calyx lobes 5, 3 - 4 x ca 1.2 mm; petals 5, elliptic-oblong, 3.6 - 3.8 x 1.5 - 1.6 mm; disc obscure; stamens 5 - 15; filaments connate below into 3.2 - 3.7 mm long column with 1 - 3 series of free filaments, the outer ones short; anthers oblong, ca 1 mm long.

Female flowers: green, ca 3 mm across, 4–8 arranged at lower part of racemes; pedicels 1.5 - 3 mm long, elongating in fruit up to 11 mm; calyx-lobes 5, narrow, 1.5 - 2 x 0.5 - 0.8 mm; petals 5, narrow, 1.4 - 2 x ca 0.5 mm or obsolete; disc of 5 short broad glands alternating with petals; ovary ovoid, 2.5 - 3 x 2 - 3 mm; styles 3, each bifid, 2 - 2.3 mm long. Fruits almost fleshy when fresh, capsular when dry, subglobose, 7 - 9 x 5 - 8 mm, densely stellate tomentose, reddish purple when mature, tinctorial when wetted; stalk 5 - 10 mm long; seeds estrophiolate, globose, ca 3 mm in diam.

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

*Distrib.* India: Wastelands, open places, near cultivated fields, roadsides, in dry and wet places from plains to 1000 m. Punjab, Rajasthan, Uttar Pradesh, West Bengal, Assam, Orissa, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Afghanistan, Pakistan, Bangladesh, Sri Lanka, Myanmar, Thailand and Java.

*Uses.* The fruits when wetted yield a blue dye. The leaves find use in the treatment of skin diseases on necks of horses. The seeds are cathartic. The plant is emetic and drastic corrosive.

*Notes.* Chromosome number:  $2n = 22$  (Datta, Taxon 16: 341 - 450. 1967);  $2n = 44$  (Sharma, Sci. & Cult. 21: 270 - 271. 1955, as *C. tinctoria*).

## 16. *Doryxylon* Zoll.

(incl. *Sumbaviopsis* J.J.Sm.)

Trees or large shrubs, monoecious, evergreen, with dense sessile and peduncled stellate or lepidote hairs; axillary buds sometimes modified into thorns. Leaves spirally arranged, simple, white tomentose beneath, long-petiolate, subpeltate or epeltate at base, entire or distantly dentate; stipules triangular, hairy, caducous. Inflorescences axillary or terminal, bracteate spiciform racemes, seldom branching; rachis densely hairy. Male flowers: in fascicles of 3 - 5, in axils of bracts; calyx 3 - 5-partite; lobes valvate; petals 4, 5 or 10, short, imbricate or valvate; disc absent or rarely very small, obsolete and dentate; stamens ca 75 to numerous, arranged on convex hairy receptacle; filaments free, erect; anthers oblong, basi-dorsifixed, longitudinally dehiscing; pistillode absent. Female flowers: solitary in each cluster of male flowers; calyx 5 - 6-partite; lobes shortly imbricate; petals absent or rudimentary; disc small, annular; ovary 3-loculed; ovule one in each locule; styles 3, connate at base, entire or slightly bifid. Fruits 3-loculed capsule with 3 bivalved cocci, septicidal from apex to base and loculicidal from base to apex, thin-walled; seeds usually 3, rarely 2, subglobose, angular, large, smooth or pitted-foveolate outside, with fleshy sarcotesta and fibrous endotesta; embryo straight; cotyledons flat; endosperm copious.

NE. India, Myanmar, Thailand, Vietnam, Malaysia, Java, Sumatra and Philippines, 2 species; one in India.

*Notes.* The genera *Sumbavia* Baillon and *Sumbaviopsis* J.J. Smith are included in this genus. The generic name *Doryxylon* Zollinger has priority over them.

*Literature.* BALAKRISHNAN, N. P. (1967). Studies in Indian Euphorbiaceae II. The genus *Doryxylon* Zoll. Bull. Bot. Surv. India 9: 56 - 58, ff. 1 - 7. VAN WELZEN, P. (1999). Revision and



phylogeny of subtribes Chrozophorinae and Doryxylinae (Euphorbiaceae) in Malesia and Thailand. *Blumea* 44: 411 – 436.

**Doryxylon albicans** (Blume) N.P.Balacr. in Bull. Bot. Surv. India 9: 58, ff. 1 - 7. 1967 (1968). *Adisca albicans* Blume, Bijdr. Fl. Ned. Ind. 611. 1826. *Sumbavia macrophylla* Müll.Arg. in Flora 47: 482. 1864 & in DC., Prodr. 15(2): 727. 1866; Kanjilal et al., Fl. Assam 4: 199. 1940. *Sumbaviopsis albicans* (Blume) J.J.Sm. in Meded. Dept. Landb. Ned.-Indie 10: 357. 1910; Govearts et al., World Checkl. & Bibl. Euphorbiaceae 4: 1494. 2000.

Trees, 6 - 15 (- 25) m tall; branches with scurfy white tomentum. Leaves elliptic, oblong-ovate or lanceolate, narrowly subpeltate by 2 - 6 mm, rounded or obtuse and biglandular at base, entire, undulate or distantly dentate along margins, obtuse, acute or cuspidate-acuminate at apex, 7 - 35 x 4 - 16 cm, coriaceous, glabrous and shiny above, densely velvety white tomentose beneath; lateral nerves 7 - 13 pairs, the basal pair opposite, extending to one-third the length of the lamina; petioles 2 - 10 cm long. Male inflorescences up to 15 cm long, female inflorescences up to 35 cm long; bracts ca 2 x 1 mm. Male flowers: in fascicles of 3 - 5; bracts small, oblong-triangular; pedicels 2 - 5 mm long; calyx lobes oblong-ovate, concave, ca 5 x 3 mm; petals obovate, ca 2.5 mm across; stamens ca 50; filaments ca 2.5 mm long; anthers linear-oblong, ca 1 mm long, versatile. Female flowers: solitary amidst male flower-clusters; pedicels 7 - 10 mm long, up to 2 - 4 cm long in fruit; calyx lobes oblong-triangular, 2 - 4 x 1.5 - 2.5 mm, stellate pubescent; petals absent or rudimentary; ovary ovoid-oblong, 3-lobed, 2.5 - 4.5 mm long, stellate pilose; styles entire, ca 1 cm long. Fruits subglobose, somewhat flattened, 2 - 3.5 x 1.5 - 3 cm, dark stellate tomentellous; seeds oblong, narrowed at base, 1.3 - 2 cm long, 1 - 1.5 cm across, longitudinally pitted foveolate, black.

*Fl.* Dec. - Feb.; *Fr.* March - April.

*Distrib.* India: Tropical humid evergreen forests, up to an altitude of 500 m, scattered in distribution. Assam, Arunachal Pradesh, Nagaland and Tripura.

Myanmar, Thailand, Vietnam, Malaysia, Borneo, Sumatra, Java and Philippines.

*Use.* The seeds are edible.

### Tribe 7. **EPIPRINEAE** (Müll.Arg.) Hurus. (N. P. Balakrishnan)

Trees or shrubs; indumentum stellate. Leaves alternate, simple, pinnately veined, eglandular or with petiolar glands, stipulate. Inflorescences terminal or axillary, paniculate, racemose or spicate. Male flowers: calyx closed in bud, splitting into 2 - 6 valvate segments; petals absent; stamens 5 - 15; filaments free or connate, usually inflexed in bud (except in *Koilodepas*); pollen grains subglobose to subporate, 3-colporate, angulaperturate; colpi inoperculate, scarcely marginate; sexine perforate-tectate or rather coarsely reticulate. Female flowers: sepals 4 - 8, imbricate, sometimes foliaceous or toothed; disc absent or rudimentary; ovary 3 (-4)-locular; styles free or connate, bifid or multifid. Fruits capsular, rarely drupaceous; seeds subglobose, smooth, dry, ecarunculate.

Tropical Africa and Asia, 9 genera; 3 in India.

## KEY TO THE GENERA

- 1 a. Inflorescences spiciform racemes, paniculate, terminal; stamens 5 - 15; filaments slender, long, free; styles connate into a column, shallowly bifid or multifid at upper part **17. Epiprinus**
- b. Inflorescences spicate, often fasciculate, terminal or axillary; stamens 3 - 6; filaments thick, short, connate at base; styles free, distally multifid 2
- 2 a. Flowers in terminal heads; filaments united into a tube, short, erect in bud; antherthecae diverging downwards from tip of filament **18. Koilodepas**
- b. Flowers clustered in terminal interrupted spikes; filaments free, long, inflexed in bud; antherthecae parallel **19. Symphyllia**

**17. Epiprinus** Griff.

Trees, monoecious. Leaves alternate, stipulate. Flowers: sometimes zygomorphic, in terminal or axillary spiciform racemes. Male flowers: numerous in clusters; calyx 4 - 8-lobed, valvate, equal or unequal; petals and disc absent; stamens as many as calyx-lobes, surrounding a columnar pistillode; anthers dorsifixed, glandular at base. Female flowers: few at the base of the racemes; calyx of 5 - 8 unequal linear lobes; petals and disc absent; ovary 3-loculed; ovules 1 per locule; styles connate at base, trifid and again branching into 6 plumose stigmatic arms above. Fruits capsular, schizocarpic, 3-lobed; seeds globose; testa crustaceous; endosperm fleshy; cotyledons flat.

Tropical Asia, from Assam to Malaysia, ca 6 species; one in India.

**Epiprinus mallotiformis** (Müll.Arg.) Croizat in J. Arnold Arbor. 23: 53. 1942. *Symphyllia mallotiformis* Müll.Arg. in Linnaea 34: 156. 1865; Gamble, Fl Madras 2(7): 1323. 1925 (repr. ed. 2: 925. 1957). *Cephalocroton indicus* Bedd., Fl. Sylv. S. India 49, t. 261. 1872. *Adenochlaena indica* (Bedd.) Hook.f., Fl. Brit. India 5: 418. 1887.

Mal. & Tam.: *Karinjikkada*.

Trees, up to 10 m tall; branchlets puberulous. Leaves broadly elliptic-ovate or orbicular, narrowed and acute at base, entire, narrowly acute and often mucronate at apex, 7 - 17 x 3 - 8.5 cm, coriaceous, glabrous except the sparsely hairy midrib, shiny above; lateral nerves ca 8 pairs; petioles 1 - 6 cm long. Inflorescences lateral or terminal, 5 - 6 cm long spikes, with densely clustered small flowers. Male flowers: calyx-lobes 4, ovate-lanceolate, up to 2 mm long; stamens 4 (or 5), exserted; filaments up to 2 mm long; anther-thecae parallel. Female flowers: calyx-lobes 6, unequal, ovate-lanceolate, up to 2 mm long; ovary 3-locular, tomentose; styles 3, each bifid above with plumose stigmatic arms. Fruits 3-lobed, ovoid to subglobose, depressed, 1 - 1.5 cm long, slightly scabrous-rugose.

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

*Distrib.* India: Evergreen tropical forests. Karnataka, Kerala and Tamil Nadu.

Endemic.

**18. Koilodepas** Hassk.

(*Coelodepas* sphalm.)

Shrubs or small trees, monoecious or dioecious. Leaves distichous, irregularly dentate-serrate along upper margins, pinnately nerved, shortly petiolate; stipules persistent.

Inflorescences axillary and terminal, slender interrupted spikes, often crowded or several together, simple or branched, bearing 1 or 2 female flowers at basal nodes and many male flowers in clusters upwards, sometimes entirely male-flowered and the 1 or 2 female flowers arising on short axillary rachis; bracts small. Male flowers: sessile; calyx connate at base into a short cup, split into 4 (or 5) valvate lobes; petals and disc absent; stamens 4 (or 5); filaments thick, dilated and flattened at base and adnate below to the fleshy base of the pistillode into a cup bearing 8 or 10 longitudinal ribs on the inside, free above; anthers introrse, 2-loculed, with spreading and pendulous thecae; pistillode thick and fleshy below, produced above into a stout 3-lobed column. Female flowers: shortly pedicelled; calyx cup-shaped to globose; lobes 5- (- 8), free, imbricate, persistent and greatly enlarged in fruit; petals and disc absent; ovary 3-loculed, each locule 1-ovuled; styles 3, strongly flabellate, widened, bearing numerous lobules along margins. Fruits schizocarpic capsules of 3 bivalved cocci, 3-lobed, encircled by the persistent calyx; stellate pubescent; seeds subglobose, carunculate, maculate.

Tropical SE. Asia, mainly in Malaysia and Indonesia (except Sumatra), one species extending up to Hainan in China, ca 11 species; one in peninsular India.

*Literature.* AIRY SHAW, H. K. (1960). Notes on Malesian Euphorbiaceae XI. A synopsis of the genus *Koilodepas* (Coelodepas) Hassk., with a note on *Calpignyne frutescens* Bl. Kew Bull. 14: 382 - 391.

**Koilodepas calycinum** Bedd., Fl. Sylv. S. India 207, t. 320. 1872 & Forester's Man. 207. 1873; Hook.f., Fl. Brit. India 5: 419. 1887; Gamble, Fl. Madras 2(7): 1324. 1925 (repr. ed. 2: 926. 1957).

Tam.: *Kattupira*.

Small trees; young parts furfuraceous. Leaves lanceolate-oblong, rounded at base, dentate-serrate along margins, acuminate at apex, 4 – 18 x 1.5 – 6 cm, glabrous or sparsely stellate furfuraceous on major nerves beneath; lateral nerves 8 – 12 pairs; petioles 5 – 10 mm long. Inflorescences axillary or terminal, 7.5 - 14 cm long, usually branched. Male flowers: bracts subulate, ca 1 mm long; sepals 4 (- 5), deltoid-ovate, ca 2 x 3 mm; stamens 4 (- 5); filaments ca 2 mm long; anther-thecae oblong, ca 1.5 mm long. Female flowers: bracts subulate, ca 2 mm long; pedicels 5 – 8 mm long; sepals 5 (- 8), orbicular-ovate, ca 4 x 3 mm; ovary subglobose, ca 2 mm across, hairy; styles 3, ca 5 mm long. Fruits subglobose, slightly depressed, ca 15 mm in diam., surrounded by membranous, broadly and irregularly lobed greatly enlarged calyx.

*Fl. & Fr.:* Period unknown.

*Distrib.* India: Rare in Western Ghats up to 600 m altitude. Tamil Nadu (Tirunelveli and Kanniyakumari dists).

Endemic.

## 19. *Symphyllia* Baill.

Shrubs or small trees, monoecious; branches glabrous or finely stellate tomentose. Leaves pseudo-verticillate, crowded at the ends of branches, penninerved; petioles short; stipules deciduous. Inflorescences terminal and axillary, interrupted glabrous spikes, bisexual, often branched, with 1 or 2 female flowers at basal nodes and fascicled male flowers at irregular intervals at distal nodes; bracteoles minute, pubescent. Male flowers: sepals 4 - 6, valvate;

petals absent; disc consisting of a few hairs; stamens 4 - 6, filaments inflexed in bud, inserted at the base of the pistillode, free, exerted; anthers versatile, 2-loculed; thecae adnate to a thick connective; pistillode columnar. Female flowers: sepals 5 - 8, imbricate, unequal, entire; petals and disc absent; ovary 3-loculed, each locule 1-ovuled; styles 3, united below into a column, distally bifid with spreading pubescent fimbriate-papillose arms. Fruits capsular with 3 bivalved cocci; seeds estrophiolate, subglobose; testa crustaceous; endosperm fleshy; cotyledons broad and flat.

India, Hainan in China and Malaya, 3 species; one in India.

**Symphyllia siletiana** Baill., Etude Euphorb. 474, t. 11, f. 6 & 7. 1858. *Symphyllia silhetiana* Baill. mut. Müll.Arg. in DC., Prodr. 15(2): 764. 1866 (as '*silhetianus*'). *S. silhetense* Baill. mut. Benth. in J. Linn. Soc. Bot. 17: 228. 1878, pro syn. *Adenochlaena silhetensis* (Baill. mut. Benth.) Benth. in J. Linn. Soc. Bot. 17: 228. 1878. *A. silhetiana* (Baill. mut. Müll.Arg.) Benth. & Hook.f., Gen. Pl. 3: 308. 1880; Hook.f., Fl. Brit. India 5: 418. 1887. *Epiprinus siletianus* (Baill.) Criotat in J. Arnold Arb. 23: 52. 1942.

Shrubs or trees, up to 5 m high. Leaves narrowly elliptic, oblong-elliptic to lanceolate-elliptic or subpanduriform, narrowly cordate at base, entire along margins, acuminate at apex, 8 - 32 x 2 - 9 cm, chartaceous to thinly coriaceous, glabrous; lateral nerves 12 - 18 per side; petioles 2 - 4 x 3 - 4 mm; stipules deciduous. Inflorescences terminal, 5 - 15 cm long, simple or shortly branched; rachis rusty pubescent. Male flowers: sessile; sepals 4, ovate, ca 1 mm long; stamens 4; filaments ca 1 mm long; anthers ovoid, ca 0.6 mm long; pistillode ca 1 mm long. Female flowers: pedicels ca 1 mm long; sepals 5, oblong, ca 2 x 1 mm; ovary subglobose, ca 1.5 mm across, stellate tomentose; styles 3, ca 2 mm long, fimbriate-papillose. Fruits not seen.

*Fl. & Fr.* Period unknown.

*Distrib.*: India: Tropical evergreen forests, up to 600 m altitude; Assam and Meghalaya.

Bangladesh, Myanmar, China, Laos, Vietnam and Thailand.

Tribe **8. PLUKENETIEAE** (Müll.Arg.) Hurus.  
(**T. Chakrabarty & N. P. Balakrishnan**)

Trees, shrubs or herbs, sometimes climbing or twining; indumentum simple, often glandular, sometimes stinging. Leaves alternate, unlobed to palmately parted, pinnately to palmately veined, sometimes glandular or stipellate at base; stipules present. Inflorescences terminal or axillary, usually bisexual, mostly racemose or spicate; bracts eglandular. Male flowers: calyxlobes 3 - 5, valvate; petals absent; disc interstaminal, extrastaminal or absent; stamens (2 -) 3 - 100, usually free; anthers introrse or extrorse, muticous or apiculate; pollen grains 3-colporate, porate or inaperturate; sexine varying from tectate to intectate; pistillode absent. Female flowers: sepals 3 - 6, imbricate; petals and disc absent; ovary 3- or 4-locular; styles unlobed, slender or dilated, sometimes papillose or lacerate, usually connate into a distinct column. Fruits capsular; columella persistent; seeds ecarunculate; testa usually dry; endosperm copious; cotyledons much longer and broader than the radicle.

Tropics of both Old and New World, the majority are Neotropical, 16 genera; 5 in India.

## KEY TO THE GENERA

- 1 a. Stinging hairs present; flowers in bibracteolate pseudanthia; pollen grains prolate, coarsely reticulate **21. Dalechampia**
- b. Stinging hairs present or absent; flowers in racemes or spikes, not in bibracteolate pseudanthia; pollen grains subglobose 2
- 2 a. Stinging hairs absent; fruits winged, crested, carinate or indehiscent; pollen grains 3-colpate **24. Plukenetia**
- b. Stinging hairs present; fruits usually not winged; pollen grains 3-colpate, 3-porate 3
- 3 a. Sepals of male flowers adaxially inflexed to form a pseudo-disc; stamens 3 or 4; anthers introrse, connective thick; style massive 4
- b. Sepals of male flowers not adaxially inflexed; stamens 2 - many; anthers extrorse, connectives not thickened; styles usually slender 5
- 4 a. Leaves narrowly emarginate at base, widest above leaf insertion, with stinging hairs; connectives of stamens with inflexed linear appendages; female calyx with 3 lobes; styles free or nearly so, long-papillose on adaxial surface **20. Cnesmone**
- b. Leaves broadly cordate at base, widest at leaf insertion, glabrous; connectives of stamens without appendages; female calyx with 6 lobes; styles connate into a massive globose or clavate column **22. Megistostigma**
- 5 a. Calyx of male flowers flat with inflexed lobes; anthers 2, subsessile; styles short, connate into a thick conical column, divergent above **23. Pachystylidium**
- b. Calyx of male flowers concave; anthers (2 -) 3 - 8 (- 50), if 2 then not subsessile; styles slender, free or partly connate **25. Tragia**

**20. Cnesmone** Blume, corr. Blume

Twining herbs, with patent common and stinging hairs. Leaves distichous; stipules large, persistent. Racemes axillary or leaf-opposed, dense, with 1 or 2 female flowers at base and many male flowers upwards. Male flowers: calyx flattened in bud, afterwards 3-lobed with patent triangular acute lobes; petals and disc absent; stamens 3, alternating with calyx-lobes, nearly enclosed by calyx-tube; filaments widened towards apex; anther-thecae 2, introrse; connective broad, produced into an incurved subulate appendage running parallel to the anthers. Female flowers: calyx-lobes 3, imbricate in bud, persistent; ovary flattened, 3-loculed; locules 1-ovuled; styles 3, shortly connate, fleshy, papillose on the inside along margin, consequently seemingly pectinately lobed, persistent. Fruits capsular.

Tropical Asia, ca 11 species; one species in India.

**Cnesmone javanica** Blume, Bijdr. Fl. Ned. Ind. 630. 1826 (sphalm. '*Cnesmona*'); corr. Blume, Fl. Jav. Praef. p.vi. 1828; Hook.f, Fl. Brit. India 5: 466. 1887.

Herbaceous climbers, bearing scattered hirsute and urticating hairs to subglabrous or glabrous. Leaves oblong to ovate or subpanduriform, cordate at base with a wide sinus, denticulate or serrulate along margins, caudate-acuminate at apex, 6 - 22 x 3 - 15 cm, membranous, patently hairy on both sides with scattered bristles or sometimes subglabrous or glabrous, trinerved at base; lateral nerves 4 - 6 pairs; petioles 1.5 - 10 cm long; stipules ovate, 6 - 15 x 3 - 8 mm. Inflorescences leaf-opposed, androgynous, 3 - 10 cm long; peduncle 1.5 - 13 cm long. Male flowers: pedicels 2 - 4 mm long; calyx trifid; lobes ovate-deltoid, 4 - 5 x 6 - 8 mm; stamens 3, ca 2 mm long, free. Female flowers: distant, subsessile; calyx-lobes 3, broadly ovate to rhombate, 7 - 12 x 6 - 8 mm, velutinous on both surfaces, slightly accrescent; ovary depressed, ca 3 mm in

diam., densely hirsute; styles 5 - 6 mm long. Fruits depressed, triple or double globose, strongly 2 or 3-lobed, 1.5 - 2 cm in diam., on 3 - 5 mm long pedicels, velutinous or hispid.

#### KEY TO THE VARIETIES

- 1 a. Plants subglabrous to glabrous **1.1. var. glabriuscula**  
 b. Plants densely villous-tomentose and scattered hirsute and urticating **1.2. var. javanica**

**1.1. var. glabriuscula** N.P.Balacr. & N.G.Nair in Gard. Bull. Singapore 31: 49, f. 1. 1978.

Twining herbs; differs from var. *javanica* in being less pubescent, subglabrous or glabrous.

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

*Distrib.* India: Inland evergreen forests, at low altitudes. Andaman & Nicobar Islands (seen only in S. Andaman Island).

Endemic.

**1.2. var. javanica**

*Fl. & Fr.* Nov. - May.

*Distrib.* India: Tropical evergreen forests, usually in secondary forests or edges of primary forests, mixed forests, bamboo forests and sometimes in clearings, up to 500 m altitude. Arunachal Pradesh, Assam, Meghalaya, Mizoram and Andaman & Nicobar Islands.

Bangladesh, Myanmar, Indo-china and Thailand to Malesia (Malaya, Sumatra, Borneo and Java).

#### 21. *Dalechampia* Plum. ex L.

Shrubs or undershrubs, often twining, monoecious. Leaves alternate, 3 - 5-lobed or 3 - 5-foliolate, usually palmately 3 - 7-nerved at base. Inflorescences axillary, sessile or peduncled racemes or heads, unisexual or bisexual and often mixed with sterile deformed flowers; involucre consisting of 2, often large, coloured, entire or 3-fid bract, with a whorl of small outer ones at their base; upper and inner floral bracts male, 3 or more-flowered, lower and outer bracts female; petals and disc absent. Male flowers: pedicels articulate; calyx 4 - 7-lobed; sepals valvate; petals absent; stamens (9 -) 20 - 40 (- 90), on a convex receptacle; filaments free or connate; anthers erect, often didymous with contiguous parallel thecae, basifixed, extrorse; pollen grains tricolpate; pistillode absent. Female flowers: sepals 5 - 12, imbricate, usually pinnately fimbriate or lacerate, gland-tipped, enlarged and accrescent in fruit; ovary pubescent, 3 or 4-loculed; ovule 1 in each locule; styles connate into a fleshy slender or stout column, with an obtuse dilated, lobed or cupular stigma. Fruits capsular, lobed, enclosed in calyx; endocarp hard; seeds globose or ellipsoid, ecarunculate; endosperm fleshy; cotyledons broad and flat.

Tropical America, Africa and Asia, majority in America, few in Africa and two in Asia, ca 110 species; 4 species in India.

*Literature:* CHAVAN, A. R. & S. J. BEDI (1962). *Dalechampia scandens* L. var. *cordofana* (Hochst.) Muell.-Arg. - a new record for India. Curr. Sci. 31: 115. RAGHAVAN, R. S. & B. G. KULKARNI (1980). A new species of *Dalechampia* (Euphorbiaceae) from peninsular India. Kew Bull. 35: 323 - 325, f. 1.

## KEY TO THE SPECIES

- 1 a. Leaves compound, 3-foliolate with 3 sessile leaflets **1. *D. indica***  
 b. Leaves simple, unlobed or 3- or rarely 5-lobed, cleft to the middle or almost up to base 2
- 2 a. Leaves some unlobed, others palmately 3-lobed **4. *D. tamnifolia***  
 b. Leaves all palmately 3-lobed 3
- 3 a. Lobes of leaves linear-lanceolate, 13 – 17 x 2 – 2.3 cm; sepals of female flowers neither pinnatifid-fimbriate nor with bulbous-based long hairs but with stipitate glands **3. *D. stenoloba***  
 b. Lobes of leaves not linear-lanceolate, broader; sepals of female flowers pinnatifid fimbriate with numerous bulbous-based long hairs **2. *D. scandens***

**1. *Dalechampia indica*** Wight, Icon. Pl. Ind. Orient. 5: t. 1882. 1852; Hook.f., Fl. Brit. India 5: 467. 1888.

Twinning climbers, up to 4 m long, finely pubescent with stinging hairs except on upper surface of leaves. Leaves 3-foliolate, chartaceous, glabrous; leaflets sessile or shortly petiolulate, acute to rounded at base, serrate along margins, short-acuminate at apex; middle leaflet elliptic-ovate to obovate or ovate-lanceolate, 5 - 10 x 2.5 - 4 cm; lateral leaflets smaller, subsessile, oblique with outer bases enlarged, rounded and sometimes lobulate; petioles 1.2 - 8 cm long; stipules and stipels lanceolate, acuminate, ca 3 mm long. Flowers: surrounded by fleshy scales formed out of deformed flowers. Male flowers: sepals 4 (or 5), lanceolate, ca 4 mm long, reflexed, folded, entire; stamens more than 20; filaments ca 0.8 mm long; anthers ca 1 mm long. Female flowers: ca 3 mm across; bracteoles with knob-like glands along margin; sepals 8 - 12, linear-lanceolate, often with pinnately laciniate lobes, ca 5 mm long, ciliate with stalked glands along margins; ovary globose, ca 3 mm across, pubescent; style up to 1.5 mm long; stigma somewhat cupular. Fruits depressed-subglobose, ca 8 mm in diam.; fruiting calyx 6 - 8 mm long, glandular hairy; seeds globose, 3 - 4 mm in diam., mottled dark grey or black.

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

*Distrib.* India: Dry hills along slopes up to 600 m altitude. Andhra Pradesh and Tamil Nadu.

Sri Lanka.

**2. *Dalechampia scandens*** L., Sp. Pl. 1054. 1753; Pax in Engl., Pflanzenr. IV.147.ix (heft 68): 32 - 34. 1919; Govaerts et al., World Checkl. & Bibl. Euphorbiaceae 2: 558. 2000.

## KEY TO THE VARIETIES

- 1 a. Leaves coriaceous, velutinous beneath **2. 3. var. *velutina***  
 b. Leaves chartaceous, scattered pubescent beneath 2
- 2 a. Fruiting calyx up to 2.5 mm long **2. 2. var. *kurzii***  
 b. Fruiting calyx 9 – 11 mm long **2. 1. var. *cordofana***

**2.1. var. *cordofana*** (Hochst. ex Webb) Müll.Arg. in DC. Prodr. 15(2): 1244. 1866; Sundararagh. & B.G.Kulkarni in Kew Bull. 35: 323. 1980. *Dalechampia cordofana* Hochst. ex Webb in Hook., Niger Fl. 178. 1849 (as *cordafana*); Chakrab. & N.P.Balacr. in J. Econ. Taxon. Bot. 32: 602. 2008.

Guj.: *Khajavani-vel, Khajoti.*

Twining or climbing undershrubs, 1 - 3 m high; stems sparsely and finely hispid-puberulous. Leaves 3 (- 5)-lobed up to the middle or to the base, chartaceous, finely pubescent beneath; middle lobe broadly elliptic-ovate to ovate-lanceolate, narrowly cordate at base, dentate-serrate along margins, acuminate at apex, 6 - 9 x 1 - 4 cm; lateral lobes oblong-lanceolate, obliquely subcordate at base, serrate along margins, acuminate, 2 - 6.5 x 1 - 2 cm; petioles 2 - 6 (- 9) cm long; stipules lanceolate to subulate, 2 - 5 x 1 - 1.5 mm; stipels caducous. Inflorescences bisexual, terminal or apparently axillary, head-like pleiochasium of cymules, consisting of 3 female flowers and many male flowers enclosed in a separate involucre on long peduncles. Male flowers: pedicels 2 - 3 mm long; involucre 2-lipped, 2 - 3.5 mm long, with fleshy broad scales of deformed flowers; calyx 3 - 5-partite, becoming reflexed; stamens 8 - 12; filaments connate into a short column, free above; anthers didymous. Female flowers: sessile or with up to 1 mm long pedicels; calyx unequally pinnatifid into 8 - 12 lobes, each lobe with a knob-like gland at tip, enlarging in fruit; ovary hispidulous; style 4 - 6 mm long; stigma peltate, ca 1 mm long. Fruits 3-loculed, 7 - 9 mm across, puberulous, brown; calyx 9 - 11 mm long with gland-tipped lobes and bristles; seeds globose, ca 3 mm across.

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

*Distrib.* India: Riversides, ravines and along railway lines, usually in rocky habitats, at low altitudes, usually seen in monsoon season. Rajasthan and Gujarat.

Tropical Africa, Arabia and Pakistan.

**2.2. var. *kurzii*** (Hook.f.) Chakrab. & N.P.Balacr. in J. Econ. Taxon. Bot. 32: 603. 2008. *Dalechampia kurzii* Hook.f., Fl. Brit. India 5: 468. 1888; Kanjilal et al. Fl. Assam 4: 222. 1940.

Scandent or prostrate shrubs, with softly hairy stems and petioles; petioles ca 2.5 cm long; male sepals 4 - 6.

*Fl. & Fr.* Aug. - Jan.

*Distrib.* India: Evergreen subtropical forests, at about 1000 m altitude. Mizoram.

Myanmar.

**2.3. var. *velutina*** (Wight) Müll.Arg. in DC., Prodr. 15(2): 1245. 1866; Chakrab. & N. P. Balacr. in J. Econ. Taxon. Bot. 32: 603. 2008. *Dalechampia velutina* Wight, Icon. Pl. Ind. Orient. t. 1881. 1852; Hook.f., Fl. Brit. India 5: 467. 1888.

Tam. *Maasu-kodi, Pulival-kodi.*

Evergreen twinning climbers, climbing up to 6 m, with stinging hairs; petioles 3 - 8 cm long; male sepals 6.

*Fl. & Fr.* Dec. - March.

*Distrib.* India: Moist hilly tracts, wayside thickets, roadside clearings on hills, up to 2000 m altitude. Tamil Nadu and Karnataka.

Endemic.



**3. *Dalechampia stenoloba*** Sundararagh. & B.G.Kulkarni in Kew Bull. 35: 325, f. 1. 1980; Sundararagh. et al. in Red Data Book 1: 144. 1987.

Scandent shrubs, ca 2 m tall; stems sparsely pilose. Leaves simple, digitately 3-lobed almost up to base; lobes linear-lanceolate to oblong-lanceolate, tapering to base, retrorsely dentate and incurved along margins, acute at apex, 13 - 17 x 2 - 2.3 cm, sparsely pilose along veins, glabrescent when mature; lateral nerves 15 - 18 pairs; petioles 4.5 - 5.5 cm long; stipules caducous. Inflorescences head-like cymes, axillary or terminal, solitary or paired on 4 - 6 cm long peduncles, elongating to 13 cm in fruits; involucre bracts 2, broadly ovate, the distal one 3-lobed, 2.5 - 3 cm long, pilose. Male cymes: not seen. Female cymes: condensed, 3-flowered; bracteoles ternate, ovate, ca 7 mm across; calyx-lobes 12, 2.5 - 3.5 x ca 0.8 mm, with 6 - 10 stipitate glands on both sides; ovary glabrous; style ca 1.2 cm long; stigma peltate. Fruits ovoid, ca 1 cm in diam.; pedicel of central fruit 0.8 - 1.5 cm long, of lateral fruits shorter.

*Fl. & Fr.* not known.

*Distrib.* India: Deciduous forests, up to 1000 m altitude, with annual rainfall of less than 100 cm, associated with Bamboo-Terminalia thickets. Karnataka (Chikmagalur Dist., Sukhalhatti forests of Lakkavali taluk). Rare and not collected since the type in 1968.

Endemic.

**4. *Dalechampia tannifolia*** Lam., Encycl. 2: 256. 1786; Thomas in J. Bombay Nat. Hist. Soc. 60: 475, ff. 1 - 2. 1963; Sebastine & Ramam. in Bull. Bot. Surv. India 8: 81. 1966.

Twining undershrubs with stinging hairs interspersed with simple hairs all over the plant. Leaves unlobed or palmately 3-lobed, when unlobed ovate-triangular, acuminate at apex, 5 - 10 x 4.5 - 8 cm, when lobed 15 - 20 x 5 - 8 cm, serrulate along margins, cordate and 5-nerved at base with a pair of recurved linear up to 1 cm long scales at the basal notch, coriaceous, puberulous above and beneath; central lobe elliptic-lanceolate, equal-sided, cuneate at base, acuminate at apex; lateral lobes falcate-lanceolate, unequal-sided, broader and rounded towards base, cuneate and narrower above, acuminate at apex; petioles 5 - 10 cm long; stipels linear, 4 - 6 mm long; stipules linear-lanceolate, 1 - 1.5 cm long, persistent. Inflorescences axillary peduncled heads; peduncles 6 - 12 cm long; bracts trilobed, 3 - 5 cm long, each enclosing the male and female inflorescences. Male cymes: compound, consisting of ca 16 flowers arranged in 5 cymose bundles of 3 flowers each and one terminal solitary flower; bracteoles 5; sepals 5 - 7, keeled; stamens 25 - 40, surmounted on an androphore. Female cymes: with 3 flowers, each subtended by a ciliate bract; sepals 12, pinnatifid, accrescent, velvety tomentose; ovary 3-lobed; stylar column broadened towards trilobed stigma. Fruits trilobed, subtended by persistent pinnately lobed sepals.

*Fl. & Fr.* not known.

*Distrib.* India: Maharashtra, Kerala and Tamil Nadu.

Madagascar.

*Note.* The original spelling given by Lamarck (1786) for the species is '*tannifolia*' and not '*tamifolia*' as given in some later treatments.

## 22. *Megistostigma* Hook.f.

Slender woody climbers with twining stems and stinging hairs. Leaves alternate, petiolate, trinerved at base; stipules conspicuous. Inflorescences terminal or leaf-opposed, racemose, bisexual, pedunculate, with 1 female flower at the proximal node and several to many male flowers at the distal nodes, bracteate. Male flowers: sepals 3, valvate, shortly connate at base; petals absent; disc trigonous-annular; stamens 3, free, alternating with calyx lobes; filaments short, thick; anthers bilocular; thecae divergent, attached to the base of thickened connective, dehiscent laterally and longitudinally; connective shortly produced at apex. Female flowers: sepals 3 + 3, imbricate; petals absent; disc absent; ovary 3-loculed, 3-lobed; locules 1-ovuled; styles thickened and united into a large subglobose mass. Fruits capsular, depressed, tricocous, consisting of 3 bivalved woody cocci; seeds globose; testa mottled; albumen fleshy; cotyledons broad, flat.

Myanmar to China, Philippines and Borneo; 5 species, one in India.

*Literature:* CHAKRABARTY, T. & N. P. BALAKRISHNAN (2006). The genera *Megistostigma* Hook.f. and *Tragia* L. (Euphorbiaceae) in India. *Rheedea* 16(1): 15 – 28.

***Megistostigma burmanicum*** (Kurz) Airy Shaw in *Kew Bull.* 23: 119. 1969; Chakrab. & N.P.Balakr. in *Rheedea* 16: 17, f. 1. 2006. *Tragia burmanica* Kurz in *J. Asiat. Soc. Bengal*, Pt. 2. *Nat. Hist.* 42(2): 244. 1873 & *Forest Fl. Burma* 2: 398. 1877; Hook.f., *Fl. Brit. India* 5: 466. 1888.

Large twining shrubs; branches appressed greyish puberulous when young, soon glabrous. Leaves ovate, widely ovate to ovate-oblong, cordate at base, irregularly serrulate towards base and the rest entire along margins, caudate-acuminate to cuspidate-acuminate at apex, (4 -) 7 – 24 x (2.5 -) 4 – 12 cm, chartaceous, puberulous, sparsely setose or strigose to glabrous above, sparsely greyish puberulous or hispid on midrib to glabrous beneath, 3 (- 5)-nerved at base; lateral primary veins ascending about halfway along the lamina; lateral nerves 4 or 5 per side above the basal; petioles 10 – 20 x 1 – 2 mm, sparsely puberulous to glabrous; stipules not seen. Racemes axillary, terminal or leaf-opposed, 8 – 15 cm long with one female flower at base and several male flowers above; peduncles 1.5 – 7 cm long; bracts and bracteoles ovate-lanceolate to linear-lanceolate. Male flowers: pedicels ca 0.5 mm long; bracts ca 2.5 x 1.5 mm; bracteoles ca 1.5 x 0.5 mm; sepals 3, orbicular-ovate to deltoid-ovate, 1.5 – 2 mm across, minutely papillose to glabrous; disc annular; stamens 3; filaments ca 0.3 mm long; anthers broadly obconic, ca 0.3 mm long. Female flowers: pedicels ca 0.5 mm long; bracts ca 4 x 3 mm; bracteoles ca 4 x 2 mm; sepals 6, oblong-lanceolate, 7 – 8 mm x ca 3 mm, accrescent and stellately spreading in fruit; ovary subglobose, 3-lobed, ca 2 x 2.5 mm, densely fulvous hirsute; styles united into a subglobose mass (ca 1 mm across). Fruits depressed, ca 0.8 x 2 – 2.5 cm, deeply 3-lobed, black when dry, ochraceous setose or hispid; fruiting sepals ovate, 1.5 – 2 x ca 1 cm, entire.

*Fl. & Fr.* March – May.

*Distrib.* India: Common in tropical evergreen forests, at about 600 m altitude. Nagaland.

Myanmar, China, Thailand and Malaysia.

### 23. *Pachystylidium* Pax & K.Hoffm.

Monotypic genus, from India, Indo-china to Java and the Philippines, not known from Sumatra and Borneo.

*Literature.* AIRY SHAW, H. K. (1969). Malesian and other Asiatic Euphorbiaceae CXII. Notes on the subtribe Plukenetiinae Pax. *Pachystylidium* Pax & Hoffm. Kew Bull. 23: 115 - 117.

***Pachystylidium hirsutum*** (Blume) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.ix - xi (heft 68): 108. 1919; S.Panda & A.P.Das in Rheedeia 7: 60. 1997. *Tragia hirsuta* Blume, Bijdr. Fl. Ned. Ind. 630. 1826. *T. gagei* Haines in J. Proc. Asiat. Soc. Bengal, 1919, n. s. 15: 317. 1920 & Bot. Bihar Orissa 2: 116. 1921.

Slender twining-climbing woody shrubs; stem with downwardly directed soft hairs, also with stinging hairs. Leaves distichous, oblong, cordate at base, shallowly dentate-serrate along margins, abruptly acuminate at apex, 10 - 18 x 4 - 8 cm, slightly setulose on upper surface, glabrous beneath; basal nerves 5 - 7, palmate; lateral nerves ca 3 pairs; petioles 2 - 4 cm long; stipules triangular, ca 1.5 mm long. Inflorescences terminal racemes, initially congested, female part elongated afterwards, 2.5 - 12 cm long; racemes bearing at base a few female flowers and many male flowers above; petals and disc absent; peduncles 1 - 4 cm long. Male flowers: calyx globose in bud; lobes 4 or 5, oblong; stamens 2, free, each inside a small, walled (circumvallated) cavity on receptacle; anthers broader than long; thecae strongly divergent at base, consequently sub-patent; almost horizontal; pistillode absent or minute. Female flowers: calyx lobes 6, oblong-ob lanceolate, ca 2 mm long; ovary covered with long appressed hairs, 3-loculed, each 1-ovuled; style ovoid-conical, terminated by 3 recoiled, short, thick-subulate stigmas. Fruits capsular, subglobose, 7 - 8 mm across, deeply 3-lobed, hispid; seeds globose, ca 5 mm in diam., smooth, sometimes strophiolate or tumid at chalazal region.

*Fl. & Fr.* March - May.

*Distrib.* India: Evergreen forests and scrub jungles, sea level to 600 m altitude. Orissa, Madhya Pradesh and Andhra Pradesh.

China, Laos, Vietnam to Java and Philippines.

### 24. *Plukenetia* L.

(syn. *Pterococcus* Hassk.)

Twining shrubs or undershrubs, monoecious. Leaves alternate, palmately 3 - 5-nerved at base; petioles 2-glandular at apex; stipules persistent. Flowers: in lateral or axillary androgynous racemes, with the female flowers towards the base. Male flowers: minute, fascicled; bracts 3-fid; calyx globose in bud, later valvately 4 or 5-lobed; petals and disc absent; stamens 8 - 13 (- 30), free, with short thick filaments; anthers erect with globose, didymous, parallel or divaricating thecae; pistillode absent. Female flowers: sepals 4 - 5, imbricate, lanceolate; ovary 4-locular; styles connate into a massive column, shortly 4-lobed. Fruits capsular, depressed with a nearly flat crown, dry or fleshy, with 3 or 4 granulate 2-valved cocci; seeds globose or turgidly lenticular, sometimes 3-ribbed on one side; testa crustaceous; endosperm fleshy; cotyledons broad, flat.

Mainly Neotropical, ca 13 species, some in Africa and one in SE. Asia; one in India.

**Plukenetia corniculata** Sm. in Nov. Acta Regiae Soc. Sci. Upsal. 6: 4. 1799; Hook.f., Fl. Brit. India 5: 464. 1888. *Pterococcus corniculatus* (Sm.) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.ix (heft 68): 22. 1919; D.Naras. et al. in J. Econ. Taxon. Bot. 13: 56, f.1. 1989; Govaerts et al., World Checkl. & Bibl. Euphorbiaceae 4: 1378. 2000.

Tel.: *Kodigandlam*.

Twining shrubs or undershrubs, subglabrous. Leaves oblong-ovate, truncate-subcordate at base, serrate-dentate along margins, caudate-acuminate at apex, 6 - 18 x 3 - 10 cm, membranous, puberulous, palmately 3 - 5-nerved at base, with 2 marginal glands on either side of basal nerves; petioles (1 -) 2 - 6 (- 9) cm long, with 2 glands at the base of the lamina on either sides; stipules subulate-lanceolate, 1 - 2 mm long. Racemes axillary or leaf-opposed, shortly pedunculate, 2 - 4.5 cm long. Male flowers: pedicels 1.5 - 2.5 mm long, articulated; sepals 4 or 5, ovate, ca 1 mm long; stamens 8 - 20, sessile on a cushion-like receptacle; anther-thecae diverging. Female flowers: pedicels ca 2.5 mm long, articulated; sepals 4, ovate-lanceolate, with 2 - 4 minute glands inside at base, ca 1.5 mm long; ovary ca 1 mm long; stigmas fused into a globose mass. Fruits on 3 - 5 cm long pedicels, depressed-globose, 4-winged, with nearly flat crown, 2 - 3.5 cm across.

*Fl. & Fr.* July - Aug.

*Distrib.* India: Subtropical evergreen forests or in thickets of moist deciduous forests and thickets, up to 800 m altitude. West Bengal, Sikkim, Arunachal Pradesh, Assam and Andhra Pradesh (Godavari Dist.).

Myanmar, Thailand, throughout Malesia to Celebes and the Philippines.

*Uses.* Tender leaves made into a paste used orally as laxative by Bagatas and Kondareddis tribal people of Andhra Pradesh.

## 25. *Tragia* Plum. ex L.

Herbs, usually twining climbers, perennial, monoecious, hispid with stinging hairs. Leaves alternate, simple or palmately 3-lobed or 3-partite, palmately 3 - 5-nerved at base, petiolate; stipules prominent, early caducous. Flowers: in terminal or leaf-opposed androgynous bracteate racemes, with many male flowers in upper portion and one or few female flowers in lower portion; petals and disc absent. Male flowers: calyx globose or obovoid, valvately 3 - 5-partite; stamens (1 -) 3, rarely more; filaments free or connate; anthers with contiguous parallel thecae. Female flowers: calyx of 6 imbricate, usually pinnatifid lobes, enlarged and spreading stellately in fruit; ovary 3-loculed; ovule one in each locule; styles united at base into a column, 3-fid, free and spreading above. Fruits capsular, depressed, consisting of 3 bivalved cocci; endocarp crustaceous; seeds 3, globose; testa crustaceous; endosperm fleshy; cotyledons broad, flat.

Mainly in America and Africa, a few in Asia, ca 168 species; 7 species in India.

*Literature.* CHAKRABARTY, T. & N. P. BALAKRISHNAN (2006). The genera *Megistostigma* Hook.f. and *Tragia* L. (Euphorbiaceae) in India. *Rheedea* 16(1): 15 - 28.

## KEY TO THE SPECIES

- 1 a. Leaves palmately 3-lobed **5. T. plukenettii**  
 b. Leaves unlobed 2
- 2 a. Leaves rounded, obtuse, acute to cuneate at base 3  
 b. Leaves cordate or narrowly so at base 4
- 3 a. Leaves 6 – 12 times longer than broad, 4 – 20 cm long, 0.4 – 2.6 cm broad, irregularly and distantly serrulate to entire along margins, attenuate or attenuate-caudate at apex, penninerved or very weakly trinerved at base with the basal lateral nerves extending 10 – 30 % way up the lamina; secondary venation mostly brochidodromous; lateral nerves 7 – 15 per side above the basal; fruiting calyx lobes very small (0.3 – 2 mm long) **7. T. sanjappae**  
 b. Leaves 1.5 – 5 times longer than broad, 3.5 – 16 x 1 – 6.5 cm, serrate to serrulate or dentate to denticulate along margins, caudate at apex, prominently trinerved at base with the basal lateral nerves extending 30 – 80 % way up the lamina; secondary venation predominantly semicraspedromous or often craspedromous; lateral nerves 3 – 7 per side; fruiting calyx lobes larger (1.5 – 3 mm long) **3. T. involucrata**
- 4 a. Mature branches, leaves and petioles usually glabrous to subglabrous; main body of fruiting sepals ovate to broadly ovate with lacerate-fimbriate margins, usually enclosing the fruits **4. T. montana**  
 b. Mature branches, leaves and petioles usually hispid or hirsute; main body of fruiting sepals linear or narrowly oblong or spatulate with 4 – 8 linear or narrowly oblong lobes per side, spreading stellately in fruit 5
- 5 a. Young shoots, upper branches and leaves densely golden yellow tomentose (mainly confined to the Nilgiri and Pulney hills) **1. T. bicolor**  
 b. Young shoots, upper branches and leaves scattered fulvous hirsute 6
- 6 a. Leaves 4 – 6 times longer than broad (5 – 14 x 1 – 5 cm), lanceolate to oblong-lanceolate, entire or with 2 – 3 teeth towards base or remotely serrate or serrulate at the basal half along margins, attenuate to attenuate-caudate at apex; lateral nerves brochidodromous **2. T. hispida**  
 b. Leaves 2 – 3 times longer than broad, ovate, cordate-ovate, ovate-oblong, ovate-elliptic, oblong, oblong-elliptic or deltoid-oblong, evenly serrate to serrulate or dentate to denticulate along margins, caudate or acuminate at apex; lateral nerves craspedromous to semicraspedromous **6. T. praetervisa**

**1. *Tragia bicolor*** Miq. in *Linnaea* 26: 222. 1853; Hook.f., *Fl. Brit. India* 5: 465. 1888; Gamble, *Fl. Madras* 2(7): 1332. 1925 (repr. ed. 2: 932. 1957). *T. miqueliana* Müll.Arg. var. *bicolor* (Miq.) Müll.Arg. in DC., *Prodr.* 15(2): 942. 1866.

Herbaceous climbers with twining stems; young shoots, upper branches and leaves golden yellow tomentose; branches glabrous in age. Leaves cordate-ovate (or narrowly so), orbicular-ovate to ovate-lanceolate, cordate to subcordate at base, serrate to serrulate along margins, caudate at apex, 4 – 16 x 1.5 – 6.5 cm, chartaceous, densely to sparsely appressed hispid, hirsute or scabrid above, coarsely tomentose or scattered hirsute (on nerves) to glabrous beneath, 3-nerved at base; lateral nerves 3 – 5 per side; petioles 5 – 35 x 0.8 – 1.8 mm; stipules caducous. Racemes 2 – 5 cm long; peduncles 0.5 – 3 cm long. Male flowers: pedicels ca 1 mm long; sepals 3, broadly ovate to suborbicular, 1 – 1.3 x 0.7 – 1 mm; stamens 3; filaments ca 0.3 mm long; anthers oblong, ca 0.3 mm long. Female flowers: sessile to subsessile; sepals 6, 3 – 5 x 3 – 4 mm, densely hirsute outside, enlarged and stellately spreading in fruit; ovary depressed, ca 1.5 mm across, densely hirsute; styles ca 2.5 mm long, connate below into a column; trifid at apex. Fruits subsessile, 4 – 5 x 8 – 10 mm, deeply 3-lobed, brown when dry, fulvous hirsute;

fruiting calyx 6–10 x 3–6 mm (including lobes); main body of sepals linear to oblong, ochraceous hispid or hirsute to glabrous outside, brown or ochraceous hirsute inside; lobes 4–8 per side, linear, 1.5–3 mm long, ochraceous hispid or hirsute.

*Fl. & Fr.* Throughout the year (flowers green or white with irritating smell).

*Distrib.* India: Common in evergreen temperate shola forests of Western Ghats between 1400–1700 m altitudes; rare in Karnataka and Tamil Nadu (Nilgiri & Pulney hills).

Endemic.

**2. *Tragia hispida*** Willd., Sp. Pl. ed. 4, 4: 323. 1805; Pax & K. Hoffm. in Engl., Pflanzenr. IV.147.ix–xi (heft 68): 79. 1919, p. p., excl. syn. *T. involucrata* var. *angustifolia* Hook.f.; Bennet, Fl. Howrah Dist. 210. 1979, p. p., excl. syn. *T. involucrata* var. *angustifolia* Hook.f.; Chakrab. & N.P.Balacr. in Rheede 16: 18. 2006; N.P.Balacr. & Chakrab., Fam. Euphorb. India 181. 2007. *T. involucrata* L. var. *hispida* (Willd.) Müll.Arg. in DC., Prodr. 15(2): 943. 1866. *T. involucrata* sensu Duthie, Fl. Gangetic Plain 2: 114. 1905, p. p., non L. 1753.

Climbers (noted up to 1 m high), trailing or twining, hispid with stinging hairs; young shoots densely hispid or hirsute; branches scattered hirsute. Leaves lanceolate to oblong-lanceolate, cordate or narrowly so at base, entire or with 2–3 teeth towards base or remotely serrate or serrulate at the basal half along margins, attenuate to attenuate-caudate at apex, 5–15 x 1–5 cm, membranous to chartaceous, scattered appressed hispid above and beneath, 3-nerved at base; lateral nerves 4–8 per side above the basal, brochidodromous; petioles 5–20 mm long, densely hirsute or hispid; stipules linear-lanceolate, 3–5 mm long, caducous. Racemes 5–18 cm long; peduncles 2–9 cm long; bracts linear, subulate or lanceolate or ovate (in female), 2–3 mm long. Male flowers: pedicels 0.5–1 mm long; sepals suborbicular, ca 1.5 mm across; stamens 3; filaments ca 0.3 mm long, united at base; anthers oblong to suborbicular, ca 0.4 mm long/across. Female flowers: subsessile; sepals 6, 4–6 mm long, pinnate-fimbriate; ovary subglobose, ca 2 mm in diam., hispid; styles ca 2.5 mm long. Fruits subsessile, depressed, deeply 3-lobed, 3–4 x 10–12 mm, scattered hirsute or hispid; fruiting sepals 8–10 x 6–8 mm (including lobes); main body of sepals oblong to linear, densely fulvous hispid to subglabrous outside, hirsute or sparsely hispid to glabrous inside; lobes of sepals 4–8 per side, linear to filiform, 2–6 mm long, often arching, densely fulvous hispid or hirsute.

*Fl. & Fr.* Aug. – March.

*Distrib.* India: Along thickets and scrubs, occasionally trailing on ground. Uttarakhand, Bihar, West Bengal and Assam.

Bangladesh.

*Note.* A rare species, noted to be common only at Mourigram of Howrah district and Kalyani of Nadia district in West Bengal in shrubberies and along railway track.

**3. *Tragia involucrata*** L., Sp. Pl. 980. 1753; Hook.f., Fl. Brit. India 5: 465. 1888, p. p. excl. *T. hispida* Willd. & excl. vars; Prain, Bengal Pl. 2: 952. 1903; Duthie, Fl. Gangetic Plain 2: 114. 1905, p. p.; T.Cooke, Fl. Bombay 2(3): 621. 1906, p. p.; Gamble, Fl. Madras 2(7): 1332. 1925 (repr. ed. 2: 931. 1957); Kanjilal et al., Fl. Assam 4: 222. 1940.

Asm.: *Germa-dhuka-guphu*; Beng.: *Bichuti*; Cachar: *Germa-dukha-guphu*, *Jong-masai*; Eng.: Indian stinging nettle; Hindi: *Barhanta*; Kan.: *Dulagondi*, *Haligilu*, *Kiriberalu*; Mal.: *Chorikannan*, *Choriyanam*, *Choriyanvalli*, *Chorikannan*, *Kodithoova*, *Kodithumba*, *Valli-choriyanam*; Mar.: *Khajakolti*, *Kolti*; Naga: *Jong-masai*; Sant.: *Sengel-sing*; Sans.: *Dhusparsha*, *Vrischikali*; Tam.: *Chenthatti*, *Kanchori*, *Kannichi*, *Ponnai-kanjan*, *Senthatti*; Tel.: *Chinna-duradagunta*, *Doola-gondi*, *Durada-gondi*, *Teegadura-dagunta*.

Herbs, shrubs (ca 1 m high) or climbers, with twining stems; branches densely hispid. Leaves successively smaller upwards, ovate to suborbicular or ovate-lanceolate to lanceolate or oblong-lanceolate to elliptic-lanceolate (very rarely 3-lobed at apex), rounded, obtuse, acute to cuneate at base, serrate to serrulate or dentate to denticulate along margins, caudate at apex, (2-) 5 - 16 x (0.4-) 1.5 - 7.5 cm, membranous to chartaceous, scattered hispid or hirsute above, densely or scattered hispid or hirsute beneath, 3 (-5)-nerved at base; lateral nerves 3 - 7 per side above the basal, predominantly semicraspedromous or often craspedromous petioles 2 - 40 mm long; stipules lanceolate, subhastate at base, 2 - 4 x 1 - 2 mm, caducous. Racemes 1.5 - 3 (-4) cm; peduncles 0.5 - 2 cm long; bracts glabrous. Male flowers: pedicels 1.5 - 2 mm long; sepals 3, wide-ovate to suborbicular, ca 1 mm across; stamens 3; filaments dilated at base; anthers oblong to suborbicular, ca 0.3 mm across. Female flowers: subsessile; sepals ca 3 x 1 mm, lobed along margins; ovary 1.5 - 2 mm in diam., hispid; styles 3 - 4 mm long, 3-fid at apex. Fruits subsessile, depressed-globose, deeply 3-lobed, 3 - 5 x 7 - 10 mm, evanescently hispid; fruiting sepals 5 - 8 x 2 - 3 mm (including lobes); main body linear to linear-oblongate, yellow or brown hispid outside, glabrous inside; lobes 4 - 6 per side, linear, 1.5 - 3 mm long, hispid.

*Fl. & Fr.* Throughout the year (flowers yellowish, pale blue or greenish).

*Distrib.* India: Common in deciduous forests, scrubs, outskirts of forests, waste places, along railway tracks, cultivated fields, roadsides on sandy humus soil or clayey loam, from sea level up to 1100 m altitude. Uttar Pradesh, West Bengal, Tripura, Orissa, Jharkhand, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Kerala, Lakshadweep and Tamil Nadu.

Sri Lanka and Bangladesh.

*Uses:* The roots are diaphoretic and alterative; administered in fever and pain in legs and arms. A paste of the roots used for the extraction of guinea worms. The same mixed with juice of *Ocimum sanctum* (Tulsi) is also used in treating itchy eruptions on the skin. The roots employed in old venereal complaints as well as a blood-purifier. The leaves used externally in headache. The fruit is a constituent of the Ayurvedic preparation, called *Kshara Guda*, used for enlarged spleen.

*Note.* Contact causes severe itching, irritation and inflammation on skin.

Chromosome numbers:  $2n = 20$  (Trivedi & Mukherjee, J. Indian Bot. Soc. 59, Suppl.: 100. 1980);  $2n = 56$  (Datta, Taxon 16: 341 - 350. 1967).

**4. *Tragia montana*** (Thwaites) Müll.Arg. in Linnaea 34: 183. 1865 & in DC., Prodr. 15(2): 944. 1866; Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.ix-xi (heft 68): 81. 1919; Chakrab. & N.P.Balacr. in Rheedeia 16: 20. 2006; N.P.Balacr. & Chakrab., Fam. Euphorb. India 182. 2007. *T. involucrata* var. *montana* Thwaites, Enum. Pl. Zeyl. 270. 1861. *T. involucrata* var. *cordata* Müll.Arg., l. c. 943. 1866; Hook.f., Fl. Brit. India 5: 465. 1888. *T. muelleriana* Pax & K.Hoffm., l. c. 80. 1919, excl.

var. *unicolor*; Gamble, Fl. Madras 2(7): 1332. 1925 (repr. ed. 2: 932. 1957). *T. muelleriana* var. *unicolor* auct. non (Müll.Arg.) Pax & K.Hoffm. 1919: A.N.Londhe in N.P. Singh et al., Fl. Maharashtra State: Dicot 2: 904. 2001, p. p., excl. syn.

Kan.: *Dulagondi*; Kon.: *Pimt-khatkhutli*; Mar.: *Khajkolti*.

Slender climbers, monoecious or dioecious, sparsely hispid-pubescent with patent simple stinging hairs; young shoots densely ochraceous hirsute; branches densely hispid but very soon glabrous. Leaves cordate-ovate to suborbicular or ovate-oblong to ovate-elliptic or deltoid-ovate to deltoid-oblong, cordate to subcordate at base, dentate, serrate or denticulate-serrulate along margins, caudate at apex, 4 – 16 x 1.5 – 8 cm, membranous to thinly chartaceous, scattered hispid or hirsute or scabrid above, sparsely so in age, scattered hispid or hirsute (mainly on nerves) to glabrous beneath, 3-nerved at base; lateral nerves 4 – 6 pairs, semicraspedromous to craspedromous; petioles 5 – 40 mm long. Racemes 3 – 7 cm long, unisexual or bisexual; peduncles 0.5 – 4 cm long; bracts narrowly ovate-oblong, linear or lanceolate, 1 – 4 mm long. Male flowers: pedicels 1 – 2 mm long; sepals 3, ovate or suborbicular, ca 1 mm long/across, glabrous; stamens 3; filaments triangular, ca 0.4 mm long; anthers oblong, ca 0.4 mm long. Female flowers: subsessile; sepals 6, ovate or broadly so, fimbriate along margins with many short and long sub-arcuate teeth or lobes, ca 5 x 5 mm; ovary 1 – 1.5 x 1.5 – 2 mm, 3-lobed, hispid; styles 2 – 5 mm long, trifid and recurved at apex. Fruits subsessile, depressed, 4 – 5 x 10 – 12 mm, deeply 3-lobed, evanescently hispid; fruiting sepals usually enclosing the fruits, 8 – 10 x 5 – 10 mm; main body of sepals ovate or broadly so, lacerate-fimbriate along margins, appressed puberulous, hirsute, sparsely pilose or glabrous outside, scattered puberulous, sparsely pilose or glabrous inside; marginal laciniae (or lobes) numerous, 1 – 3 mm long, often arching, fulvous hispid or hirsute.

#### KEY TO THE VARIETIES

- |   |                          |
|---|--------------------------|
| 1 a. Plants dioecious; inflorescences unisexual | <b>4.1. var. dioica</b>  |
| b. Plants monoecious; inflorescences bisexual   | <b>4.2. var. montana</b> |

**4.1. var. dioica** Chakrab. & N.P.Balacr. in Rheedeia 16: 21. 2006; N.P.Balacr. & Chakrab., Fam. Euphorb. India 182. 2007. *Tragia involucrata* sensu T. Cooke, Fl. Bombay 2(3): 621. 1906, p. p., non L. 1753.

Climbers with stinging hairs. Male flowers not seen. Female racemes leaf-opposed, 3 – 7 cm long, with ca 5 flowers per raceme; peduncles 1 – 4 cm long; flowers subsessile; sepals 6, ca 6 x 4 mm, wide ovate, fimbriate-laciniate; main body of sepals hirtellous; lobes of sepals 1 – 2 mm long.

*Fl.* Oct. – Nov.

Distrib. India: Deccan, Maharashtra.

Endemic.

#### **4.2. var. montana**

*Fl. & Fr.* Aug. – February (flowers yellowish green; fruits yellowish).



*Distrib.* India: Scarce on hill slopes of Western Ghats, between 650 - 1800 m altitudes. Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Note.* Chromosome number:  $2n = 96$  (Kothari et al., Taxon 29: 703 - 730. 1980 as *T. muelleriana*).

**5. *Tragia plukenetii*** Radcl.-Sm. in Kew Bull. 37: 688. 1983. *Croton hastatus* L., Sp. Pl. 1005. 1753 & Syst. Veg. ed. 13, 722. 1767 (non *Tragia hastata* Müll.Arg.). *Tragia cannabina* L.f., Suppl. Pl. 415. 1781, nom. illeg.; Duthie, Fl. Gangetic Plain 2: 114. 1905; Gamble, Fl. Madras 2(7): 1333. 1925 (repr. ed. 2: 932. 1957). *T. involucrata* var. *cannabina* (L.f.) Müll.Arg. in DC., Prodr. 15(2): 944. 1866; Hook.f., Fl. Brit. India 5: 465. 1888.

Guj.: *Moti-khajavani-vel*; Kan.: *Kiriturachi, Sannuturachi*; Mal.: *Cheru-kodithura*; Tam.: *Cheru-kanjuru, Cirru-kancharivay, Kanjuruthan, Karunchenthatti, Poonakkachi, Sirukaanchori*; Tel.: *Tella-duradagunta*.

Straggling, climbing shrubs, rarely erect herbs, ca 1 m high/long, sparsely hispid with stinging hairs; branches scattered hispid, glabrous in age. Leaves palmately 3-lobed or rarely unlobed or 2-lobed with one lateral lobe suppressed, 3 – 10 x 1.5 – 7 cm, chartaceous, sparsely hispid to glabrous above, sparsely hispid or hirsute on nerves to subglabrous beneath, 3-nerved at base; central lobe narrowly oblong or obovate in outline, 1.5 – 8 x 0.5 – 2 cm, irregularly crenate-serrate along margins; lateral lobes 0.5 – 4 x 0.3 – 1.5 cm; lateral primary veins entering into lateral lobes; lateral nerves (on central lobe) 3 – 7 per side, predominantly craspedromous; petioles 3 – 20 mm long. Racemes terminal on lateral shoots or leaf-opposed, 2 – 5 cm long, consisting of solely male flowers or associated with 1 – 3 female flowers at base; peduncles up to 3 cm long. Male flowers: pedicels ca 1 mm long; sepals widely ovate to suborbicular, ca 1 x 0.7 mm, glabrous or thinly pubescent outside; stamens 3; filaments ca 0.3 mm long; anthers oblong, ca 0.3 mm long. Female flowers: pedicels ca 1 mm long; sepals 1 – 2 mm long, fimbriate, thinly hispid outside; ovary ca 2 mm in diam., hirsute; styles ca 3 mm long, trifid at apex. Fruits depressed 3 – 5 x 6 – 8 mm, deeply 3-lobed, evanescently hispid; main body of fruiting sepals linear to oblong, 3 – 6 x 2 – 4 mm (including lobes); lobes 4 – 10 per side, linear, 1 – 2 mm long, fulvous hispid or hirsute.

*Fl. & Fr.* Throughout the year (flowers greenish or greenish yellow; fruits light green).

*Distrib.* India: Common in waste places, coastal scrubs, sides of paddy fields, cultivated fields, thickets, hedges, etc., up to 650 m altitude. Rajasthan, Gujarat, Madhya Pradesh, West Bengal, Andhra Pradesh, Maharashtra, Goa. Karnataka and Tamil Nadu.

Sri Lanka, Africa.

*Uses.* The roots are useful in guinea worms and in skin diseases. They are diaphoretic and given in fevers to cause perspiration. A decoction of the roots appears to be useful in bronchitis (*The Wealth of India, Raw Materials* 10: 272. 1976).

**6. *Tragia praetervisa*** Chakrab. & N.P.Balacr in Rheedeia 16: 23, ff. 2 – 3. 2006; N.P.Balacr. & Chakrab., Fam. Euphorb. India 183. 2007. *T. hispida* sensu auct. plur., non Willd., 1805: Gamble, Fl. Madras 2(7): 1332. 1925 (repr. ed. 2: 932. 1957); Ramamoorthy in C.J.Saldanha &

Nicolson, Fl. Hassan Dist. 349. 1976; A.N.Londhe in N.P. Singh et al., Fl. Maharashtra State: Dicot 2: 904. 2001. *T. involucrata* auct. non L., 1753: Thwaites, Enum. Pl. Zeyl. 270. 1861, p. p., quoad CP 2100 et CP 2951. *T. muelleriana* var. *cordata* sensu Bennet, Fl. Howrah Dist. 210. 1976, non (Müll.Arg.) Pax & K.Hoffm., 1919. *T. muelleriana* var. *unicolor* auct non (Müll.Arg.) Pax & K. Hoffm., 1919: S.M.Almeida, Fl. Savantwadi 1: 395. 1990, p. p.

Mar.: *Kach-kuile, Kulthi.*

Herbs or herbaceous climbers, up to 5 m high, monoecious or dioecious; young shoots tomentellous or scattered hirsute; stem and branches scattered hirsute or hispid, glabrous in age. Leaves ovate, cordate-ovate, ovate-oblong to ovate-elliptic, 3 – 18 x 1 – 6.5 cm, cordate or narrowly so at base, serrate (to serrulate) or dentate (to denticulate) along margins, caudate or acuminate at apex, membranous to thinly chartaceous, scattered hispid above and beneath (mainly on nerves), 3-nerved at base; lateral nerves 3 – 6 per side above the basal; petioles 0.5 – 5 (-7.5) cm long, glabrescent in age; stipules subulate, ca 4 mm long, caducous. Racemes terminal or leaf-opposed, 3 – 12 cm long, unisexual or bisexual; peduncles 0.5 – 3 cm long. Male flowers: pedicels ca 1 mm long; sepals ovate to suborbicular, ca 1.2 m across; stamens 3; filaments ca 0.4 mm long, slightly united at base; anthers widely oblong to suborbicular, ca 0.3 mm across. Female flowers: pedicels 0.5 – 1 mm long; sepals 2 – 5 x 1 – 3 mm; ovary ca 2 mm in diam., hirsute or hispid; style 1.5 – 2.5 mm long, trifid and recurved at apex. Fruits depressed, ca 3 x 8 mm, deeply 3-lobed, scattered hispid; fruiting sepals 5 – 10 x 2 – 5 mm (including lobes); main body of sepals linear to narrowly oblong or spatulate scattered fulvous puberulous or hispid to glabrous outside, glabrous inside; lobes of sepals 4 – 8 per side, linear to narrow oblong, 1.5 – 3 (- 5) mm long, often arching, densely fulvous hispid.

#### KEY TO THE VARIETIES

- 1 a. Plants monoecious; inflorescences bisexual  
b. Plants dioecious; inflorescences unisexual

- 6.1. var. praetervisa**  
**6.2. var. unicolor**

#### **6.1. var. praetervisa**

*Fl. & Fr.* Throughout the year but peak in August to February (flowers greenish or greenish-white; fruits yellowish green).

*Distrib.* Common in peninsular India in open forests and semievergreen forests; also along roadsides, on clayey soil, from sea level up to 1400 m altitude. West Bengal, Mizoram, Maharashtra, Goa, Karnataka, Kerala, and Tamil Nadu. Rare in West Bengal and Mizoram.

Sri Lanka.

*Uses.* A poultice prepared from the roots is applied to forehead for relief from headache (*The Wealth of India, Raw Materials* 10: 272. 1976).

**6.2. var. unicolor** (Müll.Arg.) Chakrab. & N.P.Balacr in Rheedeia 16: 25. 2006; N.P.Balacr. & Chakrab., Fam. Euphorb. India 184. 2007. *T. miqueliana* Müll.Arg. var. *unicolor* Müll.Arg., l. c. 943. 1866. *T. muelleriana* Pax & K.Hoffm. var. *unicolor* (Müll.Arg.) Pax & K.Hoffm., l. c. 81. 1919.

*Fl.* Oct. – Nov.

*Distrib.* India: Karnataka, 'Malabar & Concan'.

Endemic.

**7. *Tragia sanjappae*** Chakrab. & N.P.Balacr in Rheedeia 16: 25, f. 4. 2006; N.P.Balacr. & Chakrab., Fam. Euphorb. India 184. 2007. *Tragia involucreta* L. var. *angustifolia* Hook.f., Fl. Brit. India 5: 465. 1888; Gamble, Fl. Madras 2(7): 1332. 1925 (repr. ed. 932. 1957); D. Naras. et al. in J. Econ. Taxon. Bot. 13: 57, f. 2. 1989.

Climbing herbs, ca 75 cm high; stem and branches hispid when young, glabrous in age. Leaves narrowly oblong-lanceolate to linear-oblong, 4 – 20 x 0.4 – 2.5 cm, narrowly cuneate to cuneate-attenuate at base and obscurely contracted cordate at extreme base, irregularly and distantly serrulate to entire along margins, attenuate to attenuate-caudate at apex, chartaceous, scattered hispid or hirsute above and on nerves beneath, penninerved or very weakly trinerved at base with the basal pair of lateral nerves extending 10 – 30 % way along the lamina; upper lateral nerves 7 – 15 per side, predominantly brochidodromous; petioles 3 – 35 x 0.7 – 1.5 mm. Racemes up to 2 cm long; peduncle up to 1 cm long. Male flowers: pedicels up to 2 mm long; sepals suborbicular, ca 1 x 0.7 mm; stamens 3; filaments ca 0.5 mm long, connate at base; anthers ca 0.4 mm long. Female flowers: subsessile or with up to 1 mm long pedicels; sepals linear, ca 3 x 1 mm, pinnatifid; ovary ca 1.5 mm across, hispid; style 3 – 4 mm long, trifid and recurved at apex. Fruits subsessile, depressed, deeply 3-lobed, 3 – 4 x 8 – 10 mm, scattered hispid; fruiting sepals 4 – 6 x 1 – 3 mm (including lobes); main body linear, hispid outside, glabrous inside; lobes 5 – 8 per side, linear or subulate, 0.3 – 2 mm long, hispid or hirsute.

*Fl. & Fr.* Sept. – Jan.

*Distrib.* India: Rare in semievergreen forests between 65 – 1300 m altitudes. Andhra Pradesh, Tamil Nadu and Kerala.

Endemic.

### Tribe 9. PYCNOCOMEAE Hutch. (N. P. Balakrishnan & T. Chakrabarty)

Trees, dioecious or monoecious; indumentum simple, often glandular or absent. Leaves alternate, opposite or verticillate, simple, penninerved, eglandular, sometimes resinous; stipules caducous or absent. Inflorescences axillary, racemose or paniculate or contracted into capitula. Male flowers: calyx closed in bud, splitting into 3 or 4 valvate sepals; petals absent; disc glabrous and receptacular or absent; stamens 15 - many, free; anthers sometimes with enlarged connectives; pollen grains oblate or subglobose, 3-colporate; colpi short and narrow, inoperculate; sexine tectate-perforate, coarsely reticulate, gemmate or spinulose; pistillode absent. Female flowers: sepals 3 - 7, imbricate; petals absent; disc glabrous or absent; ovary (2 or) 3-locular; styles bifid or unlobed. Fruits capsular, often thick-walled and subdrupaceous; seeds ecarunculate; testa dry or fleshy.

Tropical Africa and Asia, 7 genera; 1 in India.

### 26. *Blumeodendron* (Müll.Arg.) Kurz

Trees, dioecious; leaf-buds and inflorescences covered with gum. Leaves alternate,

opposite or whorled or sometimes partly spirally arranged; petioles long, prominently thickened and kneeed at both ends, exstipulate. Inflorescences axillary or terminal clusters of flowers or subumbelliform racemes or panicles. Male flowers: disc fleshy, divided into many lobes; stamens 14 - 35, arranged between disc lobes; filaments long, twisted at apex; anthers short, adnate to the short connective, 2-locular, introrse; pistillode dentate-lobed. Female flowers: sepals as in male; staminodes absent; disc annular, fleshy, not distinct from ovary; ovary 2 or 3-locular; styles 2 or 3, subulate, elongated, articulate at base, spreading and recurved. Fruits woody on thickened pedicels, subglobose, smooth, dehiscing into 2 - 3 bivalved parts; seeds 1 - 3, edible.

Nicobar Islands, Myanmar, Thailand, through Malesia to New Guinea and Bismarck Islands, 5 species; 2 in India.

#### KEY TO THE SPECIES

- 1 a. Leaves whorled; basal pair of lateral nerves extending half way up the lamina; minor nerves obscure; surface of leaves shagreened or roughened; male inflorescence a condensed cyme  
**1. B. kurzii**
- b. Leaves mostly alternate or subopposite; basal pairs of lateral nerves extending only for one-third way up the lamina; minor nerves prominent; surface of leaves smooth; male inflorescence elongated, pseudo-racemose  
**2. B. tokbrai**

**1. Blumeodendron kurzii** (Hook.f.) J.J.Sm. apud Koord. & Valetton, Meded. Dept. Landb. Ned.-Indie 10: 463. 1910; Chakrab. & N.P.Balacr. in J. Econ. Taxon. Bot., Addit. Ser. 9: 27, f. 5. 1992. *Mallotus kurzii* Hook.f., Fl. Brit. India 5: 427. 1887; M.P.Nayar & A.R.K.Sastry in Red Data book of Indian Pl. 3: 118. 1990. *Blumeodendron tokbrai* sensu Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 245. 1873, non *Elateriospermum tokbrai* Blume, 1826.

Trees, 7 - 15 m tall, entirely glabrous; terminal branchlets 3 - 5 together in a whorl, thickened at nodes. Leaves in whorls of 3 - 5, elliptic to oblong-lanceolate or broadly ovate, obtuse, cuneate or rounded at base, entire, obtuse or shortly caudate-acuminate at apex, 10 - 50 x 5 - 21 cm, stiffly coriaceous, shagreened; midrib with 2 small blotch-like glands at base above; lateral nerves 4 - 10 pairs; reticulations fine, obscure, forming minutely sunken pattern on upper surface; petioles (2 -) 3 - 8 (- 11) cm long; stipules obsolete. Male flowers: borne in axils of fallen leaves at thickened knot-like nodes, condensed fascicles, (1 -) 2 - 4 cm long, shortly peduncled; pedicels 1 - 1.2 cm long; calyx lobes 3 - 4 mm long; stamens ca 30, free, 3 - 4 mm long; anthers globose. Female flowers: fascicled at thickened leafless nodes; calyx cup-shaped, 4-lobed or -dentate; ovary oblong, mostly 2-loculed. Fruits subglobose, 3 - 4 cm in diam., unlobed, woody, 2 - 3-locular, on thickened 8 - 10 mm long pedicels.

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

*Distrib.* India: Lowland humid tropical mixed forests and coastal sub-marshy areas on sandy loam. Andaman & Nicobar Islands.

Myanmar, Thailand, W. Malesia to New Guinea.

*Uses.* Seeds are edible and eaten by birds.

**2. Blumeodendron tokbrai** (Blume) Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 245. 1873 & Forest Fl. Burma 2: 391. 1877, tantum quoad synonym. Blume, emend. J.J.Sm. in Meded.

Dept. Landb. Ned.- Indie 10: 462. 1910; Chakrab. in J. Econ. Taxon. Bot. 6: 430. 1985.  
*Elaterospermum tokbrai* Blume, Bijdr. Fl. Ned. Ind. 621. 1826.

Trees, 20 - 30 m tall. Leaves in pseudo-whorls, elliptic to obovate-elliptic or broadly so, acute to obtuse at base, entire along margins acuminate at apex, 13 - 20 x 5 - 8 cm, stiffly coriaceous; lateral nerves 7 - 9 pairs, faint above, distinct beneath; minor nerves obscure to faint above, prominent and raised beneath, closely parallel, running at right angles to the midrib; petioles 2 - 5 cm long. Flowers: sepals valvate, touching in bud; disc annular; stamens 14 - 35. Fruits subglobose, 3 - 3.5 cm in diam., 3-locular, woody, with grooved sutures, tardily dehiscent, glabrous.

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

*Distrib.* India: Inland evergreen forests, at ca 75 m altitude. Andaman & Nicobar Islands.

Malaya, Sumatra, Java, Moluccas and New Guinea.

*Notes.* Very rare in Great Nicobar Island. Recognizable by the smooth leaves having distinctly raised and closely parallel tertiary nerves.

## Subfamily II. CROTONOIDEAE Pax (T. Chakrabarty & N. P. Balakrishnan)

Trees, shrubs or herbs; coloured latex present or absent; indumentum simple, stellate or lepidote. Leaves alternate, opposite or rarely whorled, stipulate or exstipulate, simple or palmately lobed or compound. Inflorescences axillary or terminal, dichasial to racemose or spicate; perianth single, or in male or in both sexes double, valvate or imbricate; disc present or absent; stamens 1 or 2-seriate, (3 -) 5 - many, outer series alternate with sepals or central in the flower; filaments free or connate; ovary (2 -) 3 (- 4)-loculed; styles bifid or multifid; ovules one in each locule, anatropous. Fruits capsular, sometimes drupaceous and indehiscent; seeds carunculate or ecarunculate; testa sometimes fleshy; endosperm copious, often oily.

Pantropical, 12 tribes; 9 tribes, 16 genera and 60 species in India.

### KEY TO THE TRIBES

- 1 a. Indumentum mostly simple, sometimes various; petals absent; pollen grains colporate or porate, sexine reticulate to clavate 2
- b. Indumentum simple, or partly mixed with malpighiaceous or stellate hairs; petals usually present; pollen grains inaperturate, sexine with 'crotonoid' pattern 5
- 2 a. Plants mostly monoecious; laticifers articulated; leaves palmately lobed or compound; basal nerves palmate, upper leaves pinnate; pollen grains 3-nucleate 3
- b. Plants mostly dioecious; laticifers not articulated; leaves simple; all nerves pinnate; pollen grains 2-nucleate 4
- 3 a. Leaves palmatifid, leaflets at least basally united, 3 - 9-nerved; styles bifid; pollen grains colporate; seeds carunculate or ecarunculate; endosperm oily **Tribe 8. MICRANDREAE**
- b. Leaves 3-foliolate, leaflets completely free; styles mostly multifid; pollen grains periporate; seeds carunculate; endosperm starchy **Tribe 7. MANIHOTEAE**
- 4 a. Leaves not pellucid-punctate; stipules free; inflorescences axillary, mostly spicate or paniculate; pollen grains colporate **Tribe 1. ADENOCLINEAE**

- b. Leaves pellucid-punctate; stipules connate; flowers in clusters opposite to the leaves; pollen grains periporate **Tribe 5. GELONIEAE**
- 5 a. Sepals of male flowers fused and completely covering petals in bud; seeds ecarunculate **Tribe 2. ALEURITIDEAE**
- b. Sepals of male flowers imbricate, free or if connate then not completely covering petals in bud; seeds carunculate or ecarunculate 6
- 6 a. Indumentum (at least in part) of stellate or lepidote hairs 7
- b. Indumentum simple 8
- 7 a. Petals present or sometimes absent, if present then free; fruits capsular; seeds carunculate **Tribe 4. CROTONEAE**
- b. Petals present and somewhat coherent into a tube; fruits drupaceous; seeds ecarunculate **Tribe 9. RICINODENDREAE**
- 8 a. Stamens 3 - 5; filaments connate; pollen sexine finely clavate **Tribe 10. TRIGONOSTEMONEAE**
- b. Stamens mostly more than 5, free or connate; pollen sexine coarsely clavate 9
- 9 a. Leaves unlobed; inflorescences terminal or axillary, racemose or spicate to paniculate; fruits capsular; seeds carunculate or ecarunculate **Tribe 3. CODIAEAE**
- b. Leaves mostly palmately lobed or compound; inflorescences terminal, mostly dichasial; fruits capsular or drupaceous; seeds carunculate or ecarunculate **Tribe 6. JATROPHEAE**

**Tribe 1. ADENOCLINEAE** (Müll.Arg.) G.L.Webster

Trees, shrubs or herbs; indumentum simple, malpighiaceus or stellate. Leaves alternate, rarely opposite, simple, penninerved or trinerved; stipules free. Inflorescences terminal, axillary or opposite to the leaves, spicate to paniculate or glomerate. Male flowers: sepals 3 - 5, imbricate, free or connate; petals absent; disc dissected or absent; stamens 3 - 30; pollen grains 2-nucleate, 3-colporate, colpi operculate or inoperculate, sexine with *Croton*-pattern; pistillode present or absent. Female flowers: sepals 3 - 5, imbricate, free or connate; petals absent; disc dissected or annular, sometimes staminodal; ovary 2 - 6-locular; styles bifid, stigmatiform. Fruits capsular or drupaceous; seeds ecarunculate.

Tropical America, Africa, Asia and Australia, 6 genera; one in India.

**27. Endospermum** Benth., nom. cons.

Trees, evergreen, usually dioecious, rarely flowers bisexual, unarmed, with watery or coloured sap, sometimes myrmecophilous; indumentum usually of simple or sometimes partly or completely of stellate hairs. Leaves alternate, petioled, peltate or non-peltate, usually palmately 3-nerved or rarely pinnately nerved; glands often present at the base of the leaf-blade and at the forks of lateral nerves beneath and also often along the margins above; petioles usually constricted at one or both the ends, leaving large conspicuous scars on branches; stipules small, caducous. Inflorescences thyrsoid, usually branched; bracts and bracteoles concave. Flowers unisexual or occasionally bisexual; calyx campanulate, 3 - 6-lobed or dentate; petals absent. Male flowers: clustered; stamens (5 -) 6 - 10 (- 12), spirally arranged on an androphore; filaments fused at base, free above; anthers peltate, (3 -) or 4-loculed, dehiscing by longitudinal slit; pistillode absent. Female flowers: solitary; ovary (1 -) 2 - 3 (- 7)-loculed, with one ovule in each locule; styles united into a disc with lobed sessile stigma; staminodes absent. Bisexual flowers: clustered or solitary; calyx lobed; stamens 5 or ca 10, either at the base of the ovary or spirally arranged on a short androgynophore; otherwise androecium and gynoecium as in male

and female flowers. Fruits drupaceous, indehiscent, 2 - 3 (- 7)-loculed; exocarp thin to rather thick and fleshy; endocarp thin, woody and fibrous. Seeds 2 or 3, ecarunculate; testa hard, reticulately ribbed; endosperm whitish to orange, soft; embryo very small, flat; cotyledons 2, elliptic or ovate; radicle triangular, acute.

Tropical and subtropical regions of NE. India, Andaman Islands, Myanmar, S. & SE. China, Thailand, Vietnam to Malesia, tropical Australia (Queensland) and up to Fiji Islands, ca 13 species; 3 in India.

*Literature.* SCHAEFFER, J. (1971). Revision of the genus *Endospermum* Bth. (Euphorbiaceae). *Blumea* 19: 171 - 192.

#### KEY TO THE SPECIES

- |   |                              |
|---|------------------------------|
| 1 a. Petiole glands 0 - 2; male inflorescences simple or almost so    | <b>2. <i>E. diadenum</i></b> |
| b. Petiole glands 2; male inflorescences compound, paniculate racemes | 2                            |
| 2 a. Petiolar glands globose, 2 - 3 mm in diam                        | <b>1. <i>E. chinense</i></b> |
| b. Petiolar glands cylindrical or spiniform, 3 - 4 mm long            | <b>3. <i>E. peltatum</i></b> |

**1. *Endospermum chinense*** Benth., Fl. Hongk. 304. 1861; Hook.f., Fl. Brit. India 5: 458. 1887; A.M.Cowan & Cowan, Trees N. Bengal 119. 1929; Kanjilal et al., Fl. Assam 4: 204. 1940.

Asm.: *Bola*, *Halud-chaki*, *Paklau-arong*, *Thing-aiveng*; Nep.: *Seti-kath*.

Trees. Leaves not peltate, rhombate or elliptic to broadly ovate, truncate or rounded to acute at base, subacute to obtuse at apex, 8 - 15 x 5 - 12 cm, palmately 3 - 5-nerved at base, puberulous along nerves beneath, with 2 conspicuous globose yellow-brown glands of 2 - 3 mm diam. at base of the blade near the apex of the petiole, often with up to 5 similar glands at the branching of lateral nerves beneath; lateral nerves 3 - 5 pairs; petioles 3 - 10 cm long. Male inflorescences paniculate, up to 21 x 8 cm, with lateral branches up to 4 cm long; calyx campanulate, conspicuously 4-lobed, ca 2 mm across; stamens ca 10; androphore 3.5 - 4 mm long; anthers 4-loculed, 4-valved. Female inflorescences simple, racemose; calyx ca 3 mm across. Infructescences racemiform, up to 18 cm long, with up to 2.5 cm long side branches. Fruits didymous, 2 or 3 (- 4)-loculed, 12 - 15 x 8 - 10 mm, tomentose; stigma 1 - 2 mm across; pericarp thin.

*Fl. & Fr.* April - Oct.

*Distrib.* India: Evergreen subtropical forests, on sandy soil, up to 700 m altitude. Sikkim, Assam and Meghalaya.

China, Myanmar, Thailand, N. Vietnam, Hongkong and Swatou Islands.

**2. *Endospermum diadenum*** (Miq.) Airy Shaw in Kew Bull. 14: 395. 1960 & 36: 293. 1981. *Melanolepis diadema* Miq., Fl. Ned. Ind., Eerste Bijv. 455. 1860. *Endospermum malaccense* Benth. ex Müll.Arg. in Flora 47: 469. 1864; Hook.f., Fl. Brit. India 5: 458. 1887. *Mallotus diadenus* (Miq.) Müll.Arg. in DC., Prodr. 15(2): 959. 1866.

Trees, 15 - 35 m tall. Leaves not peltate, obovate to broadly ovate, cordate to rounded, truncate or acute at base, rounded to obtuse or acute at apex, 7 - 25 x 4 - 22 cm, palmately 3 - 9-nerved at base; margins provided with numerous small glands above; lateral nerves 3 - 5 pairs,

often with a gland each at the axils of lateral nerves; petioles 7 - 25 cm long with 2 or 1 small glands at apex or rarely glandless. Male inflorescences simple or with very short side axes, 7 - 17 cm long. Flowers: subsessile; calyx 4 or 5-lobed, 1 - 1.3 x 1 - 1.6 mm; stamens 9 - 11; androphore 1.7 - 2.5 mm long; anthers 4-loculed, 4-valved. Female inflorescences simple, 5 - 15 cm long. Flowers: pedicels 1.5 - 5 mm long; calyx 4- or 5-lobed; ovary broadly ellipsoid, ca 3 x 2 mm, 2 - 3-loculed; stigma ca 1.5 mm wide. Infructescences simple or occasionally with 1 - 2 cm long side branches, stellate hairy, sometimes with 2 or 3 fruits in each bract. Fruits globose, didymous, mostly 2- or 3-lobed, 5 - 8 mm across, minutely stellate-hoary and glandular, wrinkled when dry.

*Fl. & Fr.* Not known.

*Distrib.* India: Primary and secondary forests, up to 400 m altitude. Andaman Islands.

Thailand and southwards through Malesia up to New Guinea.

*Uses.* Timber is durable and useful for house building and making planks and logs.

**3. *Endospermum peltatum*** Merr. in Publ. Bur. Sci. Gov. Lab. 35: 35. 1905; Chatterjee in Kew Bull. 4: 564. 1950. *E. malaccense* sec. C.E. Parkinson, Forest Fl. Andaman Isl. 238. 1923, non Benth. ex Müll.Arg. 1864.

Trees, (10 -) 20 - 35 (- 45) m tall. Leaves crowded towards the tips of branchlets, peltate or not, elliptic, orbicular or oblong-ovate, rounded to truncate or cordate at base, entire along margins, rounded to acute or apiculate at apex, (6 -) 10 - 25 x 9 - 18 cm, subcoriaceous, glabrous above, scattered stellate puberulous on nerves beneath; basal nerves 7 - 9, palmate; lateral nerves 4 - 9 pairs; petioles 6 - 8 (- 12) cm long, with 2 cylindrical spiniform glands at the junction of the petiole with lamina. Male inflorescences axillary, pyramidal-paniculate, 13 - 35 cm long, with 1 - 9 cm long peduncle and up to 7 cm long lateral branches, densely stellate hairy to sparsely pubescent. Flowers: pedicels 1 - 2.5 mm long; calyx shortly cupular, obscurely 4 or 5-dentate, 0.8 - 1.5 x 2 - 2.8 mm; disc extra-staminal, 4 - 5-angled, lobulate; stamens ca 10; androphore glabrous, 2 - 4 mm long, exserted, ca 0.5 mm across; anthers 4-loculed, 3-valved. Female flowers: not seen. Infructescences paniculate, ca 25 cm long, with up to 7 cm long lateral branches, hairy; pedicels ca 5 mm long; calyx 4 or 5-toothed, 2 - 2.5 mm across; stigma flattened.

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

*Distrib.* India: Rare in primary evergreen forests, along streams and hill slopes, up to 200 m altitude. Andaman & Nicobar Islands.

Thailand to Malesia.

*Uses.* Seeds edible and contain good oil; wood useful for making matches.

## Tribe 2. ALEURITIDEAE Hurus.

Trees or shrubs; laticifers not articulated with scanty or absent latex; indumentum simple or stellate. Leaves alternate, pinnately or palmately veined or lobed, eglandular or with laminar glands; stipules present or absent. Inflorescences terminal or axillary, dichasial-paniculate or reduced to cymose clusters. Male flowers: sepals closed in bud, splitting into valvate segments; petals mostly 5 (6 - 13), free, imbricate; disc dissected or of intrastaminal segments; stamens 8 -



20 (- 100) with free filaments; pollen grains globose, inaperturate, with *Croton*-pattern; pistillode absent. Female flowers: sepals and petals as in male flowers; disc lobed, dissected or obsolete; ovary 2 - 5-locular; styles bifid. Fruits drupaceous, indehiscent or tardily dehiscent or capsular; seeds ecarunculate; testa dry; endosperm copious, oily, straight; cotyledons broad, flat.

Tropical or subtropical or rarely temperate regions, in Old and New World, 15 genera; 2 in India.

*Literature.* AIRY SHAW, H. K. (1966). Malaysian and other Asiatic Euphorbiaceae. LXXII. Generic segregation in the affinity of *Aleurites* J. R. & G. Forst. Kew Bull. 20(3): 379-395. STUPPY, W. et al. (1999). Revision of the genera *Aleurites*, *Reutalis* and *Vernicia* (Euphorbiaceae). Blumea 44: 73 - 98. VAN WELZEN, P. C. 1999. Phylogenetic considerations of Euphorbiaceae tribe Aleuritideae. Ann. Missouri Bot. Gard. 86: 894 - 903.

*Notes.* *Vernicia* Lour., an Asian genus of three species, sometimes included in this genus, is treated as a separate genus here, following Airy Shaw (1966).

#### KEY TO THE GENERA

- 1 a. Indumentum distinctly stellate; stamens 15 - 20 in 4 whorls; ovary 2-locular; fruits drupaceous, indehiscent or tardily dehiscent **28. *Aleurites***
- b. Indumentum of bifid or simple hairs; stamens 7 - 12, in 2 whorls; ovary 3 - 5-locular; fruits dry dehiscent **29. *Vernicia***

#### **28. *Aleurites* J.R.Forst. & G.Forst.**

Trees, evergreen or deciduous, with stellate tomentum. Leaves spirally arranged, simple, long petioled, entire or palmately 3 - 7-lobed; main nerves 3 - 7; petioles long, biglandular on anterior side of apex; stipules small, early caducous. Inflorescences laxly much-branched panicle or corymbose cymes, terminal or upper axillary; flowers unisexual or rarely imperfectly bisexual. Male flowers: expanding before female flowers; calyx subglobose, spathaceously dividing into 2 - 5 subequal valvate lobes; petals 5, imbricate or contorted in bud, spatulate, conspicuous, longer than sepals; disc glands 5, free, alternipetalous; stamens 15 - 20, arising in 4 distinct whorls from the conical receptacle; filaments connate at base into a hairy column, inner 3 - 4 longer; anthers erect; thecae 2, parallel; connectives broad; pistillode absent. Female flowers: calyx and corolla same as in male; disc absent or consisting of 5 minute glands, episepalous; ovary 2-locular; styles 2 - 5, free, each 2-lobed or 2-partite with 2 linear stout arms; ovule solitary in each locule. Fruits drupaceous, large, globose; pyrene 1, 1 - 5-loculed, indehiscent or tardily dehiscent; exocarp thick, woody; endocarp crustaceous; seeds 3, globose with thick woody smooth or rugose testa.

S. E. Asia to E. Asia, from N. E. India, Myanmar, Thailand, China, Japan, Malesia to Pacific Islands, 2 species; one in India.

***Aleurites moluccana*** (L.) Willd., Sp. Pl. ed. 4, 4: 590. 1805; Hook.f., Fl. Brit. India 5: 384. 1887. *Jatropha moluccana* L., Sp. Pl. 1006. 1753.

Eng.: Candle-nut tree; Hindi: *Jungli-akhrot*; Tam.: *Katakrote*.

Trees, 15 - 20 m tall; young shoots and leaves stellate pubescent. Leaves polymorphous, crowded at the ends of branches, ovate to lanceolate or broadly rhombate or deltoid and

obtusely or acutely 3 - 7-lobed, palmately 3 - 7-nerved at base; lobes short, acuminate, obtuse or truncate; petioles 5 - 10 cm long, stellate pubescent, biglandular at apex. Inflorescences lax-flowered terminal panicles of thyrsoid cymes; secondary rachis often trichotomous, 10 - 15 cm long; bracts subulate, early caducous. Male flowers: calyx subglobose in bud, splitting irregularly into 2 or 3 valvate segments, velvety tomentose; petals 5, imbricate in bud, 6 - 8 mm long, lanceolate or obovate; disc urceolate, with 5 glands; stamens 15 - 20, verticillate in 3 - 5 rows; filaments free, hairy, produced into a small blunt point; anthers introrse. Female flowers: sessile at the divisions of panicles; calyx cylindrical and conical, splitting into 2 or 3 segments, ca 6 mm long; petals 5, narrowly oblong, 9 - 10 mm long, white; disc urceolate with 5 glands; ovary densely hispid, 2-loculed; styles 2, each bifid with linear-subulate arms. Fruits subglobose or ovoid, laterally compressed, 5 - 6 cm in diam., fleshy, smooth, olive-coloured when ripe; stone 1 - 5-loculed, 1 or 2-seeded, hard; seeds acute at apex, hard; testa woody, rugose, thick.

*Fl.* Feb. - June; *Fr.* June - Dec.

*Distrib.* India: Cultivated in tea gardens, often seen naturally regenerating and found in secondary or disturbed forests, up to 600 m altitude. West Bengal, Assam, Orissa, Maharashtra, Karnataka, Kerala and Tamil Nadu (Javadi hills).

Native of S. E. Asia and Pacific Islands. Widely cultivated.

*Uses.* The kernel of the seed is edible, has a pleasant taste, resembling that of a walnut. It is cooling, improves appetite, carminative and acts as a cardio-tonic (Kirtikar & Basu, Indian Med. Pl. 3: 2248. 1935). The oil extracted from seeds used for making candles and hence the tree bears the name 'candle-nut tree'. It also finds use in paint and varnish industry. The oil is a mild purgative, is superior to castor oil in having no offensive smell or taste, and produces cathartic action without nausea. The oil cakes used as fertilizers. The wood is soft and used for packing cases. Roots yield a brown dye.

*Notes.* Chromosome numbers:  $n = 11$  (Datta in Taxon 16: 344. 1967) and  $n = 22$  (Bedi et al., Taxon 29: 353. 1980).

## 29. Vernicia Lour.

Trees, evergreen or deciduous, monoecious or dioecious; indumentum with simple or bifurcate hairs. Leaves alternate, simple, entire or shallowly palmately 3 - 7-lobed; main basal nerves 3 - 7, pinnate along midrib; petioles long, striate, biglandular on anterior side of apex; stipules small, early caducous. Inflorescences terminal or upper axillary, laxly much-branched paniculate or corymbose cymes with solitary terminal female flower and several male flowers per cyme; flowers unisexual or imperfectly bisexual, showy. Male flowers: expanding before female flowers; calyx subglobose, spathaceously dividing into 2 - 5 subequal valvate lobes; petals 5, imbricate or contorted in bud; disc glands 5 (- 7), free, alternipetalous; stamens 8 - 15, in distinct whorls from the conical receptacle; filaments connate at base into a hairy column, inner 3 or 4 longer; anthers basifixed to dorsifixed, erect; thecae 2, parallel, dehiscing longitudinally by slits; connectives broad; pistillode absent. Female flowers: calyx and corolla as in male; disc absent or consisting of 5 minute glands, episepalous; ovary 2-locular; styles 2 - 5, free, each 2-lobed or 2-partite with 2 linear stout arms; ovule solitary in each locule. Fruits capsular; pyrene 1, 1 - 5-loculed, indehiscent or tardily dehiscent; exocarp thick, woody; endocarp crustaceous;

seeds 3, globose with thick woody smooth or rugose testa, carunculate; endosperm oily, straight; cotyledons broad, flat.

Temperate and subtropical N. E. India, Myanmar to China and Japan, 3 species; 2 in India.

#### KEY TO THE SPECIES

- 1 a. Deciduous trees with flowers appearing before leaves; petiole-apices with 2 globose capitate sessile glands; inflorescences usually bisexual; flowers reddish white to purple, veined with pink, yellow in the centre; ovary 4 (or 5) locular, gradually narrowing into styles; fruits subglobose, shortly mucronate at apex, 4 - 5 cm in diam., smooth, slightly verrucose, not grooved **1. V. fordii**
- b. Evergreen trees with both flowers and leaves together; petiole-apices with 2 capitate or cup-shaped stalked glands; inflorescences usually unisexual; flowers white; ovary 3- (- 5) locular, gradually or abruptly narrowing into styles; fruits ovoid, narrowly attenuate and pointed at apex, 4 - 6 cm long, 3.5 - 4.5 cm across, wrinkled when dry, distinctly longitudinally 3 - 5-grooved and ridged **2**
- 2 a. Glands at the apex of petioles slenderly stalked, capitate, slightly divergent, hook-shaped to almost inrolled (at least when dry); ovary abruptly narrowing into styles (cult.) **V. cordata**
- b. Glands at the apex of petioles clavately stalked, turbinate, cup-shaped; ovary gradually narrowing into the styles **2. V. montana**

**1. Vernicia fordii** (Hemsl.) Airy Shaw in Kew Bull. 20: 394. 1966; Stuppy et al. in Blumea 44: 91. 1999. *Aleurites fordii* Hemsl. in Hooker's Icon. Pl. 29: tt. 2801, 2802. 1906 & in Bull. Misc. Inform. Kew 1906: 120. 1906; Mooney, Suppl. Bot. Bihar Orissa 32. 1950. *A. cordata* auct. non (Thunb.) R.Br. ex Steud. 1841: Müll.Arg. in DC., Prodr. 15(2): 724. 1866, p. p.; Hook.f., Fl. Brit. India 5: 384. 1887.

Eng.: Chinese Tung Oil.

Trees, 5 - 10 m tall, monoecious, deciduous; branches glabrous. Leaves broadly ovate or orbicular, entire or palmately 3 - 5-lobed, cordate at base, acute at apex, 8 - 20 x 7 - 19 cm, palmately 5-nerved at base, coriaceous, glabrescent above, thinly appressed pilose beneath; petioles (7 -) 10 - 20 cm long, with 2 smooth globose glands at apex; stipules 4 - 12 x 2 - 4 mm. Inflorescences precocious, arranged at apices of branches, short cymose panicles, usually bisexual; pedicels 8 - 18 mm long; flowers 2.5 - 3.5 cm in diam., white, reddish white to purple, veined with pink; calyx irregularly 2 or 3-lobed, with simple hairs, ca 1 cm long, irregularly splitting, usually 2-fid; petals 5, orbicular-ovate, 2 - 3.5 x 1 - 2 cm, with 3 - 6 mm long claw at base, white with streaks of red or purple in the throat, glabrous; disc fleshy, with 5 linear-subulate glands, ca 3 mm long. Male flowers: stamens 8 - 10, outer ones 4 - 5 mm long, inner ones 11 - 15 mm long. Female flowers: ovary sparsely puberulous, 3 - 4 (-6)-loculed; styles 4 - 5 mm long, shortly bifid. Capsules smooth, subglobose, slightly compressed, short-mucronate at apex, (2 -) 3 - 4 (- 5) cm in diam., smooth or slightly verrucose; with thick funiculus.

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

*Distrib.* India: Subtropical humid cool hilly areas, between 800 to 1200 m altitudes, usually cultivated, sometimes seen naturally regenerating. Bihar, West Bengal, Sikkim, Assam, Orissa and Karnataka.

Native of S. China, Myanmar and Vietnam. Cultivated in other subtropical regions.

*Uses.* The species is the source of the 'Chinese Tung Oil', of excellent use for chaulking boats, painting wood, waterproofing paper and fabrics. It is extensively used in the manufacture of paints, enamels, lacquers, linoleum and electrical insulation. See Wealth of India (Vol. 1, 1948) for more details.

*Notes.* Chromosome number:  $n = 11$  (Bedi et al., Taxon 29: 353. 1980).

**2. Vernicia montana** Lour., Fl. Cochinch. 586. 1790; Stuppy et al. in Blumea 44: 92, f. 3. 1999. *Aleurites montana* (Lour.) E.H. Wilson in Bull. Imp. Inst. Gr. Brit. 11: 460. 1913; Mooney, Suppl. Bot. Bihar Orissa 33. 1950.

Eng.: Wood Oil Tree.

Trees, 5 - 10 m tall, monoecious. Leaves broadly ovate, entire or palmately 3 - 5-lobed with round glands at sinuses between lobes, often deeply lobed in young plants, cordate at base, acute at apex, 10 - 20 x 9 - 15 cm (lamina), palmately 5-veined, glabrous, subcoriaceous; petioles 7 - 22 cm long, with 2 stalked cupular glands at apex; stipules 3 - 5 x 2 - 3 mm. Inflorescences usually unisexual, paniculate corymbs; male ones much branched, 14 - 20 cm long, 20 - 30 cm broad; female ones short racemes, few-flowered, 7 - 15 cm long; flowers very fragrant, white, reddish brown in the centre; calyx entire or 2 or 3-lobed, 1 - 1.6 cm long; petals usually 5, spatulate, ca 20 x 7 mm. Male flowers: 1.5 - 3.5 cm in diam.; pedicels 7 - 12 mm long; disc lobes linear-subulate or cylindrical-fusiform, acute, 4 - 6 mm long, fleshy; stamens (8 -) 10 - 12 (- 14), in 2 series, outer ones 5 - 9, inner ones 3 - 5, those of the inner vertical; filaments 10 - 20 mm long; anthers 2 - 2.5 x 1 - 1.5 mm. Female flowers: pedicels 3 - 6 mm long; disc lobes 5, linear; ovary 4 - 5 x 3 - 4 mm, 3 - 5-loculed, pubescent; styles 5 - 8 mm long, deeply bifid. Fruits ovoid, 4 - 6 x 3.5 - 4.5 cm, longitudinally 3 - 5-grooved, strongly transversely reticulate, 3 - 4-valved, finely brown hairy; pericarp hard, thick; seeds broadly ovoid, ca 2.5 cm long, rugose.

*Fl.* March - April; *Fr.* Sept. - Oct.

*Distrib.* India: Subtropical humid regions, from plains to 1200 m in hills, in alluvial soil with annual rainfall ranging from 175 to 225 cm, usually cultivated, sometimes naturalised. Bihar, West Bengal, Sikkim, Assam, Arunachal Pradesh, Meghalaya, Orissa, Karnataka and Tamil Nadu.

Native of S. China, Myanmar, Thailand and Indo-China. Cultivated in other tropical regions.

*Uses.* The oil from the nut called 'Wood Oil' has properties similar to those of the oil of *V. fordii*, but has a slightly lower refractive index, lower iodine value and takes longer time for gelation. The oil is highly water resistant and useful for making varnishes. The oil when burnt with limited supply of air produces Carbon black, an ingredient of Indian Ink or Chinese Ink. For more details see Wealth of India (Vol. 1, 1948).

*Notes.* Chromosome number:  $n = 11$  (Bedi et al., Taxon 29: 353. 1980).

#### CULTIVATED SPECIES

**Vernicia cordata** (Thunb.) Airy Shaw in Kew Bull. 20: 394. 1966. *Dryandra cordata* Thunb., Nov. Gen. Pl. 60. 1783 & Fl. Jap. 267, t. 27. 1784. *Aleurites cordata* (Thunb.) R.Br. ex Steud., Nomencl. Bot. ed. 2, 1: 49. 1840; Müll.Arg. in DC., Prodr. 15(2): 724. 1866.

Trees, subglabrous. Leaves broadly ovate, entire or palmately 3 - 5-lobed with round glands at sinuses between lobes, cordate at leaf-base, acute at apices of lobes, 14 - 18 x 9 - 15 cm, palmately 5-nerved at base, almost glabrous; petioles 7 - 10 cm long with 2 glands at apex. Flowers in large panicles, 15 - 20 cm long; calyx ca 1 cm across; petals oblong, 1.5 - 2.2 cm long, white, barbate at base in male flowers. Fruits ca 4 x 3 cm, verrucose.

*Fl. & Fr.* March - June.

*Distrib.* India: Seen only in cultivation. Sikkim.

Native of Japan and China, introduced to many countries in S. & S. E. Asia.

*Uses:* The oil from the seeds, called 'Tung oil', has many industrial applications.

### Tribe 3. CODIAEAE (Pax) Hutch.

Trees or shrubs; laticifers not articulated with clear or sometimes reddish and non-toxic latex; indumentum simple or stellate. Leaves penninerved or triplinerved, unlobed, usually eglandular; stipules often caducous, sometimes obsolete. Inflorescences terminal or axillary, racemose or paniculate. Male flowers: sepals 4 - 6, free or connate, imbricate or valvate; petals mostly 5, free, usually imbricate; disc dissected or lobed; stamens (5 -) 10 - 100 or more, free or basally connate; pollen grains binucleate, globose, inaperturate, sexine with Croton-pattern; pistillode absent. Female flowers: sepals 4 - 6, usually imbricate, sometimes accrescent; petals as many as sepals, sometimes absent; disc annular, rarely dissected or absent; ovary mostly 3-locular; styles unlobed or bipartite. Fruits capsular; columella usually persistent; seeds carunculate or ecarunculate; testa sometimes fleshy; endosperm present.

Tropical America, Africa, Asia and Australia, 15 genera; 6 genera in India.

#### KEY TO THE GENERA

- |   |                          |   |
|---|--------------------------|---|
| 1 a. Herbs or shrubs; petals absent   | <b>30. Baliospermum</b>  |   |
| b. Shrubs or trees; petals present, at least in male flowers                          |                          | 2 |
| 2 a. Petals present in female flowers   |                          | 3 |
| b. Petals absent in female flowers  |                          | 4 |
| 3 a. Male calyx almost truncate; female calyx accrescent, often enlarged              | <b>32. Dimorphocalyx</b> |   |
| b. Male calyx lobed; female calyx not accrescent, if accrescent then not enlarged     | <b>33. Ostodes</b>       |   |
| 4 a. Inflorescences terminal  | <b>31. Blachia</b>       |   |
| b. Inflorescences axillary  |                          | 5 |
| 5 a. Wild forest plants with normal green leaves; styles bifid, quadrifid or multifid | <b>34. Sphyranthera</b>  |   |
| b. Cultivated garden plants with variegated foliage; styles entire (cult.)            | <b>Codiaeum</b>          |   |

### 30. Baliospermum Blume

Herbs or shrubs, monoecious or dioecious. Leaves simple, alternate, sometimes shallowly to deeply 3 - 5-lobed, penninerved; petioles biglandular at apex; stipules lanceolate, persistent or caducous. Inflorescences leafy at the end of branches or axillary and leafless, sometimes with long naked peduncle, bisexual or unisexual, crowded towards ends of branches, thyrsoid;

bracts occasionally foliaceous. Male flowers: pedicellate; sepals (4 -) 5 (- 6), free or shortly connate, imbricate, orbicular; petals absent; disc glands free or connate and shortly cupular; stamens 12 - 25, free, the outer shorter than the inner; anthers 2-loculed, adnate to a broad connective, basifixed, longitudinally and laterally dehiscent; pistillodes absent. Female flowers: pedicellate; sepals 5 or 6 (- 10), sometimes accrescent and enlarging in fruit, imbricate; petals absent; disc cupular; staminodes absent; ovary 3-locular, each 1-ovuled; styles 3, free or shortly connate at base; stigmas mostly expanded and flabellate, bilobed or bifid, rarely capitate, recurved. Fruits capsular, tricocous, usually with persistent sepals; seeds carunculate, marbled; endosperm fleshy; cotyledons broad.

India, S. China, S. & SE. Asia, Malesia, ca 12 species; 2 species in India.

*Literature.* CHAKRABARTY, T. & N. P. BALAKRISHNAN 1990 (1992). A revision of the genus *Baliospermum* Bl. (Euphorbiaceae) for the Indian subcontinent. Bull. Bot. Surv. India 32: 1 - 27, ff. 1 - 9.

*Notes.* This small genus shows a high degree of phenotypic variation, causing great difficulties for specific and infraspecific demarcation and classification.

Perry (Amer. J. Bot. 30: 527 - 543. 1943) reported the chromosome number of *B. montanum* to be  $2n = 28$  (from plants cultivated in Arnold Arboretum, USA). Sarkar et al. (Taxon 25: 649. 1976) recorded the chromosome number of the same species to be  $2n = 22$  (from materials obtained from wild plants of Uttar Pradesh, India). If both these counts are correct, the basic chromosome number of the genus may be  $x = 7$  and 11.

Punt (Wentia 7: 1 - 116. 1962) studied the pollen grains of *B. solanifolium* (= *B. montanum*). The grains are inaperturate with characteristic "Crotonoid" pattern of polygonally arranged clavate sexinous processes. The diameter of the grain is about 43  $\mu\text{m}$  and the diameter of the clavae is about 1.5  $\mu\text{m}$ .

The genus shows wide range of ecological adaptations from sea level to 2000 m altitude in the E. Himalayas, in shaded primary evergreen forests to secondary deciduous forests, open forests, mixed forests and scrub jungles, from damp places near watercourses to dry wastelands and also as weeds in cultivated fields.

#### KEY TO THE SPECIES

- 1 a. Plants dioecious; upper leaves not appreciably smaller than leaves of lower nodes; inflorescences leafless; male disc glands distinct; ovary glabrous or sparsely pubescent; fruits depressed, not intruded at apex, 5 - 8 x 9 - 10 mm **1. *B. calycinum***
- b. Plants mostly monoecious; upper leaves often appreciably smaller than leaves at lower nodes; inflorescences leafy; male disc glands connate into a cup; ovary tomentellous; fruits often turbinate-obovoid, intruded at apex, 8 - 10 x 11 - 13 mm **2. *B. solanifolium***

**1. *Baliospermum calycinum*** Müll.Arg. in Flora 47: 470. 1864 & in DC., Prodr. 15(2): 1126. 1866; Hook.f., Fl. Brit. India 5: 462. 1887.

Shrubs, or woody herbs, up to 3 m tall. Leaves elliptic, oblong or narrowly oblong, broadly ovate or widely obovate to oblanceolate or panduriform, rounded, obtuse, acute or subacute at base, denticulate-serrulate to coarsely crenate-dentate, sinuate-dentate or rarely

subentire along margins, caudate-acuminate (sometimes 3-lobed) at apex, (5 -) 11 - 34 x (1.5 -) 3.5 - 13 cm, thinly coriaceous to chartaceous, sparsely hispid or scabrid pubescent to glabrous above, thinly hirtellous on nerves beneath; penninerved or rarely trinerved at base; lateral nerves 7 - 15 (- 18) pairs; petioles (0.5 -) 1 - 11 cm long. Male inflorescences axillary, narrow, (2.5 -) 5 - 35 cm long, leafless, often the flowers arranged in corymbiform clusters; peduncles (0 -) 3.5 - 18 cm long; lower branches (0.5 -) 2 - 8 cm long; bracts subulate or linear-lanceolate, 0.5 - 4 (- 11) mm long or foliaceous, narrowly oblong to lanceolate, 20 - 25 mm long and successively smaller; flowers (1 -) 2 - 4 (- 5) mm across; pedicels (1.5 -) 3 - 4 mm long; sepals 5, orbicular, 1 - 2.5 mm across; disc glands 5 or 6, free, transversely oblong or obcordate, 0.2 - 0.7 x 0.6 - 1 mm; stamens 12 - 20, (1 -) 2 - 2.5 mm long; anthers ca 0.5 mm long. Female inflorescences initially subcorymbose, finally thyriform or falsely racemiform, leafless, 2 - 24 cm long, rarely flowers solitary; peduncles 1.5 - 22 cm long; lower branches 2 - 5 cm long; pedicels 1 - 6 mm long; sepals 5 or 6 (- 8), oblong-lanceolate to linear-lanceolate, 3 - 10 x 1 - 3 mm, accrescent in fruit; disc cupular, crenate, 0.4 - 1 mm high; ovary subglobose, ca 2 mm in diam.; appressed puberulous; styles 3, shortly connate or free; stigmas simple or flabelliform, 2 - 3 mm long. Fruits tricoccos, slightly depressed, 5 - 8 x 9 - 10 mm, glabrous, brown when dry; seeds globose, oblong, or oblong-ellipsoid, 4 - 5 mm long.

*Distrib.* NE. India, E. Himalayas, Nepal, Bhutan, China (Yunnan), Myanmar and Thailand, ca 10 varieties; 7 in India.

#### KEY TO THE VARIETIES

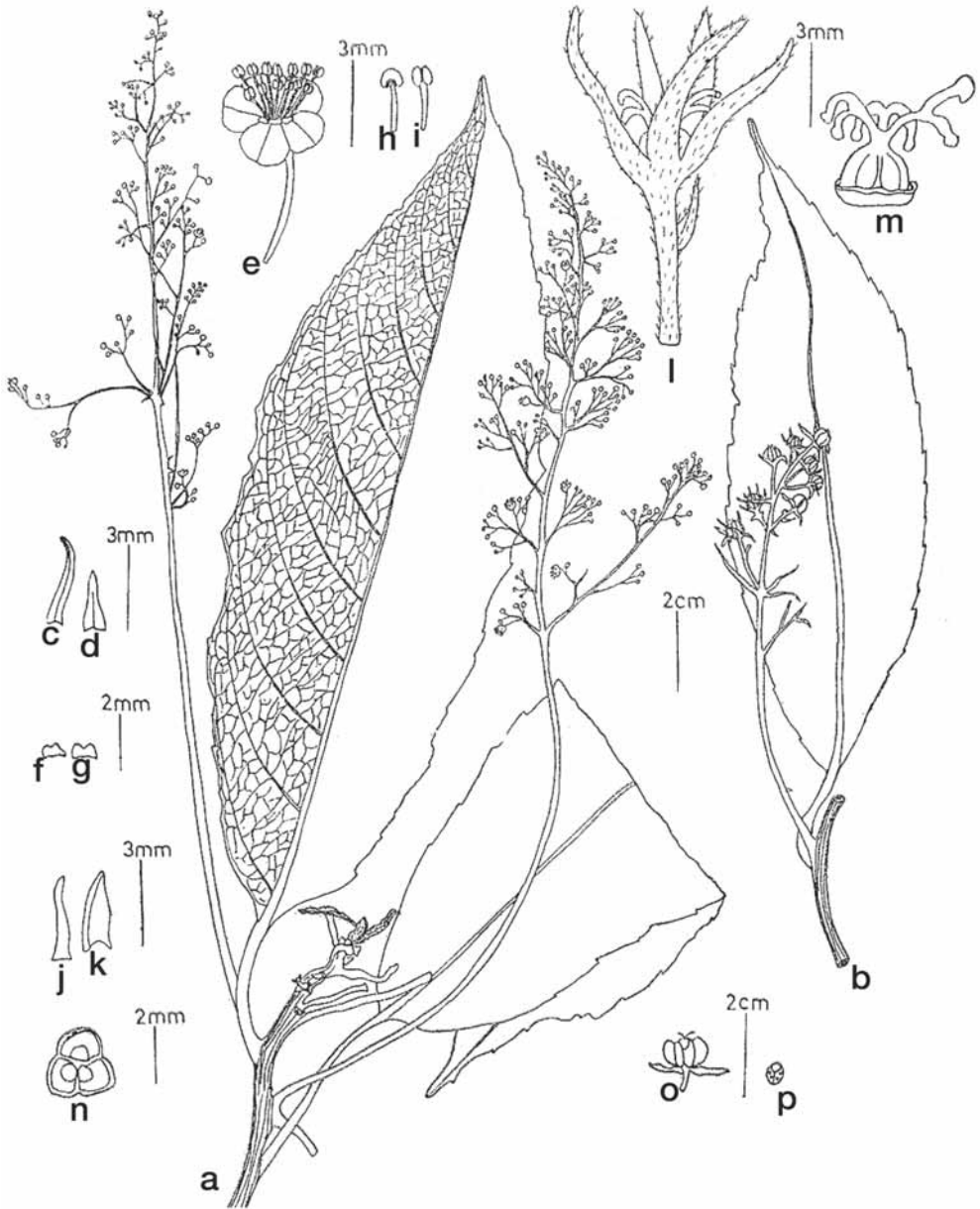
- |   |                               |
|---|-------------------------------|
| 1 a. Bracts of male inflorescences foliaceous, 2 - 2.5 cm long  | <b>1.1. var. bracteatum</b>   |
| b. Bracts of male inflorescences not foliaceous, usually less than 5 mm long, rarely up to 10 mm long               | 2                             |
| 2 a. Male inflorescences simple racemose  | <b>1.6. var. racemiferum</b>  |
| b. Male inflorescences never simple, always with at least a few branches  | 3                             |
| 3 a. Leaves thinly membranaceous; male flowers up to 1.5 mm across  | <b>1.4. var. micranthum</b>   |
| b. Leaves stiffer in texture; male flowers larger, more than 2 mm across  | 4                             |
| 4 a. Male inflorescences very narrow, the lowest branches up to 1.5 cm long   | 5                             |
| b. Male inflorescences broader, the lowest branches up to 4 cm long   | 6                             |
| 5 a. Leaves narrowing towards base, often 3-lobed, penninerved  | <b>1.7. var. sinuatum</b>     |
| b. Leaves not narrowing towards base, unlobed, often basally trinerved  | <b>1.3. var. corymbiferum</b> |
| 6 a. Leaves narrowing towards base, elliptic-oblong to obovate; female sepals appressed puberulous                  | <b>1.2. var. calycinum</b>    |
| b. Leaves not narrowing towards base, mostly ovate-lanceolate; female sepals glabrous or rarely minutely puberulous | <b>1.5. var. nepalense</b>    |

**1.1. var. bracteatum** Chakrab. & N.P. Balakr. in J. Econ. Taxon. Bot. 7: 359. 1985 (1986) & in Bull. Bot. Surv. India 32: 10, f. 3. 1990 (1992).

*Fl. & Fr.* Sept. - Oct.

*Distrib.* India: Tropical evergreen forests. Arunachal Pradesh.

Endemic.



**Fig. 30. *Baliospermum calycinum* Müll.Arg. var. *calycinum*:** a. twig with male inflorescences; b. twig with female inflorescence; c – i: male: c & d. bracts; e. flower; f & g. disc glands; h & i. stamens; j – n: female: j & k. bracts; l. flower; m. ovary with disc; n. t. s. of ovary; o. fruit; p. seed.



**1.2. var. calycinum****Fig. 30***Fl. & Fr.* Jan. - Dec.

*Distrib.:* India: Common in shaded places in forests or amidst grasses, ranging from 300 to 2000 m altitudes. Arunachal Pradesh and Assam.

Bhutan.

**1.3. var. corymbiferum** (Hook.f.) Chakrab. & N.P.Balacr. in Bull. Bot. Surv. India 32: 13, f. 4. 1990 (1992). *Baliospermum corymbiferum* Hook.f., Fl. Brit. India 5: 463. 1888.

*Fl. & Fr.* May - Dec.

*Distrib.:* India: Open forests, from 600 to 1600 m altitudes. West Bengal and Sikkim.

Bhutan and Myanmar.

**1.4. var. micranthum** (Müll.Arg.) Chakrab. & N.P.Balacr. in Bull. Bot. Surv. India 32: 16, f. 6. 1990 (1992). *Baliospermum micranthum* Müll.Arg. in Linnaea 34: 215. 1865 & in DC., Prodr. 15(2): 1126. 1866; Hook.f., Fl. Brit. India 5: 462. 1887.

Kh.: *Ja-pung-dih, Thilliski.**Fl. & Fr.* Jan. - Dec.

*Distrib.* India: Common in primary forests, evergreen forests, or open forests in shaded places as forest undergrowth, at 300 - 2800 m altitudes. Meghalaya, Nagaland and Mizoram.

Bangladesh, Myanmar and Thailand.

*Uses.* Leaves and flowers used as vegetable in NE. India.

**1.5. var. nepalense** (Hurus. & Yas. Tanaka) Chakrab. & N.P. Balacr. in Bull. Bot. Surv. India 32: 20, f. 7. 1990 (1992). *Baliospermum nepalense* Hurus. & Yas. Tanaka in H.Hara, Fl. E. Himal. 174. 1966.

*Fl.* May - Nov.

*Distrib.* India: Evergreen mixed forests, at 600 - 1850 m altitudes. Sikkim.

Bhutan and Nepal.

**1.6. var. racemiferum** Bhujel & Yonzon in J. Econ. Taxon. Bot. 18: 613, f. 1. 1994 (publ. 1995).

*Fl.* July.

*Distrib.* India: Shaded evergreen forests near streams, at about 1000 m altitude. West Bengal (Darjeeling Dist.).

Endemic.

**1.7. var. sinuatum** (Müll.Arg.) Chakrab. & N.P.Balacr. in Bull. Bot. Surv. India 32: 24, f. 9. 1990 (1992). *Baliospermum sinuatum* Müll.Arg. in Flora 47: 470. 1864 & in DC., Prodr. 15(2):

1125. 1866; Hook.f., Fl. Brit. India 5: 462. 1887.

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

*Distrib.* India: Tropical and subtropical evergreen forests, up to 1200 m. Arunachal Pradesh.

Endemic.

**2. *Baliospermum solanifolium*** (Burm.) Suresh in Nicolson et al., Interpr. Rheede's Hort. Malab. (Regnum Veg. 119) 106. 1988. *Croton solanifolius* Burm., Fl. Malab. 6. 1769. *Jatropha montana* Willd., Sp. Pl. ed. 4, 4: 563. 1805. *Baliospermum axillare* Blume, Bijdr. Fl. Ned. Ind. 604. 1826; Hook.f., Fl. Brit. India 5: 461. 1887. *B. montanum* (Willd.) Müll. Arg. in DC., Prodr. 15(2): 1125. 1866; Govaerts et al., World Checkl. & Bibl. Euphorbiaceae 1: 243. 2001. *B. razianum* Kesh. Murthy & Yogan. apud Kesh. Murthy et al. in Curr. Sci. 56(10): 486. 1987 (as *raziana*). **Fig. 31**

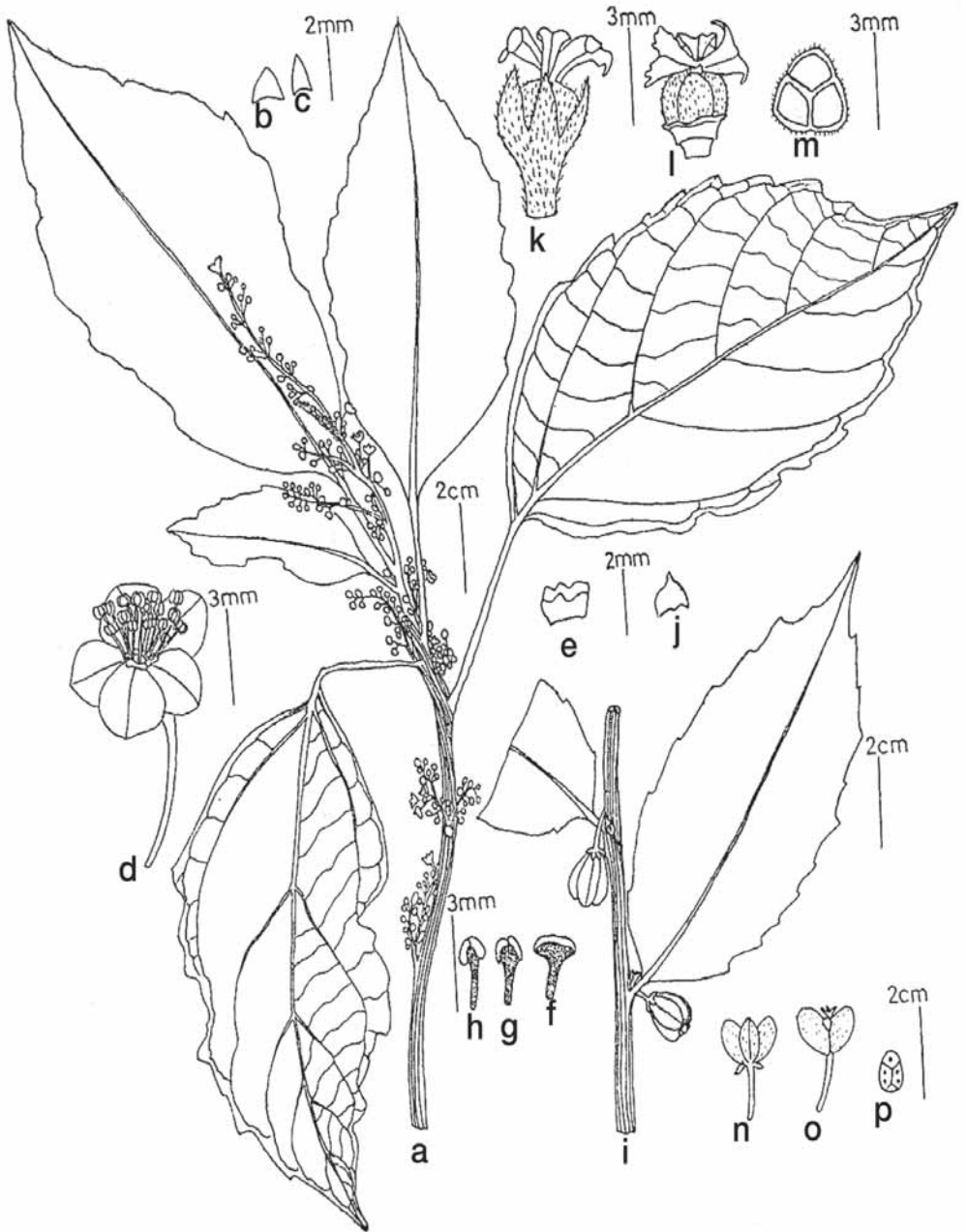
Asm.: *Phuljelong*; Beng.: *Danti, Hakum*; Guj.: *Dantimul*; Hindi: *Danti, Hakum, Jungli-jamalgotā*; Kan.: *Danti, Kaduhalaru*; Kh.: *Laam-dumuin*; Mal.: *Dantika, Nagadanti, Neruvam, Nirantimuttu*; Mar.: *Danti, Dantimul, Jamalgotā*; Nep.: *Harital*; Or.: *Danti*; Sans.: *Anukheti, Anukula, Bhadra, Dantika, Erandapatri, Jayapala, Khumbhi, Mukunda, Nagadanti, Nagasphota, Nikumbhi, Nishalya, Nishakumbha, Pratyakaparni, Raktadanti, Rechmi, Ruksha, Shighara, Shweta-ghanta, Taruni, Upachita, Varahangi, Vishalaya, Vishodhini*; Tam.: *Katamanakku, Niradimuthu, Nirethimuthu, Peyamanakku*; Tel.: *Ettadundiga, Kanakapala, Kondamudam, Nelajidi*.

Shrubs (often bushy), sometimes herbaceous, up to 2 m tall. Leaves elliptic to oblong or broadly ovate to ovate-lanceolate, sometimes shallowly to deeply 2 - 5-lobed, cordate to rounded or truncate at base, distantly repand-denticulate to coarsely sinuate or crenate-dentate along margins, caudate-acuminate at apex, 5 - 25 (- 38) x 2.5 - 13 (- 18) cm with the upper leaves usually much smaller, chartaceous to membranous, scattered appressed hispidulous to glabrous above, thinly tomentellous to sparsely pilose on nerves or glabrous beneath; petioles 1 - 11 (- 17) cm long, sparsely puberulous. Inflorescences bisexual or sometimes unisexual, thyriform, borne on main leafy branches, sparsely appressed pilose. Male flowers: pedicels 2 - 7 mm long; sepals 5, orbicular, 1 - 2 mm across; disc shortly cupular, ca 0.8 mm high; stamens 14 - 25, 1 - 2 mm long; filaments stout; anthers reniform or orbicular. Female flowers: pedicels 1.5 - 5 mm long; sepals 5, deltoid, 1 - 2.5 mm long; disc cupular, 0.7 - 1 mm high; ovary subglobose, ca 2 x 2 - 2.8 mm, tomentellous; styles 3, bifid, inconspicuous; stigma prominent, bifid, 2 - 3 mm long. Fruits subglobose to turbinate-obovoid, strongly 3-lobed, 8 - 10 x 11 - 13 mm, appressed pubescent to glabrous; seeds oblong to ovoid, 8 - 9 mm long, ca 6 mm across.

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

*Distrib.* India: Moist deciduous forests as undergrowth, scrub jungles, cultivated fields, roadsides, up to 1200 m altitude. Jammu & Kashmir, Rajasthan, Madhya Pradesh, Uttar Pradesh, Uttarakhand, Bihar, West Bengal, Sikkim, Assam, Orissa, Andhra Pradesh, Maharashtra, Goa & Nager-Haveli, Karnataka, Kerala and Tamil Nadu.

Pakistan, Sri Lanka, Bhutan, Nepal, Bangladesh, Myanmar, China, Thailand, Cambodia, Laos, Vietnam, Malaysia, Borneo, Sumatra, Java, Celebes, Moluccas and Lesser Sunda Islands.



**Fig. 31. *Baliospermum solanifolium* (J.Burm.) Suresh:** a. twig with male inflorescences; b – h: male: b & c. bracts; d. flower; e. disc; f, g & h. stamens; i – m. female: i. twig with fruits; j. bract; k. flower; l. ovary with disc; m. t. s. of ovary; n & o. fruits; p. seed.

*Uses.* Roots of this species form the raw drug required in more than 20 Ayurvedic preparations (Nambiar et al. in *Aryavaidian* 11: 95 - 108. 1977). Roots and seeds have high medicinal value, particularly as drastic purgative and seeds used externally as stimulant and rubefacient. The seed-oil resembling Castor oil, is a powerful hydragogue, cathartic, and applied externally for rheumatism. Decoction of leaves is useful in asthma. Roots are cathartic, anthelmintic, diuretic and used in dropsy, jaundice, in piles, wounds, and skin diseases. The roots find use also in enlarged spleen, itching, inflammation, anaemia, leucoderma and jaundice.

### 31. *Blachia* Baill., nom. cons.

Shrubs or trees, monoecious, evergreen, mostly entirely glabrous. Leaves alternate, simple or rarely lobed, penninerved or sometimes weakly to clearly trinerved at base, short-petioled; stipules inconspicuous. Male inflorescences terminal, cymose, umbellate to racemiform, few-flowered, peduncled; flowers ebracteate; pedicels slender; sepals 4 or 5, free, imbricate; petals 4 or 5, smaller than the sepals, hyaline; disc glands 4 or 5, alternating with petals, scale-like; stamens 10 - 40, free, arranged in whorls on raised receptacle; anthers 2-loculed; locules adnate to a broad connective, free at base, coherent at tip; pistillode absent. Female inflorescences axillary and terminal, often borne at or near the base of male inflorescences, cymose, mostly umbellate (2 - 8-flowered), sometimes solitary, shortly peduncled; flowers ebracteate; pedicels stout; sepals 4 - 6, same as in the male, but shortly connate and accrescent in fruit or deciduous (*B. andamanica*); petals absent; disc glands connate in a ring or occasionally shortly cupular; ovary 3 - 5-loculed; locules uniovulate; ovules anatropous; styles 3 - 5, erect to reflexed, bifid. Fruits schizocarpic, 3 - 5-lobed; seeds trigonous with a broad convex back, smooth, marbled.

India, Sri Lanka, Bangladesh, Myanmar, Thailand, Indo-china to Malesia, ca 10 species; 3 species in India.

*Literature.* BALAKRISHNAN, N. P. & T. CHAKRABARTY (1989). Genus *Blachia* Baill. (Euphorbiaceae) in India. Proc. Indian Acad. Sci. (Pl. Sci.) 99: 567 - 578, ff. 1 - 4.

*Notes.* The chromosome number reported so far is for one species only, *B. calycina* having  $2n = 36$  by Krishnappa & Reshme (Taxon 29: 536. 1980). Pollination is anemophilous. Pollen grains conform to the typical 'Crotonoid' pattern (Punt, Wentia 7: 1 - 116. 1972). The species occurs mostly at low elevations up to 900 m, in evergreen forests but may also grow in semi-evergreen or mixed forests or even in beach forests (*B. andamanica*).

#### KEY TO THE SPECIES

- 1 a. Female sepals deciduous; leaves often weakly to clearly trinerved at base; the first pair of lateral nerves distinct, not weaker than subsequent pairs; tertiary nerves predominantly scalariform to reticulate **1. *B. andamanica***
- b. Female sepals persistent or accrescent; leaves penninerved; the first pair of lateral nerves not distinct, weaker than subsequent pairs; tertiary nerves predominantly branching into veins of higher order **2**
- 2 a. Female sepals 5 - 15 x 2.5 - 9 mm; fruits 4 - 5-cocccous **2. *B. calycina***
- b. Female sepals 2 - 5 x 1 - 3 mm; fruits tricocccous **3. *B. umbellata***

**1. *Blachia andamanica*** (Kurz) Hook.f., Fl. Brit. India 5: 403. 1887. *Codiaeum andamanicum* Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 246. 1873. *Blachia umbellata* sec. Kanjilal et al., Fl. Assam 4: 198. 1940, non (Willd.) Baill. 1858.

Shrubs or trees, 1 - 8 m tall, glabrous. Leaves broadly to narrowly oblong-elliptic to obovate, cuneate, acute to obtuse or rounded at base, acuminate or sometimes caudate or cuspidate at apex, 4.5 - 22 x 1.5 - 10 cm, membranous to coriaceous, glossy, weakly to clearly trinerved at base; lateral nerves 4 - 9 (- 12) pairs (the first pair frequently opposite and extending up to about halfway up the lamina); petioles 3 - 17 mm long. Male inflorescences subumbellate to racemiform, often corymbose, 1.5 - 6 cm long; peduncles 1 - 5 cm long; rachis 5 - 10 mm long; pedicels 5 - 16 x 0.2 - 0.4 mm; sepals 4 or 5, orbicular to flabellate, 2 - 3.5 x 1.5 - 3.5 mm; petals 4 or 5, broadly obovate to flabellate-unguiculate, 0.6 - 2 x 0.5 - 2 mm; disc glands of various shapes (mostly obcordate), 0.6 - 1 mm in diam.; stamens 14 - 22 (- 40), 3 - 4 mm long; anthers ellipsoid to orbicular, 0.4 - 0.8 mm long. Female inflorescences mostly umbellate, sometimes racemiform, up to 5 cm long, 2 - 5 (- 8)-flowered, often pedunculate; pedicels 2 - 16 x 0.8 - 3 mm; sepals 5 (or 4 in ssp. *denudata*), ovate to oblong, 1 - 6 x 0.6 - 2.5 mm, deciduous in fruit; disc glands connate in a ring, undulate, rarely free; ovary ovoid, 1.5 - 2 x 1.5 - 2.5, appressed pubescent or glabrous; styles 3 (-5), 3 - 8 mm long, each bifid. Fruits subglobose, 3 (- 5)-lobed, 8 - 14 x 10 - 15 mm, glabrous or appressed strigose; seeds oblong-ellipsoid to subglobose, 5 - 10 mm long.

#### KEY TO THE SUBSPECIES

- 1 a. Female sepals 5; ovary densely pubescent **1.1. ssp. andamanica**  
 b. Female sepals 4; ovary glabrous or occasionally minutely and thinly pubescent **1.2. ssp. denudata**

#### **1.1. ssp. andamanica**

*Fl. & Fr.* March - Dec.

*Distrib.* India: Tropical beach forests or mixed inland forests, on sandy or clayey soil up to 100 m. Assam and Andaman & Nicobar Islands.

Bangladesh, Myanmar, China, Thailand, Malaysia, Borneo, Philippines, Celebes, Moluccas and Lesser Sunda Islands.

**1.2. ssp. denudata** (Benth.) N.P. Balakr. & Chakrab. in Proc. Indian Acad. Sci. (Pl. Sci.) 99: 571, f. 2. 1989. *Blachia denudata* Benth. in J. Linn. Soc. Bot. 17: 226. 1880. *Croton umbellatus* sec. Dalzell & A. Gibson, Bombay Fl. 231. 1861, excl. quoad Wight, Icon. Pl. Ind. Orient. t. 1874, non *Blachia umbellata* (Willd.) Baill. 1858.

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

*Distrib.* India: Evergreen or semievergreen forests, edges of forests or stream sides, up to an altitude of 850 m, along Western Ghats. Maharashtra, Goa and Karnataka.

Endemic.

*Notes.* Pollen grains inaperturate, sexine with crotonoid pattern. D = 50 µm (45 to 60) (Tissot, Chikhi & Nayar, Pollen of wet evergreen forests of Western Ghats, India, *Publ. du depart. D'ecologie, Inst. Francis de Pondichery*, p. 28, pl. 27. 1994).

**2. *Blachia calycina*** Benth. in J. Linn. Soc., Bot. 17: 226. 1880; Hook.f., Fl. Brit. India 5: 402. 1887. *Croton umbellatus* sec. Wight, Icon. Pl. Ind. Orient. t. 1874. 1842 (non Willd., 1805). *Blachia umbellata* sec. Gamble, Fl. Madras 2(7): 1338. 1925 (repr. ed. 2: 936. 1957), pro minore parte, non (Willd.) Baill., 1858.

Shrubs or trees, up to 6 m tall, entirely glabrous. Leaves elliptic-oblong to obovate or lanceolate, acute, cuneate or rounded at base, acuminate to subacute or rarely rounded at apex, 3.5 - 15 x 1 - 5 cm, membranous to thinly coriaceous; lateral nerves 5 - 16 pairs; petioles 2 - 10 mm long. Male inflorescences umbellate to racemiform, 2 - 10 cm long (peduncle 1.5 - 5 cm long, rachis 0.5 - 7 cm long); pedicels 6 - 14 x 0.3 - 0.5 mm; sepals 4, orbicular to broadly obovate, 2 - 2.5 x 2.5 - 3 mm; petals 4, flabellate-emarginate to obcordate, 0.5 - 1 x 1 - 1.3 mm; disc glands 4; stamens 12 - 23, 1.5 - 2.5 mm long; anthers orbicular, 0.5 - 0.8 mm long. Female inflorescences solitary or umbellate, 8 - 15 mm long; pedicels 5 - 25 x 0.5 - 2 mm; sepals 4 - 6 (often 4 + 2), elliptic-oblong to ovate or lanceolate, 5 - 15 x 2.5 - 9 mm, accrescent; disc glands connate in a ring or often shortly cupular, entire; ovary subglobose, 2 - 3.5 mm in diam., 4 or 5-loculed; styles 4 or 5, 4 - 8 mm long, bifid or occasionally quadrid. Fruits somewhat depressed, 8 - 12 x 12 - 16 mm, strongly 4 or 5-lobed.

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

*Distrib.* India: Common in evergreen forests or along water courses, up to 600 m altitude, along Western Ghats. Karnataka, Kerala and Tamil Nadu.

Endemic.

**3. *Blachia umbellata*** (Willd.) Baill., *Etude Euphorb.* 387, t. 19, ff. 18 - 20. 1858; Hook.f., *Fl. Brit. India* 5: 402. 1887. *Croton umbellatus* Willd., *Sp. Pl.* ed. 4, 4: 545. 1805. *Blachia reflexa* Benth. in *J. Linn. Soc., Bot.* 17: 226. 1880; Chandrab. in A.N.Henry et al., *Fl. Tamil Nadu, Ser. I. Analysis* 2: 222. 1987.

Shrubs or trees, 2 - 8 m tall, entirely glabrous. Leaves elliptic-oblong to oblong-lanceolate or obovate to oblanceolate, acute, obtuse or cuneate at base, subacuminate, caudate or cuspidate at apex, 3 - 18 x 1 - 8 cm, membranous to thinly coriaceous; lateral nerves 5 - 18 pairs; petioles 2 - 10 mm long. Male inflorescences umbellate, 1 - 5 cm long; pedicels 7 - 12 mm long; sepals 4, orbicular, 2 - 2.5 x 1.8 - 2.5 mm; petals 4, orbicular to flabellate-unguiculate, 1.3 - 1.5 x ca 1.5 mm; disc glands 4; stamens 10 - 15 (- 20), 2 - 3 mm long; anthers orbicular, less than 1 mm across. Female inflorescences umbellate, 2 - 8-flowered, sessile or frequently on 2 - 5 mm long peduncles; pedicels 7 - 17 mm long; sepals 4 - 6, oblong-elliptic or ovate, 2 - 5 x 1 - 3 mm, persistent; disc glands connate in a ring; ovary subglobose, 1.5 - 2 mm in diam.; styles 3, 3 - 5 mm long, bifid. Fruits subglobose, 3-lobed, 10 - 12 x 11 - 15 mm, smooth, brown when dry; seeds broadly oblong-ellipsoid, ca 7 mm long, 5 - 6 mm thick.

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

*Distrib.* India: Evergreen forests, often along stream sides, between 250 and 900 m altitudes in Western Ghats. Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

### 32. *Dimorphocalyx* Thwaites

Shrubs or small trees, dioecious or rarely monoecious, very rarely scandent shrubs, nearly glabrous. Leaves simple, alternate, short petioled; stipules caducous. Inflorescences unisexual or rarely bisexual, cymose, axillary and terminal, solitary, paired or 3-flowered (umbellate), shortly racemiform or thyrsoid, often tending towards dichasial branching. Male flowers: bracteate, pedicellate; calyx cupular, 5-lobed, imbricate; petals 5, imbricate, white; disc of 5 free

glands; stamens biseriate, 8 - 16, the outer usually free or sometimes partially or shortly connate; the inner united into a column; anthers 2-loculed, with broad connectives, dorsifixed or basifixed (in the same flower), longitudinally dehiscent; pistillode absent. Female flowers: bracteate, pedicellate; sepals 5, free or shortly connate, imbricate, often gland-pitted or emarginate at apex, accrescent in fruit; petals 4 or 5, imbricate, white, caducous; disc glands connate in a ring or shortly cupular-annular; staminodes absent; ovary 3-locular; locules 1-ovuled; styles 3, connate at base or free, bifid. Fruits capsular, tricocous, evanescently pubescent or glabrous, woody, splitting into bivalved parts leaving a central column; seeds trigonous with a broad convex back; endosperm fleshy; cotyledons flat, broad.

Tropical South India, Andaman & Nicobar Islands, Sri Lanka, Indo-china, Hainan, West Malesia, New Guinea and Lesser Sunda Islands, ca 15 species; 4 species in India.

*Literature.* CHAKRABARTY, T. & N. P. BALAKRISHNAN (1990). Genus *Dimorphocalyx* Thw. (Euphorbiaceae) in India. Proc. Indian Acad. Sci. (Pl. Sci.) 100: 285 - 299, ff. 1 - 4.

#### KEY TO THE SPECIES

- 1 a. Plants monoecious; inflorescences bisexual (endemic to Andaman Islands)
  - 1. *D. balakrishnanii***
- b. Plants mostly dioecious (occasionally monoecious); inflorescences unisexual (occurring in South India and Sri Lanka) 2
- 2 a. Inflorescences somewhat dichasial; stamens 8; ovary glabrous; styles 2 - 3 mm long, free; fruits glabrous
  - 2. *D. beddomei***
- b. Inflorescences not dichasial; stamens 10 - 16; ovary pubescent; styles 3 - 7 mm long, connate below into a column; fruits evanescently pubescent 3
- 3 a. Branchlets, petioles, peduncles and pedicels glabrous; leaves elliptic to lanceolate, rounded, obtuse to acute at base, acuminate at apex; female pedicels 3 - 10 mm long; sepals glabrous; stamens 10 - 16, filaments of outer stamens free almost up to base
  - 3. *D. glabellus***
- b. Branchlets, petioles, peduncles and pedicels pubescent; leaves obovate to oblanceolate, attenuate at base, obtuse to subacute at apex; female pedicels up to 2 mm long; sepals appressed-pilose; stamens 16 - 20, filaments of outer stamens shortly connate at base, free above
  - 4. *D. kurnoolensis***

**1. *Dimorphocalyx balakrishnanii*** Chakrab. & Premanath in J. Econ. Taxon. Bot. 4: 1013, f. 1. 1983. *D. dilipianus* N.P.Balacr. & Chakrab. in J. Econ. Taxon. Bot. 4: 1017, f. 1. 1983.

Shrubs or trees, sometimes scandent or subscandent, ca 6 m tall, nearly glabrous. Leaves elliptic to ovate-elliptic or oblong to ovate-oblong, cuneate, obtuse or rounded at base, acute to acuminate at apex, entire or sometimes shallowly crenate-dentate along margins, 6 - 24 x 3 - 11 cm, chartaceous to thinly coriaceous; lateral nerves 6 - 10 pairs; petioles 4 - 13 mm long; stipules caducous. Inflorescences few-flowered, androgynous or occasionally bearing 1 or 2 females (solitary or umbellate), pedunculate (2 - 5 cm long) with inconspicuous rachis (umbellate) or epedunculate with 5 - 30 mm long rachis (racemiform); bracts deltoid to linear-subulate, 1 - 6 mm long. Male flowers: pedicels 2.5 - 3 mm long; calyx 3 - 4 mm long; lobes broadly triangular to deltoid or orbicular, 1 - 3 mm long; petals narrowly elliptic to oblong, 7 - 10 x 2 - 5 mm; disc glands transversely oblong; stamens 4 - 5 + 5 - 6; outer filaments 2.5 - 4 mm long; inner united into 4 - 6 mm long column, pilose near base; anthers ellipsoid to orbicular, 0.8 - 1.2 mm long. Female flowers: pedicels 2 - 5 mm long; sepals 5, unequal, elliptic to oblong-lanceolate; petals 5, narrowly oblong to oblanceolate, 10 - 18 x 3 - 5 mm; disc glands connate in a ring; ovary subglobose, 2 -

2.8 x 2.8 - 3 mm, densely puberulous; styles 7 - 8.5 mm long, connate below into a column (0.5 - ) 2 - 3 mm long, bifid above. Fruits subglobose, ca 15 x 15 - 17 mm, appressed puberulous, black or brownish black when dry; fruiting pedicels 6 - 12 mm long; fruiting sepals 8 - 50 x 3 - 20 mm; seeds broadly oblong-ellipsoid, ca 10 mm long, ca 6 mm in diam., smooth, brown.

*Fl. & Fr.* (Feb.-) May - Oct.

*Distrib.* India: Inland evergreen forests or coastal forests on sandy soil at low altitudes. South Andaman Islands.

Endemic.

**2. *Dimorphocalyx beddomei*** (Benth.) Airy Shaw in Kew Bull. 23: 124. 1969 & 27: 92. 1972, emend. A.N. Henry et al. in Indian J. Forest. 5: 249. 1982. *Tritaxis beddomei* ('*beddomi*') Benth. in J. Linn. Soc. Bot. 17: 221. 1878; Hook.f., Fl. Brit. India 5: 384. 1887. *Trigonostemon beddomei* (Benth.) N.P. Balakr. in Bull. Bot. Surv. India 10: 245. 1968 (1969). *Dimorphocalyx glabellus* sec. N.C. Nair & P. Bhargavan in Indian J. Forest. 4: 158. 1981, pro parte, tantum quoad specim. *Bhargavan* 47484 (non Thwaites 1864).

Shrubs or trees, up to 4 m tall, dioecious or sometimes monoecious, entirely glabrous. Leaves elliptic to oblong or elliptic-lanceolate, rounded, obtuse, acute to cuneate at base, minutely glandular-toothed or shallowly sinuate to subentire along margins, acuminate or subacute at apex, 5 - 18 (- 22) x 2 - 6 (- 7.5) cm, thinly coriaceous; lateral nerves 7 - 12 pairs (the first pair shorter and weaker than subsequent pairs); petioles 5 - 15 mm long. Male inflorescences axillary (or often ramiflorous?), dichasially branched, up to 4.5 cm long, shortly pedunculate; flowers 4 - 6 mm across; pedicels ca 1.2 x 0.7 mm; calyx shallowly lobed; lobes suborbicular, ca 1 mm long; petals 5, narrowly oblong, 5 - 6 x 1.6 - 3 mm; disc glands 5, triangular-oblong to linear-subulate, ca 1 x 0.3 mm; stamens 5 + 3; outer filaments ca 4 mm long; inner united in ca 5 mm long column; anthers broadly oblong, ca 1 mm long. Female inflorescences terminal, also terminating the short lateral fertile shoots bearing 2 or 3 immature leaves, up to 5 cm long, few-flowered, often solitary, paired or 3-flowered (umbellate), sometimes shortly ca 1 cm long pedunculate; bracts deltoid, 1 - 1.5 x 1.5 - 1.8 mm; flowers 9 - 11 mm across; pedicels 3 - 4 x 0.5 - 1.5 mm; sepals oblong to obovate-oblong, 5 - 6 x 3.5 - 4 mm; petals oblong to spatulate, 5 - 6 x 2.5 - 3 mm; disc glands connate in an annular ring; ovary globose, ca 2 mm in diam., glabrous; styles 3, each bifid, 2 - 3 mm long; stigmas simple. Fruits subglobose, depressed, 11 - 13 x 16 - 18 mm; fruiting sepals up to 15 x 13 mm; seeds obtusely trigonous, ca 8 x 7 mm, mottled, marbled.

*Fl. & Fr.* May - Oct.

*Distrib.* India: Evergreen forests of southern Western Ghats, at 850 - 1000 m altitudes. Kerala and Tamil Nadu.

Endemic.

**3. *Dimorphocalyx glabellus*** Thwaites, Enum. Pl. Zeyl. 278. 1861; Hook.f., Fl. Brit. India 5: 403. 1887.

Trees or sometimes scandent shrubs, dioecious or sometimes monoecious, 3 - 6 (- 10) m tall, nearly glabrous. Leaves elliptic, oblong to obovate or oblanceolate, rounded, obtuse to acute at base, shallowly glandular-crenulate (particularly in young leaves), crenate-serrate to



entire along margins, acuminate to acute or often obtuse to rounded at apex, 4.5 - 19 x 2 - 7 cm, thinly coriaceous to chartaceous; lateral nerves 6 - 14 pairs; petioles 2 - 20 mm long. Male inflorescences axillary, 1-flowered or umbellately 2 or 3-flowered or few-flowered cymes, rarely narrowly thyriform, up to 4 cm long, often with up to 5 cm long peduncle; pedicels 2 - 6 mm long; calyx lobes deltoid or triangular, 0.5 - 1.5 mm long; petals 5, oblong, obovate to spatulate, 5 - 6 x 2 - 2.5 mm; disc glands 5, transversely oblong to obcordate, 0.3 - 1 x 0.5 - 1 mm; stamens 5 - 6 + 6 - 10 (rarely 11 - 16), the outer filaments 1 - 4 mm long, free, the inner united into a short 3 - 7 mm long column; anthers ovoid to ellipsoid, 0.5 - 1.2 mm long. Female inflorescences axillary and terminal, single or few-flowered, umbellate or up to 4 cm long racemes, often with 1 - 3 cm long peduncles; bracts triangular to linear, 1.5 - 7 x ca 0.5 mm; pedicels 3 - 10 mm long, puberulous; sepals 4 or 5, spatulate to obovate, rounded or emarginate and glandular-pitted at apex, often accrescent; petals 4 or 5, elliptic or broadly obovate, 5 - 11 x 2.5 - 7 mm; disc cupular-annular or forming a ring, entire or crenate, 0.6 - 1 x 3 - 4.5 mm; ovary subglobose, 2 - 4 x 2.5 - 5 mm, tomentellous; styles 3 - 7 mm long, free and bifid above. Fruits subglobose, triccous, 7 - 15 x 10 - 18 mm, appressed hirsute; pedicels up to 12 mm long; accrescent sepals 0.5 - 3.3 x 0.3 - 1.8 cm; seeds ellipsoid, obovoid or subtrigonal or dorsally convex, 5 - 10 x ca 8 mm, brown, marbled.

#### KEY TO THE VARIETIES

- 1 a. Leaves 4.5 - 12 (- 15) x 2 - 4 (- 5) cm; stamens 10 - 11; fruits 7 - 10 x 10 - 12 mm; fruiting sepals relatively smaller, 5 - 12 (-16) x 3 - 10 mm, equal or subequal **3.1. var. glabellus**
- b. Leaves (4.5 -) 6.5 - 19 x 3 - 6 (- 7) cm; stamens 11 - 16; fruits 12 - 15 x 15 - 18 mm; fruiting sepals relatively larger, 12 - 32 x 4 - 18 mm, subequal or unequal **3.2. var. lawianus**

#### **3.1. var. glabellus**

Tam. *Kalpottan, Velleipula*.

Trees (once noted to be a scandent shrub).

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

*Distrib.* India: Evergreen forests, up to 900 m altitude. Scarce. Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

**3.2. var. lawianus** (Hook.f.) Chakrab. & N.P.Balacr. in Proc. Indian Acad. Sci. (Pl. Sci.) 100: 296, f. 4. 1990. *Dimorphocalyx lawianus* Hook.f., Fl. Brit. India 5: 404. 1887; Gamble, Fl. Madras 2(7): 1337. 1925 (repr. ed. 2: 935. 1957).

Trees.

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

*Distrib.* India: Evergreen forests, at 150 - 1100 m altitudes. Scarce. Maharashtra, Karnataka, Kerala and Tamil Nadu.

Endemic.

*Notes.* Pollen grains inaperturate, sexine with crotonoid pattern.  $D = 52 \mu\text{m}$  (50 to 62) (Tissot, Chikhi & Nayar, Pollen of wet evergreen forests of Western Ghats, India, *Publ. du depart. D'ecologie, Inst. Francias de Pondichery*, p. 28, pl. 28. 1994).

**4. *Dimorphocalyx kurnoolensis*** R.Venkat. & T.Pullaiiah in Bot. Bull. Acad. Sin., n. s. 35: 201 - 204, ff. 1 - 2. 1994; T.Pullaiiah & Moulali, Fl. Andhra Pradesh 2: 852. 1997.

Tel. *Erra-tandra*.

Trees, up to 3 m high; branchlets pubescent. Leaves obovate to elliptic-oblong, attenuate or cuneate at base, entire to faintly sinuate along margins, subacute to obtuse or rounded at apex, 5 - 19 x 2 - 6 cm, glabrous; lateral nerves 7 - 12 pairs; petioles 1 - 2 cm long; stipules deltoid. Male flowers: in terminal pedunculate cymes; bracts lanceolate, 3 - 4 x 1 - 1.2 mm; flowers subsessile; calyx appressed pilose outside; lobes suborbicular, ca 1 x 1.3 mm; petals oblong, often emarginate, ca 8 x 2.5 mm, disc glands free, ovate-oblong, ca 0.6 x 0.8 mm, hairy at top; stamens 5 + 11 - 15; filaments ca 1.8 mm long; anthers oblong, ca 1.2 mm across; the inner stamens monadelphous, at the apex of ca 7 mm long staminal column, trifid at apex; anthers orbicular, ca 0.8 mm across. Female flowers: few, in short pedunculate racemes; flowers 5 - 8 mm across; pedicels ca 2 mm long; calyx shortly 5-lobed; lobes suborbicular, ca 2 x 2.5 mm; petals oblong; disc glands as in male; ovary ca 4 x 3 mm, appressed pilose, styles connate at base, 2-fid above. Fruits subglobose, depressed, deeply furrowed between cocci, 10 - 13 x 13 - 17 mm; fruiting calyx lobes ca 5 x 3 mm, appressed pilose outside.

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

*Distrib.* India: Dry deciduous forests, along sides of streams. Rare. Andhra Pradesh (Kurnool Dist.).

Endemic.

### 33. *Ostodes* Blume

Trees or shrubs, dioecious, with simple pubescence on young parts. Leaves alternate, crowded at tips of branches, penninerved or weakly to strongly 3-nerved at base; petioles biglandular at the junction with lamina; stipules caducous. Inflorescences below the terminal tuft of leaves, axillary or extra-axillary; the males pyramidal thyrsoid, many-flowered; the females less branched and fewer flowered, thyrsoform, occasionally tending to be pseudo-racemose; bracts triangular to linear-lanceolate. Male flowers: calyx 3 - 5-partite with imbricate lobes; petals 5 (- 7), free, borne around the disc; disc glands 5 (- 8), free, opposite to sepals; stamens (10 -) 20 - 40, free, interior filaments often shortly connate at base; anthers 2-locular; connectives broad. Female flowers: calyx (3 -) 5 - 7-partite; lobes unequal; petals 5 - 10, free; disc glands connate in a ring, crenate; ovary 3-loculed, each 1-ovuled; styles 3, bifid or quadrifid. Fruits tricocous; seeds smooth, marbled.

Eastern Himalayas, NE. India, Myanmar, Thailand, S. China, Indo-china and W. Malesia, ca 2 species; one species with one variety in India.

***Ostodes paniculata*** Blume, Bijdr. Fl. Ned. Ind. 620. 1826; Hook.f., Fl. Brit. India 5: 400. 1887; Chakrab. & N.P.Balacr. in Indian J. Forest., Addit. Ser. 7: 1 - 10, f. 1. 1993. *O. prainii* Gandog. in Bull. Soc. Bot. France 66: 287. 1919 (1920); Kanjilal et al., Fl. Assam 4: 198. 1940.

Abor: *Tardot-asa-asing*; Kh.: *Dieng-ja-cung*; Lep.: *Pakok-toung*; Nep.: *Bepari-gaach*.

Shrubs or trees, 8 - 18 m tall; young shoots densely appressed brownish pubescent. Leaves broadly to narrowly oblong-elliptic to ovate or triangular-ovate, rounded or obtuse to acute at base, denticulate or crenulate or serrulate along margins, apiculate or cuspidate-acuminate at apex, (6.5 -) 10 - 45 x (2.5 -) 4 - 14 cm, thinly coriaceous to rigidly membranous, glabrous except for tufts of hairs in leaf-axils beneath; lateral nerves 5 - 10 pairs; petioles 1.5 - 18 (- 22) cm long, with 2 stalked glands at apex. Male inflorescences: 5 - 30 cm long; flowers 4 - 6 mm across; pedicels 2 - 8 (- 12) mm long; calyx 5-lobed; lobes orbicular or broadly ovate-oblong, 2.5 - 6 mm long; petals 5, orbicular-obovate or triangular-oblong, 2 - 6 x 2.5 - 5 mm, white, tinged pink; stamens (10 -) 20 - 40, 2.5 - 5 mm long; anthers 0.5 - 1.5 mm long. Female inflorescences: 3 - 12 cm long; calyx 5 - 7-lobed; lobes orbicular-ovate to orbicular-obovate, 4 - 8 mm across; petals 7 - 9 mm long; ovary trigonous-globose, 3 - 7 mm in diam., tomentose; styles 3 - 5 mm long, bifid or quadrifid. Fruits subglobose or bluntly trigonous, tricoccous, 2.5 - 4 cm across, woody, thinly appressed ochraceous pilose; seeds orbicular to oblong, 10 - 25 x 10 - 22 mm, brown.

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

*Distrib.:* India: Subtropical forests, between 300 to 2400 m altitudes. Assam, Arunachal Pradesh, Meghalaya, Mizoram, Nagaland, Sikkim and West Bengal.

Nepal, Bhutan, Bangladesh, Myanmar, S. China, Indo-China, Thailand, Malaysia and West Indonesia.

*Uses:* Wood used for planking in Myanmar. A gum obtained from tree trunk used in manufacture of paper in NE. India. Leaves used as cattle fodder.

### 34. *Sphyranthera* Hook.f.

Shrubs or trees, dioecious, evergreen. Leaves alternate, entire along margins, penninerved, exstipulate, petiolate. Male inflorescences axillary or ramiflorous, somewhat fasciculate, many-flowered, pedunculate or epedunculate, bracteate; pedicels slender, often articulate; sepals 4, free, sub imbricate in bud, bearded at apex; petals 4, free, alternating with sepals, bilobed almost to base; disc-glands 4, thin, bilobed at apex; stamens 8 - 10, free; filaments shortly bifid at apex with broadened connectives; anther-locules at tips of filament-lobes, separating from one another, longitudinally dehiscent; pistillodes absent. Female inflorescences axillary or cauliflorous, more or less umbellate, 2 - 4-flowered, pedunculate or epedunculate, bracteate; pedicels slender, often wiry, often articulate; sepals 4 or 5, imbricate in bud; petals absent; disc glands 3 or 4, opposite to or alternating with sepals, variously shaped; staminodes absent; ovary subglobose, trilocular; ovules solitary in each locule; styles 3, free, deflexed, quadrifid or multifid with numerous fibrous-laciniate branches. Fruits depressed, tricoccous, glabrous; seeds subglobose.

Endemic to Andaman & Nicobar Islands, with 2 species.

#### KEY TO THE SPECIES

- 1 a. Leaves 2.5 - 12 x 1 - 4 cm, stiffly coriaceous; lateral nerves 4 - 7 pairs; nervules obscure above; petioles 2 - 10 mm long; male pedicels 2.5 - 4 mm long, articulate; female pedicels 2 - 10 mm long, articulate, scattered pubescent; styles quadrifid; fruiting pedicels and peduncles not wiry

1. *S. airyshawii*

- b. Leaves 8 - 26 x 3.5 - 15 cm, thinly chartaceous to thinly coriaceous; lateral nerves 6 - 10 pairs; nervules somewhat prominent above; petioles 6 - 25 mm long; male pedicels 8 - 12 mm long, not articulate; female pedicels 5 - 50 mm long, not articulate, glabrous or almost so; styles multifid with numerous fibrous-laciniate branches; fruiting pedicels and peduncles wiry

## 2. *S. lutescens*

1. *Sphyrnthera airyshawii* Chakrab. & Vasudeva Rao in J. Econ. Taxon. Bot. 5: 960. 1984 & 6: 429. 1985.

Shrubs, often bushy, ca 1 m high. Leaves elliptic, narrowly oblong-elliptic to obovate or spatulate-lanceolate, acute or cuneate-attenuate at base, obtuse or shortly acuminate at apex, 2.5 - 12 x 1 - 4 cm, stiffly coriaceous; lateral nerves 4 - 7 pairs; petioles 2 - 10 mm long. Male flowers: pedicels 2.5 - 4 mm long, articulated towards base; sepals 4, oblong to triangular-ovate, 1 - 1.3 x 0.5 - 0.8 mm; petals 4, 0.5 - 0.8 mm long; disc glands 4; stamens 8, 0.5 - 1 mm long. Female flowers: peduncles 2 - 15 mm long; pedicels 2 - 10 mm long, articulated; sepals 4 or 5, ovate or triangular or oblong, 1 - 1.3 x 0.3 - 1 mm, pubescent; disc glands 3 or 4; ovary ochraceous-tomentellous; styles 3, quadrifid. Fruits (immature ones) strongly 3-lobed, ca 4 x 5 mm, appressed ochraceous pilose.

*Fl. & Fr.* March - May.

*Distrib.* India: Hill forests on red-brown soil at about 700 m altitude. Andaman & Nicobar Islands (Saddle Peak in N. Andaman Island).

Endemic.

2. *Sphyrnthera lutescens* (Kurz) Pax & K.Hoffm. in Engl. & Prantl, Pflanzenfam. ed. 2, 19c: 231. 1931. *Codiaeum lutescens* Kurz, Forest Fl. Burma 2: 405. 1877. *Sphyrnthera capitellata* Hook.f. in Hooker's Icon. Pl. 18: t. 1702. 1877 & Fl. Brit. India 5: 477. 1888.

Shrubs or trees, 2 - 8 m tall; branchlets glabrous. Leaves elliptic to oblong or sometimes suborbicular, acute at base, shortly and bluntly acuminate at apex, 8 - 27 x 3.5 - 15 cm, thinly chartaceous to thinly coriaceous; lateral nerves 6 - 10 pairs; petioles 6 - 25 mm long. Male flowers: peduncles up to 10 mm long; pedicels 8 - 12 mm long; sepals oblong to ovate-triangular, 1 - 1.5 x 0.5 - 0.8 mm; petals 4, 0.5 - 0.8 x 0.7 - 1 mm; disc glands 4, transversely oblong to orbicular; stamens 8 - 10, 0.5 - 1 mm long. Female flowers: peduncles 3 - 25 mm long; pedicels 4 - 50 mm long; sepals 4 or 5, ovate or triangular or oblong, 1 - 1.5 x 0.5 - 1 mm; disc glands 3 or 4; ovary ca 1 mm in diam.; styles 3, 1 - 1.5 mm long, deflexed, multifid with numerous fibrous-laciniate branches. Fruits depressed globose, ca 12 mm in diam., smooth, pale greyish.

*Fl. & Fr.* March - Dec.

*Distrib.* India: Coastal forests, mixed forests, often in marshy areas along the riverbanks on clayey soil or limestones, up to 50 m altitude. Andaman & Nicobar Islands (common in Great Nicobar Island, rare elsewhere).

Endemic.

## Tribe 4. CROTONEAE Dumort.

Trees, shrubs or herbs; laticifers not reticulated, with clear or reddish and often scanty (or absent) latex; indumentum stellate or lepidote. Leaves alternate, simple or palmately lobed, sometimes pellucid-punctate; petiole with or without apical paired glands; stipules present or

absent. Inflorescences terminal or axillary, racemose or spicate. Male flowers: sepals mostly 5, imbricate to valvate, free; petals 5, imbricate, sometimes absent; disc annular or dissected; receptacle often villous; stamens 3 - 400, filaments free, often inflexed in bud; anthers muticous; pollen grains globose, inaperturate, sexine with *Croton*-pattern; pistillode absent. *Female flowers*: sepals 4 - 7 (-10), free, sometimes accrescent, imbricate or reduplicate-valvate; petals 5, mostly reduced or obsolete; ovary mostly 3-locular; styles free or nearly so, once to several times bifid. Fruits capsular; seeds carunculate; testa dry; endosperm copious.

Tropical and subtropical America, Africa and Asia, 4 genera; 2 in India.

#### KEY TO THE GENERA

- 1 a. Filaments distinctly inflexed in bud; petals reduced or absent in female flowers **35. *Croton***  
 b. Filaments not inflexed in bud; petals present in female flowers **36. *Paracroton***

#### 35. *Croton* L.

Trees or shrubs, rarely herbs, monoecious or rarely dioecious, densely or sparsely clothed with stellate hairs or lepidote scales, occasionally glabrous; stems with coloured or rarely milky sap. Leaves simple, alternate, petiolate, penninerved or palmatinerved at base, with 2 (- 10) sessile or stipitate glands at junction of petiole and lamina; stipules caducous. Inflorescences terminal and sometimes axillary, racemiform cymes or thyrses, androgynous or occasionally unisexual; female flowers solitary at lower nodes; male flowers in fascicles at upper nodes; bracts shortly subulate or triangular. Male flowers: sepals (4 -) 5 (-6), valvate; petals isomerous with free sepals; disc glands small, opposite to sepals; stamens 8 - 40, free, arranged in whorls; filaments mostly lanate towards base, inflexed at apex in bud; anthers basifixed, 2-loculed, thecae usually parallel or slightly diverging, adnate to a broad connective, longitudinally dehiscent; pistillode absent; receptacle densely lanate or rarely glabrous. Female flowers: sepals (4 -) 5 (- 10), shortly connate at base, valvate or sub imbricate; petals 0 - 5 (-6), smaller than the sepals or vestigial; disc glands small; staminodes absent; ovary (2 -) 3 (- 5)-locular; styles 3, free or shortly connate below into a column, once or repeatedly bifid above into linear or thickened branches; ovule one per locule. Fruits capsular, smooth or often muriculate, usually 3-seeded; columella persistent; seeds usually 3-angled with a broad convex back, carunculate; testa dry, thin; endosperm copious; embryo straight; cotyledons broad.

Tropics and subtropics of Old and New World, the majority of the species being in South America and West Indies, ca 1200 species in the world. In Asia, ca 150 species occur in S. China, Indo-China, S. & SE. Asia and Malesia. In India 16 species are found.

*Literature.* CHAKRABARTY, T. & N. P. BALAKRISHNAN (1997). A revision of *Croton* L. (Euphorbiaceae) for Indian subcontinent. Bull. Bot. Surv. India 34: 1 - 88.

*Notes.* Species of *Croton* contain a great diversity of chemical compounds, viz. several kinds of alkaloids, saponins, tannins and flavanoids. Some species exhibit antimicrobial, antimalarial, antiatherogenic, androgenic, insecticidal and antitumour activities. There is great scope for further studies on the Phytochemistry of this genus.

## KEY TO THE SPECIES

- 1 a. Introduced weedy herbs 2  
 b. Indigenous trees, shrubs (rarely scandent) or undershrubs 3
- 2 a. Plants sparsely whitish stellate-pubescent to glabrescent; trichomes soft, without erect central ray; leaves penninerved; glands at the base of lamina sessile; female sepals more or less equal  
**3. C. bonlandianus**
- b. Plants more or less densely ochraceous stellate-hirsute to scabrid; trichomes harsh with pronounced central ray; leaves strongly trinerved at base; glands at the base of lamina shortly stipitate; female sepals distinctly unequal  
**6. C. glandulosus** var. **hirtus**
- 3 a. Leaves densely or sparsely lepidote beneath 4  
 b. Leaves variously stellate-pubescent or glabrous beneath 7
- 4 a. Leaves strongly trinerved at base, more or less densely silvery, orange-brown, or golden lepidote above, stiff-coriaceous  
**13. C. scabiosus**
- b. Leaves penninerved, distantly scattered lepidote or glabrous above, membrous to thin-coriaceous 5
- 5 a. Foliar glands stipitate; young leaves with fine detersible stellate hairs on upper surface; trichome-base mostly colourless; style-branches twice or thrice bifid; leaves often subopposite or pseudo-verticillate and separated by long internodes  
**16. C. zeylanicus**
- b. Foliar glands sessile; young leaves with detersible lepidote scales on upper surface; trichome-base mostly coloured; style-branches once bifid; leaves never separated by long internodes 6
- 6 a. Fruits obovoid, large, 18 - 25 mm long, ca 15 mm across, shortly stipitate  
**11. C. malabaricus**
- b. Fruits subglobose, smaller, 9 - 15 mm across, without a basal stipe  
**1. C. argyratus**
- 7 a. Indumentum of young shoots, petioles, rachis and flowers lepidote 8  
 b. Indumentum of young shoots, petioles, rachis and flowers stellate-pubescent or lacking 9
- 8 a. Leaves very coarsely dentate-serrate-crenate; webbing of scales at least 80%, free portion of rays radiating in one plane; ovary intruded at apex; fruits much smaller, subglobose, up to 1 cm long, 0.8 - 1.2 cm across, prominently lobed  
**12. C. persimilis**
- b. Leaves shallowly or evenly serrate-dentate to subentire; webbing of scales 50% or less, free portion of rays radiating in all directions; ovary obtuse or rounded at apex; fruits ovoid-ellipsoid or oblong or obovoid, larger, 2.5 - 3.5 cm long, 2 - 2.5 cm across, obscurely lobed  
**7. C. joufra**
- 9 a. Leaves penninerved 10  
 b. Leaves strongly trinerved at base 13
- 10 a. Ovary and fruits usually bilocular, rarely trilocular; basal glands of leaves thinly long-stipitate  
**10. C. lissophyllus**
- b. Ovary and fruits always trilocular; basal glands of leaves subsessile or short stipitate 11
- 11 a. Petioles narrowly and shallowly sulcate above; rachis tomentellous (Andaman Islands)  
**14. C. sublyratus**
- b. Petioles distinctly deeply channelled above; rachis glabrous or almost so (Peninsular India) 12
- 12 a. Fruits larger (10 - 14 mm in diam.); leaves usually larger (7 - 25 cm long); basal glands of leaves shortly stipitate; inflorescences usually elongate, 12 - 30 cm long  
**5. C. gibsonianus**
- b. Fruits smaller (6 - 10 mm in diam.); leaves usually smaller (2 - 10 cm long); basal glands of leaves subsessile; inflorescences mostly shorter, 3 - 10 cm long  
**8. C. klotzschianus**
- 13 a. Scandent shrubs or sometimes climbers  
**4. C. caudatus**
- b. Erect shrubs, low undershrubs or trees 14

14a. Petioles 4 - 8 mm long; female sepals accrescent, 1.5 - 2 cm long; ovary glabrous

**9. C. lawianus**

b. Petioles usually longer, 5 - 80 mm or more long; female sepals not accrescent, much shorter; ovary pubescent 15

15a. Leaves hispid, scabrid-pubescent, pilose or sparsely pubescent above; style-branches usually quadrifid; fruits 8 - 14 mm in diam., muricate, scattered pubescent **2. C. aromaticus**

b. Leaves glabrous above; style-branches usually bifid; fruits 13 - 25 mm in diam., smooth, subglabrous **15. C. tigilium**

**1. Croton argyratus** Blume, Bijdr. Fl. Ned. Ind. 602. 1826; Hook.f., Fl. Brit. India 5: 385. 1887. **Fig. 32**

Burm. (And.): *Talibda*.

Shrubs or trees, 2 - 10 (-20) m tall, evergreen, all parts (except old stem and upper surface of leaves) densely clothed with appressed lepidote scales. Leaves narrowly to broadly elliptic, ovate, oblong or sometimes obovate, obtuse to rounded or acute and mostly narrowly cordate at extreme base, entire or serrulate along margins, acuminate to sub-acuminate at apex, 8 - 30 x 2.5 - 12 cm, membranous to thinly coriaceous, penninerved, sometimes weakly trinerved at base; lateral nerves 5 - 12 pairs; basal glands 2, sessile, occasionally obsolete; petioles 0.5 - 12 cm long. Inflorescences 6 - 20 cm long; bracts triangular, 0.8 - 2.5 mm long. Male flowers: pedicels 2.5 - 4 mm long; sepals 5, oblong, 1.8 - 2.5 x 0.8 - 2 mm; petals 5, spatulate, oblanceolate or oblong-lanceolate, 1.5 - 2.5 x 0.5 - 1.5 mm; stamens 10 - 12, 3 - 4.5 mm long; anthers oblong, 0.8 - 1 mm long. Female flowers: pedicels 1 - 10 mm long; sepals 5, oblong, 2.5 - 7 x 1 - 3 mm; petals 0 - 5, narrowly oblong to filiform, 0.5 - 3 mm long; ovary subglobose, 2.5 - 4 mm in diam.; styles 4.5 - 7 mm long, bifid. Capsules subglobose, 9 - 15 mm in diam., with 6 longitudinal furrows, brown when dry; pedicels 5 - 35 mm long; seeds ellipsoid, ovoid or obovoid, 6 - 8 x 4.5 - 6 mm.

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

*Distrib.* India: Fairly common in mixed forests or hill forests or edges of evergreen forests on rocks, rocky loam, sandy soil or clayey loam (once noted on limestone), up to 100 m altitude. Andaman & Nicobar Islands.

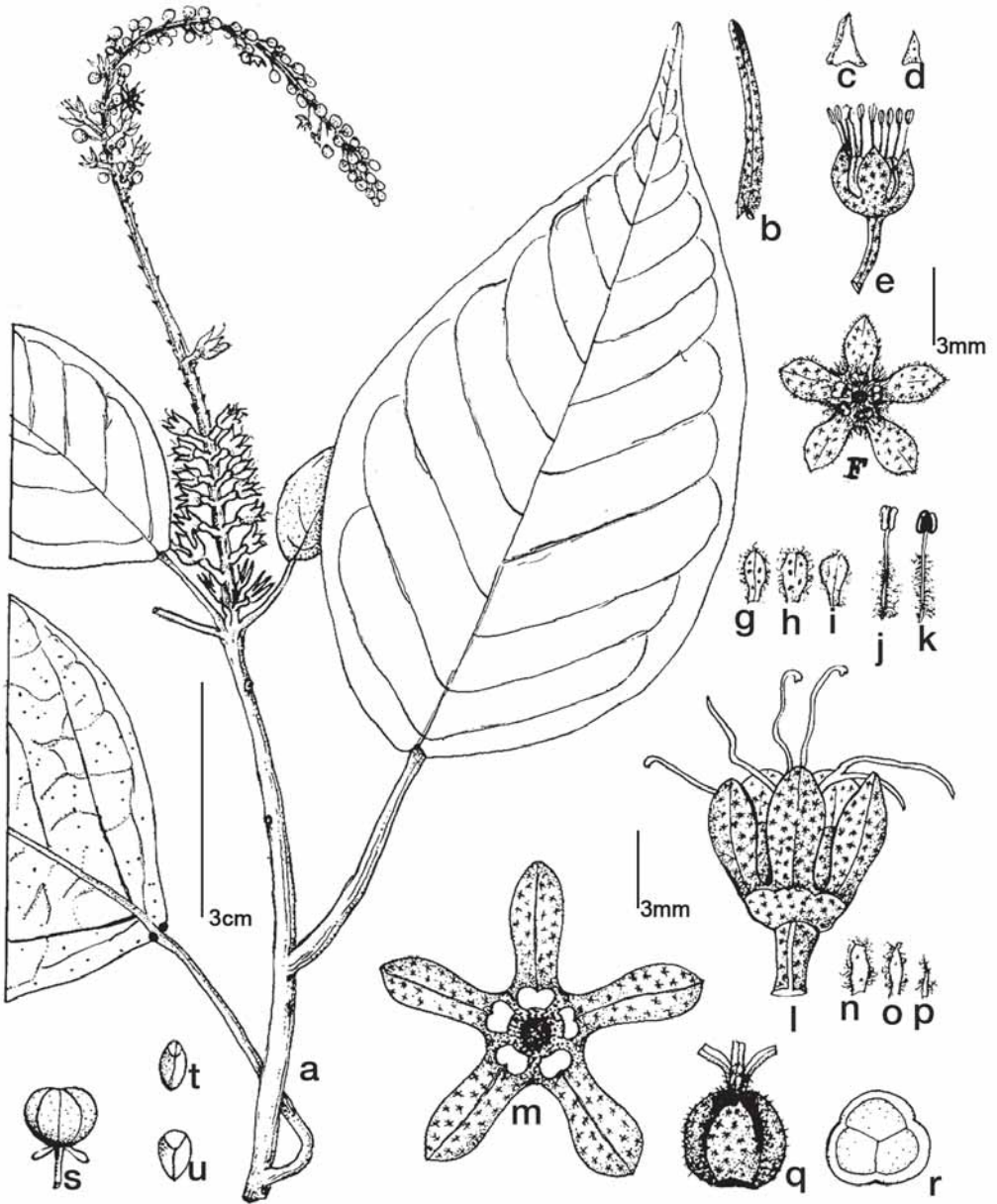
Myanmar, Indo-China, Thailand, Malaysia, Java, Sumatra, Borneo, Lesser Sunda Islands and Philippines.

*Uses.* Timber used as firewood and trunk as house posts and beams.

**2. Croton aromaticus** L., Sp. Pl. 1005. 1753; Hook.f., Fl. Brit. India 5: 388. 1887; Chakrab. & N.P. Balakr. in Bull. Bot. Surv. India 26: 200. 1984. *C. laccifer* L., Sp. Pl. 1005. 1753 (as '*lacciferum*'); Gamble, Fl. Madras 2(7): 1315. 1925 (repr. ed. 2: 920. 1957).

Tam.: *Teppadai*, *Vid-pune*.

Shrubs or trees, 3 - 15 (-20) m tall; all parts (except old branches) tomentose or scabrid-pubescent (especially on upper surface of leaves and petioles) and shortly hirsute or pilose from erect central rays. Leaves narrowly to broadly ovate, elliptic to orbicular or obovate or oblong to lanceolate, rounded, cordate or sometimes subcuneate at base, subentire to denticulate-serrulate margins, acute to acuminate or caudate at apex, 4 - 19 x 1.5 - 10 cm, membranous to thinly coriaceous, strongly trinerved at base; lateral nerves 2 - 9 pairs; basal glands shortly



**Fig. 32. *Croton argyratus* Blume:** a. flowering branchlet; b. stipule; c & d. bracts; e–k. male: e. flower; f. calyx viewed from above; g, h & i. petals; j & k. stamens; l–r. female: l. flower; m. calyx viewed from above; n, o & p. petals; q. ovary; r. t. s. of ovary; s. fruit; t & u. seeds.



stipitate or occasionally sessile; marginal glands present; petioles 0.5 - 5 cm long; stipules linear to filiform, 3 - 15 mm long. Inflorescences 6 - 15 cm long, sometimes purely male or female; bracts petaloid. Male flowers: pedicels 3.5 - 7 mm long; sepals (4 or) 5, ovate, elliptic to oblong, 2 - 3.5 x 1 - 2.5 mm; petals (4 or) 5, narrowly oblong to spatulate-oblong, 2 - 3 x 0.8 - 2 mm; stamens 15 - 30, 2.5 - 4 mm long; anthers oblong, 0.7 - 1 mm long. Female flowers: pedicels 1 - 4 mm long; sepals 5, elliptic, oblong to ovate, 1.8 - 4 x 1 - 3 mm; petals 5, filiform, 0.5 - 2.5 mm long; ovary subglobose, 2.5 - 4 mm in diam.; styles 3 - 5.5 mm long, usually twice bifid. Capsules subglobose, 8 - 14 mm in diam., shallowly 3-lobed, muriculate, scattered pubescent; pedicels 3 - 8 mm long.

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

*Distrib.* India: Fairly common in evergreen, deciduous or open forests, along streams or river banks up to 900 m altitude. Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Uses.* Bark yields a lac, used in varnish making.

**3. *Croton bonplandianus*** Baill. in *Adansonia* 4: 339. 1864; Croizat in *J. Bombay Nat. Hist. Soc.* 41: 573. 1940. *C. sparsiflorus* Morong in *Ann. New York Acad. Sci.* 7: 221. 1893; Prain in *Rec. Bot. Surv. India* 3(2): 276. 1905.

Beng.: *Banlanka, Jhunjhuni*; Or.: *Gandha-tulasi*; Tam.: *Eliama-nakku, Nai-milagai, Reil-poondy*; Tel.: *Kukka-mirapa*.

Erect herbs, up to 50 (- 100) cm high, perennial by rootstock; branches glabrous. Leaves narrowly to broadly ovate, oblong, elliptic to suborbicular or oblong-lanceolate to linear, acute, obtuse to rounded at base, shallowly serrate-dentate along margins, mucronate or acute or obtuse at apex, 1.5 - 9 (- 11) x 0.2 - 4.5 (- 5.5) cm, membranous to thinly chartaceous, glabrous above, sparsely pubescent to glabrous beneath, penninerved; lateral nerves 3 - 14 pairs; basal glands sessile; petioles 0.1 - 2 cm long, sparsely pubescent to glabrous. Inflorescences 3 - 15 (- 20) cm long, rarely unisexual. Male flowers: pedicels 1 - 3 mm long; sepals elliptic, oblong to ovate 1 - 2.5 x 0.5 - 1.5 mm; petals narrowly oblong to spatulate, 1.5 - 2.5 x 0.5 - 1 mm; stamens (11 -) 14 - 16 (- 20), 1.5 - 2.5 mm long. Female flowers: pedicels 0.5 - 1.5 mm long, with 1 or 2 sessile glands at base; sepals 5, triangular to oblong, 1 - 2 x 0.4 - 1 mm; petals obsolete; ovary oblong, 1 - 2 x 1 - 1.5 mm, 3 (- 5)-loculed, white tomentose; styles 2 - 3 mm long, bifid. Capsules oblong to ellipsoid, 4 - 7 (- 8) x 3 - 5 (- 6) mm, shallowly lobed, scattered puberulous to glabrous.

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

*Distrib.* India: Common weed in diversified habitats, mostly in wastelands and cultivated fields, up to 1000 m altitude. Jammu & Kashmir, Punjab, Haryana, Delhi, Rajasthan, Gujarat, Madhya Pradesh, Uttar Pradesh, Bihar, Jharkhand, West Bengal, Assam, Nagaland, Tripura, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu, Pondicherry and Andaman & Nicobar Islands.

Native of tropical S. America, now widespread in S. & SE. Asia (Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, Sri Lanka, Thailand, Malaysia, Borneo and Celebes).

*Uses.* The juice of young shoots is antiseptic and used to check bleeding in fresh cuts. Chemical studies reveal that the oil obtained from seeds contain palmitic, stearic, oleic, linoleic and decadienic acids (Ananthkrishnan et al. in Proc. Indian Acad. Sci. Sect. A. 14: 616 - 629. 1941). The seeds, leaves and stem contain the alkaloids, sparsiflorine and pronuciferine. Sparsiflorine has inhibitory property (*in vitro*) on heavy inocula of *Vibrio coma*, *Escherichia coli* and *Salmonella typhosa* (Acharya et al., J. Indian Med. Assoc. 43: 592 - 595. 1964). The plant is rich in potash and nitrogen and therefore suitable for composting. Oil obtained from seeds is supposed to drive away mosquitoes.

*Note.* Chromosome number:  $n = 8$  (Sanjappa, Taxon 28: 274. 1979).

**4. *Croton caudatus*** Geiseler, *Croton*. Monogr. 73. 1807; Hook.f., Fl. Brit. India 5: 388. 1887 (incl. several varieties). *C. caudatus* var. *obovoideus* N.P.Balacr. & Chakrab. in Bull. Bot. Surv. India 25: 190. 1983 (publ. 1985). **Fig. 33**

*Asm.:* Chahe-lewa, Lota-mahudi; *Beng.:* Nan-bhantur; *Gar.:* Dumi-shak; *Kh.:* Sohlam-brang; *Lep.:* Tak-chabrik, Talikkorik; *Lush.:* Mataun; *Mal.:* Umithini-kodi; *Mikir:* Kumkum-arong; *Nep.:* Halonge, Khali, Superai; *Or.:* Phalan-cokriti, Sanaushonta, Wusta.

Scandent (often bushy) or straggling shrubs or woody climbers; all parts coarsely tomentellous or scattered scabrid-pubescent (on leaves and petioles), hispid or hirsute from central rays. Leaves narrowly to broadly ovate, cordate, elliptic to oblong or orbicular, cordate or sometimes truncate or rounded at base, coarsely dentate-serrate to subserrulate along margins, acuminate to apiculate, at apex, 3 - 25 x 2 - 18 cm, membranous to thinly coriaceous, strongly trinerved at base; lateral basal nerves 2 - 6 pairs; basal glands stipitate; petioles 0.5 - 7 cm long; stipules lacerate with glandular tips, 4 - 15 mm long. Inflorescences 8 - 35 cm long, sometimes unisexual; bracts often fringed with stipitate glands. Male flowers: pedicels 3 - 9 (- 16) mm long; sepals 5 (or 6), ovate, oblong to elliptic, 2 - 4.5 x 1 - 3.5 mm; petals 5 (or 6), narrowly oblong-elliptic, 2 - 4 x 1 - 3 mm; stamens 18 - 40, 3.5 - 6 mm long. Female flowers: pedicels 1 - 5 mm long; sepals 5, oblong, elliptic to ovate, 2 - 6 x 1 - 4 mm, often fringed with sessile glands; petals 0 - 5, filiform, 0.5 - 2.5 mm long; ovary globose, 2 - 4 x 2 - 4 mm, densely hirsute or hispid; styles 5 - 13 mm long, free, bifid (rarely quadrid) almost to base. Capsules globose, oblong or obovoid, bluntly 3 or 6-angled, 1.5 - 3 x 1.5 - 2.5 cm, often muricate or verruculose, scattered pubescent; seeds scattered pubescent.

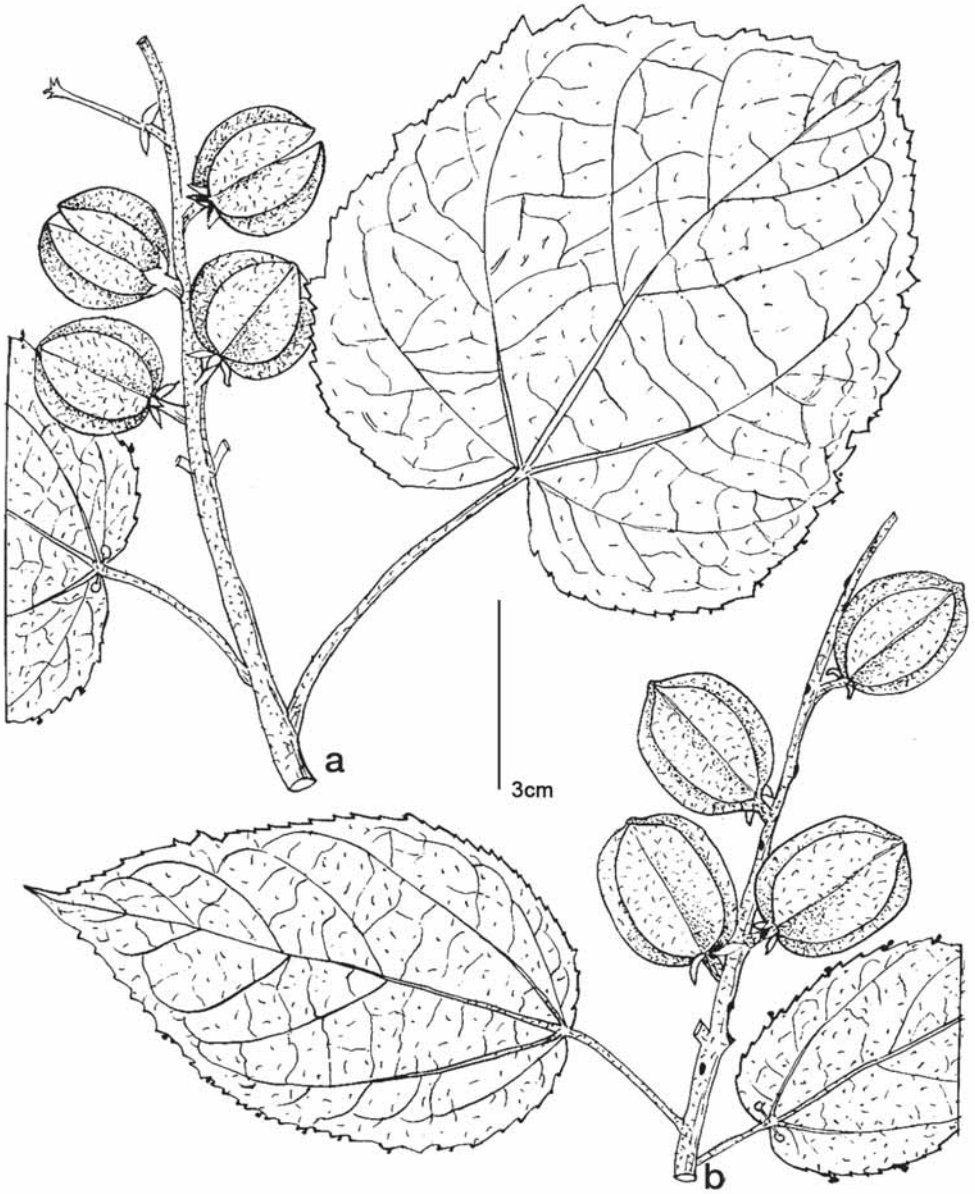
*Fl. & Fr.* Jan. - Dec.

*Distrib.* India: Evergreen forests, mixed forests or deciduous forests, often in scrubs and thickets, up to 1500 m altitude. West Bengal, Sikkim, Assam, Meghalaya, Arunachal Pradesh, Nagaland, Orissa, Karnataka, Kerala and Tamil Nadu.

Pakistan, Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, S. China, Thailand, Malaysia, Sumatra, Java, Borneo, Philippines, Celebes and Lesser Sunda Islands.

*Uses:* The branches serve as ropes. The leaves are used as poultice to sprains. The root is a purgative. The young shoots are used to cure cholera and ground with leaves of *Caesalpinia sappan* for use in treatment of liver diseases.

**5. *Croton gibsonianus*** Nimmo in J.Graham, Cat. Pl. Bombay 251. 1839; Hook.f., Fl. Brit. India 5: 392. 1887. **Fig. 34**



**Fig. 33. *Croton caudatus* Geiseler:** a & b. fruiting branchlets showing different shapes of leaves and fruits.

Shrubs, 1 - 5 m tall; branchlets glabrous. Leaves narrow, oblong to elliptic or often oblanceolate, rounded, cuneate, acute or narrowly cordate at base, shallowly crenate-serrate to subentire along margins, acute to acuminate at apex, (5.5-) 7 - 25 x (1-) 2 - 7 (-10) cm, membranous to chartaceous, glabrous, sometimes glossy, penninerved; lateral nerves 4 - 14 pairs; basal glands 2, stipitate; petioles 0.2 - 4.5 cm long. Inflorescences 12 - 30 cm long. Male flowers: pedicels 3 - 8 mm long; sepals ovate, elliptic to oblong, 1.5 - 3 x 1 - 1.5 mm; petals spatulate or oblanceolate, 1.5 - 2.5 x 0.8 - 1.5 mm; stamens 10 - 11, 2.5 - 3.5 mm long; anthers oblong, ca 1 mm long. Female flowers: pedicels 2 - 5 mm long; sepals ovate-lanceolate, 2.5 - 5 x 1 - 2 mm; petals 0 - 5, filiform, 0.5 - 1 mm long; ovary globose, 2 - 3.5 mm in diam., tomentose; styles 4.5 - 8 mm long. Capsules globose, 3-lobed, 1 - 1.5 mm in diam., sparsely puberulous to glabrous.

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

*Distrib.* India: Common in moist deciduous, evergreen rain forests and outskirts of forests as undergrowth, up to 500 m altitude. Karnataka and Kerala.

Endemic.

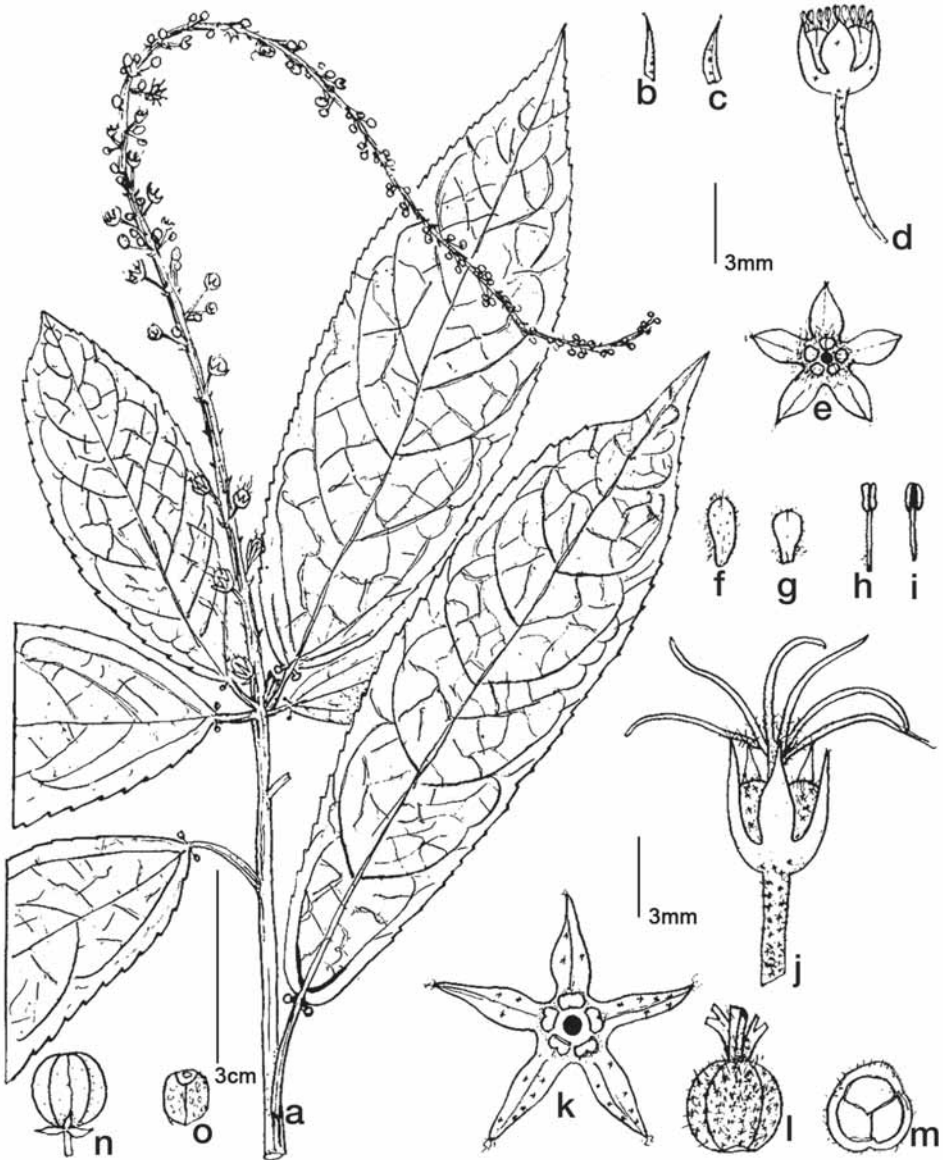
*Uses.* Said to be useful for rheumatism in local medicine.

*Notes.* Sometimes it may not be easy to separate the materials of *C. gibsonianus* from those of *C. klotzschianus*, except by their larger fruits. However, the leaves of the former are usually much larger with stipitate basal glands and the inflorescences are generally much longer. Further, here the hairs tend to be more persistent. Another strong microscopic character that distinguishes it is that the upper surfaces of leaves of *C. klotzschianus* bear stomata near the major veins, whereas in *C. gibsonianus* the stomata are totally absent on the upper surface of leaves.

Pollen grains inaperturate, sexine with crotonoid pattern. D = 60  $\mu$ m (52 to 70) (Tissot, Chikhi & Nayar, Pollen of wet evergreen forests of the Western Ghats, India, *Publ. du depart. D'ecologie, Inst. Francias de Pondichery*, p. 28, pl. 27. 1994).

**6. *Croton glandulosus*** L., Syst. ed. 10, 2: 1275. 1795. var. ***hirtus*** (L'Her.) Müll.Arg. in DC. Prodr. 15(2): 684. 1866. *C. hirtus* L'Her., Stirp. Nov. 1: 17, t. 9. 1785; V.S.Ramach. et al. in Indian J. Forest. 15(2): 183, f. 1. 1992; Govearts et al., World Checkl. & Bibl. Euphorbiaceae 2: 461. 2000.

Herbs, annual, erect, up to 50 cm high; stems woody; branches densely hirsute. Leaves triangular-ovate, rhombate-ovate to suborbicular, rounded, obtuse to subtruncate at base, denticulate-serrulate along margins, acute at apex, 2 - 9 x 1 - 4.5 cm, membranous to thinly chartaceous, scattered strigose, strongly trinerved at base; lateral nerves 3 - 5 pairs; basal glands long-stipitate; petioles 0.4 - 2.8 cm long, hirtellous; stipules filiform, 3 - 5 mm long. Inflorescences up to 4 cm long; rachis densely hirsute and with branched capitate glands towards base; bracts 2 - 4 mm long, fringed with slender capitate glands. Male flowers: pedicels 1 - 1.5 mm long; sepals obovate to elliptic, 1.5 - 1.8 x ca 1 mm; petals spatulate, ca 1.8 x 1 mm; stamens 10 - 11, ca 2 mm long; anthers oblong, ca 0.5 mm long. Female flowers: pedicels ca 0.5 mm long; sepals unequal, narrowly oblong to oblanceolate, the larger ones 3 - 4 x 0.8 - 1.5 mm, the smaller ones 1 - 2 x 0.2 - 0.5 mm, shallowly denticulate along margins; petals filiform, ca 0.3 mm long, sometimes obsolete; ovary globose, ca 1 mm in diam., densely hirsute; styles ca 2 mm long. Capsules globose, 3-lobed, 4.5 - 5 mm in diam., brown, thin-walled, scattered hirsute; pedicels ca 1 mm long.



**Fig. 34. *Croton gibsonianus* Nimmo:** a. flowering branchlet; b. stipule; c. bract; d – i. male: d. flower; e. calyx viewed from above; f & g. petals; h & i. stamens; j – m. female: j. flower; k. calyx viewed from above; l. ovary; m. t. s. of ovary; n. fruit; o. seed.

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

*Distrib.* India: A weed in wastelands, near streams and wetlands, up to 550 m altitude. Sometimes found in dry deciduous forests. Tamil Nadu (Southern districts) and Kerala (Malappuram and Alappuzha Districts).

Native to W. Indies and C. & S. America, becoming an aggressive weed in tropical Africa and Asia.

**7. *Croton joufra*** Roxb., *Fl. Ind.*, ed. Carey 3: 685. 1832; Hook.f., *Fl. Brit. India* 5: 387. 1887.

*Asm.*: Mahudi; *Beng.*: Joufra; *Kh.*: Dieng-lamosuh; *Man.*: Thauang; *Mikir*: Martuarong; *Naga*: Inthap-ching.

Shrubs or trees, deciduous, 3 - 15 m tall; all parts except older branchlets and leaves densely lepidote. Leaves elliptic to oblong or obovate to oblanceolate, cuneate or acute at base, shallowly dentate-serrate to subentire along margins, acuminate to acute or sometimes obtuse to rounded at apex, 5 - 30 (- 35) x 2 - 9 cm, thinly coriaceous to chartaceous, glabrous, penninerved; lateral nerves 6 - 19 pairs; basal glands 2, sessile; petioles 1 - 5 cm long, densely lepidote to glabrous. Inflorescences up to 35 cm long, rarely unisexual; bracts triangular or deltoid, 0.7 - 2 mm long. Male flowers: pedicels 2.5 - 6 mm long; sepals ovate to oblong, 1.5 - 3.5 x 1 - 2.5 mm; petals oblong-elliptic to oblanceolate, 2 - 3 x 0.8 - 1.5 mm; stamens 10 - 13, 3 - 4.5 mm long. Female flowers: pedicels 1.5 - 6 mm long; sepals triangular-acuminate to ovate, 1.5 - 3 x 1 - 2.5 mm; petals filiform, 0.5 - 3 mm long; ovary ovoid or oblong-ellipsoid, 2.5 - 4 x 2.5 - 3.5 mm, with irregular longitudinal ridges, usually obtuse at apex; styles 4 - 7 mm long. Capsules ovoid to ellipsoid or oblong to obovoid, very shallowly 3-lobed, 2.5 - 4 x 2 - 3 cm.

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

*Distrib.* India: Common in mixed forests, deciduous forests, edges of forests or scrub forests, up to 1300 m altitude. Assam, Arunachal Pradesh, Nagaland, Mizoram, Tripura and Meghalaya.

Bhutan, Bangladesh, Myanmar, China and Vietnam.

*Uses.* Plant contains alkaloids and tannins. In N.E. India, the leaves, seeds and roots are used in tribal medicine (unspecified) and the bark employed in veterinary medicine. Bark and leaves also used for fermenting liquor. The seeds used as arrow poison by the Khasi tribe of Meghalaya.

**8. *Croton klotzschianus*** (Wight) Thwaites, *Enum. Pl. Zeyl.* 276. 1861; Hook.f., *Fl. Brit. India* 5: 392. 1887. *Tigilium klotzschianum* Wight, *Icon. Pl. Ind. Orient.* 5: t. 1914. 1852 (as '*klotcheanum*').

*Mal.*: Nanchu; *Tam.*: Tani.

Shrubs (often bushy) or trees, 2 - 7 m tall; branchlets glabrous. Leaves oblong to elliptic or often ovate-oblong to obovate-oblong, acute, obtuse to rounded at base, shallowly serrate

to subentire along margins, acute to acuminate at apex, 2 - 12 (- 15) x 1 - 4 (- 6) cm, membranous to chartaceous, glabrous or puberulous on nerves beneath, often glossy, penninerved (occasionally weakly trinerved at base); lateral nerves 5 - 10 pairs; basal glands sessile; petioles 0.3 - 3 cm long; stipules linear-lanceolate or subulate, 3 - 7 mm long. Inflorescences terminal, (3 -) 5 - 10 (- 18) cm long. Male flowers: pedicels 2.5 - 5 mm long; sepals oblong, elliptic to ovate, 1.5 - 3 x 0.5 - 2 mm; petals obovate to oblanceolate, 1.8 - 3 x 0.5 - 2 mm; stamens (8 -) 11 - 14, 2 - 3 mm long. Female flowers: pedicels 1.5 - 4 mm long; sepals 5 (- 7), narrowly oblong to lanceolate, 1.5 - 4 x 0.5 - 2 mm; petals 0 - 5, filiform or subulate, up to 1.5 mm long; ovary subglobose, 1.5 - 2.5 mm in diam., tomentose or hirsute; styles 3.5 - 6 mm long, free, bifid. Capsules subglobose, 3-lobed, 6 - 10 mm in diam., glabrous to sparsely puberulous.

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

*Distrib.* India: Evergreen forests, at 200 - 1000 m altitude. Andhra Pradesh, Tamil Nadu and Kerala.

Sri Lanka.

*Notes.* Superficially, *C. klotzschianus* is similar to *C. gibsonianus* and distinguishable only by its smaller fruits. See notes under *C. gibsonianus*.

**9. *Croton lawianus*** Nimmo in J. Graham, Cat. Pl. Bombay 251. 1839; Dalzell & A. Gibson, Bombay Fl. 232. 1861; Hook.f., Fl. Brit. India 5: 394. 1887. **Fig. 35**

Trees; young shoots coarsely ochraceous tomentose; branchlets glabrous. Leaves ovate to ovate-lanceolate, rounded at base, entire, caudate-acuminate or occasionally acute at apex, 4.5 - 14 x 2.5 - 6 cm, membranous to chartaceous, glabrous, strongly trinerved at base; lateral nerves 2 - 4 pairs; basal glands 2 - 4, sessile; petioles 4 - 8 mm long, glabrous; stipules not seen. Inflorescences ca 5 cm or more long; bracts subflabelliform and 2 - 6 mm long in female, subulate and 0.8 - 1 mm long in male. Male flowers: pedicels sparsely hirsute; sepals broadly ovate, elliptic or suborbicular; petals oblong; stamens 15 - 20; anthers oblong. Female flowers: pedicels 2 - 2.5 mm long; sepals elliptic, oblong to ovate, 4 - 7 x 3 - 4.5 mm, accrescent; petals obsolete; ovary broadly oblong, 2 - 2.5 x ca 2 mm, subglabrous; styles 5 - 6.5 mm long, bifid or quadrifid almost to base. Capsules broadly oblong-ellipsoid, prominently 3-lobed, 13 - 17 x 11 - 15 mm, glabrous, brownish; fruiting pedicels 1 - 1.5 cm long.

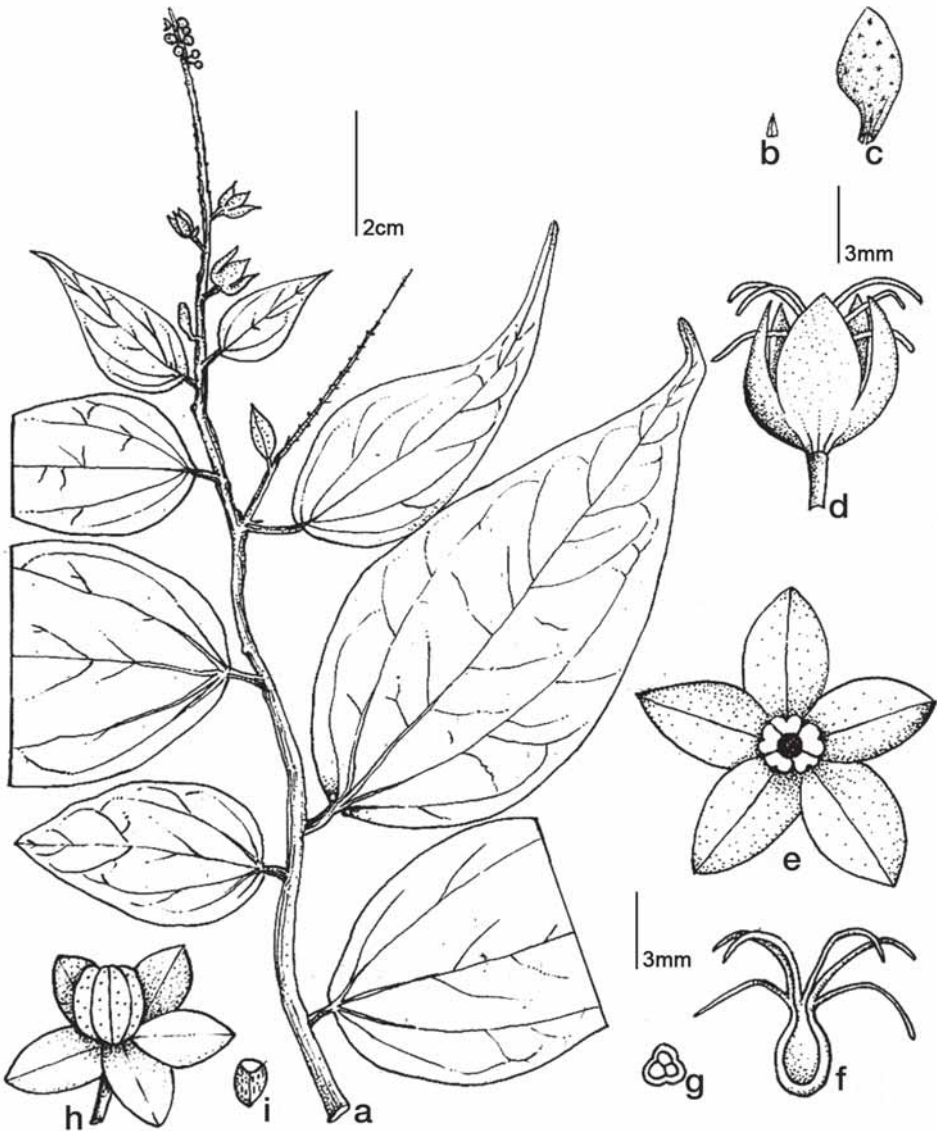
*Fl. & Fr.* Not known.

*Distrib.* India: Karnataka [Chickmagalur Dist., Bababudan Hills, *Law* s. n. (K); *ibid.* Dalzell s. n. (CAL acc. no. 411077)].

Endemic and extremely rare, no collection except the above types seen.

*Notes.* *Croton lawianus* Nimmo is a valid publication.

**10. *Croton lissophyllus*** Radcl.-Sm. & Govaerts [in Kew Bull. 52: 187. 1997, nom. nud.] ex Esser in Novon 12: 45. 2002. *C. hookeri* Croizat in J. Arnold Arb. 21: 498. 1940, nom. invalid. et illeg., non *C. hookeri* Andre, Illus. Hort. 19: 56. 1872. *C. laevifolius* auct. non Blume 1826: sec. Hook.f., Fl. Brit. India 5: 391. 1887. *C. oblongus* sec. N.P. Balakr., Fl. Jowai 2: 428. 1983 (non Burm.f. 1768).



**Fig. 35.** *Croton lawianus* Nimmo: a. branchlet with inflorescence; b. male bract; c. female bract; d. female flower; e. calyx viewed from above; f. ovary; g. t. s. of ovary; h. fruit; i. seed.



Kh.: *Dieng-kharang, Dieng-soh-rin, Soh-kymphira.*

Shrubs or trees, 3 - 5 (- 16) m tall; branchlets glabrous. Leaves elliptic to oblong or obovate to oblanceolate, cuneate or acute or rounded at base, crenulate-serrulate or subentire along margins, acute to acuminate at apex, 3 - 13 (- 16) x 1.5 - 4.5 (- 6) cm, membranous to chartaceous, glabrous or sparsely puberulous beneath, penninerved; lateral nerves 4 - 12 pairs; basal glands 2, long-stipitate, petioles 2 - 25 (- 30) mm long, subglabrous; stipules filiform, 2 - 8 mm long. Inflorescences 4 - 12 cm long; bracts lanceolate, 0.5 - 2.5 mm long. Male flowers: pedicels 1.5 - 3 mm long; sepals oblong, elliptic to ovate, 1.5 - 3 x 0.5 - 2 mm; petals oblanceolate, 1.5 - 2.5 x 0.5 - 1 mm; stamens 10 - 11, 2.5 - 3 mm long; anthers oblong, 0.5 - 0.8 mm long. Female flowers: pedicels 1.5 - 4 mm long; sepals oblong to elliptic, 1.5 - 3 x 0.5 - 2 mm; petals 0 - 5, filiform or subulate, 0.5 - 1.3 mm long; ovary obovoid, 1.3 - 2 x 1 - 1.5 mm, 2 (or 3)-locular, ochraceous tomentose; styles 2.5 - 4.5 mm long, free, bifid almost to base. Capsules obovoid or subglobose, usually bilocular, rarely 3-locular, 2 (or 3)-lobed, 6 - 10 mm in diam., intruded at apex, subglabrous.

*Fl. & Fr.* April - Nov.

*Distrib.* India: Common in primary evergreen forests, up to 1700 m altitude. Meghalaya.

Bangladesh.

**11. *Croton malabaricus*** Bedd., Forester's Man. 204. 1873 & Icon. Pl. Ind. Orient. t. 181. 1874; Hook.f., Fl. Brit. India 5: 386. 1887.

Mal.: *Anakkuru, Kolavacchi, Koluvasi, Pimbaram, Thenadal*; Tam.: *Anakkutu, Malamgouri, Thavattu-polavu.*

Trees, 6 - 30 m tall, all parts except old branches and upper surface of leaves densely lepidote. Leaves ovate, elliptic to suborbicular or oblong-elliptic, rounded, obtuse to acute at base, entire to serrulate along margins, acuminate or caudate at apex, 5 - 24 x 2.5 - 10 cm, membranous to chartaceous, glabrous above, penninerved; lateral nerves 4 - 9 pairs; basal glands sessile; petioles 1 - 7.5 cm long; stipules filiform, 0.8 - 2 mm long. Inflorescences 2.5 - 12 cm long. Male flowers: pedicels 2 - 6 mm long; sepals ovate to elliptic or triangular, 2 - 3.5 x 1 - 1.5 mm; petals narrowly oblong-elliptic to oblanceolate, 2 - 3.5 x 0.7 - 1.8 mm; stamens 10 or 11 (- 15), 4 - 6.5 mm long. Female flowers: pedicels 3 - 5 (- 10) mm long; sepals oblong to narrowly ovate-oblong, 3.5 - 5 x 1.5 - 2 mm; petals 0 - 5, lanceolate or filiform, 0.5 - 4 mm; ovary obovoid, 2 - 3 x 1.5 - 2.5 mm; styles 5 - 8 mm long, bifid above. Capsules obovoid, shallowly 3-lobed, 1.8 - 2.5 x ca 1.5 cm, shortly stipitate.

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

*Distrib.* India: Western Ghats in open forests or semievergreen forests up to 1200 m altitude. Karnataka, Kerala and Tamil Nadu.

Endemic.

*Notes.* Pollen grains inaperturate, sexine with crotonoid pattern. D = 52  $\mu$ m (45 to 57) (Tissot, Chikhi & Nayar, Pollen of wet evergreen forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery*, 28, pl. 28. 1994).

**12. *Croton persimilis*** Müll.Arg. in *Linnaea* 34: 116. 1865 & in DC., *Prodr.* 15(2): 618. 1866 (excl. var. *glabrata*) emend. Philcox in Dassan. & Clayton, *Rev. Handb. Fl. Ceylon* 11: 92. 1997; Chakrab. & N.P. Balakr. in *J. Econ. Taxon. Bot.* 30: 298, f. 1. 2006. *C. oblongifolius* Roxb., *Fl. Ind.*, ed. Carey 3: 685. 1832; Hook.f., *Fl. Brit. India* 5: 386. 1887 (non Delile 1814, nec Siebr. ex Spreng. 1826). *C. roxburghii* N.P. Balakr. in *Bull. Bot. Surv. India* 3: 39. 1961 (publ. 1962), nom. illeg. non *C. roxburghii* Wall. 1840. *C. virbala* M.R. Almeida in *J. Bombay Nat. Hist. Soc.* 100: 580. 2003.

Asm.: *Burmaparokupi, Mahunda*; Beng.: *Baragach, Chucka, Putri*; Garo: *Bol-mang-cham*; Hindi: *Arjuna, Chucka*; Kh.: *Dieng-la-masu*; Mal.: *Kote, Putol, Pongalam*; Mar.: *Ganasura, Gunsur*; Mikir: *Marthu-arong*; Naga: *Thing-ban-lin*; Nep.: *Akh*; Or.: *Mahasindhu, Masundi*; Sans.: *Nagadanti*; Tam.: *Millakumari, Milagu-nari*; Tel.: *Bhutan-kusam, Bhutala-bhairi*.

Shrubs or trees, 2 - 12 (-25) m tall, deciduous; all parts except older branchlets and leaves lepidote. Leaves oblong, elliptic to ovate-oblong or obovate, rounded or shortly cordate at base, coarsely dentate-serrate or crenate along margins, acute to short-acuminate or obtuse or rounded at apex, (6 -) 10 - 45 x (3 -) 5 - 16 cm, coriaceous to firmly chartaceous, glabrous, penninerved; lateral nerves 8 - 22 pairs; basal glands sessile, often obsolete; petioles (0.5 -) 1 - 7 (- 12) cm long, scattered lepidote, glabrescent in age; stipules linear, 4 - 7 mm long. Inflorescences 12 - 55 cm long, sometimes unisexual. Male flowers: pedicels 2 - 5 mm long; sepals ovate, elliptic to triangular, 2 - 3.5 x 1 - 2.5 mm; petals spatulate or narrowly oblong, 2 - 3.5 x 0.5 - 1.5 mm; stamens 10 - 15, 3.5 - 4.5 mm long. Female flowers: pedicels 2 - 5 mm long; sepals ovate to elliptic, 2 - 3.5 x 1 - 2.5 mm; petals spatulate to filiform, 0.3 - 1.5 mm long; ovary subglobose, 2 - 4 mm in diam.; styles 4 - 6 mm long, free, bifid. Capsules subglobose, usually slightly intruded at apex, 3-lobed, 8 - 12 mm in diam.

*Fl.* Oct. - Dec.; *Fr.* Dec. - March.

*Distrib.* India: Sub Himalayan tracts or warmer parts or in rain forests or deciduous forests or scrubs, up to 1300 m altitude. Uttar Pradesh, Bihar, Jharkhand, West Bengal, Sikkim, Assam, Nagaland, Meghalaya, Orissa, Madhya Pradesh, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

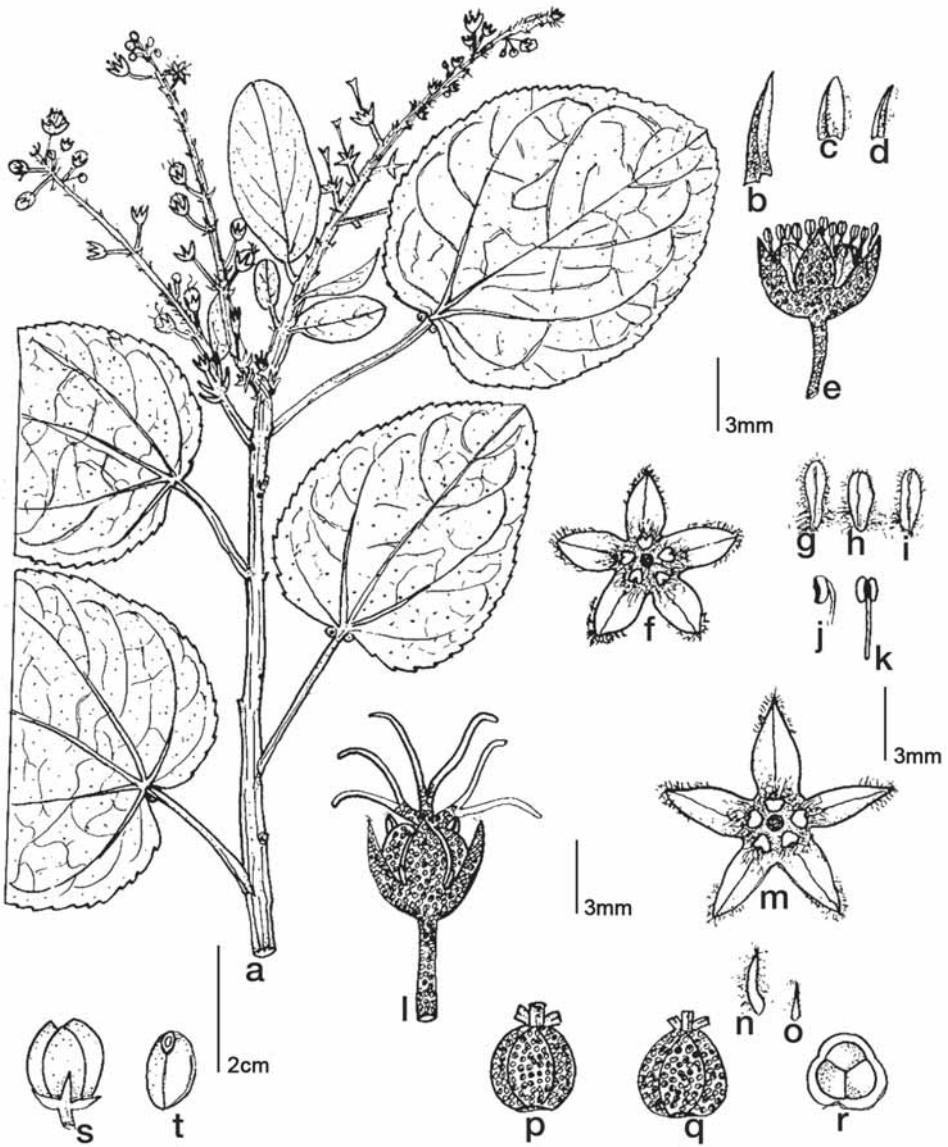
Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, SW. China (Yunnan), Indo-China and Thailand.

*Uses.* The bark contains a number of closely related diterpenes, particularly oblongifoliol and deoxy-oblongifoliol, as well as a triterpene acid called acetyl aleuritelic acid (Aiyar & Seshadri, *Indian J. Chem.* 9: 1028, 1055. 1971 & in *Curr. Sci.* 41: 839 - 840. 1972). The root bark is a remedy for chronic enlargement of liver. Powdered root bark taken orally in chronic hepatitis and applied externally to sprains, bruises and rheumatic swellings. The root, bark and seeds are drastic purgative and poisonous in large doses. Oil from the seeds, which forms a substitute for croton oil (from *C. tiglium*), often used as insecticide in N.E. India.

*Note.* Chromosome number reported is n = 10 (Bedi et al., *Taxon* 29: 353. 1980).

**13. *Croton scabiosus*** Bedd., *Fl. Sylv. S. India* t. 283B. 1872 & Forester's *Man.* 204. 1873; Hook.f., *Fl. Brit. India* 5: 386. 1887.

**Fig. 36**



**Fig. 36. *Croton scabiosus* Bedd.:** a. branchlet with flowers; b. stipule; c & d. bracts; e – k. male: e. flower; f. calyx viewed from above; g, h & i. petals; j & k. stamens; l – r. female: l. flower; m. calyx viewed from above; n & o. petals; p & q. ovary; r. t. s. of ovary; s. fruit; t. seed.

Tel.: *Chilla, Yerrichilla.*

Trees, up to 8 m tall; all parts densely silvery or orange-brown or golden lepidote. Leaves ovate, cordate, oblong, elliptic to orbicular, cordate, rounded or subtruncate at base, crenate-serrate along margins, obtuse, rounded to acute at apex, 4 - 16 x 2 - 12 cm, thinly coriaceous, strongly trinerved at base; lateral nerves above the basal 1 - 6 pairs; basal glands 2, sessile; petioles 1 - 5 cm long. Inflorescences 3 - 10 cm long; bracts ovate, subulate or linear-lanceolate, 0.5 - 3 mm long. Male flowers: pedicels 2.5 - 3.5 mm long; sepals ovate to oblong-elliptic, 1.5 - 3 x 1 - 2 mm; petals oblong-elliptic to spatulate, 2 - 3 x 0.5 - 1 mm; stamens 8 - 16, 3 - 3.5 mm long. Female flowers: pedicels 2 - 2.5 mm long; sepals as in male; ovary globose or ovoid, 1 - 2 mm in diam., 3 or 4-locular; styles 3 - 5 mm long, free, bifid. Capsules subglobose, 8 - 12 mm in diam., prominently 3 or 4-lobed; seeds oblong, 6 - 10 x 4 - 7 mm.

*Fl. & Fr.* Jan. - July (-Dec.?).

*Distrib.* India: Semievergreen or deciduous forests of Eastern Ghats between 300 to 1200 m altitudes. Andhra Pradesh.

Endemic.

*Uses:* The silvery or golden foliage is very attractive, may be cultivated as an ornamental.

**14. *Croton sublyratus*** Kurz in J. Asiat. Soc. Bengal. Pt. 2, Nat. Hist. 42(2): 243. 1873 & Forest Fl. Burma 2: 374. 1877; Hook.f., Fl. Brit. India 5: 390. 1887.

Beng. (And.): *Putri.*

Shrubs or trees, deciduous, up to 10 m tall; branchlets glabrous. Leaves lyrate, obovate, elliptic-obovate to oblanceolate, cuneate or subcuneate at base and narrowly cordate at extreme base, shallowly serrate to subentire along margins, caudate-acuminate or sometimes obtuse to rounded at apex, 5 - 24 x (1.5 -) 3 - 7 (- 9) cm, membranous to firmly chartaceous, glabrous, penninerved; lateral nerves 6 - 13 pairs; basal glands shortly stipitate or subsessile; petioles 0.5 - 7 mm long, sparsely hispid. Inflorescences (6 -) 10 - 22 cm long; bracts lanceolate or triangular to subulate, 0.8 - 3 mm long. Male flowers: pedicels 3 - 6 mm long; sepals ovate, oblong to elliptic, 2 - 3.5 x 1 - 2.5 mm, tomentose outside; petals obovate or oblong, 2 - 3 x 1 - 2 mm; stamens 11 (- 20), 3 - 4 mm long. Female flowers: pedicels 2.5 - 6 (- 9) mm long; sepals oblong, elliptic to obovate, 3 - 5.5 x 1.5 - 3 mm, tomentose outside; petals obsolete; ovary strongly 3 (or 4)-lobed, 2 - 3 x 2.5 - 3 mm, tomentose; styles 3 - 4 mm long, bifid. Capsules deeply 3 (or 4)-lobed, intruded at apex, 5.5 - 7.5 x 7 - 8 mm, thinly pubescent.

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

*Distrib.* India: Coastal and inland evergreen forests or scrub jungles, often along stream sides, on clayey soil. Andaman & Nicobar Is.

Myanmar.

*Uses.* Pounded bark applied externally as a remedy for body pain in Andamans. Vongcharoensathit & de Eknamukul (in Pl. Medica 64: 279 - 280. 1998) report from Thailand the presence a chemical called 'plaunotol' in this species, which has anti-cancer properties.

*Notes.* The inflorescences often arise precociously from the apices of defoliated branches and the fruits become ripe when the young leaves are still unfolding.

**15. *Croton tiglium* L., Sp. Pl. 1004. 1753; Hook.f., Fl. India 5: 393. 1887. *C. himalaicus* D.G.Long in Notes Roy. Bot. Gard. Edinburgh 44: 170. 1986.**

*Asm.: Jaipal, Kanibhi; Beng.: Jaifal; Guj.: Neepal, Nervalam; Hindi: Jamalgota, Jayfala, Jaipal; Kan.: Danti, Japalabeeja, Neepala, Nervalam; Kh.: Dieng-kymbat-lasam; Mal.: Dantibijam, Neervalam, Valam; Mar.: Jamalgota, Jepak; Nep.: Guj, Lepchabis; Or.: Jaipala, Konika; Sans.: Danti, Jaifala, Kanakaphala, Neepala; Tam.: Kattukkattai, Naganam, Neervalam, Nigumbam, Sambari, Sayabalam, Sevalangoltai, Siduram, Tendi; Tel.: Neepala-vitua, Neepala-vema, Neepalam, Nervalam.*

Shrubs or trees, evergreen, up to 15 m tall; branchlets glabrous. Leaves ovate, elliptic, oblong or obovate, rounded, obtuse to acute at base, serrate to distantly serrulate along margins, acuminate or sometimes acute at apex, (3 -) 7 - 20 (- 28) x (1-) 2.5 - 8 (- 11) cm, membranous, glabrous above, sparsely pubescent to glabrous beneath, strongly trinerved at base; lateral nerves 1 - 6 pairs above the basal; basal glands sessile or subsessile; petioles (0.5 -) 1 - 8 (- 12) cm long, glabrous. Inflorescences 5 - 18 cm long, sometimes unisexual. Male flowers: pedicels 2 - 5 mm long; sepals elliptic, oblong to ovate, 1.5 - 4 x 1 - 2.5 mm; petals oblong-elliptic to oblanceolate, 2 - 4 x 0.7 - 2 mm; stamens 14 - 20 (- 25), 3 - 4 mm long. Female flowers: pedicels 2 - 8 mm long; sepals oblong, triangular or lanceolate, 2 - 4.5 x 0.7 - 3 mm; petals 0 - 5, linear to filiform, 0.5 - 1.5 mm long; ovary obovoid or oblong, 2.5 - 4 x 2 - 3.5 mm, tomentose; styles 3.5 - 7 mm long, free, bifid. Capsules obovoid to oblong, 3 (or 4) lobed, 1.6 - 2.5 x 1.3 - 2 cm, subglabrous.

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

*Distrib.* India: Evergreen or mixed forests or scrubs ascending to 2000 m altitude, often widely cultivated as hedge plant and for medicinal purposes. Madhya Pradesh, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Arunachal Pradesh, Nagaland, Meghalaya, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka, Bhutan, Bangladesh, Myanmar, China, Thailand, Taiwan, Japan and throughout Malesia.

*Uses.* Popularly known as Croton oil, the oil from seeds is a very drastic purgative and used externally in rheumatism and dermatitis. The twig is said to be diaphoretic in small doses and used for clearing teeth and for curing toothache. An alcoholic extract of the seeds showed antibacterial activity against *Staphylococcus aureus* and *Escherichia coli*. Being unsafe to use, croton oil has now been removed from various pharmacopoeias.

**16. *Croton zeylanicus* Müll.Arg. in Linnaea 34: 107. 1865 & in DC., Prodr. 15(2): 581. 1866. *C. reticulatus* B. Heyne ex Müll.Arg. in DC., Prodr. 15(2): 580. 1866 (non Willd., 1805); Hook.f., Fl. India 5: 386. 1887. *C. hypoleucus* Dalzell in Hooker's J. Bot. Kew Gard. Misc. 3: 123. 1851 (non Schlecht. 1847); Dalzell & A.Gibson, Bombay Fl. 231. 1861.**

*Mar.: Panduray, Pondhari, Pandharisala.*

Shrubs, often bushy or small trees, up to 3 m tall; all parts (except older branchlets and

upper surface of leaves) densely silvery or coppery lepidote; branchlets slender. Leaves alternate but often subopposite or in false whorls separated by long bare internodes, narrowly elliptic to oblong or often ovate-oblong to ovate-lanceolate, rounded, obtuse to acute at base, entire, caudate-acuminate or sometimes acute at apex, (3 -) 6 - 14 (- 20) x (0.5 -) 1.5 - 5 (- 8) cm, chartaceous to firmly membranous, evanescently stellate-pubescent above (when young), penninerved; lateral nerves 4 - 11 pairs; basal glands 2 - 4 (- 6), long-stipitate or rarely sessile; petioles 0.5 - 3 (- 4) cm long; stipules linear or subulate, 3 - 8 mm long. Inflorescences 3 - 8 cm long, rarely unisexual. Male flowers: pedicels (1.5 -) 3 - 7 mm long; sepals ovate to oblong-elliptic, 1.5 - 3.5 x 1 - 2 mm; petals spatulate-obovate to oblong, 1.8 - 3 x 1 - 2 mm; stamens 10 - 23, 2.5 - 3.5 mm long. Female flowers: pedicels 2 - 4 mm long; sepals (4 or) 5, narrowly elliptic-oblong to oblanceolate, 3 - 6.5 x 1 - 2 mm, often slightly accrescent; petals 0 - 5, linear or oblanceolate, 1 - 2 mm long; ovary subglobose, 2 - 3.5 mm in diam.; styles up to 1 cm long, twice or thrice bifid above. Capsules globose, shallowly 3-lobed, 1 - 1.2 cm in diam.; sepals 5 - 10 mm long.

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

*Distrib.* India: Western Ghats, in evergreen moist rain forests or open areas in forests and scrubs, on clayey or red gravelly soil, between 700 to 1500 m altitudes. Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Uses:* Bark is bitter and stomachic.

**Croton lobatus** L. is recently recorded from Solapur district, Maharashtra by Gaikward et al. (unpublished).

#### EXCLUDED SPECIES

*Croton basanthi* T.K.Paul [in J. Econ. Taxon. Bot. 25: 594 - 596, f. 1. 2001] is **Allophylus chartaceus** (Kurz) Radlk. of Sapindaceae (See Paul in J. Econ. Taxon. Bot. 26: 501. 2002).

### 36. **Paracroton** Miq.

Trees, stellate hairy or lepidote. Leaves alternate, penninerved; petioles slightly pulvinate at base and apex, biglandular at apex; stipules triangular to subulate. Male inflorescences terminal and axillary, rarely leaf-opposed, narrowly thyrsoïd, mostly elongated, pendulous; flowers fasciculate or on short densely bracteate cymules, fragrant; calyx cupular, 5-lobed; lobes imbricate in bud, dorsally appendiculate; appendages knob-like or produced and horn-like; petals 5, free, but coherent along imbricate margins, white; disc glands 5, 7 or 10; stamens 12 - 32, the outer free, the inner united; anthers extrorse, dorsifixed; connectives broad; pistillode absent. Female inflorescences terminal, thyrsoïform, practically racemose; main rachis unbranched or with a few elongated branches; flowers solitary, 2 or 3 together at each node; calyx as in male, 5-lobed; lobes dorsally appendiculate (all or 1 - 2) as in male; petals 5, coherent along margins, glabrous, deciduous; disc annular, lobed, pilose at apex; ovary 3-locular; ovules one in each locule; styles 3, erect or recurved, bifid. Fruits capsular, globose or slightly depressed, 3-locular; seeds suborbicular, large.

Peninsular India, Sri Lanka, Thailand, Malaysia and Philippines, 4 species; 2 in India.

*Literature:* BALAKRISHNAN, N. P. & T. CHAKRABARTY (1993). The genus *Paracroton* (Euphorbiaceae) in the Indian subcontinent. Kew Bull. 48: 715 - 726, ff. 1 - 3.

*Notes.* The generic name *Fahrenheitia* Reichb.f. & Zoll. ex Müll.Arg. used in most recent floras of Indian region, is invalid as it was published as *nomen provisorum* by Reichb.f. & Zoll. in 1857. The next published name for the genus, *Paracroton* Miq. (1859) is to be used as discussed by Balakrishnan & Chakrabarty (l. c.).

#### KEY TO THE SPECIES

- 1 a. Leaves entire; male inflorescences short, up to 30 cm long; stamens 12 - 16; fruits ca 2 cm in diam. **1. *P. integrifolius***
- b. Leaves dentate or serrate; male inflorescences longer, 40 - 65 cm long; stamens 14- 32; fruits ca 3 cm in diam. **2. *P. pendulus* ssp. *zeylanicus***

**1. *Paracroton integrifolius*** (Airy Shaw) N.P.Balacr. & Chakrab. in Kew Bull. 48: 718, f. 1. 1993. *Ostodes integrifolius* Airy Shaw in Kew Bull. 16: 362. 1963. *Fahrenheitia integrifolia* (Airy Shaw) Airy Shaw in Kew Bull. 20: 410. 1967 & 27: 92. 1972. *Ostodes zeylanicus* (Thwaites) Müll.Arg. var. *minor* sensu Gamble, Fl. Madras 2(7): 1336. 1925 (repr. ed. 2: 935. 1957), non (Thwaites) Bedd. 1872.

Trees, 10 - 20 (- 24) m tall; branchlets lepidote to glabrous. Leaves elliptic to oblong-elliptic or obovate-elliptic to oblanceolate, acute to cuneate-attenuate at base, entire or slightly undulate along margins, bluntly acuminate or cuspidate to acute at apex, 9 - 27 x (2.5 -) 4 - 10 cm, chartaceous to thinly coriaceous, glabrous, often glossy above; lateral nerves 6 - 12 pairs; petioles 1 - 7 (- 10) cm long, glabrous or sparsely puberulous. Male inflorescences 10 - 30 cm long; bracts triangular to subulate, 1.5 - 2 mm long; flowers fascicled, ca 1.5 cm long, sparsely pubescent; pedicels 3 - 9 mm long, lepidote; calyx lobes 5, orbicular to elliptic, 3 - 8 x 3 - 5.5 mm; petals 5, oblong or oblong-elliptic, 7 - 12 x 3.5 - 6 mm; disc glands fulvous pilose at apex, of various shapes; stamens 12 -16, 3 or 4-seriate, the outer 5 free, the inner united into columns; anthers ellipsoid, ca 1 mm long. Female inflorescences not seen. Fruits trilobed, depressed-globose, bluntly keeled on sutures, 1.7 - 2 x 2 - 2.2 cm, tomentellous; fruiting pedicels 7 - 8 mm long; persistent calyx lobes ovate-orbicular to linear-subulate, 7 - 8 x 1.5 - 2 mm.

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

*Distrib.* India: Evergreen tropical forests of southern Western Ghats at 500 - 1000 m altitude. Kerala and Tamil Nadu.

Endemic.

**2. *Paracroton pendulus*** (Hassk.) Miq. ssp. ***zeylanicus*** (Thwaites) N.P.Balacr. & Chakrab. in Kew Bull. 48: 719, f. 2. 1993. *Desmostemon zeylanicus* Thwaites, Enum. Pl. Zeyl. 278. 1861. *Ostodes zeylanicus* (Thwaites) Müll.Arg. in Linnaea 34: 213. 1865 & in DC., Prodr. 15(2): 1114. 1866; Hook.f., Fl. Brit. India 5: 400. 1887. *Fahrenheitia zeylanica* (Thwaites) Airy Shaw in Kew Bull. 20: 410. 1966.

Kan.: *Bale, Sotega.*

Trees, 10 - 30 m tall; branchlets glabrescent in age. Leaves oblong to elliptic-oblong or obovate to oblong-oblanceolate, cuneate or acute at base, glandular-dentate or glandular-

serrate along margins, acuminate to cuspidate at apex, (11 -) 16 - 50 x (3 -) 5 - 15 cm, chartaceous to coriaceous, glabrous above, sparsely puberulous on midrib beneath; lateral nerves (8 -) 10 - 20 pairs; petioles 3 - 12 cm long. Male inflorescences terminal and axillary, 40 - 65 cm long, few branched, the lowermost branch 25 - 45 cm long; flowers fascicled; pedicels 2.5 - 6 mm long; calyx 4.5 - 7 x 7 - 8 mm, densely furfuraceous outside; lobes (4 or) 5, orbicular to spatulate, 3 - 5 x 3 - 6 mm, often dorsally appendiculate (all or 1 - 2); petals 5, oblong or spatulate-obovate, 6 - 9 x 2.5 - 4 mm; disc glands 5 or 10; stamens 14 - 32. Female inflorescences terminal, thyriform, 18 - 50 cm long, the lowermost branch near the base 8 - 35 cm long, almost racemiform towards apex; flowers 2 or 3 together or solitary, densely reddish furfuraceous; pedicels 2 - 7 mm long; calyx 5 - 8 mm across; lobes 5, orbicular, ovate or triangular, 3.5 - 6 x 2 - 6 mm, dorsally appendiculate; petals 5, oblong, triangular or orbicular-obovate, 6 - 8 x 2 - 4 mm, caducous; disc glands connate in a ring, lobed; ovary subglobose 2.5 - 3.5 x 3 - 4 mm, densely stellate pilose or hispid; styles 3, 1 - 3 mm long, bifid. Fruits globose, unlobed or scarcely 3-lobed, 2.5 - 3.5 cm in diam., hard, appressed furfuraceous or tomentellous, with raised sutures.

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

*Distrib.* India: Evergreen forests along West Coast and Western Ghats, up to 1800 m altitude. Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Notes.* Pollen grains inaperturate, sexine with crotonoid pattern.  $D = 72 \mu\text{m}$  (66 to 84) (Tissot, Chikhi & Nayar, Pollen of wet evergreen forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery* p. 29, pl. 32. 1994).

### Tribe 5. GELONIEAE (Müll.Arg.) Pax

Paleotropical, monogeneric.

#### 37. *Suregada* Roxb. ex Rottler

Shrubs or small trees, dioecious or rarely monoecious, glabrous throughout. Leaves alternate, distichous, entire or spinulose dentate along margins, pinnately veined, eglandular but with pellucid dots in each areole between reticulations, short petioled; stipules connate, early caducous. Flowers in short leaf-opposed clustered cymes or fascicles, often gummy when young. Male flowers: sepals 5, imbricate; disc glands many in between the stamens, angular, comose or dentate at apex; stamens many, exerted, free, inserted on vaulted receptacle, with numerous small glands at base of filaments; anthers attached close above the base; thecae 2, extrorse, longitudinally dehiscent; pistillode absent. Female flowers: sepals 5; disc ovary ovoid, 2 or 3-locular; locules 1-ovuled; styles 3, patent, shortly bifid, spreading; stigmas 2-partite or lacinate. Fruit a fleshy depressed subglobose capsule, shallowly 3-lobed, 3-seeded, tardily 3-valved, loculicidally dehiscent, bright orange, edible; seeds subglobose with somewhat fleshy testa; endosperm fleshy.

Tropical regions of Asia, ca 31 species; 2 species in India.

#### KEY TO THE SPECIES

- 1 a. Leaves obovate or oblanceolate, sharply acuminate at apex, up to 15 cm long; flowers small, few in fascicles; fruits smooth, deeply lobed, keeled on lobes, 7 - 10 mm in diam.

1. *S. angustifolia*



b. Leaves elliptic to oblong-elliptic, rounded or obtuse at apex, entire, up to 25 cm long; flowers rather large, many in cymes or clusters; fruits rough, obscurely lobed, 12 - 15 mm in diam.

## 2. *S. multiflora*

1. ***Suregada angustifolia*** (Müll.Arg.) Airy Shaw in Kew Bull. 23: 128. 1969; Manilal & Sivar. in Sci. & Cult. 41: 437. 1975. *Gelonium angustifolium* Müll.Arg. in DC., Prodr. 15(2): 1128. 1866. *G. lanceolatum* auct. non Willd. 1806: Roxb., Fl. Ind., ed. Carey 3: 831. 1832; Hook.f., Fl. Brit. India 5: 459. 1887, p. p.; Gamble, Fl. Madras 2(7): 1343. 1925 (repr. ed. 2: 940. 1957).

Tam.: *Kakaipalai*; Tel.: *Sapranji, Suragada*.

Trees, dioecious, evergreen, 6 - 10 m tall; branches glabrous. Leaves broadly elliptic, obovate to oblanceolate, acute at base, obtuse, subacute to subacuminate at apex, spinulose-dentate along margins, 5 - 15 x 3 - 6 cm, coriaceous, shiny, pellucid-punctate; lateral nerves 6 - 8 pairs; petioles 5 - 8 mm long; stipules caducous. Male flowers: 5 - 8 in axillary subumbellate tightly bracteolate clusters, ca 5 mm across; pedicels ca 5 mm long; calyx-lobes 5 or 6, concave, 2 - 3 mm long, scaly; stamens 15 - 25, mixed with rugose glands; filaments ca 1.5 mm long. Female flowers: 3 - 5 in axillary leaf-opposed pairs of clusters, ca 3 mm across; calyx-lobes 5 or 6, ca 3 mm across, ovate, finely ciliate; outer 3 subacute, ca 2.5 mm long; inner 2 smaller, obtuse; disc cupular; ovary globose, 2 - 3 mm across, 3-locular; styles 3, 1 - 1.5 mm long. Fruits ovoid, deeply 3-lobed, keeled on lobes, smooth, 1 - 1.5 cm across; cocci falling off the persistent columella.

*Fl.* Jan. - April; *Fr.* March - June.

*Distrib.* India: Eastern Ghats and Western Ghats, from coastal areas to 750 m altitude. Andhra Pradesh, Tamil Nadu and Kerala (Kozhikode Dist., Manilal & Sivarajan, l. c.).

Sri Lanka.

*Use.* Roots find use in curing fever by tribes of Sriharikota Island of Andhra Pradesh.

2. ***Suregada multiflora*** (A.Juss.) Baill., Etude Euphorb. 396. 1858. *Gelonium multiflorum* A.Juss., Euphorb. Gen. 111, t. 10, f. 31A. 1824; Hook.f., Fl. Brit. India 5: 459. 1887; Gamble, Fl. Madras 2(7): 1343. 1925 (repr. ed. 2: 940. 1957). *G. bifarium* Roxb. ex Willd., Sp. Pl. ed. 4, 4: 831. 1806, p. p.; Hook.f., l. c. 459. 1887. *G. fasciculatum* Roxb., Fl. Ind. 3: 832. 1832.

Beng.: *Ban-naranga*; Urdu: *Khakra*.

Shrubs or trees, 2 - 12 m tall, entirely glabrous. Leaves broadly elliptic, oblong-elliptic to suborbicular, cuneate, acute to obtuse at base and slightly decurrent into petioles, entire along margins, rounded to obtuse or subacuminate at apex, 5 - 25 x 2.5 - 10 cm, coriaceous to chartaceous, pellucid-punctate; lateral nerves 5 - 8 pairs; petioles 3 - 7 mm long. Inflorescences unisexual, leaf-opposed, fasciculate lax cymes, sometimes shortly pedunculate. Male flowers: pedicels 5 - 10 mm long; sepals 5, suborbicular, ca 3 x 2.5 mm; stamens many; glands many between filaments. Female flowers: pedicels 5 - 10 mm long; sepals as in male but larger, up to 5 mm long; disc annular; ovary ovoid, ca 2 mm in diam., 2 or 3-locular; styles 2 or 3, ca 1 mm long, bifid. Fruits capsular or subdrupaceous, globose or subglobose, 9 - 15 mm in diam., unlobed to lobed, 2 or 3-locular, orange-brown, tardily dehiscent.

*Fl. & Fr.* Feb. - Sept.

*Distrib.* India: Evergreen forests of inland hills and beach forests, up to 1500 m altitude. West Bengal, Sikkim, Assam, Andhra Pradesh and Andaman & Nicobar Islands.

Bangladesh, Myanmar, China, Indo-China, Thailand and Malaysia.

*Uses.* Ripe fruits after boiling in mustard oil applied to boils by the inhabitants of Sunderbans area of West Bengal.

### Tribe 6. **JATROPHEAE** (Meisn.) Pax

Trees, shrubs or herbs, monoecious or less commonly dioecious; stems with articulated and/or non-articulated laticifers; latex clear, white or reddish; indumentum simple, sometimes glandular. Leaves entire or palmately lobed or partite, usually with glands at apex of petiole; stipules persistent or caducous. Inflorescences terminal and sometimes axillary as well, dichasial-paniculate, sometimes reduced. Male flowers: sepals usually 5, distinct, imbricate; petals 5, free or sometimes connate or coherent; disc entire or lobed; stamens (6 -) 8 - 30, filaments partly connate; pollen grains globose, binucleate, inaperturate, sexine with Croton-pattern; pistillode present or absent. Female flowers: sepals 5 (or 6), free, imbricate, somewhat persistent in fruit; disc annular, lobed or dissected, sometimes with staminodes; ovary mostly 2 - 3-locular; styles unlobed or bifid, sometimes dilated. Fruits capsular or drupaceous; seeds carunculate or ecarunculate, endosperm present.

Tropical America, Africa and Asia, 7 genera; one in India.

### **38. *Jatropha* L.**

Shrubs or undershrubs, often with rhizomatous stem base, monoecious or rarely dioecious, glabrous or glandular pubescent; latex pale cloudy, yellow to distinctly red, never milky, powdery when dry; laticifers articulated, non-articulated or idioblastic. Leaves alternate, angular-lobed, palmatifid or palmately 3 - 5, or 7-lobed, palmately or rarely pinnately veined; margins entire or conspicuously serrate, with or without mucronate tips, sometimes the serrations with stipitate glands; stipules present or absent, simple, or branched, incised into long filiform branches and these often modified into serially arranged stalked capitate glands. Inflorescences axillary, terminal, subterminal corymbs of cymes, or reduced to a few or solitary flowers in axils, the main branches terminated by female flower, the others with male flowers; flowers 5-merous, unisexual, rarely bisexual. Male flowers: urceolate, subglobose or tubular; calyx-lobes 5, free, imbricate, glandular, often foliaceous; petals 5, free or variously coherent or connate, rarely absent, contorted, imbricate disc glands 5, free or united in an annular ring, entire, dissected or lobed; stamens 8 or 10 (rarely 6), all or inner whorl basally or rarely entirely connate, often 5, shorter or subconnate at base, epipetalous; anthers longitudinally dehiscent. Female flowers: calyx-lobes 5, imbricate, more often glandular margined or foliaceous; petals 5, sometimes absent, larger than sepals, free or coherent at base, recurved at apex; disc glands 5, free or united into a ring; staminodes sometimes present and diminutive; ovary (2- or) 3-loculed, each 1-ovuled; styles 3, connate at base, bifid; stigmas 2-lobed or 2-fid, narrow, capitate or horse-shoe shaped. Fruits capsular, drupaceous or dry, (2 -) 3 or 4-loculed, breaking up septicidally-loculicidally into 2 or 3 cocci; seeds 2 - 4, ellipsoid to spherical, generally carunculate, oil bearing endosperm copious, starchy; embryo spathulate; cotyledons broad, palmately nerved; radicle short; germination phanerocotylar.

Tropical America, Africa and Asia, ca 186 species; 8 species indigenous and 3 species cultivated in gardens in India.

*Notes.* Pollen grains are typically Crotonoid, and uniformly spheroidal, inaperturate, and with hexagonally arranged exinous knobs (Punt, Wentia 7: 1 - 116, 1962).

Germination of most species are phanerocotylar (i.e. cotyledons are freed from the seed coat), as in other Euphorbiaceae (Duke, Ann. Missouri Bot Gard. 56: 125 - 161. 1969; Kamilya & Paria, Acta Botanica Indica 22: 251 - 256. 1994). An exception is *J. multifida*, where the cotyledons are never completely free from the seed coat and termed cryptocotylar. This feature is unique in Euphorbiaceae and shared by *Hevea brasiliensis* (Duke, l.c. 1969).

*Literature.* BIR BAHADUR & T. VENKATESHWARLU (1976). Isomerism in flowers of four species of *Jatropha* L. J. Indian Bot. Soc. 55: 30 - 37. BIR BAHADUR, E. CHAMUNDESWARI & S. GOVARDHAN (1997). Seedling characters in *Jatropha* species. J. Swamy Bot. Club 14: 45 - 47. CHATURVEDI, M. & M. JEHAN (1982). Studies on the floral and macromorphological characters of pollen and leaf of *Jatropha* species. Acta Bot. Indica 10: 246 - 251. DEHGAN, B. (1980). Application of epidermal morphology to the taxonomic delimitation in the genus *Jatropha* L. (Euphorbiaceae). Bot. J. Linn. Soc. 80(3): 257 - 278, illus. DEHGAN, B. (1982). Comparative anatomy of the petiole and infrageneric relationships in *Jatropha*. Amer. J. Bot. 69: 1283 - 1295. KAMILYA, P. & N. PARIA (1994). Seedling morphology of some Indian species of *Jatropha* and its implications in taxonomy. Acta Bot. Indica 22: 251 - 256. RAO, S. E. & V. S. RAJU (1994). The genus *Jatropha* L. in Andhra Pradesh. J. Econ. Taxon. Bot. 18: 585 - 589.

#### KEY TO THE SPECIES

- 1 a. Stipules well-developed, divided into narrow lobes or often modified into decurrent series of stalked glands 2
- b. Stipules absent or minute and subulate 6
- 2 a. Leaves without stalked glands; young leaves green; peduncles glabrous 3
- b. Leaves with stalked glands; young leaves dark purple; peduncles hairy 4
- 3 a. Shrubs tuberous at base; leaves peltate, 5-fid for halfway down; lobes entire; sepals orange-red cult. **(3) *J. podagrica***
- b. Shrubs not tuberous at base; leaves not peltate, rarely slightly subpeltate, divided into numerous lobes to far below the middle; lobes dissected towards apex; sepals crimson-red cult. **(2) *J. multifida***
- 4 a. Lobes of leaves entire, glandular hairy along margins; flowers reddish or purplish red **3. *J. gossypifolia***
- b. Lobes of leaves serrate, each tooth ending in gland-tipped bristle; flowers green with pinkish tinge 5
- 5 a. Leaves deeply palmately lobed up to below the middle; stipules prominent, deeply divided into several gland-tipped segments, petals free or almost so to the base in female flowers; staminodes absent in female flowers **2. *J. glandulifera***
- b. Leaves shortly palmately lobed up to or above the middle; stipules short, with only a few gland-tipped segments; petals in female flowers connate to one-third the length; staminodes present in female flowers, almost stamen-like but much smaller and sterile **7. *J. tanjorensis***
- 6a. Leaves oblong-lanceolate or oblong-obovate, entire or with 1 - 5 subulate acute teeth at base on both sides, otherwise entire 7
- b. Leaves broadly ovate, 3 - 7-angular or 3 - 7-lobed 8

- 7 a. Leaves oblong-obovate or panduriform, with 1 - 5 subulate acute teeth at base; flowers crimson-red cult. (1) **J. integerrima**  
 b. Leaves oblong, not panduriform, without subulate teeth at base; flowers yellow  
**5. J. maheshwarii**
- 8 a. Leaves peltate, 3 - 7-lobed **8. J. villosa**  
 b. Leaves not peltate, 3 - 7-angular or lobed 9
- 9 a. Leaves 3-lobed, wedge-shaped, obtriangular, broadly cuneate at base **6. J. nana**  
 b. Leaves 3 - 7-angular or 3 - 7-lobed, broadly ovate, cordate at base 10
- 10a. Large branched shrubs; stem base not tuberous; leaves not glaucous beneath; petals united for half the length **1. J. curcas**  
 b. Unbranched stunted shrubs; stem base tuberous; leaves glaucous beneath; petals free or connate at base only **4. J. heynei**

**1. *Jatropha curcas* L., Sp. Pl. 1006. 1753; Hook.f., Fl. Brit. India 5: 383. 1887.**

Beng.: *Bagbheranda*, *Eranda-gach*, *Kulsera*, *Totkabendi*; Eng.: Barbados nut, Physic nut, Poison nut, Purging Nut; Guj.: *Jamalgota*, *Magali-erandi*; Hindi: *Bangbherenda*, *Jamalgota*, *Jungli-arundi*, *Ratanjota*, *Safed-erandi*, *Safed-arand*; Kan.: *Adaluharalu*, *Bettaharalu*, *Kadandla*, *Karnocchi*, *Maraharalu*, *Turukuharalu*; Kon.: *Mogali-erandi*; Mal.: *Kadalavanakku*, *Kattamanak*, *Kattu-avanakku*; Mar.: *Mogali-eranda*, *Rana-erandi*; Nep.: *Nera-khar-shing*, *Ratanjot*; Or.: *Jahazigaba*, *Kadam*; Sans.: *Kanameranda*, *Parvataranda*; Tam.: *Kadalamanakku*, *Kallamanakku*, *Kattamanakku*, *Kattu-avanakku*; Tel.: *Adavi-amidam*, *Adavi-amadam*, *Nepalam*.

Shrubs or small trees, 1 - 5 m tall, with thick branches and soapy latex, glabrous or rarely more or less flocculent tomentose in inflorescence. Leaves triangular-ovate, or orbicular in outline, (8 -) 15 - 40 x 10 - 20 cm, broadly cordate at base, entire or 3 - 5-angled or lobed with caudate-acute lobes, 5 - 15 cm across, membranous, glabrous, digitately 5 - 7-nerved from base; petioles 4 - 15 cm long; stipules small or absent. Inflorescences laxly expanded, loosely flowered; peduncles 3.5 - 5 cm long. Male flowers: sepals ovate or elliptic, 3 - 4 x 1 - 2.5 mm; petals 5 - 10, united up to middle, oblong or obovate, coherent up to middle, 7 - 8 mm long, yellowish green; disc columnar, deeply 5-lobed; stamens 8 - 10, outer filaments free, inner 5 connate at base. Female flowers: sepals longer than in male flowers; petals absent or same as in male flowers, but free and smaller; ovary 3-locular; styles short and connate at base. Fruits fleshy, drupaceous, drying to capsule, subglobose or ellipsoid, slightly 3-lobed, 2.5 - 3.5 cm in diam., glaucous, pale yellow, turning to black.

*Fl. & Fr.* Dec. - April, June - Oct.

*Distrib.* India: Tropical regions along plains and coastal regions, sea level and often up to 1500 m altitude, usually seen as a hedge plant, often as an escape and run wild along roadsides, riverbanks and near villages. Rajasthan, Gujarat, Madhya Pradesh, Uttar Pradesh, Bihar, West Bengal, Sikkim, Orissa, Andhra Pradesh, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Native of tropical America (Brazil), introduced and sometimes in cultivation throughout the tropics of the world.

*Uses.* Seeds give an oil, which is toxic due to the presence of phorbol (dipterene), curcinn and curcasin (a resinous substance). It can be used to make soaps and candles, and in fuel pumps. In mild doses, it can also be used to treat constipation. It is also reported (*Sci. & Cult.* 53: 117. 1987.) that the oil can be used for fuelling oil lamps and internal combustion engines. The leaves and fruits sometimes used as food plant for silk worms. Roots chewed in early morning to cure tooth diseases in Andaman & Nicobar Islands. Juice from twigs applied to sores. The sap used by children for bubble-blowing. Desai (*Curr. Sci.* 18: 49. 1948) has analysed the chemistry of the seeds of this species. For details on culture, yield, fatty acid composition and economic utility of the species, see S. K. Kapur & Virendra Singh (*J. Econ. Taxon. Bot.* 19: 550 - 554. 1995). Recently the Forest Research Institute has developed a process by which the toxicity in the oil can be removed and the oil used for edible purposes (*The Hindu*, Nov. 1, 1997, p. 9).

*Notes.* Chromosome numbers:  $n = 11$  (Datta, *Taxon* 16: 341 - 350. 1967),  $2n = 22$  (Darlington & Wylie, *Chromosome Atlas & Flowering Plants*, 1955) and  $2n = 44$  (Mehra & Hans, *Taxon* 18: 310 - 315. 1969).

Kamilya & Paria (1994) describes the seedlings of this species as epigeal and phanerocotylar, the paracotyledons with 7 - 9 primary veins and the first two leaves serrate with glands.

**2. *Jatropha glandulifera*** Roxb., *Fl. Ind.*, ed. Carey 3: 688. 1832; Hook.f., *Fl. Brit. India* 5: 382. 1887.

Hindi & Mar.: *Jungli-arandi*; Tam.: *Adalai*, *Adalai-chedi*, *Eliavanakku*, *Vellai-kattukottai*; Tel.: *Neela-amidam*.

Undershrubs, 1 - 2 m high, with pale yellowish juice; stem stout, dichotomously branched, glabrous, shiny and marked by prominent leaf scars; branches glabrous. Leaves orbicular in outline, deeply palmately 3 - 5-lobed, truncate or subcordate at base, 8 - 16 cm in diam., glabrous beneath; lobes obovate or oblanceolate, acute or subacuminate at apex, narrowed at base into rounded sinuses, sharply serrated with gland-tipped serrations, 3.5 - 8.5 x 1.5 - 5.5 cm, the posterior lobes smaller; main nerves 3 - 5, palmate, grooved above, raised beneath; secondary nerves many, oblique; petioles 5 - 15 cm long; stipules deeply divided into several long capillary gland-tipped segments. Inflorescences axillary, corymbose cymes, with central flower of each cyme usually female; main peduncle 8 - 15 cm long; branches alternate, up to 5 cm long. Male flowers: pedicels 2 - 3 mm long; calyx ca 2 mm long; lobes oblanceolate, ca 4 x 2 mm, glabrous; disc of 5 round glandular lobes; stamens 5 + 3; filaments connate for half the length, 2 - 2.5 cm long, outer smaller, inner longer; anthers oblong, ca 1 mm long. Female flowers: pedicels 3 - 4 mm long; calyx 3 - 4 mm long; lobes lanceolate, 2 - 3 mm long; petals free up to the base, oblong-lanceolate, ca 5 x 2 mm; disc consisting of 3 rounded glandular lobes; ovary oblong-ovoid, ca 2 x ca 1.5 mm, glabrous; styles 3, ca 1.5 mm long, connate at base; stigma club-shaped. Fruits oblong-ovoid or subglobose, faintly 3-lobed, ca 13 x 8 mm, glabrous, rugulose, with persistent sepals.

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

*Distrib.* India: Scrub forests, roadsides and edges of forests, in tropical semiarid regions, up to 1000 m altitude. Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Uses.* Oil from seeds extensively used in rheumatism and paralysis (Trimen, Handb. Fl. Ceyl. 4: 45. 1878). Green colour extracted from leaves used to colour clothes. Juice of leaves used as eye drops to cure ophthalmic diseases (Rama Rao, Fl. Pl. Travancore 364. 1914).

**3. *Jatropha gossypifolia* L., Sp. Pl. 1006. 1753 (as '*gossipifolia*'); Hook.f. Fl. Brit. India 5: 383. 1887.**

Beng.: *Lal-bherenda*; Eng.: Bellyache Bush; Guj.: *Erandi, Torspodla, Velati*; Hindi: *Bherend, Rani-jadha*; Kan.: *Cikkakadu-haralu, Hathile-heralu*; Mar.: *Kosni-ronda*; Tam.: *Adalai, Atalai, Siria-amanakku*; Tel.: *Amedem, Nala-amadam, Nela-amida, Nepalamu*.

Shrubs, somewhat succulent, up to 3 m high; young stems and leaves dark purplish red or green; branchlets glandular hairy. Leaves closely spirally arranged, entire or palmately 3 - 5-lobed or partite up to the middle, subcordate at base, 5 - 13 cm in diam., densely hairy on abaxial surface on main nerves, glandular-ciliate with viscid glands along margins, membranous, bronze-red when young; lobes entire, obovate, broadest at the middle, acute at apex; main nerves 3 - 5, basal, palmate; petioles 4 - 10 cm long. Inflorescences corymbose cymes, glandular; bracts lanceolate, 9 - 11 mm long, glandular-ciliate; flowers 7 - 8 mm across, brilliant red or purplish red; pedicels up to 5 mm long. Male flowers: sepals oblong-ovate, ca 6 x 2 mm, glandular ciliate; petals free, purplish or reddish; stamens 8 - 12, monadelphous; inner filaments longer; anthers ca 1 mm long. Female flowers: sepals and petals as in male; ovary globose, ca 2 mm in diam.; styles ca 1.5 mm long. Fruits oblong-ovoid, 3-lobed, 3-coccos, ca 1.5 cm long, reticulate-verruculose, reddish green.

#### KEY TO THE VARIETIES

- 1 a. Young leaves dark purple or bronze red, gradually becoming reddish green on maturity; hairs sparse at the divergence of primary veins; all parts including petioles and stalks of viscid glands purplish; styles shortly connate at base; fruits sparingly hirsutulous **3.1. var. *elegans***
- b. Young leaves purplish green or greenish as in mature ones; hairs dense all over, more so on abaxial surface of major veins; all parts including petioles and stalks of viscid glands greenish; styles free; fruits densely hirsutulous **3.2. var. *gossypifolia***

**3.1. var. *elegans*** (Pohl) Müll.Arg. in DC. Prodr. 15(2): 1087. 1866; Dehgan & G.L. Webster in Univ. California Publ. Bot. 74: 55. 1979; S.Rao & V.S.Raju in J. Econ. Taxon. Bot. 18: 587. 1994. *Adenoropium elegans* Pohl, Pl. Bras. Icon. Descr. 1(1): 12, t. 15. 1826.

*Fl. & Fr.* Mar. - Nov.

*Distrib.* India: Common along roadsides, railway tracks and wastelands. Andhra Pradesh.

Native of Brazil introduced and naturalised in Andhra Pradesh.

#### **3.2. var. *gossypifolia***

*Fl. & Fr.* April - Oct.

*Distrib.* India: In plains from coastal areas to 500 m altitude, usually cultivated as hedge plant, often naturalised in wastelands and roadsides. Gujarat, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Andaman Islands.

Native of New World, introduced, planted and often naturalised in many tropical countries.

*Uses.* An aqueous extract of the plant shows insecticidal properties. The roots used in leprosy. Boiled leaves applied to boils and itches. Fruits are poisonous. Seed-oil cures toothache and body pain (Jain, Econ. Bot. 19: 245. 1965). In Sriharikota Island of Andhra Pradesh, the leaves are chewed for mucous infections in the mouth and leaf-juice applied on eczema and scabies.

*Notes.* Chromosome numbers:  $n = 11$  (Datta, Taxon 16: 346. 1967; Sanjappa, Taxon 28: 274. 1979) and  $2n = 22$  (Nanda, J. Indian Bot. Soc. 41: 266 - 268. 1962)

Kamilya & Paria (1994) described the seedlings as epigeal and phanerocotylar, the paracotyledons with 5 primary nerves and the first two leaves entire.

Reddi & Reddi (Proc. Indian Acad. Sci. (Plant Sci.) 92: 215 - 231. 1983) gave a detailed account of the pollination ecology of *J. gossypifolia*.

**4. *Jatropha heynei*** N.P.Balacr. in Bull. Bot. Surv. India 3: 40. 1961. *J. heterophylla* B.Heyne ex Hook.f., Fl. Brit. India 5: 382. 1887 (non Steud., 1840).

Herbs, monoecious, stout, erect, with tuberous rootstock; stems 5 - 15 cm high, simple, glabrous. Leaves simple or deeply 3 - 5-lobed up to below the middle, cordate at base, eglandular, glaucous beneath, 3-nerved at base; lobes entire, oblong to narrowly oblanceolate, cuneate at base, acute at apex, 2.5 - 15 x 1.2 - 3 cm, chartaceous; petioles stout, 1 - 8 cm long; stipules small. Inflorescences terminal, cymose, with a central female flower surrounded by male flowers; bracts entire. Male flowers: sepals ovate, ca 2.5 mm long; petals oblong, ca 5 x 2 mm; stamens 8 - 10; filaments of inner row connate; anthers ca 2 mm long. Female flowers: sepals and petals as in male flowers; ovary 3-loculed. Fruits ovoid, ca 2 cm long, often pustulate, dehiscent into 3 cocci; each 2-valved, one-seeded.

*Fl. & Fr.* May - Aug.

*Distrib.* India: Dry scrub jungles at low altitudes. Madhya Pradesh, Andhra Pradesh, Karnataka and Tamil Nadu.

Endemic.

**5. *Jatropha maheshwarii*** Subr. & M.P.Nayar in Bull. Bot. Surv. India 6: 331, ff. 1 - 8. 1964 (1965); N.P.Balacr. in Bull. Bot. Surv. India 10: 245. 1968. *Tritaxis beddomei* auct non Benth. 1878: sensu Sundararaj in J. Bombay Nat. Hist. Soc. 53: 525, t. 2. 1956.

Shrubs, erect, up to 1.5 m tall. Leaves ovate-oblong to ovate-lanceolate, rounded and peltate at base, entire, acute to acuminate at apex, basally 3 - 5-nerved; lateral nerves on midrib 5 - 7 pairs; petioles 4 - 16 cm long; stipules small, caducous. Inflorescences terminal or rarely leaf-opposed compound cymes, the central flower of the cyme usually female; flowers yellow, shortly pedicellate. Male flowers: sepals 5, elliptic-oblong or oblanceolate, 3 - 4 mm long, glabrous; petals 5, contorted, elliptic-lanceolate to oblanceolate, 4 - 5 mm long; disc of 5 distinct glands arranged around the base of staminal column; stamens 8 or 9; filaments slender, united in a column; anthers linear-oblong; pistillode absent. Female flowers: sepals 5, oblong-elliptic

to oblong-lanceolate, 4 - 5 mm long, glabrous; petals 5, contorted, oblong-lanceolate or oblanceolate, 5 - 6 mm long, glabrous; disc as in male flower; ovary ellipsoid, glabrous; styles 3, united below, each limb bilobed; stigma clavate. Fruits oblong-subglobose to globose, 1.4 - 1.6 x 1.2 - 1.4 cm, rough, glabrous, brownish.

*Fl. & Fr.* Feb. - May.

*Distrib.* India: Coastal sandy areas. Tamil Nadu (Tirunelveli and Kanniyakumari Districts).

Endemic.

**6. *Jatropha nana*** Dalzell & A.Gibson, Bombay Fl. 229. 1861; Hook.f., Fl. Brit. India 5: 382. 1887; Khanna et al., Suppl. Fl. Madhya Pradesh 160. 2001.

Mar.: *Kirkundi*.

Undershrubs, 30 - 45 cm high, entirely glabrous; main root woody, as thick as a finger; stem terete, smooth, not much branched; branches erect. Leaves ovate, entire or 3-lobed from above the middle, 8 - 12 cm long, oddly large for the size of the plant; lobes with entire naked margins, ovate, obtuse or subacute, the middle lobe the largest, cuneate at base with 3 strong nerves; petioles 3 - 25 mm long; stipules minute. Inflorescences few-flowered terminal paniculate cymes; flowers pedicellate. Male flowers: calyx ca 3 mm long, glabrous, lobed for about halfway down; lobes 5, ovate; petals 5, obovate, 5 - 6 mm long, densely glandular hairy inside at base; stamens 8, with filaments united in lower half; disc of minute glands. Female flowers: calyx 3 - 4 mm long, glabrous; lobes 5, lanceolate; petals 5, obovate-oblong, 8 - 9 mm long, glabrous outside, glandular hairy at base inside; ovary obovoid, seated on a saucer-shaped glandular disc, glabrous; styles ca 3 mm long, divided into 3 branches from the middle, each branch again divided at apex into 2 somewhat triangular ca 3 mm long lobes. Fruits oblong-obovoid, flattened at top, slightly 6-lobed, 9 - 10 mm long.

*Fl. & Fr.* May - Sept.

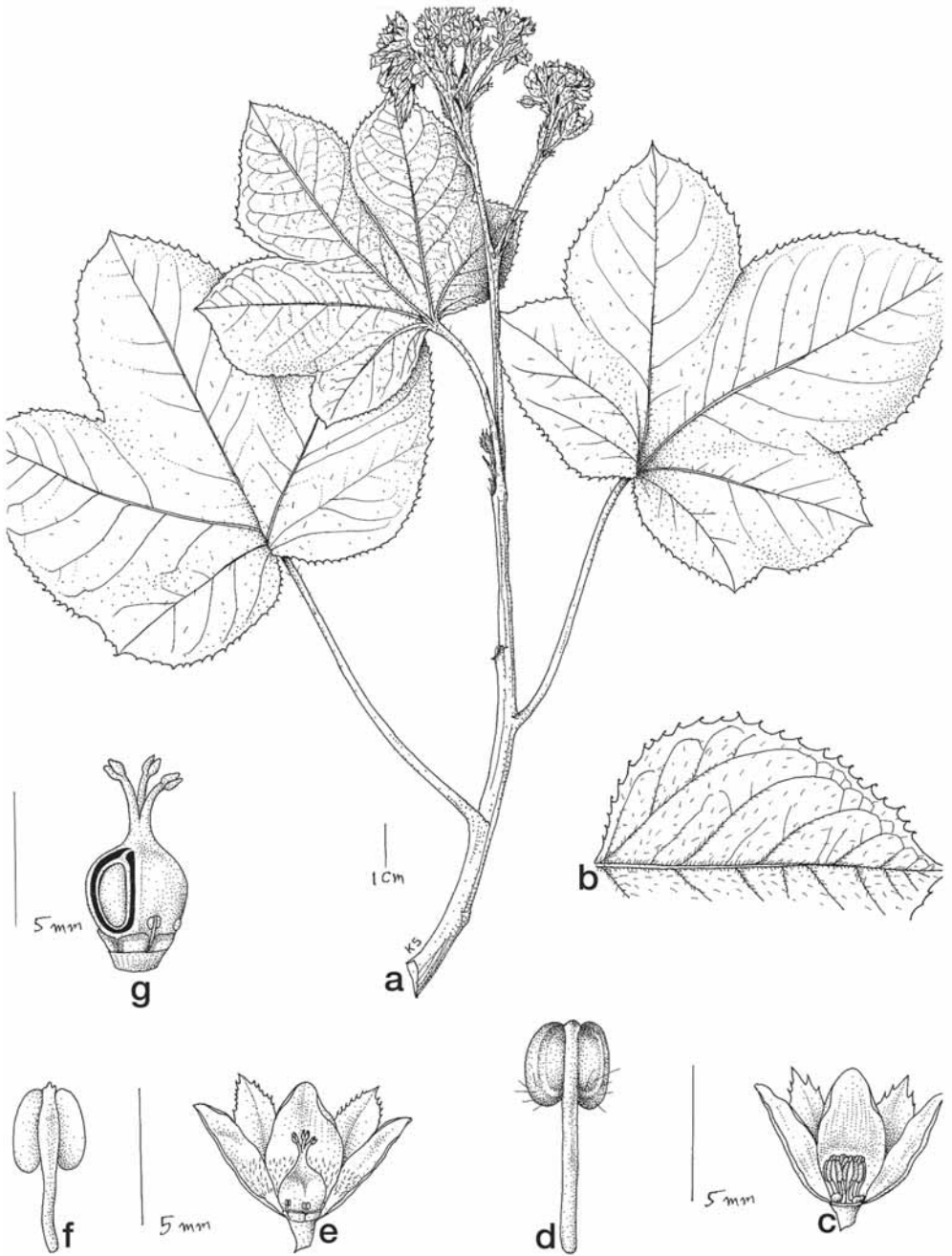
*Distrib.* India: Dry stony ground in deciduous forests and scrubs, rare. Maharashtra and Jhabua in West Madhya Pradesh (Samvatsar, Fl. West Trib. Madhya Pradesh 264. 1996).

Endemic.

**7. *Jatropha tanjorensis*** J.L.Ellis & Saroja in J. Bombay Nat. Hist. Soc. 58: 834, ff. 1 - 7. 1961 (1962); Bennet in J. Bombay Nat. Hist. Soc. 62: 329. 1965; J.L.Ellis in J. Bombay Nat. Hist. Soc. 64: 394, ff. 1 - 4. 1967; V.S.Ramachandran & V.J.Nair, Fl. Cannanore 420. 1988; Babu et al. in J. Bombay Nat. Hist. Soc. 91: 163. 1994. **Fig. 37**

Shrubs, 1.5 - 3 m high, glabrous. Leaves ovate or orbicular in outline, subcordate with a shallow sinus at base, 7.5 - 11.5 cm across, as broad as long, palmately 3 - 5-lobed above the middle; lobes broadly ovate, acuminate, distantly serrate along margins, each serrature ending in a gland-tipped bristle, sparsely hairy on both sides, velutinous on either side of the veins and veinlets, palmately 7 - 9-nerved; petioles 4.5 - 7.5 cm long. Inflorescences corymbose, consisting of ca 9 cm long cymes; flowers green with pale pink tinge; bracts lanceolate, acute, 6 - 20 x 2 - 5 mm, with gland-tipped hairs along margins. Male flowers: shortly pedicellate; calyx 5-lobed; lobes ovate, serrate, ca 4 mm long; petals 5, free, ca 4 mm long; disc of 5 small glands; stamens





**Fig. 37. *Jatropha tanjorensis* J.L.Ellis & Saroja:** a. habit; b. leaf – upper surface; c. male flower split opened; d. stamen; e. female flower split opened; f. staminode; g. ovary with one locule opened showing pendulous ovule and disc lobes and staminodes at base.

8; filaments ca 3 mm long; anthers erect; connective prominent. Female flowers: shortly pedicellate; calyx 5-lobed; lobes ovate, 5 - 8 mm long; petals connate for one-third their length at base, 5 - 8 mm long; disc of 5 glands around the ovary; staminodes (fertile ?) 6 - 8; ovary glabrous, 3-locular; styles 3, each divided into 2 stigmatic lobes. Fruits oblong-obovoid, 3-locular; seed oblong-ovoid, pale green with a few deep pink spots, dark brown when dry.

*Fl. & Fr.* Jan. - June.

*Distrib.* India: Open sandy places, in plains. Tamil Nadu (Thanjavur and Ramanathapuram Districts), West Bengal (Bennet, l. c. 1965), Andhra Pradesh (Babu et al., l. c. 1994) and Kerala (Ramachandran & Nair, l. c. 1988).

Endemic.

*Notes.* The original description states that the flowers are polygamous with male and bisexual flowers. However, the stamens in the bisexual flowers are extremely diminutive and probably sterile.

This is probably a hybrid between *J. glandulifera* and *J. gossypifolia* with characters intermediate between the two, showing similarities and dissimilarities from both. Recent discoveries in disjunct locations further indicate such a possibility. Further studies are needed to clear the doubt.

**8. *Jatropha villosa*** Wight, Icon. Pl. Ind. Orient. 3: t. 1159. 1846; N.P. Balakr. in Bull. Bot. Surv. India 3: 40. 1961 (non Baill. 1863, nec Müll.Arg. 1866). *J. peltata* Wight, l. c. 4 (1): t. 1169. 1848 (non Cerv. 1794, nec Steud. 1840). *J. wightiana* Müll.Arg. in DC., Prodr. 15 (2): 1080. 1866; Hook.f., Fl. Brit. India 5: 383. 1887.

Tam.: *Thanakku*.

Shrubs, 1 - 2 m high, pubescent, eglandular; branches rusty villous or subglabrous. Leaves peltate, rounded or subcordate at base, orbicular or ovate, entire or 3 - 7-lobed, 8 - 16 cm in diam., densely tomentose beneath, sparsely pubescent above in adult leaves, densely so in young leaves; lobes obtuse or subacute, entire; sinuses between lobes obtuse; main nerves 5 - 7, palmate; petioles 2 - 8 cm long; stipules minute, caducous. Inflorescences terminal corymbose cymes, ca 7 cm long, with central flower of each cyme usually female, ca 7 cm long and up to 8 cm across; peduncles unbranched for about 2 - 5 cm length, then alternately branching; bracts linear-lanceolate, up to 12 mm long; flowers cream-coloured or yellowish green; pedicels up to 2 mm long. Male flowers: calyx 4 - 5 mm long, pubescent; lobes ovate-lanceolate, 1.5 - 2.5 mm long; corolla salver-shaped, 12 - 13 x ca 6 mm, glabrous outside, villous inside; lobes 5, oblong-obovate to spatulate; disc of 5 free glandular lobes; stamens 8, monadelphous; anthers ovate-oblong, ca 2 mm long; filaments 5 - 8 mm long. Female flowers: calyx up to 6 mm long, lobed for three-fourth the length; corolla up to 1 cm long; disc as in male; ovary oblong-ellipsoid, 3 - 4 mm long, pubescent; styles 3, united into a slender column, ca 4 mm long; stigma 2-partite. Fruits oblong-globose, 2 - 2.5 x 1.2 - 1.5 cm, rugulose, pubescent when young; seeds oblong, ca 1 cm long, ca 6 mm in diam., glossy.

Endemic to southern Peninsular India, with 2 varieties.

## KEY TO THE VARIETIES

- 1 a. Branches, leaves and petioles glabrous or subglabrous; lobes of leaves acute or subacute; female petals pubescent inside **8.1. var. ramnadensis**  
 b. Branches, leaves and petioles densely villous pubescent; lobes of leaves obtuse; female petals subglabrous inside **8.2. var. villosa**

**8.1. var. ramnadensis** Ramam. in Bull. Bot. Surv. India 9: 278, ff. 1 - 11. 1967.

*Fl. & Fr.* July - Oct.

*Distrib.* India: Coastal areas. Tamil Nadu (Ramanathapuram District).

Endemic.

**8.2. var. villosa**

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

*Distrib.* India: Scrubs and forests, at 400 - 1500 m altitudes. Tamil Nadu (Madurai, Nilgiri and Salem Districts).

Endemic.

## CULTIVATED SPECIES

**1. *Jatropha integerrima*** Jacq., Enum. Syst. Pl. 32. 1760 [Aug. - Sep. 1790] & Select. Strip. Amer. Hist. 256, t. 183, f. 7. 1763; Mc Vaugh in Bull. Torrey Bot. Club 73: 274. 1945. *J. hastata* Jacq., Select., Stirp. Amer. Hist. 256. 1763 (non Griseb., Dec. 1760). *J. panduraefolia* Andrews, Bot. Repos. 4: t. 267. 1802; Haines, Bot. Bihar Orissa 2: 105. 1921.

Shrubs, 1 - 3 m high. Leaves fiddle-shaped, oblong, obovate or oblong-oblongate, rounded, truncate or subcordate at base, the remaining margins entire or subentire with a few distant teeth, caudate-acuminate at apex, sometimes narrowed or constricted above the base, 6 - 16 x 2 - 8 cm; lateral nerves 10 - 15 pairs; petioles 1 - 7 cm long. Inflorescences axillary, long-peduncled corymbose cymes; peduncles 8 - 15 cm long; lower branches alternate, upper ones subopposite; bracts pedicels ca 2 mm long, puberulous. Male flowers: calyx cup-shaped, ca 3 mm long; lobes 5, oblong, ca 1 mm long, separated by broad rounded sinuses; petals 5, obovate, oblanceolate to spatulate, 10 - 13 x 5 - 6 mm, scarlet red or crimson pink; stamens 10; filaments flat, united halfway into a column, the 5 outer ones 5 - 6 mm and the 5 inner ones 8 - 10 mm long; anthers sagittate; disc lobes 5, glandular, ovate to orbicular. Female flowers: calyx same as in male but often larger; petals and disc same as in male; ovary ovoid, ca 3 mm long, glabrous; styles 3, ca 5 mm long, each bifid from middle into filiform slightly hooded branches. Fruits shallowly 3-lobed, ca 1 cm long, purplish green; seeds oblong, ca 8 mm long.

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

*Distrib.* India: Cultivated in gardens at low elevations. Punjab, Rajasthan, Uttar Pradesh, Madhya Pradesh, Orissa, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. Probably in other States also.

Native of Cuba, now introduced and cultivated in several tropical regions around the World.

Notes. Chromosome number:  $2n = 22$  (Rupert et al., Bull. Torrey Bot. Club 97: 321 - 325. 1970).

Kamilya & Paria (1994) describes the seedlings of this species as epigeal and phanerocotylar, the paracotyledons with 3 primary nerves and the first two leaves simple and subsequent leaves pandurate.

Among the species studied by Bir Bahadur et al. (J. Swamy Bot. Club 14: 45 - 47. 1997), this species alone is hypostomatic, where the stomata are confined to lower surface of the leaves. All other species of *Jatropha* are amphistomatic, where the stomata are found in both lower and upper surfaces of leaves.

The two varieties are distinguished as follows:

- 1 a. Leaves narrowly panduriform, 2 - 4 cm wide, much narrowed towards middle; margins entire with a few dentate projections at the base of lamina on either side; petioles short, up to 3 cm long — var. **coccinea** (Link) N.P. Balakr. in Bull. Bot. Surv. India 22: 176. 1980 (1982). *Jatropha coccinea* Link, Enum. Hort. Berol. 2: 406. 1822. *J. pandurifolia* Andrews var. *coccinea* (Link) Pax in Engl., Pflanzenz. Heft 42: 50, t. 19 B. 1910.
- b. Leaves not panduriform, broadly oblong-obovate or oblanceolate, usually 4 - 8 cm wide, not narrowed at middle; margins dentate; petioles long, usually up to 7 cm long — var. **latifolia** (Pax) N.P. Balakr., l. c. 176. 1980 (1982). *Jatropha pandurifolia* Andrews var. *latifolia* Pax, l. c. 50, f. 19A. 1910.

However, it is rather difficult to distinguish them clearly in live plants due to intermediaries and hence, may not stand as taxonomically distinct.

## 2. *Jatropha multifida* L., Sp. Pl. 1006. 1753; Hook.f., Fl. Brit. India 5: 383. 1887.

Eng.: Coral Plant; Kon.: *Chini-emrandi*; Mal.: *Aramedakam*; Tam.: *Malai-amanakku*.

Shrubs, 1 - 5 m tall, glabrous. Leaves broadly orbicular in outline, 15 - 35 cm across, deeply palmately divided up to about 1 cm from base into 7 - 13 lobes, subpeltate or cordate at base; lobes lanceolate to linear-lanceolate, acute to acuminate at apex, pinnatifid or coarsely lobulate towards upper portion, rarely entire, glaucous green beneath; main nerves 7 - 13; lateral nerves many; petioles 10 - 25 cm long. Inflorescences long-peduncled, flat-topped corymbose cymes, 3 - 4 cm across; peduncles 10 - 20 cm long; branches alternate; pedicels 4 - 8 mm long. Male flowers: calyx cup-shaped, ca 2 mm long, 5-lobed; lobes oblong-ovate, ca 1 mm long, crimson-red; petals 5, oblong-spathulate, 4 - 5 mm long, crimson-red, glabrous; disc cup-shaped, glandular; stamens 8 (5 + 3); filaments ca 2 mm long, connate at lower half; anthers linear, sagittate, ca 1.5 mm long. Female flowers: calyx as in male; petals larger, 6 - 7 mm long; disc urceolate; ovary ovoid, ca 5 mm long, glabrous; styles 3, ca 3 mm long, connate at base, each cleft into slender elongate segments; stigma capitate. Fruits globose-pyriform, to oblate, slightly 3 or 2-lobed with 3 stout longitudinal ribs, ca 3 cm across, subdrupaceous, indehiscent, yellowish when ripe.

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

*Distrib.* India: Cultivated in tropical gardens of plains, sometimes seen regenerating

naturally by seeds. Madhya Pradesh, West Bengal, Orissa, Andhra Pradesh, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Native of tropical America now introduced and cultivated in tropical gardens of several countries in Africa and Asia.

*Uses.* The seeds are one of the best among emetics and purgatives and a glass of urine (Rama Rao, Fl. Pl. Travancore 364. 1914) stays the effect. The latex used for treatment of wounds (Kosasi et al., J. Ethno-pharmacology 27: 81 - 89. 1989).

*Notes.* Chromosome numbers:  $n = 11$  (Datta in Taxon 16: 341 - 350. 1967) and  $2n = 22$  (Perry in Amer. J. Bot. 30: 527 - 543. 1943).

This species presents the largest known seeds in the genus. Kamilya & Paria (1994) describes the seedlings as epigeal and cryptocotylar, the hypocotyl with numerous wart-like raised spots, the cotyledons enclosed in seed coat coming out together above the soil surface along with hypocotyl and the two cotyledons never get exposed except their petioles. The first two leaves are multifid. This is probably the only species in *Jatropha* known to have such cryptocotylar nature. In the entire Euphorbiaceae, this type of cryptocotylar nature is unique and has so far reported only in another species, *Hevea brasiliensis*. Dehgan & Webster (1979) states: "This situation poses a great deal of difficulty in germination of hybrid seeds where *J. multifida* is one of the parents, because the cotyledons are never completely freed and, consequently, the food reserve becomes exhausted. Since photosynthesis does not begin until the first leaves appear, the seedlings are too weak to survive. This may perhaps explain the unusually large seeds of *J. multifida* and *Hevea brasiliensis*, where sufficient food can be stored to compensate for the lack of photosynthesis by initial leaves."

**3. *Jatropha podagrica*** Hook., Bot. Mag. 74: t. 4376. 1848; Woodrow in J. Bombay Nat. Hist. Soc. 12: 371. 1899.

Shrubs, 0.5 - 1.5 m high; stem suddenly thickened and tuberous at base, bottle-shaped, widely branched dichotomously. Leaves in clusters of 6 - 8, broadly ovate-reniform or suborbicular, 12 - 30 cm across, broadly peltate, truncate to broadly rounded at base, palmately 3 - 5-lobed almost half way; lobes broad, shortly acuminate, undivided, pale glaucous beneath; main nerves 5 - 9, palmate; lateral nerves almost straight; petioles 8 - 20 cm long, glabrous; stipules pectinate into rigid glandular segments, often persistent when leaves are shed. Inflorescences axillary, long-peduncled corymbose cymes, multi-forked; peduncles 16 - 18 cm long, glabrous; branches crowded at the top of peduncle. Male flowers: pedicels 1 - 1.5 mm long; calyx cupular, 1 - 1.5 mm long, red, glabrous, lobed for half the length; lobes orbicular; petals oblong-obovate or oblanceolate-spathulate, 5 - 6 x ca 2 mm, glabrous, bright red; disc urceolate; stamens 6 - 8; filaments 2 - 3 mm long, connate at base; anthers linear-oblong. Female flowers: at the fork of each branching; pedicels 1 - 2 mm long; calyx cupular, lobed almost to base, ca 1 mm long, orange-red, glabrous; lobes ovate, obtuse; petals oblong-spathulate, 6 - 7 x ca 2 mm, bright red; disc urceolate, glandular; ovary glabrous, ovoid, ca 2 mm long; style ca 1 mm long; stigma ca 1.5 cm long, thick, bilobed. Fruits oblong, truncate or obtuse, 3-lobed, ca 1.5 x 1.2 cm, yellow, glabrous.

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

*Distrib.* India: Cultivated as ornamental garden plant in plains. West Bengal, Sikkim,

Assam, Orissa, Madhya Pradesh, Andhra Pradesh, Maharashtra, Goa, Karnataka and Tamil Nadu.

Native of tropical America occurring naturally in Guatemala, now introduced and cultivated in many parts of Old World.

*Notes.* This species can be propagated from seeds.

Chromosome numbers:  $n = 11$  (Datta in Taxon 16: 341 - 350. 1967) and  $2n = 22$  (Dehgan & Webster, in Univ. Calif. Publ. Bot. 74: 33. 1979).

Kamilya & Paria (1994) describes the seedlings as epigeal and phanerocotylar, the paracotyledons with 5 primary nerves and the first two leaves entire and ovate-peltate.

#### Tribe 7. **MANIHOTEAE** (Müll.Arg.) Pax

Trees, shrubs or herbs, monoecious (rarely dioecious); laticifers articulated; latex white; indumentum simple, sometimes with stinging hairs. Leaves alternate, mostly palmately lobed or dissected; petioles glandular or stipellate at apex; stipules usually present. Inflorescences terminal or pseudo-axillary, mostly racemose-paniculate or dichasial-paniculate, usually bisexual; flowers apetalous. Male flowers: calyx united, 5-lobed; lobes imbricate, more or less petaloid; disc intrastaminal or extrastaminal; stamens 8 - 10 (- 25); filaments free or connate; pollen grains globose, 3-nucleate, periporate, with Croton-type sexine; pistillode present or absent. Female flowers: sepals 5, sometimes caducous; disc annular; ovary 3 (- 5)-locular; styles free, mostly multifid or lacerate, rarely bifid. Fruits capsular; columella often persistent; seeds carunculate; testa dry.

Native of New World tropics, 2 genera; one in India.

#### 39. **Manihot** Mill.

Shrubs or small trees, monoecious; roots often tuberous with large quantities of starch; indumentum of simple hairs. Leaves alternate, simple or deeply palmately 3 - 5 (- 11 or more) lobed, sometimes almost digitate or upper ones entire, peltate, 5-nerved at base, long-petioled; stipules small, persistent or caducous. Inflorescences terminal, panicles or simple racemes, mostly with a few lowest flowers female and long-pedicelled, the upper male flowers more numerous and short-pedicelled; calyx campanulate, 5-lobed; lobes imbricate, inrolled along margins; petals absent; disc flat, fleshy, glandular. Male flowers: disc glands 10, radially arranged; stamens 10, in two whorls of 5 each, placed more or less outside or sometimes in between the disc glands, somewhat exserted; the inner filaments shorter and thinner; anthers oblong, versatile, sub basally dorsifixed, 2-loculed; connective with hairy prolonged apex; pistillode columnar, small. Female flowers: calyx-lobes 5-nerved; disc annular; ovary 3-loculed, each 1-ovuled; style short, 3-branched; stigmas apically broadening, often repeatedly branched, thin, folded. Fruits schizocarpic.

Neotropical, native of South America, ca 107 species; 2 in India, introduced, cultivated and naturalised or naturally regenerating.

*Literature.* VAN WELZEN, P. C., Q. D. NGUYEN & R. C. K. CHUNG 1997. A revision of the introduced species of *Manihot* Miller (Euphorbiaceae) in Malaysia. *Rheedea* 7: 77 - 85.

## KEY TO THE SPECIES

- 1 a. Shrubs, 1 - 2 m high, rarely up to 4 m tall; leaves epeltate or slightly peltate for less than 3 mm from margin; lobes narrowly oblanceolate; flowers in lax racemes; calyx 7 - 12 mm long; ovary with 6 longitudinal ridges; fruits 6-winged; seeds up to 12 mm long **1. M. esculenta**
- b. Trees, 5 - 10 m tall; leaves distinctly peltate for at least 4 - 5 mm from margin; lobes broadly obovate; flowers in panicles; calyx 15 - 18 mm long; ovary smooth; fruits not winged; seeds more than 12 mm long **2. M. glaziovii**

**1. Manihot esculenta** Crantz, Inst. Rei Herb. 1: 167. 1766. *Jatropha manihot* L., Sp. Pl. 1007. 1753. *Manihot utilissima* Pohl, Pl. Bras. Icon. Descr. 1: 55 1827, nom. superfl.; Müll.Arg. in DC., Prodr. 15 (2): 1064. 1866; Hook.f., Fl. Brit. India 5: 239. 1887.

Eng.: Brazilian Arrowroot, Cassava, Manioc, Tapioca; Hindi: *Malayala-alu* (in Andamans); Kh.: *Phan-kah*; Kon.: *Portugalem-chinem*; Mal.: *Kappa, Kolli-kizhangu, Poola-kizhangu, Marachini*; Nep.: *Dori, Simal-tarul*; Tam.: *Aalvalli-kizhangu, Maravalli-kizhangu, Kappa-kizhangu*.

Shrubs, 1 - 3 (- 7) m high, entirely glabrous. Leaves epeltate or subpeltate for up to 3 mm from the margin, deeply palmately 3 - 9-partite to near the base, the uppermost sometimes entire, rounded at base, 5 - 20 cm across; lobes elliptic, oblong-obovate or elliptic-oblanceolate or panduriform, caudate-acuminate or acute at apex, entire along margins, (3 -) 8 - 17 x 1 - 6 cm, chartaceous, puberulous on main nerves; lateral nerves 5 - 18 pairs; petioles 6 - 35 cm long; stipules entire, triangular to lanceolate or with 1 - 2 lobes, 5 - 7 mm long. Inflorescences terminal and pseudo-axillary, laxly paniculate or branched cymes, 5 - 15 cm long; bracts caducous. Male flowers: pedicels 4 - 7 mm long; calyx 7 - 10 mm long, campanulate, 5-lobed up to the middle; disc central, glabrous; stamens 10, free; filaments white. Female flowers: pedicels 1 - 2 cm long; calyx as in male, up to 12 mm long; disc pulviniform; ovary with 6 longitudinal ridges, 3-locular; stigmas warty, lobed. Fruits globose or ellipsoid, 3-lobed or 3-winged when young, later smooth, 2 - 3 cm in diam., muricate-rugulose, on 1 - 2.5 cm long pedicels.

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

*Distrib.* India: Cultivated near villages and in farms, rarely seen as an escape in wastelands near villages, up to 1700 m altitude. Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Orissa, Madhya Pradesh, Andhra Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Native of tropical NE. Brazil, now widely cultivated in tropical regions of Old World.

*Uses.* The tuberous roots are rich in starch, but poor in protein. Two forms are cultivated, Sweet Cassava and Bitter Cassava, the later containing Prussic acid and is poisonous when eaten raw, but edible after boiling and decanting the water. The tubers are exploited commercially to make starch, sago and flour. It forms one of the staple foods for many in Kerala. Plants with variegated leaves are often cultivated as ornamental garden plant.

*Notes.* Chromosome number:  $2n = 36$  (Darlington & Wylie, Chromosome Atlas Fl. Pl. 129. 1955). Abraham (Proc. Indian Sci. Congr. Assoc. 3: 73. 1944) reports natural and artificial polyploids.

**2. *Manihot glaziovii*** Müll.Arg. in Mart., Fl. Bras. 11(2): 446. 1874; Brandis, Indian Trees 582. 1906; Gamble, Fl. Madras 2(7): 1346. 1925 (repr. ed. 2: 942. 1957).

Eng.: Ceara rubber.

Trees, 5 - 10 (- 13) m tall, entirely glabrous; exuding thick white latex. Leaves peltate for 5 - 15 (- 20) mm from the margin, deeply digitately 3 - 5-lobed, 10 - 30 cm across; lobes asymmetric, elliptic, obovate-rhombate, spatulate or oblanceolate, acute to cuspidate-acuminate at apex, entire along margins, (6 -) 10 - 18 x 2.5 - 7 (- 10) cm, chartaceous; lateral nerves 7 - 16 pairs; veins scalariform; petioles (5 -) 10 - 25 cm long; stipules lacinate towards upper part. Inflorescences terminal and pseudo-axillary, bisexual, laxly paniculate, 5 - 20 cm long. Male flowers: pedicels ca 7 mm long; calyx 15 - 18 mm long, divided for half way down; filaments white; anthers yellow. Female flowers: pedicels 10 - 12 mm long; calyx as in male; ovary smooth; stigma sub-penicillate. Fruits subglobose, 2.5 - 3 cm in diam., 3-lobed, warty, muricate, green with yellow sutures, on 1 - 1.5 cm long pedicels.

*Fl.* June - Sept.; *Fr.* Sept. - Jan.

*Distrib.* India: Introduced for cultivation and now naturalised, though its cultivation has been discontinued. Kerala, Tamil Nadu (Shevaroy Hills, up to 1200 m altitude) and Andaman Islands (up to 200 m altitude).

Native of tropical Brazil, introduced and naturalised in many tropical Asian countries in Malesia.

*Uses.* The latex can be turned into rubber, but inferior to *Hevea brasiliensis* in quality.

### Tribe 8. MICRANDREAE (Müll.Arg.) G.L.Webster

Trees, monoecious or dioecious; laticifers articulate; latex white; indumentum simple or stellate. Leaves alternate, entire, penninerved or triplinerved; petioles with laminar glands at apex; stipules often caducous. Inflorescences terminal or axillary, dichasial-paniculate; bracts small or large; flowers apetalous. Male flowers: sepals 5, imbricate; disc lobed or absent; stamens 5 - 10, free or connate; pistillode present or absent. Female flowers: sepals 5, imbricate, free, caducous in fruit; disc 5-lobed; ovary 3-locular; styles free, bifid. Fruits capsular; columella persistent; seeds large, carunculate or ecarunculate; endosperm oily.

South America, 4 genera; one in India.

### 40. *Hevea* Aubl.

Trees with milky latex. Leaves alternate, long-petioled, palmately 3-foliolate, glabrous; leaflets stalked, entire; stipules caducous. Inflorescences in axils of leaves, paniculate cymes, the central flower of each cyme female, the others male; calyx 5-dentate or 5-lobed; petals absent. Male flowers: disc small, 5-lobed, hairy; receptacle columnar; filaments adnate to the column; anthers 5, in one series or 10 in 2 superposed series; pistillode terminal on the column, ovoid-subulate, rather large. Female flowers: ovary sessile, ovoid, 3-loculed, each locule 1-ovuled; stigmas 3, sessile, broad, 2-lobed. Capsules schizocarpic, 3-lobed; seeds ellipsoid, large.



Tropical America, ca 19 species; one in India.

**Hevea brasiliensis** (Willd. ex A.Juss.) Müll.Arg. in *Linnaea* 34: 204. 1865. *Siphonia brasiliensis* Willd. ex A.Juss., *Euphorb. Gen.* 113, t. 12, f. 38B. 1824.

Eng.: Para-rubber; Mal. & Tam.: *Rubber-maram*.

Trees, 10 - 20 m tall. Leaves long-petioled, digitately 3-foliolate; leaflets elliptic-oblong, cuneate and often oblique at base, acuminate at apex, entire along margins, 12 - 30 x 4 - 10 cm; petiolules 1 - 1.5 cm long, glandular at base. Inflorescences paniculate, 10 - 25 cm long, densely patently pubescent; flowers light yellow; pedicels short, densely hairy; calyx ca 5 mm long, light yellow; lobes subulate from a broad base. Male flowers: 8 - 10 mm long; anthers 10 in 2 series; pistillode caducous. Female flowers: 10 - 12 mm long; ovary densely short hairy. Fruits subglobose, 4 - 5 cm across, trilocular, 1-seeded.

*Fl. & Fr.* April - Nov.

*Distrib.* India: Cultivated in plantations in humid tropical areas, sometimes as an escape near plantations in Kerala, capable of natural regeneration. Assam, Manipur, Kerala, Tamil Nadu, Goa and Andaman & Nicobar Islands.

Native of Brazil now cultivated throughout humid tropics of Africa and Asia.

*Uses.* The latex from the tree trunk produces the natural rubber for wide utilities and commercially highly valuable.

*Notes.* The germination of seeds in this species is termed as cryptocotylar (i. e. the cotyledons are never completely freed from the seed coat), a feature unique in Euphorbiaceae, probably shared only by another species, *Jatropha multifida* (Duke, *Ann. Missouri Bot. Gard.* 56: 125 - 161. 1969).

### Tribe 9. RICINODENDREAE (Pax) Hutch.

Trees or shrubs, dioecious or monoecious; indumentum stellate. Leaves alternate, unlobed, lobed or palmatisect; stipules entire or lobed or absent. Inflorescences axillary or the female flowers terminal, paniculate or reduced to clusters or solitary flowers. Male flowers: sepals 4 or 5, imbricate; petals 5, coherent into a tube; disc dissected or lobed; stamens (3 - ) 5 - 20, filaments connate below; pistillode absent. Female flowers: sepals 4 or 5, imbricate; petals 5, coherent; disc lobed; ovary 1 - 3-locular. Fruits drupaceous, 1 - 3-seeded; seeds ecarunculate; endosperm copious, oily; cotyledons broad, flat.

Paleotropical, 2 genera; one in India.

#### 41. *Givotia* Griff.

Trees, dioecious, stellate tomentose. Leaves exstipulate, petiolate, palmately 5 - 9-nerved at base. Inflorescences terminal or subterminal, paniculate, unisexual; male panicles long, female panicles very short; calyx-lobes 5, imbricate, unequal; petals 5, longer than calyx, cohering into a campanulate 5-lobed corolla. Male flowers: disc glandular, lobed; stamens 13 - 25, inserted

on a villous receptacle, the outer ones shorter; filaments erect, connate below; pistillode absent. Female flowers: disc cupular; ovary 2 or 3-locular; each locule 1-ovuled; style short, bifid. Fruits drupaceous, 1-seeded; endocarp thin, crustaceous; seed solitary; testa bony.

Tropical NE. Africa, Madagascar, Peninsular India and Sri Lanka, 4 species; one in India.

**Givotia rottleriformis** Griff. [in Calcutta J. Nat. Hist. 4: 88. 1844] ex Wight, Icon. Pl. Ind. Orient. 5: 24, t. 1889. 1852; Hook.f., Fl. Brit. India 5: 395. 1887; Radcl.-Sm. in Kew Bull. 22: 504. 1968. *Croton moluccanus* L., Sp. Pl. 1005. 1753, p. p. quoad spec. Hermann. *Givotia moluccana* (L.) Sreem. in Taxon 24: 696. 1975; Govaerts et al., World Checkl. & Bibl. Euphorbiaceae 3: 937. 2000.

Kan.: *Pubeer*; Mar.: *Polki*; Tam.: *Kottaitthanakku, Thalamaram, Vandalai, Vellai-poothali*; Tel.: *Tella-puliki*.

Trees, 8 - 15 (- 20) m tall, deciduous, stellate-pubescent; branchlets marked with prominent leaf scars. Leaves broadly ovate to orbicular-deltoid, rounded or widely cordate at base, coarsely and irregularly toothed along margins, acute at apex, (3 - ) 8 - 18 (- 25) x (3 - ) 6 - 15 (- 18) cm, minutely stellate pubescent above and stellate tomentose beneath, palmately 5-nerved at base; petioles 2 - 8 (- 12) cm long, sometimes with 2 black round glands at top and several about the middle; stipules up to 5 mm long. Inflorescences axillary or terminal paniculate cymes; bracts linear, up to 12 mm long. Male inflorescences 12 - 20 cm long, branched; flowers yellow; sepals oblong to obovate, cucullate, 4 - 6 mm long, densely stellate pubescent; petals campanulate, 5-lobed with cuneate and truncate lobes, longer than sepals; disc of 5 free orbicular glands; stamens 8 - 20, outer ones ca 6, with free filaments and inner ones ca 10, with filaments connate at base and exserted; filaments unequal, ca 5 mm long; anthers oblong, ca 1 mm long. Female inflorescences shorter and smaller than in male; sepals and petals as in male; ovary globose, stellate hairy; styles 2, forked from base. Drupes subglobose, ovoid or ellipsoid, 2 - 2.5 cm long, indehiscent, smooth, green, densely fulvous-tomentose.

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

*Distrib.* India: Dry deciduous and semideciduous forests of Central and Peninsular India, up to 1000 m. Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Uses.* Wood used for making toys, decorative articles etc., and takes paint readily. Seeds yield valuable oil used for lubricating machinery.

## Tribe 10. TRIGONOSTEMONEAE G.L. Webster

Paleotropical, monogeneric.

### 42. *Trigonostemon* Blume, nom. cons.

Shrubs or small trees, with simple hairs, monoecious. Leaves alternate, often falsely whorled and then often separated by bare internodes, penninerved or sometimes triplinerved at base, long or short petioled; stipules short or obsolete. Inflorescences axillary or terminal, occasionally cauli- or ramiflorous, unisexual or bisexual, variously cymose (often abbreviated or even reduced to a solitary flower), thyriform, racemiform or pseudoracemose, rarely with

conspicuous foliaceous bracts. Male flowers: shortly pedicelled; sepals 5, imbricate, sometimes dorsally gibbous; petals 5, free, exceeding the sepals, mostly brightly coloured; disc glands 5, often connate; stamens 3 (- 4) or 5 or very rarely 13; filaments connate or rarely somewhat free or rarely lacking; anthers 2-loculed, extrorse, vertical to horizontal; connectives broad, often produced and horn-like; pistillode absent. Female flowers: pedicels initially short, gradually elongating; sepals 5, imbricate, rarely fringed with capitate glands; petals 5, free, coloured as in males, caducous; disc glands free or united; ovary 3-locular, glabrous or pubescent; each locule 1-ovuled; styles 3, bifid or occasionally simple or quadrifid, erect or spreading. Fruits tricoccus capsules, often depressed, smooth or verruculose; seeds trigonous, orbicular or ovoid; endosperm fleshy; cotyledons flat, broad.

Sri Lanka, S. & NE. India to China and Malesia, ca 90 species; 5 species in India.

*Literature.* BALAKRISHNAN, N. P. & T. CHAKRABARTY (1991). A revision of *Trigonostemon* Bl. (Euphorbiaceae) for Indian subcontinent. *Candollea* 46: 601 - 637, ff. 1 - 12.

#### KEY TO THE SPECIES

- 1 a. Leaves clearly trinerved at base; inflorescences bisexual **5. T. viridissimus**
- b. Leaves solely penninerved, never trinerved at base; inflorescences unisexual 2
- 2 a. Female inflorescences with a few conspicuous foliaceous bracts **1. T. aurantiacus**
- b. Female inflorescences without such foliaceous bracts 3
- 3 a. Inflorescences reduced, short, up to 3.5 cm long **3. T. semperflorens**
- b. Inflorescences not reduced, much longer 4
- 4 a. Petioles bistipellate at apex with glandular appendages below the lamina on both sides; sepals often conspicuously dorsally gibbous; anthers sessile with thecae separated from one another and partially embedded on somewhat triquetrous fleshy coherent connectives, forming a globose mass as a whole on the receptacle **2. T. nemoralis**
- b. Petioles not bistipellate at apex; sepals not gibbous; anthers not as above, but subtended by a connate column of filaments **4. T. villosus**

**1. *Trigonostemon aurantiacus*** (Kurz ex Teijsm. & Binn.) Boerl., *Handl. Fl. Nederl. Ind.* 3(1): 284. 1900. *Tylosepalum aurantiacum* Kurz ex Teijsm. & Binn. in *Natuurk. Tijdschr. Ned-Indie* 27: 50. 1864. *Trigonostemon aurantiacus* var. *rubriflorus* N.P.Balacr. & Chakrab. in *J. Econ. Taxon. Bot.* 5: 169. 1984.

Shrubs or trees, 1 - 10 m tall. Leaves elliptic, oblong-elliptic to obovate (often narrowly so) or oblanceolate, cuneate-attenuate or obtuse to rounded at base, repand-serrulate or repand-denticulate to subentire along margins, caudate or acuminate at apex, 7 - 32 x 3 - 9 cm, coriaceous, glabrous above, glabrous or often sparsely appressed puberulous towards base beneath, penninerved; lateral nerves 7 - 14 pairs; petioles 2 - 3 (- 4) cm long, with 2 setiform glandular (0.8 - 1.3 mm long) appendages at apex on upper side; stipules minute or obsolete. Male inflorescences cauli- or ramiflorous or often axillary, fasciculate, few-flowered, subtended by minute hairy bracts; pedicels 6 - 12 mm long; sepals orbicular, 0.8 - 1.3 mm across, orange when fresh, dorsally gibbous; petals subflabellate or spatulate-obovate, ca 2 x 1.3 - 2 mm, deep red or orange-red when fresh, blackish crimson when dry; disc glands 0.4 - 0.6 mm long; stamens 3; column 1 - 1.5 mm long, very shortly trifid at apex; anthers ovoid. Female inflorescences terminal, pseudo-racemose or very narrowly thyrsoid, (2 -) 9 - 60 cm long; peduncles 1.5 - 40 cm long; bracts foliaceous, 1 - 1.5 x 0.2 - 0.6 cm, the upper bracts subulate, 4 - 7 mm long; pedicels 6 - 20 mm long, thickened upwards; sepals broadly ovate, elliptic to orbicular, 0.7 - 1 x 0.7 - 2 mm, dorsally

gibbous; petals elliptic to obovate-spathulate, 3.5 - 4 x 2 - 2.5 mm, deep red inside, orange outside when fresh, blackish crimson when dry; disc glands squarish or oblong, ca 0.5 mm long; ovary trigonous to subglobose, ca 1 mm in diam., glabrous; styles 0.3 - 0.6 mm long; stigmas capitate. Fruits subglobose, 10 - 12 mm in diam., glabrous, smooth, blackish when dry; pedicels 2.5 - 4.5 cm long.

*Fl. & Fr.* March - Aug.

*Distrib.* India: Common in inland primary forests as the second storey, or in mixed forests or scrubs, on sandy, clayey or rocky loam, up to about 200 m altitude. Andaman & Nicobar Islands.

Myanmar, Thailand, Malaya, Java and Sumatra.

**2. *Trigonostemon nemoralis*** Thwaites, Enum. Pl. Zeyl. 277. 1861; Bedd., Fl. Sylv. S. India 213. 1873 & Icon. Pl. Ind. Orient. 41, t. 182. 1874; Hook.f., Fl. Brit. India 5: 398. 1887; N.P. Balakr. & Chakrab. in Candollea 46(2): 623, f. 8. 1991; R. Gopalan in J. Econ. Taxon. Bot. 23: 684, f. 2. 1999.

Shrubs or small trees; young shoots ochraceous sericeous; branchlets glabrous. Leaves crowded towards apices of branches (alternate to subopposite or appearing verticillate), elliptic to oblong-elliptic or narrowly so or obovate-elliptic to narrowly obovate, cuneate-attenuate at base and adaxially decurrent into petioles, minutely glandular-denticulate or serrulate along margins, acute-mucronate to acuminate at apex, 6 - 16 (- 20) x 3 - 6 cm, membranous to subchartaceous, glabrous, penninerved; lateral nerves 8 - 16 pairs; petioles (2 -) 4 - 10 mm long, bistipellate at apex; stipules subsistent. Male inflorescences apparently unisexual, pseudo-racemose, up to 18 cm long; pedicels ca 2 mm long; sepals suborbicular to orbicular-obovate, 1.5 - 2 x 0.8 - 1.5 mm, dorsally gibbous; petals ovate to oblong, 2 - 3 x 1 - 1.5 mm, red, appearing black when dry; disc shortly cupular or of 5 distinct glands; anthers 3; thecae 2, partially embedded in connectives and separated from one another; connectives fleshy, bilobed, somewhat triquetrous, coherent (forming a globose head as a whole), connate towards base forming a short (ca 0.5 mm long) stalk. Female inflorescences terminal and axillary, racemiform, up to 9 cm long; bracts as in male; pedicels 2 - 6 mm long; sepals ovate to oblong, 3 - 4 x 1.8 - 3 mm, dorsally gibbous; petals not seen, caducous(?); disc glands free or connate in a ring and lobed; ovary subglobose, ca 2 x 3 mm, 3-lobed, densely hirsute; styles simple or shortly bifid, ca 2 mm long. Fruits tricoccus, ca 1 x 1.2 cm, verruculose, puberulous.

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

*Distrib.* India: Evergreen forests of Western Ghats, often along riverbanks, at 600 to 900 m altitudes. Tamil Nadu and Kerala.

Sri Lanka.

**3. *Trigonostemon semperflorens*** (Roxb.) Müll. Arg. in DC., Prodr. 15(2): 1110. 1866; Hook.f., Fl. Brit. India 5: 397. 1887. *Clusia semperflorens* Roxb., Fl. Ind., ed. Carey 3: 730. 1832.

Kh.: *Diang-soh-kot, Dieng-soh-pyda.*

Shrubs (often bushy) or trees, 1.5 - 5 m tall; young shoots densely ochraceous-hirsute; branchlets ochraceous-pilose or hirsute, glabrous in age. Leaves crowded towards tips of

branches, alternate and very often pseudo-verticillate and separated by bare internodes, narrowly obovate to cuneate-oblongate or panduriform, narrowly cordate (often rounded) at extreme base, serrulate to subentire along margins, caudate-acuminate at apex, (6 -) 10 - 30 x (2 -) 3 - 8 cm, membranous to chartaceous, glabrous above, sparsely ochraceous-hirsute or pilose (on major nerves) to glabrous beneath, penninerved; lateral nerves 9 - 20 pairs; petioles 1 - 8 mm long. Male inflorescences axillary or cauliflorous, glomerate-fascicled; pedicels short; petals deep purple; disc glands free; stamens 3 with connate filaments. Female inflorescences axillary, also in the axils of fallen leaves, abbreviated, sub-fasciculate to solitary or racemiform cymes, up to 3.5 cm long; peduncles up to 2 cm long or absent; pedicels 2 - 5 mm long; sepals elliptic, oblong, ovate or triangular, 3.5 - 8 x 1 - 3 mm; petals spatulate-obovate, 3 - 4 x 1.8 - 3 mm, deep purple; disc glands squarish, ca 0.6 x 0.5 mm; ovary subglobose, 1.5 - 2 x 2 - 3 mm, tomentose or densely hirsute; styles bifid to base, 1 - 1.5 mm long. Fruits subglobose, 9 - 12 x 13 - 15 mm, pilose or hirsute; seeds suborbicular, ca 7 mm long, ca 6 mm in diam., trigonous, marbled.

*Fl. & Fr.* Apr. - May, Nov. - Jan. (perhaps round the year).

*Distrib.* India: Primary evergreen forests, up to 1550 m altitude. Assam and Meghalaya. Bangladesh.

**4. *Trigonostemon villosus* Hook.f. var. *nicobaricus* (Chakrab.) N.P.Balacr. & Chakrab.** in *Candollea* 46: 629, f. 11. 1991. *T. nicobaricus* Chakrab. in *J. Econ. Taxon. Bot.* 5: 203. 1984.

Trees, 5 - 7 m tall; branchlets glabrous. Leaves oblanceolate or sometimes narrowly oblong-obovate to elliptic, cuneate and narrowly rounded at base, serrulate along margins, caudate-acuminate at apex, 12 - 30 x 3 - 7 cm, thinly chartaceous, glabrous above, scattered yellowish puberulous on major nerves beneath; lateral nerves 10 - 16 pairs; petioles (3 -) 5 - 20 mm long; stipules triangular-acuminate, ca 1 mm long. Male inflorescences axillary, pseudo-racemose, 5 - 13 cm long; pedicels 2 - 5 mm long; sepals oblong or often triangular, 1 - 1.5 x 0.7 - 1.2 mm; petals spatulate-obovate, ca 2.5 x 1.2 - 1.5 mm, blackish crimson; disc glands obcordate or deltoid, ca 0.5 x 0.4 mm, coherent, forming a false cup; stamens 3; column 1 - 1.3 mm long, very shortly trifid at apex; anthers ellipsoid to orbicular, ca 0.5 mm long. Female inflorescences axillary, racemiform, 6 - 10 cm long; bracts linear, 2.5 - 5 x 0.5 - 1 mm; pedicels 3.5 - 4 mm long; sepals ovate-lanceolate to lanceolate, 4 - 6 x 1.5 - 2 mm; petals 5, oblong-elliptic, ca 2 x 1 mm, blackish crimson; disc glands squarish, ca 0.5 mm across; ovary globose, 3-lobed, ca 1 mm in diam., coarsely and densely yellow villous; styles 3, erect, bifid, ca 0.8 mm long. Fruits not seen.

*Fl. & Fr.* April - May.

*Distrib.* India: Primary hill forests at low altitudes, up to 300 m. Andaman & Nicobar Islands (Great Nicobar Island).

Endemic.

**5. *Trigonostemon viridissimus* (Kurz) Airy Shaw** in *Kew Bull.* 25: 545. 1971 & 36: 358. 1981 & 37: 36. 1982 & in *Kew Bull. Addit. Ser. IV:* 205. 1975. *Sabia viridissima* Kurz in *J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist.* 41(2): 304. 1872; Hook.f., *Fl. Brit. India* 2: 3. 1876. *Kurziodendron viridissimum* (Kurz) N.P.Balacr. in *Bull. Bot. Surv. India* 8: 68, ff. 1 - 7. 1966.

Shrubs or small trees, 1 - 4 m tall. Leaves crowded towards ends of branches, elliptic or elliptic-lanceolate to oblong or obovate to oblanceolate, acute or cuneate or obtuse to rounded

at base, distantly serrulate or shallowly denticulate to entire along margins, acuminate to caudate at apex, 2.5 - 29 x 1 - 9 cm, membranous to chartaceous, glabrous above, glabrous or sometimes sparsely ochraceous puberulous beneath; lateral nerves 3 - 10 pairs; petioles (0.3 -) 2 - 4.5 (- 6) cm long; stipules caducous. Inflorescences terminal and axillary, bisexual, usually pyramidal-thyrsoid or sometimes tending towards dichasial branching or even almost racemiform or pseudo-racemose, (0.5 -) 2.5 - 12 cm long, often pedunculate; male flowers numerous; female flowers fewer and terminating the branches; bracts subulate to ovate, 0.5 - 1.5 mm long. Male flowers: pedicels 5 - 18 mm long; sepals elliptic, oblong to ovate, 0.8 - 2 x 0.6 - 1.2 mm; petals orbicular-obovate to spatulate, 3 - 7 x 1.5 - 4 mm, yellow or orange-yellow; disc cupular or often campanulate, crenate, 0.5 - 0.9 x 0.5 - 1.2 mm; stamens 3 (or 4), free or connate; column 1 - 2.6 mm long, trifid at apex; anthers widely ellipsoid to oblong, initially vertical, finally horizontal, 0.5 - 0.8 mm long. Female flowers: pedicels 6 - 30 mm long; sepals ovate to suborbicular or triangular-oblong, 1 - 2.5 x 0.8 - 2 mm; petals obovate, orbicular-obovate or spatulate, 4 - 5 x 3 - 3.5 mm, yellow; disc shortly cupular, crenate, 0.6 - 1 x 1.5 - 1.8 mm; ovary globose, 1 - 2 mm in diam., glabrous; styles 3, 1 - 2 mm long, often shortly connate below; stigmas capitate or reniform. Fruits slightly depressed, 7 - 8 x 10 - 13 mm, shallowly 3-lobed, glabrous, brown or orange-brown when dry; pedicels 1.5 - 3 cm long; seeds trigonous-orbicular, 5 - 9 mm in diam.

*Distrib.* NE. India, Andaman & Nicobar Islands, Myanmar, Malaysia, Indonesia, Timor and Lesser Sunda Islands.

#### KEY TO THE VARIETIES

- 1 a. Leaves small, on the average 2.5 - 6.5 x 1 - 3 cm, entire along margins, acute to obtuse at apex; petioles short, 2 - 6 mm long; inflorescences short, 0.5 - 1 cm long, racemiform **5.2. var. confertifolius**
- b. Leaves larger, on the average up to 29 cm long, serrulate or denticulate along margins, caudate or acuminate at apex; petioles longer, up to 6 cm long; inflorescences longer, up to 12 cm long, thyrsoform **2**
- 2 a. Filaments almost free **5.1. var. chatterjii**
- b. Filaments connate **5.3. var. viridissimus**

**5.1. var. chatterjii** (Deb & G.K.Deka) Chakrab. & N.P.Balakr. in J. Econ. Taxon. Bot. 5: 967. 1984. *Trigonostemon chatterjii* Deb & G.K. Deka in Indian Forester 91: 577. 1965.

*Fl. & Fr.* April - May.

*Distrib.* India: On rocky slopes of tropical evergreen forests, up to 500 m altitude, rare. Meghalaya.

Endemic.

**5.2. var. confertifolius** N.P.Balakr. & N.G.Nair in Bull. Bot. Surv. India 24: 36. 1982 (1983).

Stunted shrubs, ca 1 m tall; inflorescences reduced, racemiform.

*Fl. & Fr.* Nov. - Dec.

*Distrib.* India: Subtropical evergreen forests at 500 - 700 m altitudes. Andaman & Nicobar Islands (Saddle Peak in N. Andaman Isl.).

Endemic.

**5.3. var. viridissimus**

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

*Distrib.* India: Common in coastal forests or thickets of mixed forests or inland forests on sandy, clayey or rocky loam up to about 200 m altitude. Andaman Islands.

Myanmar, Malaysia, Indonesia, Philippines, Timor and Lesser Sunda Islands.

## CULTIVATED GENUS

**Codiaeum** A.Juss., nom. cons.

Throughout tropical and subtropical regions of Asia, Australia and Pacific Islands, ca 17 species; one species cultivated as garden ornamental in India.

**Codiaeum variegatum** (L.) A.Juss., Euphorb. Gen. 80, 111, t. 9, f. 30. 1824; Blume, Bijdr. Fl. Ned. Ind. 606. 1826; Hook.f., Fl. Brit. India 5: 399. 1887. *Croton variegatus* L., Sp. Pl. 2: 1199. 1753 & ed. 3, 1424. 1764.

Beng.: *Patabahar*; Eng.: Croton.

Shrubs or trees, monoecious, 1 - 3 m high, glabrous or glabrescent. Leaves alternate, spirally arranged, often shallowly lobed, oblong to lanceolate to oblong-obovate, spatulate or linear, entire or undulate along margins, 5 - 40 x 1 - 9 cm, glossy, variegated with green, yellow, purple or red, usually spotted variously in different colours, coriaceous; petioles 0.5 - 5 cm long. Inflorescences solitary or rarely in paired racemes, in upper leaf axils, up to 25 cm long, unisexual or bisexual with male and female flowers in the same raceme. Male flowers: fascicled; pedicels 3 - 6 mm long; sepals 5, ovate or suborbicular, 2 - 4 mm long; petals 5 or 6, minute; disc glands alternating with petals; stamens 15 - 35, free; anthers erect. Female flowers: solitary; pedicels 3 - 7 mm long; sepals same as in male, appressed on ovary, 1.5 - 2 mm long; petals and staminodes absent; disc cupular; ovary 3-loculed, each locule 1-ovuled; styles 3, connate at base. Fruits capsular, globose, 3-lobed, breaking into 2-valved cocci, 7 - 8 x ca 9 mm, glabrous; seeds ca 6 mm long, glossy, brown, variegated.

*Fl. & Fr.* April - July.

*Distrib.* India: Cultivated for the ornamental foliage in gardens, throughout in tropical and subtropical regions in India.

Native of Malaysia, now under cultivation throughout tropical and subtropical regions of the World.

## Subfamily III. EUPHORBOIDEAE

Trees, shrubs or herbs, rarely scandent; laticifers not articulated; latex usually white, sometimes scanty or apparently absent; indumentum simple or absent. Leaves alternate or opposite, simple, entire or dentate, usually pinnately veined, often with glands at base of blade; stipules usually small or absent. Inflorescences terminal or axillary, spicate or racemose, paniculate or cyathiate; bracts often biglandular at base; flowers apetalous. Male flowers: sepals 3 - 6, imbricate or valvate, mostly open in bud, often reduced or obsolete; disc absent;

stamens 1 - 20 (- 70); filaments free or connate; pistillode absent. Female flowers: sepals 3 - 6, free or connate, imbricate or open in bud, sometimes reduced or obsolete; disc absent; ovary 2 - 3 (- 20)-locular; styles 3, free or connate into a column. Fruits 3-coccos, capsular, rarely drupaceous; seeds carunculate or ecarunculate; testa dry or fleshy; endosperm copious.

Tropical, subtropical and temperate regions around the World, ca 40 genera; 4 indigenous and 3 cultivated genera in India.

#### KEY TO THE TRIBES

- 1 a. Inflorescences cyathiate, usually with a single terminal pistillate floret and 4 or 5 lateral monochasia or dichasia of male flowers; perianth reduced or absent; styles mostly bifid  
Tribe **1. EUPHORBIEAE**
- b. Inflorescences mostly racemose or spicate (if capitate, not cyathiate); male flowers usually with developed calyx; styles mostly undivided 2
- 2 a. Floral bracts usually biglandular at base, not peltate, nor adnate to the rachis; seeds carunculate or ecarunculate  
Tribe **2. HIPPOMANEAE**
- b. Floral bracts eglandular, peltate or adnate to the rachis of inflorescences and covering flowers; seeds ecarunculate  
(cult.) Tribe **3. HUREAE**

#### Tribe **1. EUPHORBIEAE** (M. S. Binojkumar & N. P. Balakrishnan)

Trees, shrubs or herbs, monoecious or rarely dioecious; latex milky; indumentum simple or absent. Leaves alternate, opposite or whorled, mostly unlobed, pinnately veined; stipules present or absent. Inflorescences: cyathia with connate involucre bracts forming a cup enclosing many male florets surrounding a single central female floret. Male florets: many, in 4 or 5 monochasia; calyx reduced or absent; stamen single. Female floret: calyx present or absent; ovary (2 -) 3 (- 4)-locular with one ovule in each locule; styles 3, free or basally connate, each bifid or rarely entire. Fruits capsular, rarely drupaceous; seeds carunculate or ecarunculate; testa dry, smooth or ornamented.

Tropical, subtropical and temperate regions around the World, 11 genera; 3 in India, of which two are exotics under cultivation.

#### KEY TO THE GENERA

- 1 a. Cyathium bilaterally symmetrical on the vertical axis and asymmetrical in radial axis, the glands hidden with the nectar spur; styles connate into a long column  
(cult.) **42a. Pedilanthus**
- b. Cyathium symmetrical in two axes, vertical and radial (horizontal), the glands not hidden within a nectar spur; styles mostly free or partially connate 2
- 2 a. Involucre glands 4 or 5, separate and alternating with the involucre lobes of cyathium along the rim  
**42. Euphorbia**
- b. Involucre glands connate into an annular ring, with gaps (cult.) **42b. Synadenium**

#### **42. Euphorbia** L., sensu lato

Herbs, shrubs, or trees, sometimes hysteroanthous geophytes, monoecious, often succulent, cactus-like shrubs or trees, inermous or aculeate, with milky latex; stems well-developed or rarely as underground tuberous rootstock, the main stem developed or abortive and continues



above the cotyledons by sympodial growth, branched or unbranched, angular or terete, glabrous or pubescent. Leaves alternate, opposite or whorled, sometimes minute, persistent or caducous, simple, often of 3 types, with lower stem leaves, median pseudoumbel leaves and upper ray leaves, sessile or petiolate, penninerved or palminerved; stipules small or absent. Inflorescence a cyathium, terminal or axillary, solitary or usually in cymes, corymbs, dichasium, pleiochasium, on short axillary microphyllous branches or umbellate, often with axillary rays below the umbels. Cyathia actinomorphic or sometimes zygomorphic, consisting of an involucre cup, enclosing unisexual flowers with the central solitary female floret surrounded by 4 or 5 fascicles of male florets, intermingled with bracteoles; involucre cup with 4 or 5 triangular or oblong variously toothed well-developed or obsolete lobes along the margin, alternating with 4 (- 10) glands which are rounded or oblong, with or without horns, or often the cyathia with 1 - 3 extra-involucre cupular, saucer-shaped or discoid glands; glands often with 4 or 5 triangular or oblong, entire or lacinate, variously coloured or petaloid limbs. Male florets: monandrous, simulating a single stamen, with filament articulating on the pedicel, without calyx or corolla; anther subglobose, 2-locular, longitudinally or introrsely dehiscent; bracteoles single for each floret, usually a little longer than the pedicel. Female floret: solitary, central in the involucre cup or rarely undeveloped or abortive, the gynophore usually protruding out from the involucre cup by the combined pedicel and gynophore, bearing ovary at the apex, naked or often with 3 minute perianth lobes; ovary 3-locular, smooth, granulate or papillate, glabrous or pubescent; ovule one per locule, axile, anatropous; styles 3, free or connate, each divided or not; stigma often bifid. Fruits capsular, smooth or often warted, glabrous or hairy; endocarp woody or cartilaginous; central columella more or less persistent; seeds smooth, ridged, tuberculate or pitted, carunculate or not; testa thin, crustaceous; endosperm copious; cotyledons fleshy, broader than radicle.

Cosmopolitan, mainly in tropical, subtropical and warm temperate regions around the World, ca 1836 species; 84 species indigenous or naturalised and 3 species cultivated as garden plants in India.

*Notes.* The leaves subtending the primary branches (rays of pseudoumbels) of the umbel named here as *pseudoumbel leaves* and those subtending ultimate branches as *ray leaves*.

The integrity of the genus has long been questioned, and many 20th century workers favour subdividing this vast genus into two or more smaller genera. Hurusawa (J. Fac. Sci. Univ. Tokyo sect III, 6: 209 - 342. 1954) recognised 6 genera, viz. *Arthrothamnus*, *Euphorbia*, *Poinsettia*, *Chamaesyce*, *Agaloma* and *Galarhoeus*. Small (Fl. SE. U. S. 707. 1903), Croizat (Bull. Torrey Bot. Club 63: 525 - 531. 1936 & *Webbia* 20: 573 - 706. 1965), and G.L. Webster (J. Arnold Arb. 48: 420. 1967 & Ann. Missouri Bot. Gard. 81: 127. 1994) are in favour of keeping *Chamaesyce* as a separate genus, retaining the rest in *Euphorbia*. However, L.C. Wheeler (Contr. Gray Herb. Harvard. Univ. 127: 51. 1939; *Rhodora* 43: 110. 1941 & Amer. Midl. Nat. 30: 478. 1943), Khan (Notes Royal Bot. Gard. Edinburgh 25: 71 - 161. 1964), Smith (Fl. Pakistan 172: 1 - 176. 1986), S. Carter (Kew Bull. 40: 809 - 825. 1985 & 42: 673 - 681. 1987), etc. are in favour of treating *Chamaesyce* as one of the subgenera of *Euphorbia* L. The traditional conservative *sensu lato* treatment of the genus is preferred in this work. The main argument is that no useful purpose is achieved by splitting *Euphorbia* into a number of smaller genera (with the need for many new combinations), and the difficulty in clearly defining them.

*Literature.* BINOJKUMAR, M. S. & N. P. BALAKRISHNAN (2010). The genus *Euphorbia* L.

(Euphorbiaceae) in India – A taxonomic revision. Bishen Singh Mahendra Pal Singh, Dehra Dun. OUDEJANS, R. C. H. M. (1989). World catalogue of species names published in the tribe Euphorbieae (Euphorbiaceae) with their geographical distribution. Oudejans, Utrecht. SANTAPAU. H. (1954). The genus *Euphorbia* in Bombay. Bull. Bot. Soc. Bengal 8: 1 – 17. THOMAS, Daisy (1986). Palynological studies of Euphorbiaceae. Ph. D. Thesis, University of Pune (unpublished).

#### KEY TO THE SPECIES

- 1 a. Plants geophytic, with stems and branches tuberous, normally not developed above the ground; leaves in rosettes at the ground level 2
- b. Plants not geophytic, with stems and branches not tuberous, well developed above the ground level; leaves distributed along the stems and branches 4
- 2 a. Rootstock less than 8 cm long, irregularly shaped and sometimes several tubers clustered together or branched; primary peduncles 4 – 6, ca 3 cm or less long; styles connate at base or up to the middle; stigmas bifid at apex **82. E. nana**
- b. Rootstock more than 10 cm long, regularly fusiform, not clustered or rarely branched; primary peduncles 1 – 3, 5 cm or more long; styles free from the base 3
- 3 a. Leaves entire along margins, entirely green or pale yellowish green, very rarely with purplish tinge, never mottled; cyathial peduncles usually long, up to 4.5 cm long; involucre bracts ovate-lanceolate, obtuse at apex; seeds ovoid or oblongoid **80. E. fusiformis**
- b. Leaves thickened and crisped along margins, variegated, deep green or purplish green and mottled with dense red or purple patches; cyathial peduncles short, up to 5 mm long; involucre bracts triangular, acute-mucronate at apex; seeds globose **81. E. meenae**
- 4 a. Plants succulent; leaves early caducous 5
- b. Plants not succulent; leaves persistent 21
- 5 a. Plants not spiny 6
- b. Plants spiny 8
- 6 a. Branches flat; cyathia along the margins of the flat winged branches **33. E. epiphylloides**
- b. Branches terete; cyathia at the forks and tips of the branches 7
- 7 a. Trees with woody main stems; cyathia early caducous; ovary hirsute; styles connate up to middle **84. E. tirucalli**
- b. Herbs or bushy shrubs; cyathia persistent; ovary sparsely hairy or glabrous; styles free from base **83. E. mauritanica**
- 8 a. Spine-shield absent; bracts brightly coloured, larger than the involucre **76. E. milii**
- b. Spine-shields present; bracts pale coloured, smaller than the involucre 9
- 9 a. Branches terete; spine shields rounded 10
- b. Branches winged; spine shields conical 11
- 10 a. Shrubs, bushy with branching from base, usually less than 2 m high; spines ca 5 mm long; leaves ovate or oblong-ovate, undulate along margins, 2 – 6 x 1 – 3 cm; primary peduncles several in fascicles **64. E. caducifolia**
- b. Trees, stems solitary from base, branching towards the top only, usually more than 2 m high; spines ca 1 cm long; leaves long spatulate, oblong-obovate to oblanceolate, flat along margins, 6 – 12 x 2 – 4 cm; primary peduncles solitary or paired **69. E. nivulia**
- 11 a. Branches crowded at apex; area between the wings flat 12
- b. Branches not crowded at apex (except in *E. lactea*); area between the wings not flat, shallowly curved 13
- 12 a. Branches usually 4-winged, rarely 3- or 5-winged; leaves less than 1 cm long; seeds subglobose, ca 2.5 x 2 mm **72. E. susan-holmesiae**
- b. Branches usually 5-winged, rarely 6- or 7-winged; leaves more than 4 cm long; seeds globose, ca 3 mm in diam. **70. E. royleana**

- 13 a. Branches spirally twisted; capsules always acutely keeled 14  
 b. Branches straight; capsules obtusely keeled (except in *E. cattimandoo*) 15
- 14 a. Branches 3-winged; leaves less than 1 cm long; primary peduncles always in fascicles  
**73. E. tortilis**  
 b. Branches 5-winged; leaves more than 4 cm long; primary peduncles never in fascicles  
**68. E. neriifolia**
- 15 a. Branches more than 5-winged; cyathia always solitary **71. E. santapau**  
 b. Branches 5-winged or less than 5-winged; cyathia in diads or triads 16
- 16 a. Leaves petiolate, acute-acuminate at apex; gynophore more than 1 cm long  
**65. E. cattimandoo**  
 b. Leaves sessile or subsessile, obtuse or acute at apex; gynophore less than 1 cm long 17
- 17 a. Trees; leaves less than 1 cm long, early deciduous; podarium less than 1 cm long 18  
 b. Shrubs; leaves more than 2 cm long, persistent; podarium more than 1 cm long 20
- 18 a. Ultimate branches 2-winged, lower branches 4- or 5-winged; primary peduncles less than 1 cm long  
**75. E. vajravelui**  
 b. All branches 3-winged; primary peduncles more than 1 cm long 19
- 19 a. Branches crowded at apex; marbled white-coloured between the wings; flowers and fruits usually not developing **67. E. lactea**  
 b. Branches spreading; not marbled white-coloured between the wings; flowers and fruits developing in every season **63. E. antiquorum**
- 20 a. Branches ascending and straight upwards, marbled white-coloured between the wings  
**74. E. trigona**  
 b. Branches curving and drooping downwards, not marbled white-coloured between the wings  
**66. E. lacei**
- 21 a. Stipules usually present, interpetiolar; involucre glands with petaloid limbs, though often very small or minute 22  
 b. Stipules absent or if present never interpetiolar; involucre glands without petaloid limbs 53
- 22 a. Main stem well developed; exotic cultivated ornamental plants 23  
 b. Main stem aborted above the cotyledons; indigenous plants 24
- 23 a. Leaves ovate, 2 - 5 x 1 - 4 cm, glabrous, red, later becoming dark green; floral leaves pink; limbs of glands orbicular, lacinate; seeds ovoid, ca 2.5 x 2 mm  
 (cult.) **1. E. cotinifolia** ssp. **cotinoides**  
 b. Leaves elliptic to elliptic-oblong, 2.5 - 7 x 0.7 - 2 cm, sparsely hairy, green, later becoming red; floral leaves white; limbs of glands oblong to oblong-lanceolate, entire; seeds quadrangular, ca 5 x 2 mm  
 (cult. ) **2. E. leucocephala**
- 24 a. Subshrubs or shrubs; stems stout; stipules always broadly sheathing; plants of coastal regions only **25. E. pallens**  
 b. Herbs; stems slender; stipules triangular, linear or rarely sheathing; plants of inland regions 25
- 25 a. Roots or at least root primordia present at all nodes; leaves retuse at apex; stipules connate **31. E. serpens**  
 b. Roots or root primordia not present at all nodes; leaves rounded, obtuse, subacute or acute at apex; stipules free 26
- 26 a. Leaves of main stems distinctly larger than those elsewhere 27  
 b. Leaves of stems and branches almost equal in size 29
- 27 a. Plants densely hispid-villous hairy; seeds 6 - 8-striate or irregularly rugulose  
**12. E. granulata**

- b. Plants glabrous or sparsely hairy; seeds 2 - 4-striate or smooth 28
- 28 a. Plants prostrate or decumbent; stipules cleft into 2 or 3 lobes, each further lacini-ate; limbs of glands of same size as the glands **4. E. clarkeana**
- b. Plants erect; stipules usually not cleft into 2 or 3 lobes, deeply laciniate; limbs of glands larger than the glands **19. E. jodhpurensis**
- 29 a. Limbs of glands indistinct or of same size as the glands 30
- b. Limbs of glands distinct and a little to much larger than the glands 35
- 30 a. Plants prostrate, only branches or tips of branches decumbent; cyathia solitary, paired or 3 together 31
- b. Plants erect, decumbent or ascending; cyathia more than 3 in glomerules 33
- 31 a. Stems and branches pinkish grey; mature capsules remaining within the involucre **32. E. thymifolia**
- b. Stems, branches and leaves green, glaucous-green, purplish green or blackish green; mature capsules protruding out from the involucre 32
- 32 a. Stems, branches and leaves blackish or purplish green; capsules acutely keeled, with ciliate hairs confined to keels only **26. E. prostrata**
- b. Stems, branches and leaves green to glaucous-green; capsules obtusely keeled, glabrous or sparsely hairy all over the surface **13. E. heyneana**
- 33 a. Plants glabrous; leaves linear-lanceolate, 3 - 6 mm wide, glabrous to sparsely pilose **17. E. hyssopifolia**
- b. Plants hispid hairy; leaves ovate, oblong-ovate to elliptic-lanceolate, more than 6 mm wide, appressed pubescent 34
- 34 a. Plants with patent yellowish hairs, mixed with white crisped hairs; internodes ribbed; leaves often with a purple or pink patch in the middle; seeds transversely 3 - 4-furrowed **14. E. hirta**
- b. Plants with appressed flexuous or crispate white hairs; internodes terete, not ribbed; leaves without any such patch in the middle; seeds smooth or obscurely 1- 2-furrowed **18. E. indica**
- 35 a. Leaves obliquely obovate or linear-spathulate; 2 upper limbs of glands distinctly larger than the 2 lower limbs **28. E. rosea**
- b. Leaves neither obliquely obovate nor linear-spathulate; limbs of glands equal in size 36
- 36 a. Cyathia many in each cluster 37
- b. Cyathia solitary, 2 or 3 in each cluster 38
- 37 a. Plants erect; rootstock slender, wiry; stems shiny tan to reddish brown, limbs of glands entire; seeds wrinkled **16. E. hypericifolia**
- b. Plants decumbent or ascending; rootstock thick, woody; stems green or glaucousgreen; limbs of glands wavy; seeds smooth **7. E. corrioloides**
- 38 a. Floral leaves imbricate and concealing the cyathia 39
- b. Floral leaves neither imbricate nor concealing the cyathia 42
- 39 a. Plants glabrous; limbs of glands almost entire **27. E. pycnostegia**
- b. Plants hairy; limbs of glands laciniate or sinuate 40
- 40 a. Rootstock woody; stems unbranched or once dichotomously branched; limbs of glands glabrous **21. E. laciniata**
- b. Rootstock wiry; stems branched many times; limbs of glands hairy 41
- 41 a. Leaves hairy on both surfaces; limbs of glands laciniate **8. E. cristata**
- b. Leaves glabrous on upper surface, hairy on lower surface; limbs of glands sinuate **10. E. elegans**
- 42 a. Stems prostrate, less than 10 cm long **5. E. coccinea**

- b. Stems decumbent, ascending or erect, more than 10 cm long 43
- 43 a. Leaves often with a purple patch at middle; seeds smooth **3. E. balakrishnanii**
- b. Leaves without purple patch at middle; seeds scrobiculate, obscurely or clearly furrowed or rarely smooth 44
- 44 a. Leaves ovate to suborbicular; internodes ribbed **22. E. lawsonii**
- b. Leaves elliptic, oblong-elliptic or oblong; internodes terete, smooth (except in *E. hispida*) 45
- 45 a. Branches 3 - 6 from each node; capsules acutely keeled, hairy only along keels **29. E. sebastinei**
- b. Branches 1 - 2 from each node; capsules obtusely keeled, glabrous or hairy all over, not only on keels 46
- 46 a. Plants clothed with long hairs; seeds scrobiculate **15. E. hispida**
- b. Plants glabrous or rarely pubescent; seeds obscurely or distinctly furrowed 47
- 47 a. Plants unbranched or rarely dichotomously branched; leaves at least 3 cm long **20. E. katrajensis**
- b. Plants branched; leaves less than 3 cm long 48
- 48 a. Plants more than 30 cm high; leaves silvery white below **11. E. erythroclada**
- b. Plants less than 30 cm high; leaves green or pale green below 49
- 49 a. Branches filiform towards apex; styles more than 1.5 mm long 50
- b. Branches not filiform; styles less than 1.5 mm long 51
- 50 a. Branches puberulous; limbs of glands multifid-pectinate up to base; cocci with distinct veins **23. E. longistyla**
- b. Branches not puberulous; limbs of glands entire, minutely sinuate; cocci with obscure veins **30. E. senguptae**
- 51 a. Leaves mucronate at apex; cocci of capsules with 2 or 3 prominent wings **24. E. notoptera**
- b. Leaves subacute or acute at apex; cocci of fruits ridged or keeled, but not winged 52
- 52 a. Leaves oblong to ovate-oblong, subacute to obtuse or rounded at apex, 5 - 11 mm long; capsules prominently broadly and obtusely keeled, distinctly ridged along sutures **6. E. concanensis**
- b. Leaves oblong-lanceolate, acute to subacute at apex, 10 - 25 mm long; capsules faintly narrowly and acutely keeled, not ridged along sutures **9. E. deccanensis**
- 53 a. Leaves usually of 3 types; cyathia always arranged in pseudoumbels 54
- b. Leaves usually of 1 type, rarely 2 types; cyathia never in pseudoumbels 81
- 54 a. Stem leaves opposite-decussate; capsules indehiscent; seeds more than 5 mm across **45. E. lathyris**
- b. Stem leaves alternate; capsules dehiscent; seeds less than 5 mm across 55
- 55 a. Ray leaves usually opposite; glands with horns 56
- b. Ray leaves usually ternate; glands without horns 67
- 56 a. Ray leaves connate at base; glands distinctly wavy-undulate at apex **53. E. perbracteata**
- b. Ray leaves free; glands entire or slightly denticulate at apex 57
- 57 a. All leaves almost equal in shape and size **39. E. dracunculoides**
- b. Stem leaves, pseudoumbel leaves and ray leaves differing in shape and sizes 58
- 58 a. Leaves of stems petiolate; capsules acutely keeled, with 2 parallel dorsal wings on the ridges of the keels **52. E. peplus**
- b. Leaves of stems sessile; capsules obtusely keeled, without wings 59
- 59 a. Leaves obovate-spathulate to oblanceolate; horns longer than the width of the glands **47. E. maddenii**

- b. Leaves neither obovate-spathulate nor oblanceolate; horns usually not longer than the width of the glands 60
- 60 a. Leaves coriaceous; nerves distinct; branches profuse; involucre cupular **54. *E. prolifera***
- b. Leaves chartaceous; nerves usually obscure; branches not profuse; involucre campanulate 61
- 61 a. Ray leaves cuspidate to aristate at apex; horns minute or indistinct **40. *E. falcata***
- b. Ray leaves acute to retuse at apex; horns always distinct 62
- 62 a. Plants decumbent or ascending; rootstock wiry; stem leaves retuse or emarginate at apex **43. *E. kanaorica***
- b. Plants usually erect; rootstock not wiry; stem leaves neither retuse nor emarginate at apex 63
- 63 a. Stems woody, dark brown, with prominent leaf scars; leaves usually crowded below the pseudoumbels **55. *E. rothiana***
- b. Stems herbaceous, grey, with obscure leaf scars; leaves not crowded below pseudoumbels 64
- 64 a. Ray leaves ovate-deltoid; axillary rays many below the pseudoumbels **60. *E. thyrsoides***
- b. Ray leaves triangular or orbicular-reniform; axillary rays absent or few below the pseudoumbels 65
- 65 a. Glands trapezoidal, pectinate-lacerate; caruncle petasiform **49. *E. osyridea***
- b. Glands neither trapezoidal, nor pectinate-lacerate; caruncle not petasiform 66
- 66 a. Stems ribbed; rays 2 - 3 times dichotomous; seeds ovate-orbicular, later with rostrate appendages **35. *E. boissieriana***
- b. Stems terete; rays once dichotomous; seeds ovate, smooth **50. *E. pamirica***
- 67 a. Plants ascending or decumbent, less than 20 cm high 68
- b. Plants erect, more than 20 cm high (except in *E. luteoviridis*) 72
- 68 a. Pseudoumbel leaves much larger than upper stem leaves; cyathia saucer-shaped **61. *E. tibetica***
- b. Pseudoumbel leaves and upper stem leaves almost equal; cyathia campanulate 69
- 69a. Ray leaves opposite; capsules more than 5 mm across **59. *E. thomsoniana***
- b. Ray leaves ternate; capsules less than 5 mm across 70
- 70 a. Leaves oblong-elliptic to obliquely oblong; capsules densely warty **48. *E. micractina***
- b. Leaves neither oblong nor obliquely oblong; capsules smooth or minutely granulate 71
- 71 a. Leaves petiolate; ray leaves reniform; styles free from base **56. *E. sharmae***
- b. Leaves sessile; ray leaves obovate; styles connate to the middle **58. *E. stracheyi***
- 72 a. Leaves spatulate to obovate-spathulate; cocci with prominent veins **41. *E. helioscopia***
- b. Leaves other than spatulate or obovate-spathulate; cocci with obscure veins or not veined 73
- 73 a. Axillary rays on main stems absent; pseudoumbel rays less than 2 cm long **42. *E. jacquemontii***
- b. Axillary rays on main stems present; pseudoumbel rays usually more than 2 cm long 74
- 74 a. Leaves obtuse at apex; capsules densely warty **37. *E. cornigera***
- b. Leaves acute-apiculate at apex; capsules smooth or sparsely warty 75
- 75 a. Plants annual; glands peltate; capsules purple **51. *E. peltata***
- b. Plants perennial; glands not peltate; capsules yellow 76
- 76 a. Leaves ovate to elliptic, rounded at base; styles usually less than 2 mm long 77
- b. Leaves linear to oblanceolate or elliptic-lanceolate, cuneate or attenuate at base; styles usually more than 2 mm long 78

- 77 a. Rootstock thick; scale leaves present; branches villous, glands 5 **46. E. luteoviridis**  
 b. Rootstock slender; scale leaves absent; branches glabrous; glands 4 **36. E. cashmeriana**
- 78 a. Leaves usually more than 3 cm broad, puberulous on upper surface or at least on midrib; cyathia ca 6 x 10 mm **62. E. wallichii**  
 b. Leaves less than 2.5 cm broad, quite glabrous on upper surface; cyathia less than ca 5 x 6 mm  
 79
- 79 a. Leaves petiolate; ovary smooth **57. E. sikkimensis**  
 b. Leaves sessile or subsessile; ovary papillate 80
- 80 a. Leaves less than 5 cm long; ray leaves obovate, subrhomboid; styles free from base **44. E. khasyana**  
 b. Leaves more than 5 cm long; ray leaves ovate; styles connate up to middle **38. E. donii**
- 81 a. Leaves often with gland-tipped marginal teeth; involucre glands 4 or 5 at the rim of the involucre; seeds carunculate **34. E. agowensis**  
 b. Leaves without gland-tipped marginal teeth; involucre glands solitary or rarely 4 or 5, external to the involucre; seeds ecarunculate 82
- 82 a. Shrubs or trees; upper leaves completely coloured; cyathia more than 6 mm long; gynophore long protruding from involucre; seeds ca 10 x 8 mm, smooth (cult.) **79. E. pulcherrima**  
 b. Herbs; upper leaves green or partially coloured; cyathia less than 5 mm long; gynophore least protruding from involucre; seeds ca 5 mm across, sculptured 83
- 83 a. Floral leaves green or rarely purple-spotted at base; involucre glands with a circular mouth; seeds angular, bluntly tuberculate **78. E. heterophylla**  
 b. Floral leaves red or purple for nearly half towards base; involucre glands with elliptic-oblong mouth; seeds oblong-ovoid, sharply tuberculate  
**77. E. cyathophora**

## KEY TO THE SUBGENERA

- 1 a. Plants geophytes, with underground elongated fleshy tuberous rootstocks; stems not or scarcely developed above the ground; leaves all radical in rosettes at ground level, deciduous and leafless when in flower (hysteranthous) Subg. **9. Rhizanthium**  
 b. Plants not geophytes, with no tuberous underground rootstocks; stems well-developed above the ground; leaves cauline, alternate, opposite or in whorls, per-sistent or caducous but never hysteranthous 2
- 2 a. Plants succulent, cactiform; leaves early caducous, fleshy, or often scale-like 3  
 b. Plants neither succulent nor cactiform; leaves persistent, usually not fleshy 6
- 3 a. Trees or shrub-like plants; stems and branches green, terete, without angles or tubercles, longitudinally finely striate; cyathia in clusters, terminal or at forks of branches, often unisexual Subg. **10. Tirucalli**  
 b. Trees, or shrubs; stems and branches green or brown-green, succulent with spines on wings or angles; cyathia axillary, usually subterminal, simple cymes of diads or triads, usually bisexual 4
- 4 a. Plants not spiny; branches flat, 2-winged; leaf scars usually present Subg. **3. Epiphyllodes**  
 b. Plants spiny; branched mostly terete, 3 – 5 angled or winged, rarely flat and 2-winged in *E. vajravelui*; leaf scars absent 5
- 5 a. Shrubs or trees; stems and branches terete or prominently angular or winged regularly branched with erect or ascending branches; leaves mostly scale-like, occasionally well-developed; podarium (spine-shield) present, horny, bearing spines inserted on grey or brown spine shields; cyathia subsessile to shortly pedunculate; involucre leaves inconspicuous, usually smaller than the cyathia, same color as inflorescence; gynophore generally long and keeping the ovary out of the involucre; seeds globose or ovoid, ecarunculate Subg. **6. Euphorbia**

- b. Stunted shrubs irregularly branched; stems terete or obscurely angled; leaves always well-developed; podarium (spine shield) absent; spines present; inflorescence long pedunculate; involucre leaves conspicuous, usually red, sometimes yellow or variously coloured; gynophore generally short, keeping the ovary inside the involucre; seeds cylindrical, obscurely 4-angled, carunculate Subg. 7. **Lacanthis**
- 6 a. Main stem of seedlings of restricted growth, soon abortive above the cotyledon, all subsequent growth by lateral branches; leaves opposite and inequilateral and oblique at base; veins of leaves with chlorenchyma sheaths; stipules always present, interpetiolar, scarious; seeds usually not carunculate Subg. 2. **Chamaesyce**
- b. Main stem of unrestricted growth, not abortive above the cotyledon; leaves alternate, opposite or whorled, if opposite then symmetric and not inequilateral at base; veins of leaves without chlorenchyma sheaths; stipules usually absent or rarely present, if present then never interpetiolar; seeds carunculate or ecarunculate 7
- 7 a. Cyathia always in terminal clusters; cyathial glands one or rarely 3 - 4, extra-involucre Subg. 8. **Poinsettia**
- b. Cyathia axillary or terminal, 1 - 3, never in clusters; cyathial glands 4, rarely 5, in between the involucre lobes 8
- 8 a. Stipules absent; leaves always of 3 types, cauline leaves, pseudoumbel leaves and ray leaves; flowering branches in whorls; cyathia always in pseudoumbels; cyathial glands falcate or with horns Subg. 5. **Esula**
- b. Stipules present; leaves of single type or rarely of 2 types; flowering branches not in whorls; cyathia never in pseudoumbels; glands never falcate, without horns 9
- 9 a. Shrubs; all leaves or floral leaves alone pink or white; stipules absent; cyathial glands with petaloid limbs Subg. 1. **Agaloma**
- b. Herbs or undershrubs; all leaves of a single type and completely green; stipules subulate, minute, often caducous; cyathial glands without petaloid limbs Subg. 4. **Eremophyton**

### Subgenus 1. **Agaloma** (Raf.) House

Shrubs or small trees. Leaves alternate, petiolate, green or dark green, pinkish or at least floral leaves white; stipule usually present. Cyathia terminal, solitary or in dichasial cymes; involucre turbinate, glabrous or hairy; glands usually 5, oblong or cupular; limbs of glands prominent, entire or lacinate. Male florets: usually in 5 fascicles, with lacinate bracteoles. Female floret: gynophore protruding from the involucre; ovary subglobose, smooth; styles 3, each bifid. Fruits acutely to obtusely keeled; seeds smooth, warty or tuberculate, ecarunculate, usually with a white hyaline papilla.

Mainly in New World, ca 100 species; 2 species in India under cultivation as garden plants, both belonging to the sect. *Alectoroctonum*.

**1. Euphorbia cotinifolia** L. ssp. **cotinoides** (Miq.) Christenh. in Harvard Papers Bot. 7: 3. 2002; Binojk. & N.P.Balacr., Genus Euphorbia in India 98, f. 1. 2010. *E. cotinoides* Miq. in Linnaea 21: 473. 1848 et Stirp. Surinam. Select. 96. 1850; Binojk. & N.P.Balacr. in J. Econ. Taxon. Bot. 15: 463. 1991.

Shrubs or small trees, 1 - 2 m high, unarmed; stems branched, terete, pinkish to reddish purple. Leaves opposite or ternate, ovate to orbiculate, rounded at base, entire, subacute, 2 - 6 x 2 - 4 cm, pink to reddish purple or pinkish green; midrib prominent; lateral nerves numerous; petioles 2 - 5 cm long, reddish, sparsely hairy. Cyathia terminal, solitary or in elongated dichasia, yellowish cream; peduncles 1 - 2 cm long, hairy; bracts triangular to linear, ca 2 mm long;



involucre cupular, turbinate, ca 4 mm across; lobes broadly oblong, laciniate; glands 4 – 6, transversely oblong, ca 1.5 x 2 mm, greenish yellow; limbs of glands orbicular, laciniate-margined, white or pale yellow. Male florets: pedicels ca 1.5 mm long; anthers subglobose; bracteoles linear, laciniate, ca 1.5 mm long. Female floret: gynophore ca 3 mm long, sparsely hairy; ovary trigonous, ca 3 x 2.5 mm in diam., glabrous; styles 3, each bifid, ca 1 mm long; stigma capitate. Fruits broadly ovoid, trigonous, 4 – 6 x 3 – 5 mm, sparsely hairy; seeds ovoid, ca 2.5 x 2 mm, brown, pitted or warted, ecarunculate.

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

*Distrib.* India: Introduced into many states of the country, as ornamental garden plant. Uttar Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Native of America, introduced into Asia.

*Notes.* Stem cuttings can easily propagate this species.

**2. *Euphorbia leucocephala*** Lotsy in Bot. Gaz. 20: 350, t. 24. 1895; Binojk. & N.P. Balakr. in Indian J. Forest. 15: 181. 1992 & Genus *Euphorbia* in India 100, f. 2. 2010.

Shrubs or small trees, 3 - 4 m high, sometimes climbing; stems densely branched, subterete, pale brownish pubescent. Leaves opposite or in whorls of 3, ovate-lanceolate to elliptic-oblong, rounded to cuneate at base, entire, obtuse or acute or apiculate, 2 - 8 x 0.7 - 3 cm, sparsely pubescent on both sides; veins pinnate, 14 - 16 pairs, curved; petioles 1 - 2.5 cm long; stipules small, triangular, deciduous. Upper floral leaves white or pink, showy, oblanceolate, 1 - 2 x 0.5 - 1 cm. Cyathia terminal, solitary or in dichasial cymes, ca 2 mm across; peduncles ca 3 mm long, hairy; bracts spatulate, white; involucre turbinate, 1.5 - 2 mm across, appressed white hairy; lobes triangular, laciniate; glands 5, broadly oblong, cup-shaped ca 1 mm in diam.; limbs oblong to oblong-lanceolate, obtuse, 3 - 3.5 x ca 1 mm, petaloid. Male florets: in 5 fascicles with 8 - 10 flowers in each; pedicels ca 1 mm long; anthers subglobose; bracteoles filiform, ca 1.5 mm long. Female floret: gynophore ca 1.5 mm long, sparsely hairy; ovary subglobose, ca 1.5 mm in diam., obtusely keeled; styles ca 1 mm long, each bifid from middle; stigmas simple. Fruits obtusely keeled, ca 7 x 5 mm, glabrous; seeds quadrangular, ca 5 x 2 mm, coarsely tuberculate, pale greyish black.

*Fl. & Fr.* Dec. - March.

*Distrib.* India: Introduced to various parts of the country as an ornamental plant, for the conspicuous attractive large white bracts. Sometimes seen as escape.

Native of tropical America.

*Notes.* *E. systyla* reported by Ghosh & Murmu (Geobios 4: 276. 1977) is referable to this species.

## Subgenus 2. **Chamaesyce** Raf.

Herbs or undershrubs, annuals, biennials or perennials, prostrate, decumbent or erect, glabrous or pubescent; root stock thin, rarely thick; main stem abortive above the first pair of true leaves (rarely continuing shortly), the apparent main axis sympodial. Leaves opposite, petioled or sessile, inequilateral at base; stipules interpetiolar, connate or free. Cyathia in

pseudo-axillary cymes, 1 - 3, often on microphyllous branches, sometimes concealed by imbricate leaves; involucre lobes 5; involucre glands 4, each with a petaloid limb; limbs of glands white, pink or yellow. Male florets: in fascicles or dispersed, few to many; anther transversely or longitudinally dehiscent; bracteoles filiform; peripheral ones lacinate, rarely absent. Female floret: gynophore usually protruding out from the involucre; styles free or connate at base, each bifid or entire, stigma capitate. Capsular cocci keeled; seeds angular or terete, smooth, wrinkled or transversely clearly or faintly grooved; testa mucilaginous, smooth, ecarunculate.

Cosmopolitan, mainly concentrated in New World, ca 250 species in the World; 30 species in India.

**3. *Euphorbia balakrishnanii*** Binojk. & R.Gopalan in *Rheedea* 8: 67, f. 1. 1998; Binojk. & N.P.Balakr., Genus *Euphorbia* in India 151, f. 14. 2010. *Chamaesyce balakrishnanii* (Binojk. & R.Gopalan) V.S. Raju in *J. Econ. Taxon. Bot.* 28: 91. 2004.

Herbs, annual, prostrate or decumbent; stems many from a slender weak rootstock, 10 - 28 cm long; nodes slightly thickened; internodes 1.5 - 2.5 cm long, glabrous. Leaves ovate, elliptic-oblong, to suborbicular, oblique at base, serrate along margins towards upper portion, acute to subacute at apex, 5 - 10 x 4 - 6 mm, with irregular purple patches on upper surface at the centre; petioles ca 3 mm long; stipules lacinate along margins, ca 1 mm long. Cyathia axillary, solitary or 2 or 3 together; peduncles ca 2 mm long; involucre turbinate, ca 1.5 x 1.5 mm; lobes 5, oblong, lacinate; glands 4, rounded; limbs of glands suborbicular, minutely wavy along upper margins, ca 0.7 x 1 mm, white or pale pink. Male florets: 8 - 12 in each cyathium; bracteoles filiform, ca 1.5 mm long; pedicels ca 1 mm long; anthers subglobose. Female floret: gynophore ca 3 mm long, glabrous; ovary ca 1 mm in diam., sparsely hairy; styles 3, each bifid at apex, 0.7 - 1 mm long; stigma capitate. Fruits subglobose to ovoid, 1.5 - 1.7 mm in diam., acutely keeled and hairy along keels only; seeds oblongoid, 1 - 1.5 mm long, smooth, grey-coloured.

*Fl. & Fr.* June - March.

*Distrib.* India: Scrub jungles, moist or marshy areas at ca 200 m altitude. Rare. Tamil Nadu (Tirunelveli District).

Endemic.

**4. *Euphorbia clarkeana*** Hook.f., *Fl. Brit. India* 5: 253. 1887; Binojk. & N.P.Balakr., Genus *Euphorbia* in India 106, f. 3. 2010. *E. heyneana* auct. non Spreng. 1826: Boiss. in DC., *Prodr.* 15(2): 35. 1862. *Chamaesyce clarkeana* (Hook.f.) Sojak in *Cas. Nar. Mus., Odd. Prir.* 140: 169. 1972.

Herbs, prostrate or decumbent, up to 25 cm high; stems branched, sparsely hairy; nodes annular; internodes 1 - 2 cm long. Leaves sessile, oblong, entire or denticulate towards apex along margins, oblique at base, obtuse or subacute at apex, 3 - 13 x 1 - 5 mm (leaves on main stems larger), glabrous; petioles ca 1 mm long; stipules 2 or 3-clefted, each further lacinate. Cyathia terminal and axillary, solitary or 2 - 3 together on microphyllous shoots; peduncles ca 1 mm long; involucre campanulate, ca 1 x 0.7 mm, glabrous; lobes triangular, hairy; glands 4, rounded, ca 0.1 x 0.2 mm, pinkish; limbs of glands minute. Male florets: few; pedicels ca 0.2 mm long; anthers subglobose; bracteoles setaceous, ca 1 mm long. Female floret: gynophore ca 1 mm long; ovary ca 2 mm in diam., sparsely hairy; styles free, each bifid; stigma capitate. Fruits

subglobose, obtusely keeled, ca 3 mm in diam., glabrous; seeds obovoid, quadrangular, smooth, reddish brown, mucous when wet.

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

*Distrib.* India: Cultivated fields and roadsides, in open areas, on moist sandy soil, at 100 - 3000 m altitudes. Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Delhi, Rajasthan, Gujarat, Uttar Pradesh, Uttarakhand, Maharashtra, Karnataka and Andhra Pradesh.

Afghanistan and Pakistan.

*Notes.* Pollen grains: Sub-prolate, 31 x 24  $\mu$ m (Khan, J. Palynology 4: 32. 1968).

Chromosome number: n = 11 (Choda & Mehra, Curr. Sci. 41: 76. 1972; Mehra & Choda, Cytologia 43: 218. 1978).

**5. *Euphorbia coccinea*** B. Heyne ex Roth, Nov. Pl. Sp. 228. 1821; Hook. f., Fl. Brit. India 5: 248. 1887; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 109, f. 4. 2010. *Chamaesyce coccinea* (B. Heyne ex Roth) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 169. 1972.

Herbs, prostrate, up to 10 cm high, entirely hirsute; stems spreading from thick rootstock, slender; nodes not thickened; internodes ca 1.5 cm long. Leaves distant, ovate-oblong to obliquely oblong, oblique at base, entire along margins, emarginate at apex, 5 - 7 x 3 - 5 mm, coriaceous, sparsely hairy on upper surface, hirsute on lower surface; nerves obscure; petioles ca 1.5 mm long; stipules triangular, lacinate. Cyathia axillary, solitary; peduncles ca 1.5 mm long; involucre turbinate, ca 1.5 x 1.2 mm, hispid outside; involucral lobes triangular or oblong, fimbriate, as long as the gland; glands 4, transversely oblong, ca 0.2 x 0.1 mm; limbs of glands obovate, ca 1 x 1.5 mm, subundulate along apical margin, pale pink. Male florets: few; pedicels ca 0.5 mm long; anthers subglobose; bracteoles filiform, ca 1.2 mm long. Female floret: gynophore ca 2 mm long, glabrous; ovary subglobose, ca 2 x 2 mm, long white hairy; styles ca 1 mm long, connate at base or nearly up to middle, each bifid at apex; stigma capitate. Fruits subglobose, ca 4 x 4 mm, obtusely keeled, white woolly hirsute, more hairy on keels; seeds sub-quadrangular, ca 1 mm long, with 4 - 6 transverse striations, red-brown.

*Fl. & Fr.* June - Oct.

*Distrib.* India: On gravelly soil along streambeds up to 400 m altitude. Rare. Rajasthan, Gujarat, Maharashtra, Goa and Karnataka.

Endemic.

*Notes.* Pollen grains: Medium, sub-prolate, P: E 29-32; 20-22  $\mu$ m, trizonocolporate, fossaperturate (Daisy Thomas, l. c. 1986).

**6. *Euphorbia concanensis*** Janarth. & S.R. Yadav in Rheedea 5: 148, f. 1. 1995; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 179, f. 20. 2010. *Chamaesyce concanensis* (Janarth. & S.R. Yadav) M.R. Almeida, S. Dutta & S.M. Almeida in J. Bombay Nat. Hist. Soc. 100: 580. 2003; V.S. Raju in J. Econ. Taxon. Bot. 28: 91. 2004.

Herbs, perennial, decumbent, 10 - 30 cm long, entirely glabrous; stems dichotomously

branched, up to 1 mm thick; internodes terete, 1 - 7 cm long. Leaves elliptic-oblong, oblique at base, serrulate, acute to obtuse at apex, 5 - 11 x 3 - 5 mm; petioles up to 1 mm long; stipules toothed. Cyathia terminal, solitary; peduncles up to 7 mm long; involucre turbinate; lobes lacinate; glands 4, transversely oblong; limbs obovate, wavy in outline, 2 x 2.5 mm, rosy pink. Male florets: pedicels up to 1.5 mm long; filaments up to 0.7 mm long. Female florets: gynophore ca 1 mm long; ovary triquetrous; styles bifid at apex. Fruits ovoid, trigonous, broadly and obtusely keeled, distinctly ridged along the sutures, ca 2 x 3 mm, maturing outside the involucre; fruiting pedicels up to 2 mm long, recurved, projecting outside the cyathia; seeds ca 1 x 0.8 mm, pustulate-tuberculate.

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

*Distrib.* India: Amidst grasses and bushes on laterite red soil and among rocks. Rare. Maharashtra (Sindhudurg District, at Achirane between Phonda and Vaibhavadi) and Goa.

Endemic.

**7. *Euphorbia corrigioloides*** Boiss., Cent. Euphorb. 11. 1860 & in DC., Prodr. 15(2): 32. 1862; Hook.f., Fl. Brit. India 5: 251. 1887; Binojk. & N.P. Balakr., Genus Euphorbia in India 153, f. 15. 2010. *Chamaesyce corrigioloides* (Boiss.) Sojak, Cas. Nar. Mus., Odd. Prir. 140: 169. 1972.

Tam.: *Karupu-mambalai*.

Herbs, erect, decumbent or ascending, up to 50 cm high, glabrous or sparsely hairy; stems from a long thick woody rootstock, branched or unbranched, terete; nodes annular, thickened; internodes ca 1 cm long, glabrous. Leaves oblong to elliptic-oblong, oblique at base, entire or serrate, obtuse, acute to acuminate, 0.5 - 1.5 x 0.4 - 0.5 cm, glabrous; nerves obscure; petioles ca 1 mm long, glabrous; stipules sheathing, lacinate along margins. Cyathia in axillary condensed cymes or clusters; involucre turbinate, ca 2.3 x 2 mm; lobes triangular, trifid, exceeding the gland; glands 4, transversely oblong, ca 0.5 x 1 mm; limbs suborbicular to transversely oblong, ca 1 x 1.5 mm, wavy along apical margin. Male florets: 4 or 5 in each fascicle; pedicels ca 1 mm long; bracteoles filiform, ca 1.5 mm long; anthers subglobose. Female floret: gynophore ca 1.5 mm long, sparsely hairy; ovary ovoid, ca 1.5 x 1 mm; styles free, ca 1 mm long, each bifid; stigma capitate. Fruits globose, ca 4 mm in diam., keeled, glabrous or puberulous; seeds smooth, reddish brown.

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

*Distrib.* India: Usually in moist low areas and coastal lands on gravelly soil up to 400 m altitude. Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Endemic.

*Uses.* The tribal Kurumbas of Nilgiri Hills use the milky latex against scabies.

*Notes.* Pollen grains: Medium, prolate, spheroidal, P:E 32 : 30  $\mu$ m, trizonocolporate, peritreme (Daisy Thomas, l. c. 1986).

**8. *Euphorbia cristata*** B. Heyne ex Roth, Nov. Pl. Sp. 226. 1821; Hook.f., Fl. Brit. India 5: 247. 1887, p. p.; Binojk. & N.P. Balakr., Genus Euphorbia in India 136, f. 10. 2010. *E. cristata* var. *major*

B. Heyne ex Roth, l. c. 226. 1821, p. p. *E. fimbriata* auct. non B. Heyne ex Roth, 1821: Boiss. in DC., Prodr. 15(2): 19. 1862. *Chamaesyce cristata* (B. Heyne ex Roth) G.L. Webster in J. Arnold Arb. 48: 424. 1967.

Herbs, erect, ascending, up to 30 cm high; stems dichotomously branched, clothed with flexuous hairs, pinkish; internodes 2 - 3 cm long. Leaves ovate to ovate-oblong, truncate at base, entire or serrate towards apex along margins, acute or obtuse at apex, 1.5 - 2.5 x 0.7 - 1.5 cm; lateral nerves 3 - 6 pairs; upper leaves smaller, closer, imbricate and concealing the cyathia; petioles ca 3 mm long. Cyathia subterminal or axillary, solitary or 2 - 3 together; peduncle ca 5 mm long, hirsute; involucre campanulate, 1.5 - 4 x 1 - 2 mm; lobes triangular; glands 4, transversely oblong, ca 1.5 x 1 mm, hairy; limbs lacinate or palmately 7 - 11-lobed for half way, ca 1.5 x 2.5 mm, sparsely pubescent on lobes, crimson-red. Male florets: few; pedicels ca 1.5 mm long; anthers subglobose; bracteoles setaceous, ca 1.5 mm long; peripheral bracteoles lacinate at tip, adnate to involucre cup, ca 1 mm long. Female floret: gynophore ca 3 mm long, hairy; ovary subglobose, hirsute, 1.5 - 2.5 x 1 - 1.7 mm; styles free, bifid up to middle, stigma capitate. Fruits subglobose, ca 2.5 x 2.5 mm, hirsute, pale pink; seeds obtusely quadrangular, transversely 3 or 4 furrowed, reddish brown.

*Fl. & Fr.* Dec. - March.

*Distrib.* India: Moist deciduous forests among grasses, at 400 - 1500 m altitudes. Jammu & Kashmir, Uttar Pradesh, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Sri Lanka, Bangladesh, Myanmar and Thailand.

*Uses.* The tribals Kurumbas of Nilgiri hills apply a paste made out of the tender leaves on small fractures.

*Notes.* Pollen grains: Medium, prolate spheroidal, P:E 34 : 33 im, trizonocolporate (Daisy Thomas, l. c. 1986).

Chromosome numbers: 2n = 90 (Krishnappa & Reshme, Taxon 29: 537. 1980); n = 9 (Datta in Taxon 16: 345. 1967).

**9. *Euphorbia deccanensis*** V.S. Raju in Taxon 34: 519. 1985, nom. nov. pro *E. linearifolia* Roth; V.S. Ramach. & Balasubr. in Sci. & Cult. 56: 209. 1990; Binojk. & N.P. Balakr., Genus Euphorbia in India 181, f. 21. 2010. *E. linearifolia* Roth, Nov. Pl. Sp. 224. 1821, non Willd., 1799; Hook. f., Fl. Brit. India 5: 249. 1887. *Chamaesyce linearifolia* (Roth) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 169. 1972.

Herbs, erect or decumbent, up to 30 cm high, entirely glabrous; rootstocks thin or thickened; stems unbranched or rarely dichotomously branched; nodes thickened; internodes terete, 1 - 5 cm long. Leaves linear-oblong, to oblong-lanceolate, oblique at base, distantly serrate to entire, acute to acute-mucronate at apex, 1 - 3 x 0.1 - 0.5 cm; midvein prominent; petioles ca 0.5 mm long; stipules ovate, multifid or fimbriate at apex. Cyathia terminal or in axils of upper leaves, solitary or in pairs; peduncles 1 - 2 mm long; involucre turbinate, ca 2 x 1.2 mm; lobes 5, triangular, lacinate; glands 4, transversely oblong or cupular, 0.2 - 0.3 x 0.1 - 0.2 mm, red; limbs patent, obovate to orbicular, wavy-margined, 1 - 1.2 x 1.2 - 2 mm, white or pink with a red spot. Male florets: pedicels 1 - 1.5 mm long; anthers subglobose; bracteoles filiform, ca 2 - 2.5

mm long, peripheral bracteoles laciniate. Female floret: gynophore ca 3 mm long; ovary subglobose, ca 2 mm across; styles ca 0.8 mm long, connate at base, bifid above; stigma capitate. Fruits subglobose, ca 2 - 2.5 x 2 - 3 mm, smooth, glabrous; seeds 1 - 1.5 mm long, smooth, pale brown.

#### KEY TO THE VARIETIES

- 1 a. Rootstock thin; stems dichotomously branched; internodes 3 - 6 mm long; cyathia solitary; glands flat and transversely oblong **9.1. var. deccanensis**  
 b. Rootstock thick; stems unbranched or shortly branched at apex; internodes 5 - 20 mm long; cyathia solitary or in subcorymbose pairs; glands cupular and rounded **9.2. var. nallamalayana**

#### **9.1. var. deccanensis**

*E. katrajensis* Gage var. *kasaragodensis* V.J.Nair et al. in J. Econ. Taxon. Bot. 14: 471. 1990. *Chamaesyce katrajensis* (Gage) Sojak var. *kasaragodensis* (V.J. Nair et al.) V.S.Raju, J. Econ. Taxon. Bot. 28: 92. 2004.

*Fl. & Fr.* June - Sept.

*Distrib.* India: In gravelly soil and crevices of rocks, up to 500 m altitude. Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Endemic.

**9.2. var. nallamalayana** (J.L.Ellis) V.S.Raju in Taxon 34: 520. 1985; Binojk. & N.P.Balacr., Genus Euphorbia in India 184. 2010. *E. linearifolia* Roth var. *nallamalayana* J.L. Ellis in Bull. Bot. Surv. India 8: 345. 1966. *Chamaesyce linearifolia* (Roth) Sojak var. *nallamalayana* (J.L.Ellis) V.S.Raju & P.N.Rao in Phytologia 37: 454. 1999. *E. coudercii* auct. non Gagnep. (1921): Radcl.-Sm. in Kew Bull. 26: 263. 1972.

*Fl. & Fr.* July - Oct.

*Distrib.* India: In moist deciduous forests. Rare. Andhra Pradesh.

Endemic.

**10. Euphorbia elegans** Spreng., Syst. Veg. 3: 794. 1826; Hook.f., Fl. Brit. India 5: 246. 1887; Binojk. & N.P.Balacr., Genus Euphorbia in India 140, f. 11. 2010. *E. variegata* auct. non Sims, 1815: Roth, Nov. Pl. Sp. 225. 1821. *Chamaesyce elegans* (Spreng.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 169. 1972.

Guj.: *Unaravan*.

Herbs, erect or ascending, up to 30 cm high; stems dichotomously branched, hairy; internodes 3 - 5 cm long. Leaves distant, sessile or shortly petiolate, elliptic to oblong-elliptic, oblique at base, entire or serrate along margins, obtuse or subacute at apex, 2 - 2.5 x 1 - 1.5 cm, glabrous above, hirsute beneath; upper leaves closer, broader, distichously imbricating and usually concealing the cyathia; petioles ca 1 mm long; stipules triangular, laciniate. Cyathia terminal, solitary, or 2 or 3 together; peduncle ca 3 mm long; involucre turbinate, ca 3 x 2 mm, hirsute; lobes triangular, toothed, hairy, exceeding the glands; glands 4, transversely oblong, ca

1.5 x 1 mm; limbs suborbicular, 2 - 3 x 3 - 5 mm, pale yellow or pink, densely hirsute. Male florets: in 4 or 5 fascicles of 5 - 8 flowers each; pedicels ca 2 mm long; anthers subglobose; bracteoles setaceous, exserted, 1.5 - 2.5 mm long. Female floret: gynophore ca 2 mm long; ovary subglobose, ca 2 mm across, sparsely hairy; styles ca 3 mm long, connate at base, free above, each deeply 2-lobed; stigma capitate. Fruits subglobose, 3 - 4 x 2 - 3 mm, glabrous or sparsely hairy; seeds oblongoid, transversely 4 or 5-furrowed, yellowish brown.

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

*Distrib.* India: Hill slopes, grasslands and waste places, at 200 - 1300 m altitudes. Orissa, Chhattisgarh, Madhya Pradesh, Gujarat, Maharashtra, Karnataka and Tamil Nadu.

Endemic.

*Notes.* Pollen grains: Medium, prolate, P: E 48: 32  $\mu$ m, trizonocolporate, fossaperturate (Daisy Thomas, l. c. 1986).

**11. *Euphorbia erythroclada*** Boiss. in DC., Prodr. 15(2): 25. 1862; Hook.f., Fl. Brit. India 5: 247. 1887; Binojk. & N.P.Balakr., Genus *Euphorbia* in India 185, f. 22. 2010. *Chamaesyce erythroclada* (Boiss.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 169. 1972.

Mar.: *Dudheri*.

Herbs, erect, up to 50 cm high, entirely glabrous; stems dichotomously branched, terete, thickened at nodes; internodes 2 - 4 cm long. Leaves obliquely oblong, subobovate or ovate-oblong, oblique at base, entire or serrate along margins, obtuse or rarely acute at apex, 1 - 4 x 0.5 - 1 cm, penninerved, dark green above, pale green or silvery white beneath; petioles 1 - 2 mm long; stipules triangular, laciniate. Cyathia axillary or terminal, solitary; peduncles 1 - 3 mm long; involucre subcampanulate, turbinate, ca 2 x 1 mm; lobes triangular, fimbriate, exceeding the glands; glands 4, transversely oblong, ca 1 x 0.5 mm; limbs almost surrounding the glands, suborbicular, ca 1 x 1.5 mm, pink. Male florets: pedicels ca 1 mm long; anthers subglobose; bracteoles filiform, ca 1.5 mm long; peripheral bracteoles laciniate. Female floret: gynophore ca 1 mm long; ovary subglobose, ca 2 x 2 mm; styles free, bifid, with capitate stigma. Fruits subglobose, obtusely keeled, ca 4 mm across, slightly channelled on keels; seeds obtusely tetragonous, transversely 2 or 3 striate, reddish brown.

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

*Distrib.* India: Usually on hilltops, slopes and in plains on gravelly soil in rock crevices, up to 600 m altitude. Rare. Madhya Pradesh, Maharashtra, Goa and Karnataka.

Endemic.

**12. *Euphorbia granulata*** Forssk., Fl. Aegypt.-Arab. 94. 1775; Hook.f., Fl. Brit. India 5: 252. 1887; Binojk. & N.P.Balakr., Genus *Euphorbia* in India 112, f. 5. 2010. *E. arillata* Edgew. in J. Asiat. Soc. Bengal 16(2): 1218. 1847. *E. aegyptiaca* Boiss. var. *indica* Boiss. in DC., Prodr. 15(2): 35. 1862. *E. granulata* var. *glabrata* Boiss., l. c. 34. 1862. *E. granulata* var. *glabra* Blatt. & Hallb. in J. Bombay Nat. Hist. Soc. 26: 971. 1920. *Chamaesyce granulata* (Forssk.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 169. 1972.

Raj.: *Dudheli*; Tel.: *Kliviol*.

Herbs, prostrate, up to 20 cm long, usually hispid-villous; stems spreading from a thick rootstock, branched, hairy; internodes compact, 0.5 - 1 cm long. Leaves ovate-oblong or subobovate, oblique at base, entire along margins, obtuse or emarginate at apex, 1 - 3 x 0.5 - 2 mm (often leaves of ca 5 x 3 cm size are seen at nodes of main stems and branches), coriaceous, hirsute or sparsely hairy on both surfaces or glabrous above; petioles ca 1 mm long; stipules triangular, laciniate. Cyathia axillary or terminal, solitary, or 2 or 3 together, crowded with small hirsute leaves; peduncles ca 1 mm long; involucre turbinate, ca 1.5 x 1 mm, white pilose; lobes triangular, ciliate; glands 4, transversely oblong, ca 1 x 0.7 mm; limbs minute, larger than gland, unequal, subentire, white or pink. Male florets: few; pedicels ca 0.5 mm long, glabrous; anthers subglobose; bracteoles filiform, ca 1 mm long, peripheral ones laciniate. Female floret: gynophore ca 1 mm long, glabrous; ovary subglobose, ca 1.5 x 1 mm, hirsute; styles free, ca 0.7 mm long; stigma capitate. Fruits ovoid, obtusely keeled, ca 2 x 2 mm, coarsely villous; seeds oblong-ovoid, ca 1 mm long, 6 - 8 striate or irregularly rugulose, foveolate, pale brown to pinkish grey..

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

*Distrib.* India: Dry gravelly soil, along plains and roadsides, up to 800 m altitude. Punjab, Haryana, Delhi, Uttar Pradesh, Rajasthan, Madhya Pradesh, Gujarat, Maharashtra and Andhra Pradesh.

Pakistan, Afghanistan, Iran, Arabia, Egypt, Russia and China.

*Uses.* The latex used as an antidote for scorpion stings (Shekhawat & Anand, J. Econ. Taxon. Bot. 5: 597. 1984).

*Notes.* Pollen grains: Subprolate; P/E: 30 - 32/26 im (Anand et al., J. Econ. Taxon. Bot. 3: 57. 1982).

Chromosome number: n = 20 (Perry, Amer. J. Bot. 30: 535. 1943).

**13. *Euphorbia heyneana*** Spreng. Syst. Veg. 3: 791. 1826 (as 'heyneana'); Panigrahi in Kew Bull. 29: 695. 1974; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 115, f. 6. 2010. *E. microphylla* B. Heyne ex Roth, Nov. Pl. Sp. 229. 1821, non Lam., 1788; Hook.f., Fl. Brit. India 5: 252. 1887. *E. orbiculata* Miq., Fl. Ned. Ind. 1(2): 421. 1859, non Kunth, 1817; Sharma & B. Tiagi, Fl. NE. Rajasthan 375. 1979. *E. bombaiensis* Santapau in Bull. Bot. Soc. Bengal 8: 17. 1955. *Chamaesyce heyneana* (Spreng.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 169. 1972.

Herbs, annual, prostrate or decumbent, up to 15 cm long; stems spreading, filiform, glabrous; nodes thickened; internodes 1 - 2.5 cm long, ribbed. Leaves sessile, elliptic-oblong to ovate-oblong, oblique at base, entire or serrulate towards apex, subacute or acute at apex, 2 - 8 x 1 - 5 mm, glabrous; petioles ca 2 mm long; stipules triangular, ca 3 mm long, laciniate. Cyathia axillary, solitary, 2 or 3 in small axillary microphyllous branches; involucre campanulate, 3 - 4 x 2 - 3 mm; peduncles ca 1 mm long; lobes 5, triangular, exceeding the glands; glands 4, cupular, ca 1 x 1 mm; limbs ca 1 x 1.5 mm, transversely oblong, wavy near apical margin. Male florets: few in each cyathium; pedicels ca 1 mm long; anthers subglobose; bracteoles filiform, ca 0.7 mm long. Female floret: gynophore ca 3 mm long; ovary globose, ca 1 mm across, glabrous; styles ca 2 mm long, free, each bifid; stigma simple. Fruits globose, obtusely 3-keeled, ca 2 x 2 mm, glabrous; seeds obtusely 4-angular, ca 1.5 mm long, with 2 or 3 obscure furrows, yellowish brown.



## KEY TO THE SUBSPECIES

- 1 a. Plants prostrate; stems green, glaucous green or straw-coloured      **13.1. ssp. heyneana**  
 b. Plants decumbent; stems reddish brown      **13.2. ssp. nilagirica**

**13.1. ssp. heyneana**

Mar.: *Dudhli*.

*Fl. & Fr.* Throughout the year, peak in Sept. - Oct.

*Distrib.* India: Grasslands, on moist soil, up to 200 m altitude. Jammu & Kashmir, Himachal Pradesh, Punjab, Bihar, West Bengal, Orissa, Chhattisgarh, Madhya Pradesh, Gujarat, Maharashtra, Goa, Andhra Pradesh, Karnataka, Lakshadweep, Kerala and Tamil Nadu.

Africa, Pakistan, Bangladesh, Myanmar, China and Java.

*Uses.* The tribal Kurumbas of Nilgiri hills make a paste of the branches and leaves with pepper and apply to forehead to relieve headache.

*Notes.* Pollen grains: Medium, prolate, spheroidal, P: E 24:22 im, trizonocolporate, fossaperturate. (Daisy Thomas, l. c. 1986).

Chromosome number: n = 14 (Choda & Mehra, Curr. Sci. 41: 76. 1972; Mehra & Choda, Cytologia 43: 218. 1978).

**13.2. ssp. nilagirica** (Miq.) Panigrahi in Kew Bull. 29: 697. 1974 (1975); Binojk. & N.P. Balakr., Genus Euphorbia in India 119. 2010. *Euphorbia nilagirica* Miq. in Ann. Bot. Ind. 3: 17. 1852; Hook.f., Fl. Brit. India 5: 265. 1887. *E. sanguinea* Boiss. var. *nilagirica* (Miq.) Boiss. in DC., Prodr. 15(2): 35. 1862. *E. microphylla* B. Heyne ex Roth var. *nilagirica* (Miq.) Gamble, Fl. Madras 2(7): 1267. 1925 (repr. ed. 2: 893. 1957).

*Fl. & Fr.* Not known.

*Distrib.* India: Grassy slopes in hills, above 1000 m altitude. Rare. Tamil Nadu (Nilgiri hills).

Endemic and probably endangered. Apart from type, no other specimen is available in any herbaria.

**14. Euphorbia hirta** L., Sp. Pl. 454. 1753; Burm.f., Fl. Indica 112. 1768; Binojk. & N.P. Balakr., Genus Euphorbia in India 156, f. 16. 2010. *E. pilulifera* L., Sp. Pl. 454. 1753, p. p.; Hook.f., Fl. Brit. India 5: 250. 1887. *Chamaesyce hirta* (L.) Millsp., Publ. Field Columbian Mus., Bot. Ser. 2: 303. 1909.

Beng.: *Baro-kheruie*, *Kerui*; Guj.: *Dudeli*; Hindi: *Dudhi*; Kan.: *Acegida*, *Karihalsoppu*; Mal.: *Nilapala*; Mar.: *Dudhi*; Or.: *Chia-kuteli*; Sans.: *Dugudhika*; Tam.: *Amman-patchai-arisi*; Tel.: *Palaku*, *Reddinanabrolu*.

Herbs, erect, ascending or prostrate, all parts hirsute with yellow patent spreading multicellular hairs; stems 10 - 25 cm long, branched; nodes slightly thickened; internodes 2 - 4

cm long, terete or slightly ribbed. Leaves asymmetric, oblong-ovate to elliptic-lanceolate, oblique at base, serrate along margins, acute at apex, 2 - 4.5 x 1 - 1.5 cm, membranous; lateral nerves 3 - 5 from base, running up the blade; petioles 1 - 6 mm long; stipules linear-lanceolate, ca 2 mm long, lacinate. Cyathia glomerulate in axillary globose heads, 0.5 - 1 cm in diam.; peduncles simple or dichotomously branched, 2 - 7 mm long, leafless; involucre turbinate, ca 1 x 0.5 mm; lobes deltoid, acute, ca 1 mm long; glands 4, cupular, 0.5 - 0.8 mm across; limbs minute or as large as the gland, rounded, hyaline, white with purple tinge. Male florets: 4 - 6; pedicels ca 0.8 mm long; anthers subglobose; bracteoles setaceous, ca 0.5 mm long. Female floret: gynophore ca 1 cm long; ovary globose, ca 0.8 mm in diam.; styles ca 0.4 mm long, free, each bifid halfway; stigma capitate. Fruits subglobose to trigonous, 1.2 - 2 mm in diam., pubescent; seeds oblong, ca 1 mm long, with 3 or 4 obscure transverse ridges, purplish or reddish grey.

*Fl. & Fr.* Throughout the year, peak in Dec. - July.

*Distrib.* India: Grassy slopes, wastelands, roadsides, lawns and cultivated fields, up to 1500 m altitude. Almost throughout, including Andaman & Nicobar Islands.

Tropics, subtropics of Old and New World.

*Uses.* Plant latex is useful for removing warts on skins, particularly in children. Tribal people of Madhya Pradesh give juice of leaves mixed with milk in cases of gonorrhoea (Mishra & Sahu, J. Econ. Taxon. Bot. 5: 792. 1984).

*Notes.* Pollen grains: Small, prolate, P:E 16 - 20; 12 - 14  $\mu$ m, trizonocolporate, fossaperturate (Daisy Thomas, l. c. 1986).

Chromosome numbers: n = 9 (Choda & Mehra, Curr. Sci. 41: 76. 1972; Mehra & Choda, Cytologia 43: 218. 1978); 2n = 18 (Krishnappa & Reshme, Taxon 29: 537. 1980).

**15. *Euphorbia hispida*** Boiss., Cent. Euphorb. 8. 1860 & in DC., Prodr. 15(2): 37. 1862; V.S.Ramach. et al. in J. Econ. Taxon. Bot. 17: 497, f. 1. 1993; Binojk. & N.P.Balacr., Genus Euphorbia in India 187. 2010. *E. emodi* Hook.f., Fl. Brit. India 5: 250. 1887. *Chamaesyce hispida* (Boiss.) V.S.Raju & P.N.Rao in Phytologia 37: 454. 1977. *C. emodi* (Hook.f.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 169. 1972.

Herbs, erect or ascending, up to 30 cm high, hairy; stems dichotomously branched, terete; nodes thickened; internodes 2 - 3.5 cm long. Leaves obliquely oblong, oblique at base, serrate, obtuse or subacute at apex, 1 - 1.5 x 0.3 - 1 cm, sparsely or densely hairy; petioles ca 1 mm long, puberulous; stipules linear-lanceolate, ca 1.5 mm long, lacinate. Cyathia axillary or terminal, solitary, 2 or 3 together; peduncle ca 2 mm long; involucre turbinate, ca 1 mm across, glabrous; lobes triangular, lacinate, exceeding the gland; glands 4, rounded, ca 1 mm in diam.; limbs slightly larger than glands, rounded, entire. Male florets: pedicels ca 0.5 mm long; anthers subglobose; bracteoles filiform, ca 1.5 mm long. Female floret: gynophore ca 1.5 mm long; ovary subglobose, ca 1 mm across, sparsely hairy; styles ca 1.5 mm long, free, each deeply bifid at apex with capitate stigma. Fruits subglobose, obtusely keeled, ca 3 mm in diam., sparsely hairy; seeds oblongoid, tetragonous, ca 1.5 mm long, scrobiculate, wrinkled, reddish brown.

*Fl. & Fr.* June - Dec.

*Distrib.* India: On silty loam, dry stony grounds, grassy slopes and waste places, up to

2500 m altitude. Jammu & Kashmir, Himachal Pradesh, Rajasthan, Uttarakhand, Uttar Pradesh, Orissa and Tamil Nadu (Ramanathapuram Dist.).

Iran, Afghanistan, Pakistan and China.

**16. *Euphorbia hypericifolia* L.**, Sp. Pl. 454. 1753; Burm.f., Fl. Indica 113. 1768; Hook.f., Fl. Brit. India 5: 250. 1887, p. p.; Binojk. & N.P. Balakr. in Bull. Bot. Surv. India 35: 74. 1993 (1997) & Genus *Euphorbia* in India 163, f. 17. 2010. *Chamaesyce hypericifolia* (L.) Millsp. in Publ. Field Columbian Mus., Bot. Ser. 2: 302. 1909.

Guj.: *Dudheli*; Hindi: *Dudhi*; Mar.: *Dhakti-dudhi*; Punj.: *Hazardana*.

Herbs, erect, 0.3 - 1 m high, almost entirely glabrous; stems stiff, unbranched at base, branched above, terete; nodes thickened; internodes 2 - 5 cm long. Leaves oblong-lanceolate, oblique at base, serrate or serrulate above the middle on margins, acute at apex, 1.5 - 3.5 x 0.7 - 1 cm; lateral nerves obscure; petioles 1 - 5 mm long; stipules triangular. Cyathia in axillary glomerules, often with a few floral leaves; involucre campanulate, ca 1.5 x 0.7 mm, glabrous; lobes lanceolate, ca 1 mm long, lacinate; glands 4, stalked, orbicular, ca 1 mm across, sparsely puberulous at base; limbs orbicular, entire, ca 5 x 4 mm, white, purplish or pale pink. Male florets: pedicels ca 1 mm long, anthers subglobose; bracteoles filiform, ca 1.2 mm long. Female floret: gynophore ca 1.5 mm long; ovary ca 2 mm long, glabrous; styles ca 0.5 mm long, free, deeply bifid, stigma capitate. Fruits obtusely keeled, subspherical, ca 3 x 3.5 mm, glabrous; seeds ovoid, ca 1 mm long, wrinkled, light brown.

*Fl. & Fr.* July - Nov.

*Distrib.* India: In humid soil and as weed in cultivated fields, from plains to 2000 m altitude. Rare. Introduced into India, now found in Jammu & Kashmir, Uttarakhand, Maharashtra, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Central tropical America, Mexico, Venezuela, Pakistan, Bangladesh, Sri Lanka and Myanmar.

*Uses.* Infusion used as an astringent in diarrhoea, dysentery, and leucorrhoea (Ambasta, The useful plants of India 213. 1986).

*Notes.* Pollen grains: Medium, P:E 35:25  $\mu\text{m}$ , trizonocolporate, fossaperturate (Daisy Thomas, l. c. 1986).

Chromosome numbers:  $2n = 28$  (Perry, Amer. J. Bot. 30: 534. 1943);  $n = 14$  (Choda & Mehra, Curr. Sci. 41: 76. 1972);  $n = 18$  (Krishnappa & Reshme, Taxon 29: 537. 1980).

**17. *Euphorbia hyssopifolia* L.**, Syst. Nat. ed. 10, 2: 1048. 1759; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 166, t. 31. 2010. *Chamaesyce hyssopifolia* (L.) Small in Bull. New York Bot. Gard. 3: 429. 1905; V.S. Raju in J. Indian Bot. Soc. 66 (suppl.): 23. 1987; Reddy & V.S. Raju in J. Econ. Taxon. Bot. 26: 195. 2002.

Annual, erect, ascending or decumbent glabrous herbs; stems 2 or 3 from rootstock, branched and woody at base; nodes slightly thickened; branches filiform. Leaves opposite, linear-lanceolate, inaequilateral, serrulate towards apex, 1.5 - 3.5 x 0.3 - 0.6 cm, glabrous; stipules deltoid, 0.8 - 0.9 mm. Cyathia terminal and axillary in short-stalked leafy dichasia; glands transversely elliptic to suborbicular, sessile; limbs obsolete to distinct, entire or subwavy, white

or pale pink. Male florets: 5 – 12; anthers red, visible outside. Female floret: gynophore glabrous; ovary glabrous; styles free. Fruits truncate, oblong or ovoid, lobed, ca 1.6 mm long, glabrous, splitting into 3 bivalved 1-seeded cocci; seeds oblong-ovoid, ca 1 mm long, with 3 or 4 transverse ridges and furrows, brown to blackish brown.

*Distrib.* India. Weed in cultivated fields and human habitations. Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Native of Neotropics, adventives in Old World tropics.

*Notes.* Reddy & Raju (l. c.) reported this New World species from Warangal of Andhra Pradesh, where it was introduced and now occur as a garden weed. *E. hyssoipifolia* is closely related to *E. hypericifolia* L., both being of New World origin and now introduced to many Asian countries.

**18. *Euphorbia indica*** Lam., *Encycl.* 2: 423. 1788; Hook.f., *Fl. Brit. India* 5: 250. 1887, in adnot.; Binojk. & N.P.Balacr., *Genus Euphorbia in India* 168, f. 18. 2010. *E. bracteolaris* Boiss., *Cent. Euphorb.* 8. 1860 & in DC., *Prodr.* 15(2): 22. 1862; Hook.f., l. c. 5: 250. 1887, in adnot. *E. parviflora* auct. non L. 1759: Roxb., *Fl. Ind.*, ed. Carey 3: 473. 1832; Hook.f., l. c. 5: 250. 1887, in adnot. *E. hypericifolia* auct. non L. 1753: Haines, *Bot. Bihar Orissa* 1: 151. 1925, p. p.; Gamble, *Fl. Madras* 2(7): 1275. 1925 (repr. ed. 2: 892. 1957); Nicolson et al., *Interpret. Rheede's Hortus Malab.* (Regnum Veg. 119): 110. 1988. *Chamaesyce indica* (Lam.) Croizat in *Lilloa* 8: 406. 1942. *E. hypericifolia* L. var. *coimbatorensis* Chandrab. in *Fl. Coimbatore* 266. 1988.

Beng.: *Dudhi*; Konk.: *Dhakri-dudurli*; Mal.: *Neerkottampala*; Mar.: *Dudhmogra*.

Herbs, erect, decumbent or ascending, (2 - ) 10 - 50 cm high, sparsely puberulous or densely hirsute; main stems arising from rootstock; internodes 1 - 2 cm long. Leaves elliptic-oblong, oblique at base, entire or serrate above the middle along margins, obtuse at apex, (4 - ) 10 - 20 x (2 - ) 6 - 16 mm, glabrous or pubescent on both surfaces; lateral nerves 5 - 7 pairs obscure above, prominent beneath; petioles ca 2 mm long; stipules triangular to setaceous, ca 1 mm long. Cyathia clustered on 1 - 2 cm long axillary microphyllous shoots, usually with 1 - 3 pairs of small leaves; involucre turbinate, ca 1.2 x 1 mm, hirsute outside; lobes triangular, ca 0.5 mm long, lacerate; glands 4, rounded, ca 0.1 mm across; limbs obovate or orbicular, as long as or slightly longer than the gland, entire or slightly sinuate, white or pale pink. Male florets: in 2 or 3 fascicles of 3 or 4 flowers each; pedicels 0.5 - 1 mm long; anthers subglobose; bracteoles filiform, ca 1 mm long; peripheral bracteoles laciniate. Female floret: gynophore ca 1 mm long; ovary ca 1 mm long, hairy; styles ca 0.2 mm long, free, each bifid halfway; stigma capitate. Fruits subglobose, ca 1.5 mm across, dorsally keeled; seeds oblong-ovoid, with 5 or 6 transverse broken ridges and shallow furrows, greyish brown.

*Fl. & Fr.* Throughout the year, peak in Aug. - Oct.

*Distrib.* India: Open grasslands, gardens, shaded forest edges, and cultivated fields as weed, up to 1200 m altitude. Himachal Pradesh, Punjab, Haryana, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Orissa, Jharkhand, Madhya Pradesh, Andhra Pradesh, Maharashtra, Goa, Daman & Diu, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Africa and Asia.

*Uses.* The whole plant, except the roots, made into a paste with pepper leaves and applied on forehead to relieve headache by Kotas in Nilgiris.

*Notes.* Pollen grains: Prolate, P:E 42:48  $\mu\text{m}$  range, 40 - 44 / 26 - 30  $\mu\text{m}$ ; Os lolongate (size 4/1  $\mu\text{m}$ ); exine baculariate, 4  $\mu\text{m}$  thick (Anand et al. in J. Econ. Taxon. Bot. 3: 57: 1982 = as *E. parviflora* L.).

Chromosome number:  $n = 8$  (Datta in Taxon 16: 346. 1967 as *E. parviflora* L.).

**19. *Euphorbia jodhpurensis*** Blatt. & Hallb. in J. Bombay Nat. Hist. Soc. 26: 971. 1920; Binojk. & N.P.Balagr., Genus *Euphorbia* in India 189, f. 23. 2010. *E. clarkeana* Hook.f. var. *erecta* Hook.f., Fl. Brit. India 5: 253. 1887. *Chamaesyce jodhpurensis* (Blatt. & Hallb.) V.S.Raju & P.N.Rao in Phytologia 40: 392. 1978.

Raj.: *Dudheli*.

Herbs, erect, up to 50 cm high, entirely glabrous; stems pseudo-dichotomously branched, terete, stramineous; nodes annular, thickened; internodes 2 - 4.5 cm long. Leaves oblong to obliquely oblong, oblique at base, serrate towards apex, 0.5 - 2 x 0.1 - 0.4 cm; midnerve distinct, lateral nerves obscure; petioles ca 1 mm long; stipules broad, deeply lacinate. Cyathia terminal or subterminal, solitary or paired; peduncle ca 1 mm long; involucre campanulate, ca 1.2 x 1 mm; lobes 5, triangular, toothed; glands 4, rounded, ca 1 mm in diam.; limbs slightly larger than the gland, orbicular, entire, white or pink. Male florets: few; pedicels ca 0.5 mm long; anthers subglobose. Female floret: gynophore ca 1 mm long; ovary subglobose, ca 1 mm across; styles ca 1.3 mm long, free, each bifid at apex; stigma capitate. Fruits subglobose, obtusely keeled, ca 4 mm across, glabrous; seeds oblongoid, sub-quadrangular, ca 1.5 mm long, pale pink.

*Fl. & Fr.* July - Oct.

*Distrib.* India: Sandy soil, usually in cultivated farms, up to 500 m altitude. Rare. Rajasthan.

Endemic? There is an unconfirmed report from Sind in Pakistan.

*Notes.* Pollen grains: Subprolate, P: E 30 - 33 / 24 - 28  $\mu\text{m}$  (Anand et al., J. Econ. Taxon. Bot. 3: 57. 1982).

**20. *Euphorbia katrajensis*** Gage in Bull. Misc. Inform. Kew 1914: 236. 1914; Santapau in Bull. Bot. Soc. Bengal 8: 14. 1954; N.P. Singh & B.G.Kulkarni in Red Data Book of Indian Pl. 3: 120, illus. 1990; Binojk. & N.P.Balagr., Genus *Euphorbia* in India 192, f. 24. 2010. *Chamaesyce katrajensis* (Gage) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 169. 1972.

Herbs, erect, up to 40 cm high; stems terete, unbranched or dichotomously branched or often sympodial, pink; nodes thickened. Leaves oblong to oblong-lanceolate, oblique at base, distantly serrulate, acute to acuminate, apiculate at apex, 2.5 - 6.5 x 0.3 - 0.8 cm, glabrous; midnerve prominent, lateral nerves obscure; petioles ca 2 mm long; stipules subulate, ca 1 mm long. Cyathia axillary, solitary; peduncle ca 8 mm long; involucre turbinate, ca 2.5 x 2 mm, sparsely hairy; lobes 5, oblong or triangular, fimbriate; glands 4, transversely oblong, ca 2 x 1 mm, puberulous at base; limbs patent, suborbicular to sub-rhombate, undulating at apical margin, 1.5 - 2 x 1 - 1.5 mm, white or pale pink. Male florets: pedicels ca 1 mm long, glabrous; anthers subglobose; bracteoles filiform, ca 1.5 mm long. Female floret: gynophore ca 1.5 mm long,

glabrous; ovary ovoid, ca 1 mm long; styles 0.5 - 0.7 mm long, free, each bifid at apex; stigma capitate. Fruits subobovoid, obtusely keeled, ca 3 mm long, glabrous; seeds oblongoid, sub-quadrangular, transversely 3 or 4 striated, pale pink.

*Fl. & Fr.* July - Nov.

*Distrib.* India: Open hill slopes, among grasses, up to 500 m altitude. Maharashtra.

Endemic.

*Uses.* Gond tribes of Maharashtra use the latex as an antidote for snakebite and apply it on wounds.

**21. *Euphorbia laciniata*** Panigrahi in Kew Bull. 30: 531. 1975; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 143, f. 12. 2010. *E. fimbriata* B. Heyne ex Roth, Nov. Pl. Sp. 227. 1821, non Scopoli 1788; Gamble, Fl. Madras 2(7): 1274. 1925 (repr. ed. 2: 891. 1957). *E. fimbriata* Boiss. var. *laxa* Boiss. in DC., Prodr. 15(2): 19. 1862, p. p. *E. cristata* auct. non B. Heyne ex Roth 1821: Hook. f., Fl. Brit. India 5: 247. 1887, p. p. *Chamaesyce fimbriata* (B. Heyne ex Roth) R.R. Rao & Razi in J. Mysore Univ. B. 23: 53. 1970. *C. laciniata* (Panigrahi) V.S. Raju & P.N. Rao in Phytologia 37: 454. 1977.

Herbs, erect or decumbent, up to 15 cm high; stems many from a thick black perennial woody rootstock, the lower part simple, unbranched or once dichotomously branched upwards; nodes thickened. Leaves shortly petiolate, ovate, oblique at base, entire, obtuse at apex, 4 - 7 x 3 - 4 mm, sparsely hairy or glabrous above, hirsute beneath; midnerve prominent; lateral nerves obscure. Cyathia terminal or axillary, solitary; peduncles ca 1 mm long; involucre turbinate, ca 2 x 1.5 mm, hairy; lobes lacinate; glands 4, transversely oblong, ca 1.5 x 0.7 mm; limbs orbicular to obovate in outline, pectinately multifid for one-third the length with setaceous lobes, ca 1.5 x 2 mm, glabrous, reddish brown. Male florets: pedicels ca 1 mm long; anthers subglobose; bracteoles filiform, setaceous, peripheral ones lacinate hairy. Female floret: gynophore ca 2 mm long, hairy; ovary globose, ca 1 mm in diam., white hirsute; styles ca 1.5 mm long, free, each bifid; stigma capitate. Fruits subglobose, ca 2 mm in diam., obtusely keeled, pubescent; seeds oblongoid, quadrangular, with 3 or 4 transverse striations and furrows, brownish red.

*Fl. & Fr.* Jan. - May.

*Distrib.* India: Dry grassy slopes and other exposed areas, at 200 - 300 m altitudes. Rare. Maharashtra, Karnataka and Tamil Nadu.

Endemic.

**22. *Euphorbia lawsonii*** Binojk. & Dwarakan in Rheedeia 4: 60, f. 1. 1994; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 120. 2010. *Chamaesyce lawsonii* (Binojk. & Dwarakan) V.S. Raju in J. Econ. Taxon. Bot. 28: 92. 2004.

Herbs, decumbent, ca 20 cm high, puberulous; rootstock long, woody; stems dichotomously branched; nodes annular, slightly thickened; internodes 1 - 2 cm long, ribbed. Leaves opposite, ovate to suborbicular, oblique at base, entire or serrulate, obtuse or retuse at apex, 5 - 12 x 4 - 6 mm; nerves obscure above, slightly distinct beneath, hirsute; petioles ca 1 mm

long; stipules triangular, laciniate, ca 0.2 x 0.1 mm. Cyathia terminal, solitary or in pairs; involucre turbinate, ca 1 x 1.2 mm; lobes triangular, laciniate, ca 0.2 mm long; glands 4, tiny, rounded, pink; limbs orbicular, entire, 0.2 x 0.4 mm, pink. Male florets: sparsely dispersed; pedicels ca 1 mm long; anthers subglobose; bracteoles filiform, ca 1 mm long. Female floret: gynophore ca 0.5 mm long; ovary globose, ca 1 mm across, pubescent; styles 3, free, each bifid halfway; stigma capitate. Fruits subglobose, obtusely keeled, ca 2 by 2 mm, pubescent; seeds oblong-ovoid, tetragonous with 2 or 3 clear transverse grooves.

*Fl & Fr.* Nov. - April.

*Distrib.* India: Moist areas and in evergreen forests at 500 - 1200 m altitudes. Rare. Karnataka (Bellary dist.) and Tamil Nadu (Salem dist.).

Endemic.

**23. *Euphorbia longistyla*** Boiss., Cent. Euphorb. 9. 1860 & in DC., Prodr. 15(2): 20. 1862; Hook.f., Fl. Brit. India 5: 247. 1887; Subr. & N.P.Balacr. in J. Madras Univ. B. 29(1): 45–47, ff. 1-15. 1959; Binojk. & N.P.Balacr., Genus Euphorbia in India 194, f. 25. 2010. *Chamaesyce longistyla* (Boiss.) Croizat in O.Deg., Fl. Hawaiiensis Fam. 190, Chamaesyce, leafl. 2. 1937, in obs. et in adnot.; V.S.Raju & P.N.Rao in Phytologia 37(5): 454. 1977.

Herbs, erect, up to 30 cm high; stems pseudo-dichotomously branched, terete, yellowish brown, glabrous; nodes thickened, internodes 2 - 3 cm long; branches puberulous, filiform towards apex. Leaves elliptic to oblong-elliptic, oblique at base, entire or serrulate, apiculate at apex, 1 - 2 x 0.5 - 1 cm, glabrous; midrib prominent; lateral nerves faint; petioles 1 - 2 mm long; stipules linear-lanceolate, incised along margins. Cyathia terminal, solitary; peduncles ca 2 mm long, glabrous; involucre turbinate, 1 - 2 x 1 - 1.5 mm, glabrous; lobes 5, laciniate, pubescent towards margins; glands 4, shortly stalked, rounded, very velutinous at base; limbs ca 1 x 1.5 mm, multifid-pectinate up to base into 7 - 9 filiform lobes. Male florets: few; pedicels ca 1 mm long, glabrous; anthers subglobose; bracteoles filiform, laciniate, ca 1.5 mm long. Female floret: gynophore ca 2 mm long, glabrous; ovary subovoid, ca 2 x 2.2 mm, glabrous; styles ca 2 mm long, free; stigma capitate. Fruits subglobose, keeled, ca 4 mm across, glabrous, with distinct veins on the cocci; seeds oblong-subovoid, quadrangular, transversely 3 or 4-furrowed, reddish brown.

*Fl. & Fr.* July - Nov.

*Distrib.* India: Moist slopes, among grasses, rocky stream sides, under shade, up to about 500 m altitude. Rare. Andhra Pradesh and Karnataka.

Endemic.

**24. *Euphorbia notoptera*** Boiss. in DC., Prodr. 15(2): 26. 1862; Hook.f., Fl. Brit. India 5: 247. 1887; Binojk. & N.P.Balacr., Genus Euphorbia in India 196, f. 26. 2010. *Chamaesyce notoptera* (Boiss.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 169. 1972.

Herbs, erect or decumbent, up to 30 cm high, entirely glabrous; stems filiform, branched or unbranched, terete; nodes thickened; internodes 3 - 6 cm long. Leaves distant, oblong to oblong-elliptic, oblique at base, serrate, mucronate at apex, 1.5 - 2.2 x 0.5 - 0.7 cm, coriaceous, obscurely nerved; petioles ca 1 mm long; stipules short, broad, bifid. Cyathia terminal, solitary;

peduncles ca 2 mm long; involucre turbinate, ca 2.5 x 2 mm; lobes broadly triangular, fimbriate; glands 4, transversely oblong, ca 1 x 0.4 mm; limbs orbicular, wavy along upper margin, ca 5 x 3 mm, white or yellow. Male florets: pedicels ca 1 mm long; anthers subglobose; bracteoles filiform, ca 1.8 mm long. Female floret: gynophore ca 2 mm long; ovary subglobose, ca 2 x 1.5 mm; styles ca 1.5 mm long, free, each bifid; stigma capitate. Fruits subglobose or subovoid, ca 4.2 x 4 mm; cocci keeled with 2 or 3 prominent wings on keels; seeds obtusely subquadrangular, ca 1.5 x 1 mm, rugulose, tuberculate, pale brown.

*Fl. & Fr.* April - Sept.

*Distrib.* India: Deciduous forests, from lower slopes of the hills along the plains up to 400 m. Rare. Maharashtra, Goa and Karnataka.

Endemic.

*Notes.* Pollen grains: Medium, prolate, spheroidal, P: E 36:34 µm. trizonocolporate, peritreme (Daisy Thomas, l. c. 1986).

**25. *Euphorbia pallens*** Dillwyn, Rev. Hortus Malab. 54. 1839; V.S. Raju in Rheedea 11: 45. 2001 [*Ven-pala* Rheedea, Hortus Malab. 10: 115, t. 58. 1690 (epitype)]. *E. articulata* Dennst., Schlüssel, Hortus Malab. 20. 1818 (non Aubl. 1775, nec Lam. 1788); Binojk. & N.P. Balakr. in Rheedea 3: 113, f. 1. 1993. *E. atoto* auct. non G. Forst., 1786: Hook.f., Fl. Brit. India 5: 248. 1887; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 201, f. 28. 2010. *E. halophila* Miq., Anal. Bot. Ind. 3: 16. 1852; Boiss. in DC., Prodr. 15(2): 13. 1862. *Chamaesyce pallens* (Dillwyn) V.S. Raju in J. Econ. Taxon. Bot. 28: 92. 2004.

Mal.: *Ben-pala*, *Ven-pala*.

Herbs, erect, ascending or decumbent, glabrous or sparsely hairy, up to 50 cm high; stems many from a thick root-stock, somewhat woody, pseudo-dichotomously branched, articulate; nodes thickened; internodes 1 - 3 cm long, terete. Leaves elliptic to elliptic-oblong, cordate at base, entire along margins, acute or subacute at apex, 2 - 3 x 1 - 1.5 cm, sparsely hairy beneath, glabrous above, coriaceous; midnerve prominent, lateral nerves faint; petioles 1.5 - 2.5 mm long; stipules interpetiolar, sheathing at base, triangular to linear-lanceolate, fimbriate. Cyathia axillary or in terminal clusters; involucre turbinate, ca 1.5 x 1.5 mm; peduncles ca 1 mm long, glabrous; lobes 5, triangular, suboblong, laciniate, hairy, as long as the gland; glands 4, rounded, ca 1 mm across; limbs orbicular to obovate, slightly larger than the gland, whitish. Male florets: many; pedicels ca 0.5 mm long; anthers subglobose; bracteoles filiform, ca 1.5 mm long, peripheral bracteoles deeply laciniate. Female floret: gynophore ca 2 mm long, glabrous; ovary ca 4 x 2 mm, glabrous; styles ca 0.5 mm long, free, each bifid at apex; stigma capitate. *Fruits* subglobose, obtusely keeled, ca 6 mm across, glabrous; fruiting pedicels up to 5 mm long; seeds oblong-ovoid, 2 - 2.5 x 1.5 - 2 mm, pale yellowish, brown striate.

*Fl. & Fr.* Throughout the year, mostly during Jan. - April.

*Distrib.* India: Moist sandy soil along seashores, coconut groves or along roadsides, up to 50 m altitude. Orissa, Karnataka, Kerala and Andaman & Nicobar Islands.

Sri Lanka.



*Uses.* Latex used as abortifacient and emmenagogue (Ambasta, The Useful Plants of India 213. 1986).

*Notes.* Chromosome number:  $n = 8$  (Hassal, Austr. J. Bot. 24: 640. 1976).

**26. *Euphorbia prostrata*** Aiton, Hort. Kew. 2: 139. 1789; Hook.f., Fl. Brit. India 5: 266. 1887, in adnot.; Binojk. & N.P.Balacr., Genus Euphorbia in India 121, f. 7. 2010. *E. chamaesyce* auct. non L. 1753: Raizada, Suppl. Fl. Gangetic Plain 247. 1976. *Chamaesyce prostrata* (Aiton) Small, Fl. SE. U.S. 713. 1903.

Hindi: *Dudhia*; Tam.: *Chinna-patcharisi*.

Herbs, up to 20 cm high, with a long taproot, prostrate and partially suberect; stems many from base, each branched or unbranched, glabrous or hairy, blackish or purplish green; nodes thickened; internodes terete, 1 - 2 cm long, hairy in narrow bands. Leaves obliquely obovate to suborbicular, oblique at base, entire or serrulate along margins near apex, obtuse or rounded at apex, 3 - 8 x 1 - 5 mm, with obscure nerves, glabrous or sparsely hairy beneath; petioles ca 1 mm long; stipules lacinate, ca 0.5 mm broad. Cyathia axillary, solitary, 2 or 3 together on microphyllous branches; peduncles ca 3 mm long; involucre campanulate, ca 1 x 0.7 mm; lobes triangular, ciliate; glands 4, stalked, rounded, ca 0.2 x 0.2 mm, purple; limbs as large or a little larger than the glands. Male florets: usually 2 or 3; pedicels ca 1 mm long; anthers subglobose, pinkish. Female floret: gynophore ca 1 mm long; ovary subglobose; styles ca 0.1 mm long, free, each bifid at apex; stigma capitate. Fruits long exserted from the involucre on a deflexed pedicel, ovoid to subglobose, acutely keeled, ca 1 x 1.5 mm, with 2 - 3 rows of hairs restricted to the keels only; seeds ovoid, tetragonous, transversely rugulose with 5 - 7 sharp ridges, ca 0.8 x 0.5 mm, pale brown to grey.

*Fl. & Fr.* More or less throughout the year.

*Distrib.* India: Moist sandy soil in gardens, roadsides and cultivated fields, up to 1500 m altitude. Uttarakhand, Punjab, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Arunachal Pradesh, Meghalaya, Tripura, Orissa, Chhattisgarh, Madhya Pradesh, Gujarat, Maharashtra, Goa, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Native of tropical and subtropical America and introduced into many parts of the Old World.

*Uses.* Irula tribals of Coimbatore District, Tamil Nadu make a paste of this plant and apply on mumps.

*Notes.* Chromosome numbers:  $n = 9$  (Datta, Taxon 16: 346: 1967);  $2n = 20$  (Munir & Choudhari, Taxon 19: 267. 1970).

Pollen grains: Prolate, spheroidal P/E: 24/22  $\mu$ m (Anand et al., J. Econ. Taxon. Bot. 3: 57. 1982).

**27. *Euphorbia pycnostegia*** Boiss., Cent. Euphorb. 9. 1860 & in DC., Prodr. 15(2): 18. 1862; Hook.f., Fl. Brit. India 5: 216. 1887; Binojk. & N.P.Balacr., Genus Euphorbia in India 146, f. 13. 2010. *Euphorbia pycnostegia* Boiss. var. *laxa* Boiss. in DC., Prodr. 15(2): 19. 1862. *Chamaesyce pycnostegia* (Boiss.) Sojak in Cas. Nar. Mus., Odd. Priir. 140: 170. 1972.

Herbs erect, glabrous, up to 70 cm high; stems pseudo-dichotomously branched, terete, somewhat thickened at nodes; internodes 2 - 3 cm long, reddish brown. Lower leaves opposite, distant, oblong-ovate, oblique at base, entire or serrulate, obtuse at apex, 2 - 3.5 x 0.5 - 1.5 cm, whitish on lower surface; midrib distinct, lateral nerves obscure; petioles ca 1 mm long. Upper leaves imbricate, concealing the cyathia, sessile, subcordate to amplexicaul at base, 0.5 - 1 x 0.4 - 0.6 cm; stipules ca 1.5 mm long, fimbriate. Cyathia axillary, solitary; involucre campanulate, ca 2.5 x 2 mm; lobes 5, oblong, fimbriate, ca 0.3 mm long; glands 4, oblong, ca 0.5 x 0.2 mm; limbs transversely obovate, wavy at apical margin, ca 1 x 1.3 mm, white or purplish pink. Male florets: pedicels ca 1 mm long; anthers subglobose; bracteoles filiform, ca 1.5 mm long. Female floret: gynophore ca 2 mm long, glabrous; ovary globose, ca 4 mm in diam.; styles free, bifid; stigma capitate. Fruits ovoid, obtusely trilobed, obtusely angled or acutely keeled at base, ca 3 x 2 mm, glabrous or sparsely hairy; seeds ovoid, transversely 3 or 4-furrowed or not, reddish brown or pale grey.

#### KEY TO THE VARIETIES

- 1a. Limbs of glands white; capsules sparsely hairy; cocci obtuse; seeds oblong, subquadrangular transversely 3 or 4-furrowed, glabrous **27.1. var. pycnostegia**  
 b. Limbs of glands purplish pink; capsule glabrous; cocci acutely keeled at base; seeds ovoid, not furrowed, minutely tuberculate, papillose **27.2. var. zornioides**

#### **27.1. var. pycnostegia**

*Fl. & Fr.* Sept. - Dec.; *Fr.* Up to March.

*Distrib.* India: Grasslands and forest edges, at 300 - 500 m altitudes. Orissa, Gujarat, Maharashtra, Karnataka and Tamil Nadu.

Endemic.

*Notes.* Pollen grains: Polycolporate, spheroidal (diam. 48  $\mu$ m); longate (size 2/1  $\mu$ m); exines 1.5  $\mu$ m thick, sexine as thin as nexine, reticulate (Anand et al., J. Econ. Taxon. Bot. 3: 57. 1982); subprolate, P:E 22 : 18  $\mu$ m, trizonocolporate, fossaperturate, colporate, colpus thin, long, 20 x 1.0  $\mu$ m, margin distinct, wavy, tips acute (Daisy Thomas, l. c. 1986).

**27.2. var. zornioides** (Boiss.) Santapau in Bull. Bot. Soc. Bengal 8: 11. 1954 & in Rec. Bot. Surv. India, ed. 3. 16(1): 241. 1967. *Euphorbia zornioides* Boiss. in DC., Prodr. 15(2): 19. 1862; Hook.f., Fl. Brit. India 5: 246. 1887. *Chamaesyce zornioides* (Boiss.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 170. 1972.

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

*Distrib.* India: Hill slopes and grassy lands, up to 1000 m altitude. Madhya Pradesh, Andhra Pradesh, Maharashtra, Goa, Daman, Diu, Karnataka, Kerala and Tamil Nadu.

Endemic.

**28. Euphorbia rosea** Retz., Observ. Bot. 4: 26. 1786; Hook.f., Fl. Brit. India 5: 251. 1887; Binojk. & N.P. Balakr., Genus Euphorbia in India 174, f. 19. 2010. *E. parviflora* auct. non L. 1759; Lam., Encycl. 2: 424. 1788. *E. auricularia* Boiss., Cent. Euphorb. 17. 1860 & in DC., Prodr. 15(2):

50. 1862. *Chamaesyce rosea* (Retz.) G.L. Webster in J. Arnold Arb. 48: 423. 1967, in adnot. *C. auricularia* (Boiss.) V.S.Raju & P.N.Rao in Phytologia 37: 453. 1977.

Mal.: *Venm-pala*; Tam.: *Utharappalatai*.

Herbs, biennial or perennial, decumbent to ascending or prostrate, 5 - 25 cm high, glabrous or sparsely hairy; stems many from a woody rootstock, unbranched or dichotomous towards the apex, terete; nodes thickened; internodes 1 - 5 cm long, pinkish or yellow. Leaves arranged compactly or distantly, obliquely obovate, oblong or linear-spathulate, oblique at base, entire or serrate towards apex, obtuse or retuse at apex, 5 - 13 x 3 - 5 mm, glabrous or pubescent; lateral nerves obscure; petioles ca 1 mm long; stipules ca 1 mm long, bifurcated, each triangular, lacinate. Cyathia terminal, solitary or in small subterminal clusters; peduncles ca 1 mm long; involucre campanulate, 1 - 2 x 0.7 - 1.2 mm; lobes triangular, lacinate; glands 4, peltate, rounded, ca 1 mm across, shortly stalked; limbs subequal, pale pink or white, upper 2 larger, obliquely oblong, 1.5 - 2.5 x 1 - 2 mm, entire or undulate along apical margin, the lower 2 orbicular, ca 1 x 1.2 mm. Male florets: few; pedicels ca 1.2 mm long; anthers subglobose; bracteoles filiform, ca 1.5 mm long; peripheral ones lacinate. Female floret: gynophore ca 2 mm long, glabrous; ovary subglobose, ca 1 mm across, sparsely hairy; styles ca 0.5 mm long, connate at basal half, bifid above; stigma subglobose. Fruits subovoid, obtusely keeled, ca 3.5 x 3.5 mm, hirsute or glabrous; seeds oblong, tetragonous, 1.5 - 2 mm long, transversely rugose and faintly furrowed, reddish brown.

*Fl. & Fr.* Sept. - March.

*Distrib.* India: Usually in sandy or gravelly soil, often along sea shores, up to 500 m altitude. Uttarakhand, Uttar Pradesh, Madhya Pradesh, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Iran, Afghanistan, Pakistan, Nepal and Sri Lanka.

*Uses.* The leaves and seeds used as vermifuge (Ambasta, Useful Plants of India 214. 1986).

*Notes.* Pollen grains: Medium, prolate, P:E 36:24  $\mu\text{m}$ , trizonocolporate, fossaperturate (Daisy Thomas, l. c. 1986).

Chromosome number:  $2n = 18$  (Kothari et al., Taxon 30: 512. 1981).

**29. *Euphorbia sebastinei*** Binojk. & N.P.Balacr. in Rheedeia 3: 26, f. 1. 1993; Reddy et al. in J. Threatened Taxa 2(10): 1160 - 1161, t. 1. 2010; Binojk. & N.P.Balacr., Genus Euphorbia in India 125. 2010. *Chamaesyce sebastinei* (Binojk. & N.P.Balacr.) V.S.Raju in J. Econ. Taxon. Bot. 28: 92. 2004.

Herbs, erect or decumbent, 10 - 20 cm high, pubescent; stems many from a thick rootstock, rigid; branches 2 - 6 together at almost all nodes, stramineous; nodes thickened, annular; internodes 1 - 1.5 cm long, terete. Leaves petiolate or sessile, crowded towards tips of branches, oblong to elliptic-oblong, oblique at base, serrate, acute or subacute and apiculate at apex, 5 - 10 x 3 - 5 mm, pubescent on both the surfaces; nerves obscure; stipules triangular, lacinate, ca 2 mm long. Cyathia terminal, solitary, rarely 2 or 3 together on short microphyllous

branches; peduncles ca 1 mm long; involucre turbinate, 0.8 - 1 mm across; lobes triangular, toothed, exceeding the glands; glands 4, tiny, orbicular; limbs obovoid, wavy at apical margin, ca 0.5 x 0.8 mm, white or pink. Male florets: pedicels ca 0.5 mm long; anthers subglobose; bracteoles filiform, ca 0.7 mm long. Female floret: gynophore ca 1.5 mm long; ovary subglobose, ca 1 mm in diam., hairy; styles free, ca 0.4 mm long, each bifid at apex. Fruits ovoid, ca 1.5 x 1.5 mm, acutely keeled, hairy only on keels, maturing outside the cyathia; seeds oblong, tetragonous, 2 or 3-grooved on faces, ca 1 x 0.5 mm.

*Fl. & Fr.* Throughout the year, peak in March - June.

*Distrib.* India: Moist gravelly soil, at 200 - 850 m altitude. Rare. Gujarat, Maharashtra and Andhra Pradesh.

Endemic.

**30. *Euphorbia senguptae*** N.P.Balacr. & Subr. in Bull. Bot. Surv. India 2: 175. 1960; J.L.Ellis, Fl. Nallamalais 2: 356. 1990; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 199, f. 27. 2010. *Chamaesyce senguptae* (N.P.Balacr. & Subr.) V.S.Raju & P.N.Rao in Phytologia 37: 454. 1977.

Herbs, erect, up to 30 cm high, entirely glabrous; stems woody, terete, pseudo-dichotomously branched; branches slender, thickened at nodes; internodes 1 - 3 cm long. Leaves oblong to ovate-oblong, oblique at base, entire or serrulate, acute at apex, 0.5 - 2.5 x 0.2 - 1.5 cm, glabrous; lateral nerves obscure; petioles ca 2 mm long; stipules scaly, lacinate. Cyathia terminal, solitary; peduncle ca 2 mm long; involucre turbinate, ca 2 x 2.5 mm; lobes 5, triangular; glands 4, small, cup-shaped, shortly stalked; limbs subovate, entire, minutely sinuate, hyaline, pale pink. Male florets: pedicels ca 1 mm long; anthers subglobose; bracteoles filiform, ca 2 mm long. Female floret: gynophore ca 2 mm long; ovary oblong-ovoid, ca 1.5 x 1 mm; styles up to 2 mm long, free, each bifid at apex; stigma minute, capitate. Fruits subovoid, deeply keeled, ca 3 x 3 mm, glabrous; seeds oblongoid, tetragonous, ca 2 x 1 mm, reddish brown.

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

*Distrib.* India: Grassy hill slopes, open and partially shaded places, along stream sides, up to about 500 m altitude. Rare. Andhra Pradesh (Anantapur, Cuddapah and Kurnool Districts).

Endemic.

**31. *Euphorbia serpens*** Kunth in Humb., Bonpl. & Kunth, Nov. Gen. Sp. (quarto ed.) 2: 52. 1817; R.L.Mitra in J. Bombay Nat. Hist. Soc. 68: 854. 1971; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 126, f. 8. 2010. *E. microphylla* auct. non B.Heyne ex Roth, 1821: Hook.f., Fl. Brit. India 5: 252. 1887, p. p. *E. orbiculata* Kunth var. *jawaharii* Rajagopal & Panigrahi in Taxon 17: 547. 1968. *Chamaesyce serpens* (Kunth) Small, Fl. S.E. US. 709. 1903.

Beng.: *Chotto-kerui*.

Herbs, annual, prostrate, glabrous, up to 20 cm long; stems branched; nodes thickened, with roots or at least root primordia at nodes; internodes 0.5 - 1.5 cm long. Leaves subquadrate to ovate, obliquely cordate at base, entire along margins, retuse at apex, 4 - 6 x 3 - 5 mm, sub-fleshy; petioles ca 1 mm long; stipules united, scaly, broadly triangular, ca 0.5 mm long, incised. Cyathia axillary, solitary, paired or 3 on short microphyllous shoots; peduncles 1 - 2 mm long,

glabrous; involucre turbinate, ca 1 x 0.5 mm; lobes lacinate, minutely hairy; glands 4, transversely oblong, ca 0.2 mm across; limbs reniform, subentire or shallowly 2 or 3-lobed, little broader than the gland. Male florets: few, ebracteolate; pedicels ca 1 mm long; anthers subglobose. Female floret: gynophore ca 0.8 mm long; ovary glabrous, ca 1 x 1.5 mm; styles ca 0.5 mm long, each bifid from middle; stigma capitate. Fruits subglobose, ca 1.5 mm diam., glabrous; seeds ovoid, sub-tetragonal, ca 1 x 0.7 mm, smooth, pinkish brown.

*Fl. & Fr.* Throughout the year.

*Distrib.* India: Gardens, roadsides, wastelands and other moist areas in fields as weed, up to 500 m altitude. Punjab, Haryana, Delhi, Rajasthan, Uttar Pradesh, West Bengal, Madhya Pradesh, Andhra Pradesh, Maharashtra, Goa, Karnataka, Tamil Nadu and Andaman Islands.

Native of Tropical America introduced into the Mediterranean regions, Asia and Africa.

*Notes.* Pollen grains: Subprolate P/E: 25 - 28 / 20 - 23  $\mu$ m. (Anand et al., J. Econ. Taxon. Bot. 3: 57. 1982).

Chromosome numbers: n = 12 (Datta, Taxon 16: 398. 1968, under *E. bombaiensis* Santapau); 2n = 24 (Datta, Sci. & Cult. 34: 398. 1968, under *E. bombaiensis* Santapau).

**32. *Euphorbia thymifolia* L.**, Sp. Pl. 454. 1753; Hook.f., Fl. Brit. India 5: 252. 1887; Binojk. & N.P.Balakr., Genus Euphorbia in India 130, f. 9. 2010. *E. foliata* Buch.-Ham. ex Dillwyn, Rev. Hortus Malab. 52. 1839. *Chamaesyce thymifolia* (L.) Millsp., Publ. Field Columbian Mus., Bot. Ser. 2(11): 412. 1916.

Beng.: *Shwet-kerucie*; Hindi-Bihar: *Safed-doohi*; Kan.: *Bilee-chitrappala*; Konk: *Duduni*; Mal.: *Caicotten-pala*, *Chitrappala*, *Nilapala*; Mar.: *Chakdiduhi*; Sans.: *Laghududhika*; Tam.: *Sittarapaladai*; Tel.: *Reddivari-manubala*.

Herbs, annual, prostrate, 5 - 30 cm long, puberulous; stems spreading, radiating from woody rootstock, branched; nodes thickened; internodes 0.5 - 2 cm long, terete. Leaves distichous, ovate-oblong, oblique at base, crenulate-serrulate or entire up to middle along margins, obtuse or subacute at apex, 3 - 8 x 2 - 5 mm, glabrous above, scattered hairy beneath, 3-veined at base; petioles 0.5 - 1 mm long. Cyathia terminal or on short axillary microphyllous shoots, solitary or few together, subtended by several minute leaves; peduncles ca 1 mm long; involucre turbinate, ca 1 x 0.7 mm; lobes 5, small, triangular, ciliate; glands 4, suborbicular, ca 0.2 mm across, purplish red; limbs as large as or smaller than glands, white or pink. Male florets: pedicels ca 1 mm long, glabrous; anthers subglobose; bracteoles filiform, ca 1.5 mm long. Female floret: gynophore ca 5 mm long; ovary subglobose, ca 1 mm across, pubescent; styles ca 1.5 mm long, free, each bifid, stigma capitate. Fruits scarcely exerted from involucre, trigonous-subglobose, obtusely keeled, ca 1.5 x 1 mm, appressed hispid; seeds oblong, tetragonal, bluntly pointed, transversely 2 or 3 furrowed, reddish brown or pinkish grey.

*Fl. & Fr.* Throughout the year, peak in Jan. - June.

*Distrib.* India: Weed of moist gravelly soil in gardens, cultivated fields, wastelands, roadsides, temple grounds, etc., up to 1000 m altitude. Common. Almost throughout the country.

Pantropical, in Asia, Africa and America.

*Uses.* Widely used in Ayurveda to cure many illnesses. Recent studies show that the plant has antioxidant and antiviral properties. The tribe Muduvras of Kerala apply a paste made out of the whole plant on painful joints.

*Notes.* Pollen grains subprolate, P: E 29/22  $\mu\text{m}$ ; range 27 - 32/20 - 24  $\mu\text{m}$  (Anand et al., J. Econ. Taxon. Bot. 3: 58. 1982).

Chromosome number reported is  $n=9$  (Choda & Mehra, Curr. Sci. 41: 76. 1972; Mehra & Choda, Cytologia 43: 228. 1978).

### Subgenus 3. *Epiphylloides* Binojk. & N.P.Balacr.,

Genus *Euphorbia* in India 287. 2010.

Shrubs or trees, up to 5 m high, unarmed; main stem terete, branching at apex only; branches flat or two-winged, curving downwards, becoming pendulous; leaves subobovate, obtuse-retuse at apex. Cyathia shortly pedunculate, in dichotomous cymes or rarely solitary at the margins of the wings. Capsules smooth, glabrous.

Andaman & Nicobar Islands. Monospecific.

**33. *Euphorbia epiphylloides*** Kurz [Rep. Veg. Andaman Isl. ed. 2, 48. 1870, nom. nud.] in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 247. 1873 & Forest Fl. Burma 2: 416. 1877; Hook.f., Fl. Brit. India 5: 254. 1887; C.E.Parkinson, Forest Fl. Andaman Isl. 233. 1923; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 287, f. 56, t. 7. 2010.

Andamans (Hindi): *Sabar*; Andamans (Burmese): *Zizaung*.

Shrubs or small trees, up to 3 m tall, succulent unarmed; main stems terete, up to 15 cm in diam.; branches thickly 2-winged, sinuate along margins, curving and becoming pendulous, shiny green. Leaves obovate, obtusely cuneate at base, entire, obtuse or retuse at apex, 2 - 4.5 x 1.5 - 2.5 cm, shiny green; midnerve distinct, lateral nerves faint; petioles ca 5 mm long. Cyathia ivory-coloured, arranged singly or short pedunculate cymes at the crenatures along the margins of branch-wings; peduncles ca 3 mm long; bracts 2, opposite, ovate, ca 2 x 1.5 mm; involucre turbinate, ca 4 mm across; lobes 5, obovate, laciniate or toothed at apical margins; glands 5, transversely oblong, ca 2 x 1 mm, yellow. Male florets: in 4 or 5 fascicles; pedicels ca 3 mm long; anthers subglobose; bracteoles laciniate, ca 2 mm long. Female floret: gynophore ca 5 mm long; ovary subglobose, ca 2 mm in diam., glabrous. Fruits subglobose, acutely 3-lobed, glabrous, ca 5 mm in diam.; seeds globose, ca 3 mm across, black.

*Fl. & Fr.* Dec. - April.

*Distrib.* India: On red lateritic rocky soil along open slopes in moist or dry tropical forests, up to 700 m altitude. Rare. Andaman & Nicobar Islands (Saddle Peak area of North Andaman Islands).

Myanmar? (See Kress et al., A. Checklist of trees, shrubs, herbs, and climbers of Myanmar, p. 228. *Contr. U. S. National Herbarium*, Vol. 45. 2003).

### Subgenus 4. *Eremophyton* (Boiss.) L.C.Wheeler

Herbs or subshrubs, up to 1.5 m high; stem branched, fruticose at base, twisted when young; old branches rigid. Leaves alternate, often becoming subopposite, opposite or ternate

towards the apices of the stem; stipules subulate, minute, often caducous. Cyathia terminal or axillary at the forks of branches, solitary or a few together; glands entire or palmatifid; limbs of glands absent. Male florets: in 3 or 4 fascicles, with laciniate bracteoles. Female floret: gynophore and ovary hairy. Fruits oblong-ovoid, puberulous; seeds oblong, compressed, variously sculptured.

Mostly confined to Africa and Australia and a few migrated to other areas of the world, ca 20 species; one species with two varieties in India.

**34. *Euphorbia agowensis*** Hochst. ex Boiss. in DC., Prodr. 15(2): 70. 1862 & Icones Euphorb. 16, t. 44. 1866; Kumari & Subba Rao in Bull. Bot. Surv. India 15: 126. 1973; V.S.Raju in Kew Bull. 41: 419. 1986; Binojk. & N.P.Balacr., Genus Euphorbia in India 207, f. 29. 2010. *E. wightiana* sensu Hook.f., Fl. Brit. India 5: 248. 1887, p. p., non Boiss. 1860.

Herbs, perennial or biennial, erect, up to 1.5 m high; stems 2 or 3 times branched, woody at base; branches twisted when young, rigid when old, dichotomous or trichotomous. Leaves alternate below, opposite or ternate towards apex, subobovate, broadly elliptic-lanceolate to linear-lanceolate, cuneate-attenuate at base, acute or subacute at apex, entire or serrate along margins, often with gland-tipped marginal teeth at the base of the leaves, 3 - 5 x 1 - 3 cm, sparsely pubescent; lateral nerves 4 or 5 pairs, distinct; stipules obsolete; petioles 4 - 7 mm long; stipules glandular. Cyathia 2 - 3 mm across, terminal or at the forks of the branches, solitary and subsessile or sometimes 2 or 3 on peduncles; involucre turbinate, ca 3 x 2.5 mm, velvety outside, subtended by 2 ovate-rounded leaves; lobes 5, ovate-triangular, denticulate, ca 1 mm long; glands 4 or 5, transversely oblong, wavy along outer margin, ca 1.2 x 1 mm, shiny. Male florets: pedicels 1 - 2 mm long, puberulous; anthers subglobose; bracteoles laciniate, ca 1.5 mm long. Female floret: gynophore 3 - 5 mm long, puberulous; ovary oblong, hirsute; styles ca 1 mm long, free, bifid at apex; stigma capitate. Fruits oblong to ovoid, 4 - 5 x 3 - 5 mm, smooth, puberulous; seeds oblong, compressed, ca 4 x 2 mm, longitudinally 4 or 5-ridged, wrinkled, white.

#### KEY TO THE VARIETIES

- 1 a. Leaves obovate, subovate, ovate-oblong to elliptic-lanceolate, rarely with gland-tipped marginal teeth at the base **34.1. var. agowensis**
- b. Leaves linear to linear-lanceolate, always with gland-tipped marginal teeth at the base **34.2. var. pseudoholstii**

#### **34.1. var. agowensis**

*E. wightiana* Hook.f., Fl. Brit. India 5: 248. 1887, p. p., non Boiss. 1860. *Chamaesyce wightiana* V.S. Raju & P.N. Rao in Phytologia 37(5): 454. 1977, published as comb. nov.

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

*Distrib.* India: Moist hill slopes in forests, at 200 - 800 m altitudes. Not common. Andhra Pradesh and Tamil Nadu.

Arabian peninsula, Ethiopia, Somalia, Tanzania and Kenya.

**34.2. var. pseudoholstii** (Pax) Bally & S. Carter in Kew Bull. 39: 650. 1984; Binojk. & N.P. Balakr. in J. Econ. Taxon. Bot. 17: 452, f. 3. 1993 & Genus Euphorbia in India 209. 2010. *Euphorbia pseudoholstii* Pax in Engl., Bot. Jahrb. Syst. 33: 287. 1903; Brown in Fl. Trop. Africa 6: 521. 1911.

*Fl. & Fr.* July - Sept.

*Distrib.* India: Dry hill slopes in forests and scrubs in plains, at 200 - 800 m altitude. Scarce. Andhra Pradesh and Tamil Nadu.

Arabian Peninsula, Ethiopia, Kenya and Tanzania.

### Subgenus 5. **Esula** Pers.

Herbs or shrubs, up to 2 m high; rootstock thick or thin, persistent or not; stems umbellately branched or unbranched. Leaves of 3 types: lower leaves alternate or rarely opposite, tapered or rounded at base, entire or serrate along margins, obtuse, acute or subacute at apex, estipulate; pseudoumbel leaves as many as the number of rays, whorled, size and shape almost same as the upper stem leaves or rarely slightly different; ray leaves opposite or ternate, free or rarely connate at base, differs in size and shape from stem and pseudoumbel leaves. Pseudoumbels 2 - many-rayed or rarely not developed; rays once or many times divided. Cyathia usually solitary or 1 - 3 together surrounded by ray leaves, rarely at the apex of the main stem, generally in the axils and apices of the rays; involucre usually turbinate, cupular or saucer-shaped; glands 4 or 5, horned or not; limbs of glands absent. Male florets: usually dispersed or in fascicles; anthers subglobose. Female floret: gynophore usually protruding from the involucre, varying in length; ovary smooth, papillate, granulate, glabrous or pubescent. Fruits smooth, granulate or warty, dehiscent or rarely indehiscent; seeds smooth or variously sculptured, carunculate.

Temperate Asia, Arabia, Africa, Europe and America, ca 500 species; 28 species in India.

**35. Euphorbia boissieriana** (Woronow) Prokh. in Kom., Fl. URSS 14: 445. 1949; Stewart, Ann. Cat. Vasc. Pl. W. Pak. & Kashmir 447. 1972; Radcl.-Sm. in Fl. Pakistan 172: 161. 1986; Binojk. & N.P. Balakr., Genus Euphorbia in India 213. 2010. *Tithymalus boissierianus* Woronow, Herb. Fl. Caucas. No. 479. 1931.

Herbs or small shrubs, perennial, 40 - 140 cm high, glabrous, glaucescent; rootstock cylindrical, vertical; stems few, erect, more or less ribbed-sulcate, branched; axillary rays 4 - 8 (-16) on main stem, 2 - 9 cm long. Leaves shortly petiolate, lanceolate or linear-oblong, entire and slightly incurved along margins, obtuse and mucronulate at apex, 3 - 8 x 4.5 - 13 mm; nerves indistinct. Pseudoumbels 7 - 14-rayed; leaves sessile, oblong-ovate or oblong-elliptic, rounded or subcordate at base, truncate or rounded at apex, 13 - 28 x 3 - 8 mm; rays 1.5 - 10 cm long, 2 or 3 times dichotomous; ray leaves 2, triangular-reniform, 6 - 13 x 8 - 12 mm, slightly yellowish. Cyathia terminal, solitary; involucre campanulate, ca 3 mm across, lobes ovate-dentate; glands bicornute; horns linear-spathulate, longer than the width of the glands; styles 1.5 - 2 mm long, connate at base, bifid at apex. Fruits flattened-subglobose, 4.5 - 5 x 5.5 - 6 mm, deeply trisulcate, smooth; seeds ovoid, later rostriform-appendaged.

*Fl. & Fr.* May - June.



*Distrib.* India: Mountain slopes, fallow lands, at 3000 - 3400 m altitudes. Jammu & Kashmir.

South-west. & Central Asia (Radcl.-Sm., 1986).

**36. *Euphorbia cashmeriana*** Royle, Ill. Bot. Himal. Mts. 329, t. 82, f. 4. 1836; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 248, f. 41. 2010. *E. edgeworthii* Boiss. in DC., Prodr. 15(2): 120. 1862; Hook.f., Fl. Brit. India 5: 261. 1887. *Tithymalus edgeworthii* (Boiss.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 172. 1972.

Perennial herbs, erect, up to 30 cm high, quite glabrous; stems 4 or 5 from a slender rootstock; branches weak, slender. Leaves alternate, sessile, oblong to ovate-oblong, rounded at base, entire along margins, obtuse or subacute at apex, 2 - 3.5 x 1 - 1.5 cm, penninerved. Pseudoumbels 4 - 6-rayed; leaves 4 - 6, whorled, ovate to broadly ovate, rounded at base, entire along margins, obtuse at apex, 1 - 2.5 x 0.5 - 2 cm; rays short, 2 - 4 cm long, usually not further divided. Cyathia terminal, solitary, sessile; involucre campanulate, ca 3 x 2 mm; lobes broadly triangular, lacinate along margins; glands 4, transversely oblong, ca 2 x 1 mm. Male florets: pedicels ca 3 mm long; anthers subglobose. Female floret: gynophore ca 3.5 mm long; ovary ca 2 mm long, minutely papillate; styles ca 2 mm long, connate up to middle. Fruits not seen.

*Fl. & Fr.* May - Sept.

*Distrib.* India: Temperate and alpine regions, above 3000 m altitude. Very rare. Jammu & Kashmir and Himachal Pradesh.

Endemic.

**37. *Euphorbia cornigera*** Boiss. in DC., Prodr. 15(2): 122. 1862; Dhar & Kachroo, Alpine Fl. Kashmir Himalaya 250. 1983; Radcl.-Sm. in Fl. Pakistan 172: 131. 1986; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 250, f. 42, t. 4. 2010. *E. pilosa* L. var. *cornigera* (Boiss.) Hook.f., Fl. Brit. India 5: 261. 1887. *E. pilosa* auct. non L. 1753; Bamber, Fl. Punjab 317. 1916; Blatt., Beautif. Fl. Kashmir 2: 108. 1928; Kachroo, Forest Fl. Srinagar 151. 1976; N.C. Nair, Fl. Bashahar Himal. 254. 1977.

Sans.: *Carmasahva*, *Tiktala*.

Herbs, erect, perennial, up to 1 m high, glabrous or sparsely pubescent; stems many from a thick rootstock; branches usually many below the pseudoumbels. Leaves alternate, sessile, oblong-lanceolate to oblong-oblancheolate, cuneate, attenuate or obtuse at base, entire to serrate towards apex along margins, acute, obtuse or retuse at apex, 3 - 7 (- 10) x 0.5 - 2 cm, glabrous or sparsely hairy beneath; lateral nerves 10 - 12 pairs, parallel, distinct. Pseudoumbels 5 - 8 (- 15)-rayed; leaves 5 - 8 (- 15), whorled, ovate to lanceolate, cuneate or rounded at base, entire or serrate, acute or subacute, 2 - 6 x 0.6 - 2 cm; rays unbranched, bifid or trifid; leaves ternate or opposite, deltoid, ovate, rhombate or suborbicular, cuneate to truncate at base, 0.5 - 2 x 0.5 - 2 cm, yellowish. Cyathia terminal, solitary, sessile; involucre turbinata, ca 4 x 3 mm, glabrous; lobes 5, broadly triangular, lacinate, hairy along margin; glands 4, transversely oblong or semilunar, ca 1 x 2 mm. Male florets: pedicels ca 3 mm long; anthers subglobose. Female floret: gynophore ca 4 mm long; ovary subglobose, 3-lobed, ca 2 x 3 mm, covered with ca 1 mm long conical papillae; styles ca 3 mm long, connate up to half way, each shortly bifid. Fruits subglobose,

ca 4 x 5 mm, warty with many dry conical processes on surface; seeds subglobose, ca 3 x 2 mm, smooth, pale grey.

#### KEY TO THE VARIETIES

- 1 a. Plants few-branched, usually pilose; leaves entire; fruits sparingly covered with ca 0.5 mm long conical processes **37.1. var. cognata**
- b. Plants much-branched, usually glabrous or subglabrous; leaves serrate or subentire; fruits densely covered with ca 1 mm long cylindrical processes **37.2. var. cornigera**

**37.1. var. cognata** (Klotzsch ex Klotzsch & Garcke) Binojk. & N.P. Balakr. in N.P. Balakr. & Chakrab., *Fam. Euphorb. India* 266. 2007 & *Genus Euphorbia in India* 251, t. 3. 2010. *Tithymalus cognatus* Klotzsch ex Klotzsch & Garcke [Abh. Konigl. Akad. Wiss. Berlin 1859: 66. 1860, nom. subnud.] *Bot. Ergebn. Reise Waldemar* 114 - 115. 1862. *Euphorbia cognata* (Klotzsch ex Klotzsch & Garcke) Boiss. in DC., *Prodr.* 15(2): 120. 1862; Radcl.-Sm. in *Fl. Pakistan* 172: 136. 1986. *E. pilosa* L. var. *cognata* (Klotzsch ex Klotzsch & Garcke) Hook.f., *Fl. Brit. India* 5: 261. 1887.

*Fl. & Fr.* April - Nov.

*Distrib.* India: Grassy hill slopes, cool shady places, at 2000 - 3000 m altitudes. Rare. Jammu & Kashmir, Himachal Pradesh and Uttarakhand.

Afghanistan and Pakistan (Radcliffe-Smith, 1986).

#### **37.2. var. cornigera**

*Fl. & Fr.* May - Nov.

*Distrib.* India: On steep grassy hill slopes, on sand and old avalanche tracks and roadsides, at 2000 - 4000 m altitude. Jammu & Kashmir, Himachal Pradesh and Arunachal Pradesh.

Pakistan.

*Uses.* The crushed seeds and leaves boiled in water and mixed with milk forms an antidote in cases of severe food poisoning (Paliwal & Badoni, *J. Econ. Taxon. Bot.* 14: 49. 1990 as *E. pilosa* L.).

**38. Euphorbia donii** Oudejans in *Phytologia* 67: 45. 1989, nom. nov. pro *E. longifolia* Buch.-Ham. ex D. Don, non Lam. 1788; Sinnott in *Curtis's Bot. Mag.* 21(1): 39. 2004; Binojk. & N.P. Balakr., *Genus Euphorbia in India* 254, f. 43. 2010. *E. longifolia* Buch.-Ham. ex D. Don, *Prodr. Fl. Nepal.* 162. 1825 (non Lam., 1788); Hook.f., *Fl. Brit. India* 5: 261. 1887. *Tithymalus longifolius* (Buch.-Ham. ex D. Don) Hurus. & Yas. Tanaka in *H. Hara, Fl. E. Himal.* 182. 1966, in adnot.

Subshrubs, erect, up to 1 m high, sparsely hairy; rootstock perennial, woody; stems single or clustered; branches many from below the pseudumbels. Leaves alternate, sessile, linear-oblong, elliptic-oblong to elliptic-lanceolate, narrowed towards base, entire, subacute at apex, 5 - 13 x 0.7 - 2.5 cm, glabrous or pubescent beneath; midnerve prominent; lateral nerves indistinct; lowermost leaves scale-like. Pseudumbels 5 (- 7)-rayed; leaves as many as the pseudumbels, whorled, elliptic-ovate to oblong-elliptic, rounded or cuneate at base, entire along margins, acute to subacute and apiculate at apex, 2 - 5 x 0.6 - 2 cm; rays 3 - 10 cm long, each

3- to 5-fid, leaves ternate, ovate or subdeltooid, ca 2 x 1.5 cm, yellowish. Cyathia terminal, solitary; peduncle ca 2 mm long; involucre cupular, ca 3 x 3 mm, glabrous; lobes 5, rounded, dentate along margins; glands 4 or 5, transversely oblong, ca 1.5 x 1 mm. Male florets: pedicels ca 3 mm long; anthers subglobose; bracteoles setaceous, ca 4 mm long. Female floret: gynophore ca 3 mm long; ovary subglobose, ca 3 x 2 mm, papillate, glabrous or sparsely hairy; styles 3 - 4 mm long, connate up to middle, bifid at apex; stigma capitate, papillose. Fruits ovoid, 3 - 4 mm across, granulate, sparsely warty; seeds ovoid, 2 - 2.5 x 1.5 - 2 mm, smooth, grey; caruncle peltate, yellowish.

*Fl. & Fr.* March - Sept.

*Distrib.* India: Grassy slopes and on exposed habitats in forests, at 1500 - 2800 m altitudes. Rare. Himachal Pradesh and Uttarakhand.

Nepal and China.

*Uses.* The juice of plant is useful for fistular sores (Ambasta, The Useful Plants of India 213. 1986).

**39. *Euphorbia dracunculoides*** Lam., *Encycl.* 2: 428. 1788; Roxb., *Fl. Ind.*, ed. Carey 2: 474. 1832; Hook.f., *Fl. Brit. India* 5: 262. 1887; Binojk. & N.P. Balakr., *Genus Euphorbia in India* 213, f. 30. 2010. *E. angustifolia* Buch.-Ham. ex D. Don, *Prodr. Fl. Nepal.* 62. 1825, non (Haw.) Steud., 1821. *Tithymalus dracunculoides* (Lam.) Klotzsch & Garcke, *Abh. Akad. Berlin* 1859: 84. 1860. *E. hamiltonii* Oudejans in *Phytologia* 67: 46. 1989, nom. nov. pro *E. angustifolia* Buch.-Ham. ex D. Don 1825, non (Haw.) Steud. 1812.

Beng.: *Chagul-putput, Puputi*; Hindi: *Jaichi*; Kan.: *Bilee-kaddi*; Punj.: *Dondri, Jaunchi*; Sans.: *Sankini*; Tam. & Tel.: *Tillakada*.

Herbs, annual or perennial, erect, 20 - 70 cm high, glaucous, glabrous; stems many-branched from rootstock; branches terete, weak. Leaves alternate, sessile, linear to linear-lanceolate, tapered at base, entire along margins, acute or obtuse at apex, 2 - 7 x 0.2 - 0.4 cm; midnerve prominent. Pseudoumbels 3 or 4-rayed, with 3 or 4 leaves, usually resembling the stem leaves or a little broader; rays 4 - 7 cm long, 2 - 5 times bifid, leaves opposite, linear-lanceolate, oblique at base, entire along margins, acute at apex, 1 - 2 x 0.3 - 0.4 cm, glabrous. Cyathia terminal, solitary on main stem as well as on pseudoumbels and rays; peduncles 0.5 - 1.5 mm long; involucre campanulate, ca 2 x 1.5 mm, glabrous outside, villous inside; lobes 5, broadly triangular or ovate; glands 4, transversely oblong, semilunate, 2-horned, ca 1.5 x 1 mm. Male florets: pedicels ca 2 mm long; anthers subglobose; bracteoles filiform, laciniate, hairy. Female floret: gynophore ca 3 mm long, glabrous; ovary subovoid, ca 3 mm long, glabrous; styles ca 1 mm long, connate at base, each deeply bifid; stigma capitate. Fruits subglobose, obtuse, roundly trigonous, ca 4 mm long, glabrous; seeds ovoid or ellipsoid, 2 - 2.5 x 1.5 - 2 mm, shallowly tuberculate-rugulose, dark grey between whitish ridges and tubercles; caruncle stipitate, peltate, white, early caducous.

*Fl. & Fr.* May - Jan.

*Distrib.* India: Cultivated fields and wastelands, on sandy soil, up to 500 m altitude. Punjab, Haryana, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Orissa, Chhattisgarh, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

China, Pakistan, Afghanistan, Arabia, Egypt to Africa.

*Uses.* Tribal people of Madhya Pradesh use fruits to cure warts (Mishra & Sahu, J. Econ. Taxon. Bot. 5: 792. 1984).

*Notes.* Pollen grains subprolate, 37 x 31  $\mu\text{m}$  (Khan, J. Palynology 4: 32. 1968); prolate-spheroidal P/E 39/31  $\mu\text{m}$  (Anand et al., J. Econ. Taxon. Bot. 3: 57. 1982).

Chromosome number  $n = 8$  (Choda & Mehra, Curr. Sci. 41: 76. 1972; Mehra & Choda, Cytologia 43: 218. 1978).

**40. *Euphorbia falcata* L.,** Sp. Pl. 456. 1753; Boiss. in DC., Prodr. 15(2): 140. 1862 & in Fl. Orient. 4: 111. 1866; Hook.f., Fl. Brit. India 5: 263. 1887; Binojk. & N.P. Balakr., Genus Euphorbia in India 217, f. 31, t. 28. 2010. *Tithymalus falcatus* (L.) Klotzsch & Garcke ex Garcke, Fl. N. Mitt.-Deutschland, ed. 4, 292. 1858 et in Abh. Akad. Berl. 83. 1860.

Herbs, annual, erect, glabrous or sparsely hairy, up to 25 cm high; stems branched or unbranched, terete; nodes indistinct; axillary rays few below the pseudumbels. Leaves alternate, sessile, linear-oblongate, narrowed and cuneate at base, entire or serrulate, subacute or acuminate, 5 - 12 x 1 - 5 mm. Pseudumbels 2 - 6-rayed; leaves 3 - 5, whorled, resembling the upper stem leaves but broader; rays 2 - 5 times bifid, leaves opposite, sessile, deltoid or rhombate, subentire or serrulate along margins, awned or cuspidate-aristate at apex, 5 - 10 x 4 - 7 mm. Cyathia axillary or terminal, solitary, sessile; involucre turbinate, ca 1 mm across; lobes very small, triangular; glands 4, stalked, rounded or suboblong, ca 0.3 x 0.2 mm; horns minute or indistinct. Male florets: pedicels ca 1 mm long; anthers subglobose; bracteoles setaceous, lacinate, 0.5 - 1 mm long. Female floret: gynophore ca 3 mm long; ovary ovoid, ca 2 x 1 mm, glabrous; styles ca 1 mm long, free, each bifid at apex; stigma capitate. Fruits ovoid-conic, ca 2 x 1.5 mm, smooth, brown; seeds subovoid-quadrangular, compressed, ca 1 x 0.7 mm, pale grey; caruncle terminal, white, early caducous.

*Fl. & Fr.* April - Aug.

*Distrib.* India: Weed on sandy soil, rocky hill slopes and riverbanks, at 1000 - 1500 m altitudes. Rare. Jammu & Kashmir.

Africa, Afghanistan, Arabia, SW. & C. Asia, C & S. Europe and Pakistan.

*Notes.* Chromosome number  $2n = 36$  (Hans in Taxon 22: 595. 1973).

**41. *Euphorbia helioscopia* L.,** Sp. Pl. 459. 1753; Boiss. in DC., Prodr. 15(2): 136. 1862 & Fl. Orient. 4: 1197. 1879; Binojk. & N.P. Balakr., Genus Euphorbia in India 256, f. 44. 2010. *Tithymalus helioscopius* (L.) Hill, Hort. Kew. 172.3. 1768.

Kash.: *Gursotsul*; Hindi: *Hiruseeah*; Punj.: *Chatriwal*.

Herbs, erect, annual, 20 - 30 (- 50) cm high, sparsely hairy; stems many from a narrow rootstock, unbranched, weak. Leaves on main stems alternate, shortly petiolate, spatulate to obovate, sub-attenuate and tapered at base, serrulate along margins, obtuse, rounded or retuse, 1 - 3 x 0.5 - 1.2 cm, early deciduous. Pseudumbels usually 5-rayed, leaves 5, whorled, obovate to spatulate, 1 - 4 x 0.5 - 1.3 cm; rays 2 - 8 cm long, trifid, then 1 or 2 times bifid, leaves usually ternate, whorled or opposite, obliquely obovate or suborbicular, lower ones larger than upper

ones. Cyathia axillary and terminal, solitary; peduncle ca 1 mm long; involucre campanulate, ca 2.5 x 2 mm; lobes 5, broadly oblong, laciniate along apical margin; glands 4, tiny, transversely ovate, green; bracteoles filiform, ca 2 mm long. Male florets: pedicels ca 2 mm long; anthers subglobose; bracteoles filiform. Female floret: gynophore ca 3.5 mm long; ovary subglobose, ca 2 x 1 mm; styles ca 1 mm long, free, bifid at apex; stigma capitate. Fruits subglobose, trigonous, 3 - 5 mm in diam., glabrous; cocci obtuse with deep grooves in between, prominently nerved; seeds obovoid, 2 - 2.5 x 1.5 - 2 mm, strongly reticulate; caruncle flat, transversely oblong, apiculate, pale yellow.

*Fl. & Fr.* April - July.

*Distrib.* India: Weed in cultivated fields, on sandy soil and along banks of canals and rocky slopes of evergreen forests, up to 3000 m altitude. Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Uttarakhand, Uttar Pradesh, Bihar and hills of Tamil Nadu.

Europe, N. Africa, Asia. Introduced into N. America,.

*Uses.* Paste of plants is useful for healing up wounds. The seeds mixed with roasted pepper acts against cholera (Kumar & Naqshi, J. Econ. Taxon. Bot. 14: 70. 1990).

*Notes.* Pollen grains medium, prolate spheroidal, P:E 34:33  $\mu$ m, trizonocolporate, fossaperturate (Daisy Thomas, Unpublished thesis, Pune Univ. 1986).

Chromosome numbers: n = 21 (Gill et al., Cytologia 38: 394. 1977; Sarkar et al. in Taxon 25: 649. 1976; Krishnappa & Reshme, Taxon 29: 537. 1980); 2n = 42 (Perry, Amer. J. Bot. 30: 539. 1943).

**42. *Euphorbia jacquemontii*** Boiss. in DC., Prodr. 15(2): 113. 1862; Hook.f., Fl. Brit. India 5: 259. 1887; Binojk. & N.P.Balacr., Genus Euphorbia in India 260, f. 45, t. 12. 2010. *E. jacquemontii* var. *lasiocarpa* Boiss., l. c. 113. 1862; Hook.f., l. c. 289. 1887. *Tithymalus jacquemontii* (Boiss.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 173. 1972.

Shrubs, 40 - 50 cm high, glabrous or pubescent, usually unbranched. Leaves on main stems alternate, subsessile, oblong-lanceolate, narrowed to base, entire, acute at apex, 3 - 8 x 1.5 - 2.5 cm; midrib prominent, lateral nerves distinct; petioles ca 2 mm long. Pseudoumbels 3 - 5-rayed, leaves 3 - 5, whorled, sessile, elliptic-lanceolate, acute, 2 - 4 x 1 - 1.5 cm, pale yellow; rays 1 - 2 cm long, pubescent, leaves ternate, ovate or subdeltoid, ca 1.5 x 1 cm, yellow. Cyathia terminal, solitary; peduncles 1 - 2 mm long; involucre turbinate, ca 5 x 4 mm, pubescent; lobes 5, broadly oblong; glands 4, rounded, ca 2 x 1 mm, subentire along outer margin. Male florets: pedicels ca 1.5 mm long; anthers subglobose; bracteoles ca 2 mm long, filiform, hairy. Female floret: gynophore ca 2 mm long; ovary ca 3 x 3 mm, granulate, pubescent; styles ca 1.5 mm long, connate up to middle, each bifid at apex; stigma capitate. Fruits subglobose, ca 5 x 4 mm, minutely granulate or sparsely warty.

*Fl. & Fr.* June - Oct.

*Distrib.* India: Open areas in brown soil, above 3000 m altitude. Rare. Jammu & Kashmir.

Endemic.

**43. *Euphorbia kanaorica*** Boiss. in DC., Prodr. 15(2): 154. 1862; Hook.f., Fl. Brit. Ind. 5: 264.

1887; Binojk. & N.P.Balacr., Genus Euphorbia in India 220, f. 32. 2010. *Tithymalus kanaoricus* (Boiss.) Prokh., Consp. Syst. Tithymalus As. Med. 144. 1933, in obs.

Herbs, perennial, decumbent or ascending, up to 15 cm high, entirely glabrous; stems many, from long slender wiry rootstock, somewhat fleshy; axillary rays not developed. Leaves on main stems alternate, shortly petiolate or subsessile, obovate to obovate-spathulate, attenuate at base, entire or wavy-margined, obtuse, rounded or emarginate at apex, 2 - 11 x 1 - 6 mm; nerves obscure; petioles 1 - 2 mm long. Pseudoumbels 3 or 4-rayed, leaves 3 or 4, whorled, similar to upper stem leaves in size and shape but broader; rays 2 - 3 cm long, 3 or 4 times bifid, leaves opposite, sessile, suborbicular, ovate or deltoid, 2 - 10 x 1 - 5 mm, yellow. Cyathia solitary, axillary or terminal; involucre turbinate, ca 1.5 x 1 mm; glands semilunar, ca 1 mm long, truncate on outer edges, yellowish green; horns 2, slender, equal to glands. Male florets: pedicels ca 1 mm long; anthers subglobose. Female floret: gynophore ca 1.5 mm long, ovary subglobose, ca 2.5 x 2 mm; styles ca 1 mm long, united at base, each shortly bifid. Fruits subglobose, rounded-trilobate, 3 - 3.5 x 2 - 3 mm, smooth or slightly granulate towards keels; seeds ovoid, hexagonal, ca 2 x 1.5 mm, punctate, pale grey; caruncle conical-depressed.

*Fl. & Fr.* July - Aug.

*Distrib.* India: On stony and gravelly slopes along open areas, at ca 2500 m alt. Rare. Jammu & Kashmir and Himachal Pradesh.

Afghanistan and Pakistan.

**44. Euphorbia khasyana** Boiss. in DC., Prodr. 15(2): 120. 1862; Hook.f., Fl. Brit. India 5: 262. 1887; Kanjilal et al., Fl. Assam 4: 141. 1940; Binojk. & N.P.Balacr., Genus Euphorbia in India 262, f. 46. 2010. *Tithymalus khasyanus* (Boiss.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 173. 1972.

Kh.: *Soh-kyrmoit-blang*.

Herbs, erect, up to 60 cm high, sparsely hairy; stems from a thick rootstock, terete, with 3 - 5 branches or axillary rays below the pseudoumbels. Leaves on main stems alternate, elliptic to elliptic-lanceolate, cuneate or acute at base, entire, acute, 1.5 - 4.5 x 0.5 - 1 cm, glabrous or sparsely pubescent; midnerve prominent; lateral nerves obscure; petioles ca 1 mm long. Pseudoumbels 5-rayed, leaves 5, whorled, similar to upper stem leaves, elliptic-lanceolate, 1.5 - 4 x 0.5 - 1 cm; rays 3-fid, each bifid, leaves 3, broadly ovate or sub-rhombate, acute. Cyathia terminal on primary and secondary rays, sessile; involucre turbinate, ca 3 x 2 mm; lobes 5, suborbicular, shortly laciniate; glands 4, transversely oblong, ca 1.5 x 1 mm. Male florets: pedicels ca 3 mm long; anthers subglobose; bracteoles laciniate, hairy, ca 2 mm long. Female floret: gynophore ca 2 mm long; ovary subglobose, 2 - 3 mm in diam., obtusely keeled, covered with conical papillate processes; styles 2 - 3.5 mm long, connate at base. Fruits ovoid, subglobose, trigonous, obtusely keeled, ca 4 x 3.5 mm, sparsely warted, grey; seeds subglobose, ovoid, ca 2.5 x 2 mm, smooth; caruncle subglobose, small.

*Fl. & Fr.* June - Aug.

*Distrib.* India: Moist deciduous pine forests, above 2000 m altitude. Rare. Meghalaya and Nagaland.

Bhutan and Bangladesh.

*Uses.* The tribes of Khasi hills apply latex for toothache.

**45. *Euphorbia lathyris* L.**, Sp. Pl. 457. 1753; Boiss. in DC., Prodr. 15(2): 99. 1862; Binojk. & N.P.Balacr. in J. Econ. Taxon. Bot. 17: 449, f. 1. 1993 & Genus *Euphorbia* in India 244, f. 40, t. 32. 2010. *Tithymalus lathyris* (L.) Hill. Hort. Kew ed. 1. 173.3. 1768.

Herbs, annual or biennial, erect, glabrous, up to 1.5 m high; stems branched, terete; branches or axillary rays usually arising above the middle. Leaves opposite, decussate, sessile or subsessile, linear-lanceolate, truncate or subcordate at base, entire, acute, subacute or mucronate at apex, 3 - 9 x 0.5 - 2 cm, dark green and shiny above; mid-nerve prominent. Pseudoumbels absent or 2 - 4-rayed, leaves 2 - 4, opposite or whorled, ovate-lanceolate, 3 - 7 x 0.4 - 1.2 cm, glabrous, palmately 5 - 7-nerved; rays 4 - 5 cm long, 2 or 3 times dichotomously branched, leaves opposite, triangular-ovate, 1.5 - 2.5 x 1 - 1.5 cm; cyathophylls 2, ovate-triangular, clasping at base. Cyathia axillary and terminal, solitary, shortly pedunculate; involucre turbinate, ca 3 mm across, pale greenish yellow; lobes 5, oblong; glands reniform, 2-horned; horns spatulate, divergent, greenish yellow tinged purple. Male florets: pedicels ca 2 mm long; anthers subglobose; bracteoles ca 3 mm long, hairy. Female floret: gynophore 2 - 3 mm long; ovary projecting above male florets, subglobose, ca 2 x 1.5 mm, smooth; styles ca 3 mm long, connate at base, free above, each bifid; stigma capitate. Fruits nodding, globose, 0.8 - 1.2 x 1 - 1.6 cm, smooth, wrinkled when dry, indehiscent with spongy mesocarp; seeds ovoid, netted-rugose, pale grey to dark brown; caruncle subapical, pale yellow.

*Fl. & Fr.* April - Aug.

*Distrib.* India: Weed in cultivated fields and wastelands, preferring moist areas; sometimes cultivated as an oil-yielding plant. Introduced into Jammu & Kashmir (Srinagar) and West Bengal (Darjeeling).

N. & E. America, NW. & NE. Africa, Atlantic Islands, Europe, Caucasus, China and Japan.

*Uses.* The plant is cultivated in China, Japan, Russia, etc. for its oil-yielding seeds. The milky latex contains high percentage of hydrocarbons and hence called as the fuel-supplying plant (Calvin, Bot. J. Linn. Soc. 94: 100. 1987).

*Notes.* Chromosome number: 2n = 20 (Perry, Amer. J. Bot. 30: 534. 1943).

**46. *Euphorbia luteoviridis* D.G.Long** in Notes Roy. Bot. Gard. Edinburgh 44: 163. 1986 (as '*luteo-viridis*') & in Grierson & D.G. Long, Fl. Bhutan 1(3): 764. 1987; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 265, f. 47, t. 15. 2010. *E. himalayensis* auct. non Klotzsch ex Boiss. 1862: Hook.f., Fl. Brit. India 5: 258. 1887, p. p.

Herbs, biennial or perennial, up to 40 cm high; stems many from thick rootstock, branching above the middle; young branches crispate pubescent. Leaves on main stems alternate, sessile or shortly petiolate, ovate-elliptic, oblique or subcordate at base, entire, acute at apex, 1.5 - 4.5 x 1 - 2.5 cm, yellowish green, glabrous. Pseudoumbels 3 - 5-rayed, leaves as many as pseudoumbels, oblong-ovate, subacute, 1 - 2 x 0.5 - 1 cm; rays 1 - 3 cm long, crispate-pubescent; ray leaves 3, whorled, broadly ovate, 7 - 15 x 8 - 12 mm, yellow. Cyathia terminal and solitary on rays; involucre campanulate, ca 3 x 3 mm; lobes 5, ca 1 mm across, greenish yellow, sometimes tinged red, hirsute outside; lobes 5, orbicular, ca 1 mm across; glands 5, transversely oblong, ca 1.5 x 1 mm. Male florets: pedicels ca 1 mm long; anthers subglobose; bracteoles filiform, ca 2 mm

long. Female floret: gynophore ca 2.5 mm long; ovary subglobose, ca 2.5 mm across, glabrous, smooth; styles 2 - 2.5 mm long, connate up to middle; stigma recurved, minutely bilobed. Fruits ovoid, obtusely trilobed, 3 - 5 x 2 - 6 mm, smooth; seeds oblong-ovoid, 3 - 3.5 x 2 - 2.5 mm, smooth; caruncle minute.

*Fl. & Fr.* May - Aug.

*Distrib.* India: In *Rhododendron* forests, along hill slopes, between 2000 to 4000 m altitudes. Himachal Pradesh, Sikkim and W. Bengal (Darjeeling).

Nepal, Bhutan and Tibet.

**47. *Euphorbia maddenii*** Boiss. in DC., Prodr. 15(2): 141. 1862; Hook.f., Fl. Brit. India 5: 263. 1887; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 222, f. 33, t. 33. 2010. *Tithymalus maddenii* (Boiss.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 173. 1972.

Herbs, erect, up to 30 cm high, glabrous; branches terete. Leaves on main stems alternate, subsessile, obovate-spathulate to oblanceolate, acute-attenuate at base, entire, obtuse, rounded or retuse at apex, 1 - 4 x 0.5 - 1 cm, palminerved, glabrous or sparsely pubescent. Pseudoumbels 3 (rarely 5)-rayed, leaves (1 -) 3 (- 5), usually similar to upper stem leaves, 1.5 - 5 x 0.7 - 1.2 cm; rays 2 - 4 times dichotomous, leaves opposite, very varied, obliquely obovate to triangular-ovate, 0.5 - 1 x 0.4 - 0.7 cm. Cyathia solitary, axillary, shortly pedunculate; involucre turbinate, 2 - 2.5 x 1 - 1.5 mm; lobes 5, broadly triangular; glands 4, semilunar, crescent-shaped, ca 0.5 x 1 mm, 2-horned; horns slender, as long as the gland, yellow or straw-coloured. Male florets: few; pedicels ca 1 mm long; anthers subglobose; bracteoles filiform, ca 1.5 mm long. Female floret: gynophore ca 3 mm long; ovary subglobose, ca 2 x 1 mm, smooth; styles ca 0.7 mm long, connate at base; stigma bifid. Fruits trilobed, obtusely keeled, ca 3 x 2.5 mm, smooth, pale green; seeds ovoid, obtusely hexagonal, 2 - 2.5 x 1.5 - 2 mm, pale grey; caruncle hemispheric, white.

*Fl. & Fr.* May - Sept.

*Distrib.* India: In muddy areas, fields and in dry hill slopes and forest paths, up to 3000 m altitude. Jammu & Kashmir, Himachal Pradesh, Uttarakhand and Uttar Pradesh.

Pakistan.

*Notes:* Chromosome number  $n = 8$  (Choda & Mehra, Curr. Sci. 41: 76. 1972; Mehra & Choda, Cytologia 43: 229. 1978).

**48. *Euphorbia micractina*** Boiss. in DC., Prodr. 15(2): 127. 1862; Hook.f., Fl. Brit. India 5: 261. 1887; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 267, f. 48. 2010. *Tithymalus micractinus* (Boiss.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 174. 1972.

Herbs, erect or ascending, up to 20 cm high, puberulous; stems few to many from a tuberous rootstock; branches 2 or 3, slender. Leaves sessile, alternate on main stems, oblong to elliptic-oblong, cuneate or rounded at base, entire to denticulate towards apex along margins, obtuse or subacute at apex, 1 - 2 x 0.5 - 0.6 cm; midrib prominent, grooved above, puberulous beneath. Pseudoumbels 3 - 5-rayed, leaves 3 - 5, whorled, elliptic to oblong-elliptic, 1 - 2 x 0.4 - 0.7 cm; rays 1 - 1.5 cm long, unbranched or rarely 3-fid, leaves supporting cyathia opposite or ternate, sessile, broadly ovate to rhombate. Cyathia subsessile, solitary; involucre cupular, turbinate, ca 2.5 x 2 mm; lobes triangular; glands 4, semilunar, rounded at outer edges, ca 1 x 0.5



mm, yellow-brown. Male florets: pedicels ca 2 mm long; anthers subglobose. Female floret: gynophore 1.5 - 2 mm long; ovary subglobose, covered with conical warts or papillae; styles ca 1 mm long, connate up to middle, each shortly bifid. Fruits subglobose, ca 3 x 3.5 mm, yellowish green, densely covered with reddish warts on back; seeds ovoid, ca 2 x 1.5 mm, greyish brown, white striate; caruncle peltate, stipitate, greenish.

*Fl. & Fr.* June - Aug.

*Distrib.* India: Grassy slopes, above 3000 m altitude. Rare. Jammu & Kashmir.

Pakistan, Russia, China and Korea.

**49. *Euphorbia osyridea*** Boiss., *Diagn. Pl. Orient.* 7: 87. 1846 & in DC., *Prodr.* 15(2): 107. 1862; Radcl.-Sm. in *Fl. Pakistan* 172: 126. 1986; Binojk. & N.P.Balacr., *Genus Euphorbia in India* 225, f. 34. 2010. *Tithymalus osyrideus* (Boiss.) Sojak in *Cas. Nar. Mus., Odd. Prir.* 140: 175. 1972.

Herbs or small shrubs, erect or decumbent, glabrous or tomentellous, glaucous; stems many, arising from a thick woody rootstock, wiry. Leaves alternate, subsessile, linear-lanceolate, tapered at base, entire, acute or subacute at apex, 1 - 5.5 x 0.1 - 0.5 cm. Pseudumbel leaves whorled, sessile, elliptic-oblongate, 1 - 3 x 0.5 - 0.8 cm; rays 5, leaves opposite, sessile, ovate-deltoid to ovate-rhombate, truncate or rounded at base 7 - 8 mm across. Cyathia solitary, terminating the main and lateral shoots and in the forks of the pseudumbel-dichotomies; glands trapeziform, truncate and pectinate-lacerate or crescent-shaped and shortly or broadly 2-horned, yellowish green or orange. Male florets: pedicels ca 1.5 mm long; anthers subglobose; bracteoles wedge-shaped, minutely dentate at apex. Female floret: gynophore ca 1.5 mm long; ovary subglobose, 3 - 4 x 2.5 - 3 mm; styles ca 2.5 mm long, connate at base, each bilobed. Fruits rounded-trigonous, 4 - 4.5 x 4.5 - 5 mm, smooth, glabrous or tomentellous; seeds obovoid-cylindric, ca 3 x 2 mm, pale grey; caruncle petasiform.

*Fl. & Fr.* March - July.

*Distrib.* India: Rocky hills, limestone gorges in gravelly and sandy beds of streams, on sandy clay soil, at 1000 - 2200 m altitudes. Jammu & Kashmir.

Afghanistan, Iran and Pakistan.

**50. *Euphorbia pamirica*** (Prokh.) Prokh. in V.L. Kumarov., *Fl. URSS* 14: 438. 1949; Radcl.-Sm. in *Fl. Pakistan* 172: 162. 1986; Binojk. & N.P.Balacr., *Genus Euphorbia in India* 227. 2010. *Tithymalus pamiricus* Prokh., *Consp. Syst. Tithymalus As. Med.* 198. 1933.

Herbs, erect, 17 - 60 cm high, glabrous, bluish-glaucous; rootstock cylindrical; stems few, erect, terete, with sterile branches at lower portion and fertile axillary rays above. Leaves linear-elliptic or rarely linear-subulate, rounded or subcordate at base, entire, acuminate at apex, 1.5 - 5 x 0.2 - 0.4 cm; midnerve prominent. Pseudumbels 8 - 11-rayed, leaves elliptic or linear-oblong, 1 - 15 x 2 - 5 mm; rays once dichotomous, leaves triangular or orbicular-reniform, 5 - 8 x 6 - 11 mm. Cyathia terminal, solitary; involucre campanulate, 3 - 4 x 3 - 4 mm, glabrous; lobes orbicular, fimbriate; glands crescent-shaped, bicornute; horns spatulate, obtuse; styles 1 - 1.5 mm long, connate up to middle, hardly bifid. Fruits ovoid, truncate, ca 3 mm long, trisulcate, smooth, shiny; seeds ovoid, ca 2.5 mm long, whitish, brown-spotted; caruncle disciform, shortly stalked.

*Fl. & Fr.* May - July.

*Distrib.* India: Stony slopes in subalpine belt, at 2900 - 3700 m altitude. Rare. Jammu & Kashmir (based on literature only).

Central Asia and Pakistan.

**51. *Euphorbia peltata*** Roxb. [Hort. Bengal. 36, 1814, nom nud.] Fl. Ind., ed. Carey 2: 474. 1832; Boiss. in DC., Prodr. 15(2): 137. 1862; Hook.f., Fl. Brit. India 5: 262. 1887; Binojk. & N.P. Balakr., Genus Euphorbia in India 269, f. 49. 2010. *Tithymalus peltatus* (Roxb.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 175. 1972.

Herbs, annual, erect, up to 50 cm high, glabrous; stems branched from below. Leaves alternate, sessile, obovate to oblanceolate or subspathulate, cuneate at base, serrate along margins, subobtusate or acute at apex, 5 - 15 x 3 - 6 mm; upper leaves larger. Pseudumbels 5-rayed, leaves similar or a little larger than the upper stem leaves; rays dividing into 3 or 4 branches, leaves 3 or 4, whorled, ovate to oblong-ovate, 3 - 6 x 2 - 3 mm. Cyathia terminal, solitary; involucre campanulate; lobes 5, triangular-ovate, ciliate; glands 4, peltate, reniform, ca 1.2 x 1 mm, purple. Male florets: few; pedicels 2 - 3 mm long; anthers subglobose. Female floret: gynophore ca 3 mm long; ovary globose; styles free, bifid at apex; stigma capitate. Fruits globose, smooth, purple.

*Fl. & Fr.* Feb. - March.

*Distrib.* India: Coromandel Coast. Rare. Andhra Pradesh and Tamil Nadu.

Endemic.

*Note.* The species is based on the illustration of Roxburgh (Icon. no. 1248 in K & CAL), made from a plant grown in Calcutta Botanic Garden, the seeds of which originated from Coromandel Coast. Nobody has recollected this since then.

**52. *Euphorbia peplus*** L., Sp. Pl. 456. 1753; Boiss. in DC., Prodr. 15(2): 141. 1862; Hook.f., Fl. Brit. India 5: 226. 1887, in adnot; C.R. Babu, Herb. Fl. Dehra Dun 460. 1977; Binojk. & N.P. Balakr., Genus Euphorbia in India 228, f. 35, t. 35. 2010. *Tithymalus peplus* (L.) Hill, Hort. Kew, ed. 1. 172.3. 1768.

Herbs, erect or ascending, glabrous, somewhat fleshy, up to 35 cm high; stems solitary or 2 - 4 from base, many-branched towards top. Leaves on stems alternate, petiolate, elliptic-obovate to suborbicular, cuneate or attenuate at base, entire, obtuse or rounded at apex, 1 - 2 x 0.5 - 1.3 cm, glabrous, membranous, obscurely penninerved; petioles 0.1 - 1.5 cm long. Pseudumbels 3- or rarely 5-rayed, leaves as many as the pseudumbels, similar in size and shape to upper stem leaves, petioles ca 5 mm long; rays 3 or 4, many times dichotomous, leaves opposite, sessile or shortly petiolate, obliquely ovate or ovate-deltoid, 0.5 - 1 x 0.3 - 0.7 cm. Cyathia solitary, axillary; peduncles ca 1 mm long; involucre cupular, turbinate, 1 - 2 mm across, glabrous; lobes 5, oblong, lacinate along margin; glands 4, semilunar, truncate on the outer edge, greenish yellow; horns 2, subulate, pale yellow. Male florets: pedicels ca 1 mm long; anthers subglobose; bracteoles filiform, ca 1.5 mm long. Female floret: gynophore ca 2 mm long; ovary subglobose, ca 1 mm long; styles free, shortly bifid; stigma capitate. Fruits subglobose, oblong-trigonous, keeled, with 2 parallel longitudinal dorsal wings per lobe, ca 2 mm long, pale

green; seeds cylindrical, sub-hexagonal, ca 1.5 x 1 mm, with longitudinal grooves and pits, pale grey on ridges and dark grey in pits and 2 or 3 grooves on lateral and 3 or 4 pits on dorsal facets; caruncle obliquely conical, peltate, white.

*Fl. & Fr.* March - May.

*Distrib.* India: Weed in open wastelands and *Quercus-Cedrus* forests in moist places with clayey sands, at 1500 -2500 m altitudes. Jammu & Kashmir, Uttarakhand, Nagaland and Meghalaya.

N. Africa, SW. & C. Asia, Europe and Macronesia.

*Uses.* Dried plants are powerful purgative (Lindley, Medical & Economic Botany. 1984, revised).

*Notes.* Pollen grains are spheroidal, P = 26, 5  $\mu$ m E. = 28.5  $\mu$ m. P: E = 0, 93; PA. 1. = 0.25 (Punt, Wentia 7: 100. 1962).

Chromosome number reported is  $2n = 16$  (Perry, Amer. J. Bot. 30: 533. 1943).

**53. *Euphorbia perbracteata*** Gage in Bull. Misc. Inform. Kew 1914: 238. 1914; Haines, Bot. Bihar Orissa 1: 155. 1925; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 230, f. 36, f. 36. 2010. *Tithymalus perbracteatus* (Gage) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 175. 1972. *Euphorbia laeta* auct. non B. Heyne ex Roth, 1821: Sedgw. in J. Bombay Nat. Hist. Soc. 26: 599. 1919.

Mar.: *Litilli, Litali*; Tel.: *Vathani*.

Herbs, erect up to 50 cm high, nearly glabrous; rootstock woody, terete, tortuous; stems branched; branches many, terete. Leaves on stems alternate, sessile, linear-lanceolate or linear-oblong, cuneate at base, entire, acute at apex, 2 - 6 x 0.2 - 0.5 cm; midnerve prominent; lateral nerves obscure. Pseudoumbels 2 - 4-rayed, leaves broader than stem leaves, cuneate at base, 3 - 3.5 x 0.5 - 1 cm; rays 5 - 10 cm long, 2 - 4 times dichotomous, leaves opposite, connate at base, broadly orbicular or deltoid, 1 - 2 x 1 - 1.5 cm. Cyathia solitary, terminal; peduncle ca 1 mm long; involucre turbinate, ca 3 x 2 mm, pubescent outside; lobes 5, broadly triangular; glands 4, semi-lunate, not horned, ca 1.2 x 2 mm, wavy at outer edge, brown. Male florets: pedicels ca 2 mm long, glabrous; anthers subglobose; bracteoles setaceous, ca 3 mm long, hairy. Female floret: gynophore ca 4 mm long, glabrous; ovary subglobose, trigonous, ca 3 x 2 mm; styles ca 1 mm long, free; stigma bifid, capitate. Fruits ovoid-oblong, 3 - 5 x 3 - 4 mm, glabrous; seeds ovoid, 2 - 3 x 1.5 - 2 mm, smooth, pale yellow, mottled brown; caruncle small, subhyaline.

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

*Distrib.* India: Weeds of wastelands in moist areas. Bihar, Madhya Pradesh, Chhattisgarh, Andhra Pradesh, Maharashtra, Daman, Goa and Karnataka.

Endemic.

*Uses.* Whole plant is powdered and mixed with water in ponds as fish poison by the tribe Kolams of Adilabad District of Andhra Pradesh.

**54. *Euphorbia prolifera*** Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 62. 1825; Hook. f., Fl. Brit. India 5: 264. 1887; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 233, f. 37, t. 37. 2010. *E. nepalensis* Boiss. in DC., Prodr. 15(2): 157. 1862, nom. superfl. *Tithymalus proliferus* (Buch.-Ham. ex D. Don) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 175. 1972.

Herbs or subshrubs, erect, up to 50 cm high, nearly glabrous; stems many from a thick woody rootstock, terete, branched; branches proliferating below the pseudoumbels. Leaves on stems alternate, subsessile, compactly arranged, oblong, linear-oblong or oblanceolate, obtuse or rounded at base, entire, acute to obtuse at apex, 2 - 3 x 0.1 - 1.1 cm, coriaceous, palmately trinerved at base; lateral nerves indistinct. Pseudoumbels 2 - 5-rayed, leaves 2 - 5, opposite or whorled, ovate, oblong-ovate to ovate-lanceolate, 1 - 2 x 0.2 - 1.5 cm; rays unbranched or 1 - 3 times dichotomous, 1 - 5 cm long, leaves opposite, sessile, ovate to oblong-ovate, ca 1 x 0.8 cm. Cyathia terminal, solitary on main stem as well as in the pseudoumbel; involucre cupular, sessile or shortly pedunculate, 5 - 9 x 3 - 5 mm; lobes 5, broadly triangular; glands 4, transversely ovate, ca 1 x 2 mm; horns 2, short. Male florets: pedicels ca 1 mm long; bracteoles broad, laciniately lobed at apex, covering the male florets. Female floret: gynophore ca 3.5 mm long; ovary subglobose, 1.5 - 2 x 1 - 1.5 mm, velvety; styles ca 1.5 mm long, connate at base, broader and spreading towards the tip; stigma bifid, papillose. Fruits on ca 8 mm long pedicels, ovoid, rounded-lobate, ca 4 x 6 mm, smooth; seeds ovoid, 2.5 - 3.5 x 1.5 - 2 mm, punctate-rugulose, pale grey; caruncle minute, pale yellow.

*Fl. & Fr.* March - Aug.

*Distrib.* India: Along borders of cultivated fields and in open grasslands forests clearings, red soils, often in pine forests, up to 1500 m altitude. Himachal Pradesh, Uttarakhand, Punjab, Uttar Pradesh, Bihar, Chhattisgarh, Madhya Pradesh and Maharashtra.

Pakistan, Nepal, Myanmar, China, Indo-china and Thailand.

*Uses.* The tribal people Tharus of Uttar Pradesh make a paste of the tender leaves and swallow for abortion and antifertility..

*Notes.* Pollen grains subprolate, P/E 44 x 35 µm (Khan, J. Palynology 4: 32. 1988).

Chromosome number: n = 14 (Gill et al., Cytologia 38: 394. 1973).

**55. *Euphorbia rothiana*** Spreng., Syst. Veg. 3: 796. 1826, nom. nov. pro *E. laeta*, auct. non Aiton, 1789; Boiss. in DC., Prodr. 15(2): 156. 1862; Hook. f., Fl. Brit. India 5: 263. 1887; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 237, f. 38. 2010. *E. laeta* B. Heyne ex Roth, Nov. Pl. Sp. 230. 1821, non Aiton 1789. *E. oreophila* Miq., Annal. Bot. Ind. 3: 17. 1852; Sedgw. in J. Bombay Nat. Hist. Soc. 26: 599. 1919. *Tithymalus rothianus* (Spreng.) Klotzsch & Garcke in Abh. Konigl. Akad. Wiss. Berlin 1859: 89. 1860. *Euphorbia oreophila* var. *pubescens* Boiss. l. c. 156. 1862. *E. oreophila* var. *wightiana* Boiss., l. c. 156. 1862. *E. rothiana* var. *pubescens* (Boiss.) Gamble, Fl. Madras 2(7): 1278. 1925 (repr. ed. 2: 894. 1957).

Hindi: *Chagul-putpputi*; Mal.: *Nilapala*; Mar.: *Dudhill*.

Herbs, perennial, erect, up to 1.5 m high; stems woody, terete; branches many, glabrous or sparsely hairy towards the upper portion. Leaves alternate below, crowded and whorled below pseudoumbels, linear, elliptic-lanceolate or oblong-elliptic, narrowed at base, entire, acute to subacute at apex, 3 - 8 x 0.5 - 1.5 cm, glabrous, softly puberulous; lateral nerves obscure;

petioles 2 - 6 mm long. Pseudoumbels 3 - 6-rayed, leaves whorled, elliptic, cuneate at base, 3 - 7 x 0.5 - 1.6 cm; rays 2 - 10 cm long, once or twice dichotomous, leaves opposite, ovate or deltoid, 1 - 2 x 1 - 2 cm. Cyathia terminal or axillary, solitary; peduncles ca 2 mm long, glabrous; involucre sub-campanulate, glabrous outside, villous inside, ca 3 x 2 mm; lobes 5, subquadrate, toothed; glands 4, semi-lunate, 2-horned, ca 1 x 0.5 mm wide; horns ca 1.5 mm long. Male florets: pedicels ca 2 mm long, ciliate; anthers subglobose; bracteoles filiform, ciliate, ca 1.5 mm long; peripheral bracteoles laciniate, hairy, adnate to the involucre cup, ca 2 mm long. Female floret: gynophore ca 5 mm long, glabrous; ovary ca 3 mm long, glabrous; styles 1 - 2 mm long, deeply bifid; stigma capitate. Fruits subglobose, with rounded cocci, ca 5 mm long, smooth; seeds oblong-ovoid, ca 3 x 2 mm, white to bluish black.

*Fl. & Fr.* Mostly throughout the year, peak in July - Oct.

*Distrib.* India: Open sunny grasslands and evergreen forests, 1000 - 2500 m altitude. Madhya Pradesh, Gujarat, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Uses.* Seeds used by tribes of Madhya Pradesh to remove warts (Mishra & Sahu, J. Econ. Taxon. Bot. 5: 792. 1984).

*Notes.* Chromosome number:  $n = 18$  (Perry, Amer. J. Botany 30: 534. 1943).

**56. *Euphorbia sharmae*** U.C.Bhattach. in Bull. Bot. Soc. Bengal 21: 33. 1967 Binojk. & N.P.Balacr., Genus *Euphorbia* in India 271, f. 50. 2010. *E. stracheyi* Boiss. ssp. *sharmae* (U.C.Bhattach.) D.Maity & N.P.Balacr. in J. Econ. Taxon. Bot. 30: 188. 2006.

Herbs, erect, ascending or decumbent, up to 8 cm high; stems from a thick rootstock, branched from middle, pubescent. Leaves on main stem sessile, scaly, ovate, ovate-lanceolate to elliptic-oblong, cuneate at base, obtuse at apex, 5 - 7 x 2 - 3 mm; leaves on branches alternate, ovate to ovate-elliptic, truncate at base, entire, obtuse or subacute at apex, 5 - 6 x 3 - 4 mm; nerves obscure; petioles 1 - 2 mm long. Pseudoumbels 5 or more rayed, leaves as many as the rays, similar in shape and size to the upper stem or branch leaves; rays dichotomous, leaves 2, opposite, deltoid to reniform, 5 - 7 x 3 - 5 mm. Cyathia terminal, solitary; involucre turbinate, ca 2.5 x 2 mm; lobes 5, broadly oblong, ca 1 mm across, wavy along apical margin, sparsely hairy; glands 5, transversely oblong, ca 0.5 x 1 mm, rounded along outer margins. Male florets: pedicels ca 1 mm long; anthers subglobose. Female floret: gynophore ca 1.5 mm long; ovary subglobose, ca 1 mm across; styles free, recurved; stigma capitate. Fruits subglobose, 4 - 5 mm in diam., 3-lobed, minutely granulate; seeds oblong, ca 2 x 1.5 mm, faintly keeled, brown with grey-white bloom; caruncle truncate at apex.

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

*Distrib.* India: Hill slopes and wastelands, above 4000 m altitude. Uttarakhand and Sikkim.

Endemic.

**57. *Euphorbia sikkimensis*** Boiss. in DC., Prodr. 15(2): 113. 1862; Hook.f., Fl. Brit. India 5: 259. 1887; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 273, f. 51, t. 38. 2010. *Tithymalus sikkimensis* (Boiss.) Hurus. & Yas. Tanaka in H.Hara, Fl. E. Himal. 1: 184. 1966.

Subshrubs, erect, 50 - 70 cm (rarely up to 1 m) high, glabrous; stems from a woody rootstock, single or clustered, many-branched. Leaves alternate, linear-lanceolate to oblong-lanceolate, tapering to base, entire, acute to subacute at apex, 3 - 6 x 0.8 - 1.5 cm, thinly coriaceous, with obscure nerves; petioles slender, up to 3 cm long. Pseudoumbels 5-rayed, leaves whorled, as many as the rays, elliptic or elliptic-ovate, 4 - 5 x 1.5 - 2 cm; rays 3 - 8 cm long, 2 or 3 times dichotomous or trichotomous, leaves ternate, ovate to elliptic-ovate, 1 - 1.5 x 0.7 - 1 cm. Cyathia terminal, solitary, campanulate, turbinate, ca 4 x 3 mm, glabrous outside, villous inside; lobes oblong-obovate, ca 2 x 1 mm; glands 4, peltate, transversely oblong, ca 1.5 x 2 mm. Male florets: pedicels ca 1.5 mm long; anthers subglobose; bracteoles subulate, broadened and lacinate at apex, ca 1.5 cm long, hirsute. Female floret: gynophore 4 - 5 mm long, glabrous; ovary globose, ca 2 mm across, glabrous; styles slender, ca 2 mm long, united up to middle, each bifid at apex; stigma capitate. Fruits subglobose to ovoid, 3.5 - 5 x 3 - 4 mm, smooth; seeds ovoid, 2 - 2.5 mm in diam. grey or dark brown, white-striate; caruncle, peltate, small, pale yellow.

*Fl. & Fr.* June - Sept.

*Distrib.* India: Temperate regions in mixed scrubs, at 2000 - 4000 m altitudes. Rare. Sikkim and West Bengal.

Nepal, Bhutan, Myanmar and China.

**58. *Euphorbia stracheyi*** Boiss. in DC., Prodr. 15(2): 114. 1862; Hook.f., Fl. Brit. India 5: 259. 1887, p. p.; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 276, f. 52, t. 39. 2010. *E. stracheyi* var. *radiata* Hook.f., l. c. 260. 1887. *Tithymalus stracheyi* (Boiss.) Hurus. & Yas. Tanaka in H.Hara, Fl. E. Himal. 1: 184. 1966.

Herbs, erect or decumbent, up to 25 cm high, glabrous or villous towards the apex; stems from a thick rootstock; branches many, mainly towards the base, slender, straggling, 2 - 12 cm long. Leaves alternate, sessile, obovate-oblong, cuneate-attenuate at base, entire, obtuse to subacute at apex, 5 - 15 x 3 - 8 mm, glabrous; lateral nerves inconspicuous. Pseudoumbels 3 - 5-rayed, leaves 3 - 5, whorled, same as the stem leaves; rays 1 - 3 cm long, white hirsute, leaves 4, broadly obovate or subdeltooid, 4 - 6 x 4 - 5 mm, pale yellow. Cyathia terminal, solitary, sessile; involucre turbinate, ca 5 x 3 mm; lobes 5, broadly oblong, ca 3 x 2 mm; glands 5, stalked, transversely oblong, ca 1 x 3 mm. Male florets: many; pedicels ca 3 mm long; anthers subglobose; bracteoles setaceous, ca 2 mm long. Female floret: gynophore ca 3 mm long; ovary subglobose, ca 3 mm across; styles ca 2 mm long, connate up to middle; stigma capitate, bifid. Fruits subglobose, ca 4 mm in diam., pubescent or minutely granulate; seeds oblongoid, ca 2.5 x 1.5 mm, mottled with brown-black; caruncle peltate, sessile, white.

*Fl. & Fr.* May - July.

*Distrib.* India: Alpine grassy slopes, at 3500 - 5000 m altitudes. Himachal Pradesh, Uttarakhand and Sikkim.

Nepal, Tibet and China.

*Note.* Highly variable depending on nature of soil and exposure.

**59. *Euphorbia thomsoniana*** Boiss. in DC., Prodr. 15(2): 113. 1862; Hook.f., Fl. Brit. India 5: 260. 1887; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 279, f. 53, t. 40. 2010. *Tithymalus thomsonianus* (Boiss.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 177. 1972.

Kash.: *Hirtiz*; Sans.: *Haimvati*, *Suvarnaksiri*.

Herbs, perennial, erect or decumbent-ascending, 10 - 25 cm high, usually glabrous; stems many from a thick woody rootstock, unbranched or rarely branched. Leaves on stems alternate, sessile, elliptic to ovate-elliptic, rounded to obtuse at base, entire, acute or subacute at apex, 2 - 3 x 1 - 1.5 cm, chartaceous; nerves indistinct. Pseudombels 3 - 5 (rarely 6)-rayed, leaves 3 - 5, whorled, ovate to ovate-elliptic, 1 - 2 x 1 - 1.5 cm, glabrous; rays 1 - 5 cm long, unbranched or dichotomous, occasionally not developing or aborted into a solitary cyathium, leaves opposite, sessile, ovate or suborbicular, 1 - 2 x 0.7 - 1 cm. Cyathia solitary, terminal; peduncle absent or ca 1 mm long; involucre turbinate, ca 3 x 2.5 mm; lobes oblong-triangular; glands 4, stalked, reniform, ca 3 x 1 mm, green turning to pale brick red. Male florets: pedicels ca 3 mm long; anther-thecae divaricate, reniform. Female floret: gynophore ca 2 mm long; ovary oblong-ovoid, ca 4 x 2.5 mm, granulate when young, smooth or sub-granulate when old; styles 3 - 4 mm long, connate up to middle, shortly bifid; stigma capitate. Fruits ovoid to subglobose, trilobed, ca 8 x 7 mm, smooth, greyish brown, puberulous; seeds ovoid, 2.5 - 4 mm long, pale grey with brown reticulum; caruncle obconical.

*Fl. & Fr.* May - Sept.

*Distrib.* India: Subalpine regions, open stony slopes along river valleys, among bushes and wastelands at 2000 - 4200 m altitudes. Rare. Jammu & Kashmir.

Pakistan, Afghanistan, Central Asia and China.

*Uses.* The natives of Kurram use crushed rootstocks as detergents for washing hair, and when boiled as purgative (Caius, J. Bombay Nat. Hist. Soc. 40: 268. 1938).

**60. *Euphorbia thyrsoides*** Boiss. in DC., Prodr. 15(2): 164. 1862; Hook.f., Fl. Brit. India 5: 265. 1887; Binojk. & N.P.Balakr., Genus *Euphorbia* in India 241, f. 39. 2010. *Tithymalus thyrsoides* (Boiss.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 177. 1972.

Herbs, perennial, erect, up to 50 cm high, glabrous; stems many from a thick woody rootstock, sulcate-striate; branches many, closely arranged below the pseudombels giving a thyriform appearance. Leaves sessile, alternate, rhombate-oblong, lanceolate or rounded, cuneate or attenuate at base, entire to denticulate along margins, acute to subacute at apex, 2 - 9 x 0.7 - 1.5 cm, glabrous, membranous, distinctly nerved beneath. Pseudombels 5 - 8 (- 11)-rayed, leaves 5 - 8, whorled, ovate to ovate-lanceolate, 1 - 2 x 0.5 - 1 cm; rays once bifid, leaves opposite, ovate-deltoid, 0.7 - 1.2 x 0.7 - 1.3 cm. Cyathia terminal, solitary, shortly pedunculate; involucre cupular, turbinate, hemispherical, ca 3 mm across, glabrous; lobes 5, broadly oblong, truncate, retuse or toothed at apex, glabrous; glands 4, semilunar, rounded, 2-horned, ca 2 x 1 mm, red or purple; horns ca 1 mm long, arising from corners of the gland, curved. Male florets: pedicels ca 2 mm long; anthers subglobose; bracteoles filiform, ca 4 mm long. Female floret: gynophore ca 4 mm long; ovary subglobose, ca 1.5 x 1 mm, glabrous; styles ca 2 mm long, connate at base, each deeply bifid; stigma capitate. Fruits and seeds not seen.

*Fl.* May - Aug.

*Distrib.* India: Along sunny meadows, at 2500 - 2750 m altitudes. Rare. Jammu & Kashmir.

Endemic.

**61. *Euphorbia tibetica*** Boiss. in DC., Prodr. 15(2): 114. 1862; Hook.f., Fl. Brit. India 5: 260. 1887; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 281, f. 54, t. 42. 2010. *Tithymalus tibeticus* (Boiss.) Prokh., Consp. Syst. Tithymalus As. Med. 59. 1933, in obs., nom. invalid; validated in Komarov, F. USSR 14: 385. 1949.

Johar (Kashmir): *Dud-bug*.

Herbs, perennial, procumbent or decumbent, somewhat fleshy, up to 20 cm high, glabrous; stems many from a long narrow woody rootstock; branches many, proliferating. Leaves on main stems alternate, subsessile, elliptic-oblong to linear-oblong, narrowed to base, entire or serrate towards apex, obtuse or acute at apex, 2 - 15 x 1 - 3 mm, indistinctly nerved; petioles ca 1 mm long. Pseudumbels 2 or 3-rayed, leaves 2 or 3-whorled, larger than stem leaves, obliquely oblong or ovate-lanceolate, serrate, 5 - 20 x 2 - 5 mm; rays dichotomous, proliferating, leaves opposite, smaller than pseudumbel leaves. Cyathia axillary, solitary; peduncles ca 2 mm long; involucre saucer-shaped, ca 3 x 2 mm; lobes 5, triangular, acute; glands 4, transversely oblong, rounded on the outer edge, ca 1 mm across. Male florets: pedicels ca 2 mm long; anthers subglobose; bracteoles setaceous, ca 2 mm long. Female floret: gynophore ca 1 cm long, protruding out of involucre when mature; ovary ellipsoid, ca 2 mm long, glabrous; styles ca 1 mm long, free from base. Fruits ovoid, tetragonous, ca 5 x 3 mm, smooth; pedicels protruding up to 1 cm out of involucre, curved; seeds oblong-ovoid, ca 2.5 x 1.5 mm, grey brown to black brown; caruncle trigonous-conical, yellow.

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

*Distrib.* India: Stony slopes and exposed rocky areas, in dry places in alpine deserts, at 2500 - 5500 m altitude. Jammu & Kashmir, Himachal Pradesh and Uttarakhand.

W. China, W. Tibet, Pakistan and Central Asia.

*Uses.* A nutritious herb for cattle. The milky latex is useful in nausea (Rawat & Pangtey, J. Econ. Taxon. Bot. 11: 142. 1987).

**62. *Euphorbia wallichii*** Hook.f., Fl. Brit. India 5: 258. 1887; Blatt. Beautiful Fl. Kashmir 2: 107. 1928; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 284, f. 55. 2010. *Tithymalus wallichii* (Hook.f.) Sojak in Cas. Nar. Mus., Odd. Prir. 140: 177. 1972.

Herbs, erect, 40 - 70 cm high; stems 6 - 10 from a stout woody rootstock; branches or axillary rays few, puberulous. Leaves sessile or subsessile, elliptic-lanceolate, ovate-lanceolate or elliptic-oblong, attenuate at base, entire, acute, subacute or obtuse at apex, 5 - 8 x 1.5 - 4 cm, bright green above, pale beneath, white puberulous on midrib, purple-tinged along margins; scale leaves present towards the base of the stem. Pseudumbels 4 - 6-rayed, leaves 4 - 6, whorled, elliptic to ovate-elliptic, 4 - 7 x 2 - 2.5 cm; rays 1 - 3 cm long, once or twice trichotomous or dichotomous, pubescent, leaves in whorls of 2 or 3, ovate to ovate-lanceolate, 1 - 3.5 x 1 - 2 cm, glabrous above, yellow above, white hirsute below. Cyathia terminal, solitary, sessile in axillary rays, pedunculate on main stem; involucre cupular, 6 - 8 x 8 - 10 mm; lobes 5, rounded, obtuse, ca 2.5 x 2 mm; glands 4, transversely ovate, ca 2 x 4 mm, pale orange. Male florets many, exerted; pedicels 4 - 6 mm long; anthers subglobose; bracteoles filiform, ca 4 mm long. Female floret: gynophore ca 8 mm long; ovary ca 4 mm long, smooth, hirsute; styles 2 - 3 mm long,



connate up to middle; stigma bifid. Fruits subglobose, ovoid, trigonous, 5 - 7 x 7 - 8 mm, smooth, glabrescent; seeds ovoid, 4 - 5 x 3 - 4 mm, pale grey; caruncle disc-like.

*Fl. & Fr.* May - Sept.

*Distrib.* India: Alpine dry rocky slopes, open areas or amongst scrubs and in open forests, at 2200 - 4100 m altitudes. Jammu & Kashmir, Himachal Pradesh, Uttarakhand and Sikkim.

Afghanistan, Pakistan, Nepal and Tibet.

*Uses.* A decoction of the leaves is useful against constipation (Paliwal & Badoni, J. Econ. Taxon. Bot. 14: 432. 1990).

*Notes.* Pollen grains spheroidal, 39  $\mu$ m (Khan, J. Palynology. 4: 32. 1968).

Chromosome number:  $n = 10$  (Choda & Mehra, Curr. Sci. 41: 76. 1972; Mehra & Choda, Cytologia 43: 219. 1978).

### Subgenus 6. **Euphorbia**

Herbs, shrubs or trees, succulent, cactiform; stems well developed above the ground; branches terete or winged; wings 2 - 10; podarium projected or not, spine-shield usually present; spines 2, divaricating, equal or rarely unequal. Leaves tiny to large, fleshy, usually early caducous. Cyathia solitary, in diads or triads on the margins of the wings, forks and tips of the branches, pseudoumbellate or not; primary peduncles solitary or in fascicles; bracts small or large, bright or pale in colour; glands 4 - 10, rounded or transversely oblong; limbs of glands absent. Male florets: many in each fascicle; bracteoles lacinate, hairy; anthers yellow or pinkish. Female floret: gynophore usually protruding from the involucre cup; ovary ovoid, smooth; styles free or connate, bifid. Fruits ovoid to globose; cocci obtusely or acutely keeled, smooth; seeds globose or ovoid, smooth or tuberculate.

Mainly in Old World, with most species in Africa, a few species introduced into New World, ca 1000 species; 17 species in India.

**63. *Euphorbia antiquorum*** L., Sp. Pl. 450. 1753, p. p.; Burm.f., Fl. Indica 110. 1768; Hook.f., Fl. Brit. India 5: 255. 1887; Binojk. & N.P. Balakr., Genus Euphorbia in India 294, f. 57. 2010. *E. antiquorum* var. *polygona* Wight, Icon. Pl. Ind. Orient. 2: t. 897. 1843. *E. mayuranathanii* Croizat in Hooker's Icon. Pl. 35 t. 3404. 1940; Binojk. & N.P. Balakr. in The Euphorbia Journal 10: 27-28. 1996.

Beng.: *Bajvaran*; Guj.: *Tridharisend*; Hindi: *Sayord*, *Tridhara-sehnd*; Kan.: *Mulajemudu*; Mal.: *Chathura-kalli*; Mar.: *Narsej*; Sans.: *Vajra-kantaka*; Tam.: *Sadura-kalli*; Tel.: *Bonthakalli*.

Shrubs or trees, up to 10 m tall; stems woody, terete; branches jointed, 3-winged, spreading; wings broad, wavy-margined; podaria in rows, 1.5 - 2 cm apart, slightly lobulate; spines 2, divaricate, stout, ca 5 mm long, blackish. Leaves sessile or subsessile, broadly ovate or suborbicular, obtuse at base, entire, apiculate at apex, 4 - 12 x 3 - 6 mm, fleshy, glabrous, early caducous; petioles ca 1 mm long. Cyathia in simple axillary dichasial cymes, central one sessile,

lateral two pedunculate; primary peduncle 1 - 1.5 cm long, stout; secondary peduncles 0.5 - 1 cm long; bracts broadly triangular, obtuse, ca 3 x 2.5 mm; involucre turbinate, 6 - 10 x 4 - 8 mm, pinkish outside; lobes 5, ca 2 mm in diam., lacinate; glands 5, transversely oblong, fleshy, spongily pitted, ca 2 x 5 mm, yellow. Male florets: in 5 fascicles of 5 or 6 flowers in each; pedicels ca 1 mm long; anthers subglobose; bracteoles broadly setaceous, deeply lacinate, ca 2.5 mm long, overtopping anthers. Female floret: gynophore ca 2 mm long; ovary ca 4 mm in diam.; styles connate up to middle, deeply lobed; stigma papillose. Fruits trilobed, 7 - 9 mm in diam. obtusely keeled, separating into 3 bivalved 1-seeded cocci, yellowish orange; seeds globose, ca 3 mm in diam., greyish brown.

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

*Distrib.* India: Dry hot areas, thorny scrubs, rocky areas, also in evergreen forests, up to 1000 m altitude. Often cultivated as hedge plant. Widespread throughout India, mainly in Peninsular India.

Pakistan, Bangladesh, Myanmar, China, Thailand, Sri Lanka, Indonesia (Java) and Malaysia.

*Uses.* A plaster prepared from the roots and mixed with asafoetida is applied externally on the stomach of children suffering from worms. The bark of the root is purgative and used externally in rheumatism. The milky latex finds use in nervine diseases, dropsy, palsy, deafness and amaurosis (Caius, J. Bombay Nat. Hist. Soc. 40: 282. 1938). The tribes of Madhya Pradesh use the latex for killing maggots in wounds, and apply on the skin for warts and other cutaneous infections (Mishra & Sahu, J. Econ. Taxon. Bot. 5: 792. 1984).

*Notes.* Pollen grains medium, spheroidal, P/E: 40 / 40  $\mu\text{m}$ , trizonocolporate (Daisy Thomas, Unpublished thesis, Pune Univ. 1986).

Chromosome number:  $n = 30$  (Choda & Mehra, Curr. Sci. 41: 76. 1972; Mehra & Choda, Cytologia 43: 218. 1978; Krishnappa & Reshme, Taxon 29: 537. 1980).

**64. *Euphorbia caducifolia*** Haines in Indian Forester 40: 154. 1914 & Bot. Bihar Orissa 1: 143. 1925; C.E.C.Fisch. in Bull. Misc. Inform. Kew 1925: 341. 1925, descr. emend.; Binojk. & N.P.Balacr., Genus Euphorbia in India 298, f. 58, t. 2. 2010.

Hindi: *Thor*; Kan.: *Balagalli*; Tel.: *Kattai-jemadu*.

Shrubs, dendroid, fleshy, up to 1.5 m tall; main stem almost absent above the ground; branches suberect from the ground, terete, 3 - 5 cm in diam., pale green with silvery white coating; podaria spirally arranged, distant; spines 2, divaricate, often with 2 small ones above, rigid, curved at tip, 5 - 8 mm long, reddish when young, blackish when old. Leaves located singly just above the spines, variable, ovate, ovate-elliptic to orbicular, cuneate at base, undulate along margins, acute at apex, 2 - 8 x 1 - 5 cm, fleshy with prominent midnerve and indistinct lateral nerves, early deciduous. Cyathia in small fascicles, each solitary or in triads, reddish pink; peduncles 0.5 - 1 cm long, fleshy, brown; bracts opposite, broadly triangular; involucre turbinate, 3 - 4 x 2 - 3 mm; lobes 5, broadly cuneate, fimbriate at apex; glands 5, transversely oblong. Male florets: in 5 fascicles of 6 or 7 flowers each; pedicels ca 1 mm long; anthers subglobose; bracteoles ca 1.5 mm long, broad, lacinate at apex, covering florets. Female floret: gynophore ca 1.3 mm long; perianth lobes 3, minute, triangular; ovary trigonous, minutely papillose; styles connate up to middle; stigma minutely bilobed, papillose. Fruits trilobed, with laterally compressed

and sharply keeled cocci, 7 - 9 mm in diam., smooth, glabrous, reddish; seeds ovoid to spherical, brownish.

*Fl. & Fr.* Jan. - April.

*Distrib.* India: Dry rocky areas, up to 500 m altitude. Rajasthan, Gujarat, Madhya Pradesh, Bihar, Orissa, Chhattisgarh, Andhra Pradesh and Maharashtra.

Pakistan.

*Uses.* The milky latex is a cure for cough and applied to blistered skin and wounds. The latex is useful as a cure injuries and fractures. Latex is also useful as a cure to cough (Shekhawat & Anand, J. Econ. Taxon. Bot. 5: 597. 1984). A few leaves taken with betel leaf and arecanut are considered to be a cure for malaria (Mayuranathan, J. Bombay Nat. Hist. Soc. 41: 185. 1939). The leaves are eaten, and sometimes being sold in the market as vegetables (Bhandari, Fl. Indian Desert 339. 1978).

*Notes.* Pollen grains 3-zonicolporate, prolate spheroidal P/E: 38 - 45/32 - 38  $\mu$ m (Anand, et al., J. Econ. Taxon. Bot. 3: 57. 1982).

**65. *Euphorbia cattimandoo*** Elliot ex Wight, Icon. Pl. Ind. Orient. 6: t. 1993. 1853; Elliot, Fl. Andhra 1: 89. 1859; Gamble, Fl. Madras 2(7): 1277. 1925 (repr. ed. 2: 894. 1957); Binojk. & N.P. Balakr., Genus Euphorbia in India 302, f. 59. 2010. *E. trigona* auct. non Mill. 1768, nec Haw. 1812: sensu Hook.f., Fl. Brit. India 5: 256. 1887, p. p.

Tel.: *Cattimandoo*.

Trees, up to 3 m tall; main stem terete; branches many, crowded at apex, 5-winged; podarium projecting, ca 5 mm long; spines 2, divaricate, 3 - 5 mm long. Leaves elliptic-obovate, attenuate at base, entire, acute to acuminate at apex, 3 - 4 x 0.7 - 1.2 cm; petioles ca 0.5 cm long. Cyathia solitary, in diads or in triads, not in fascicles; primary peduncles 1 - 3 above the podarium, ca 8 mm long; lateral peduncles ca 5 mm long; involucre cupular, ca 4 x 5 mm; bracts opposite, below the involucre, oblong, fimbriate along apical margin; lobes sheathing, lacinate, ca 2 x 1 mm; glands 5, transversely oblong, ca 3 x 1.5 mm. Male florets: in small fascicles or dispersed; pedicels ca 1.5 cm long; anthers subglobose; bracteoles lacinate, ca 1.5 cm long. Female floret: gynophore ca 1 cm long, protruding from the involucre cup; ovary subglobose, ca 4 mm across, glabrous; styles 3, connate at base, free above, each deeply bifid; stigma papillose. Fruits subglobose, ca 7 mm across; cocci acutely keeled; seeds ovoid, ca 4 x 3 mm, blackish brown.

*Fl. & Fr.* March - May.

*Distrib.* India: Deciduous open forests and scrub jungles, up to 500 m altitude. Not common. Andhra Pradesh.

Endemic.

*Uses.* Some tribes of Andhra Pradesh use boiled latex as gum to fix knives onto wooden handles. They also apply the latex externally for rheumatism.

**66. *Euphorbia lacei*** Craib in Bull. Misc. Inform. Kew 1911: 456. 1911 & Contr. Fl. Siam. Dicot.: 182. 1912; Esser & Chayamarit in Harvard Papers in Bot. 6(1): 262. 2001; Binojk. &

N.P.Balakr., Genus Euphorbia in India 304, f. 60, t. 13. 2010. *E. trigona* Roxb. [Hort. Bengal. 36. 1814, nom. nud.] Fl. Ind., ed. Carey, 2: 468. 1832, non Mill. 1768. *E. barnhartii* Croizat, Euphorb. Antiq. Offic. 25, 54. 1934; Santapau in Bull. Bot. Soc. Bengal 8: 8. 1954. *E. trigona* auct. non Mill., 1768; Boiss. in DC., Prodr. 15(2): 82. 1862, p. p.; Hook.f., Fl. Brit. India 5: 256. 1887, p. p.

Hindi: *Tridhara*; Tel.: *Aavijamuku*, *Kattimandu*.

Shrubs, up to 3.5 m tall; stems terete; branches 3-winged, flexible, deeply repand along margins; podaria projected, tuberculate, ca 1.5 x 2 cm, reddish maroon; spines 2, divaricate, 2 - 3 mm long, straight, reddish to black. Leaves alternate, sessile or up to 6 mm petioled, arising from the sides of the wings, subobovate or obovate-oblong, attenuate at base, entire, obtuse or subacute and mucronate at apex, 2 - 5 x 2 - 3 cm, fleshy. Cyathia solitary or in triads, in the sinuses of wings; middle one sessile, lateral ones with ca 1 mm long peduncles; involucre turbinate, up to 8 mm long, ca 15 mm wide; lobes cuneiform, fimbriate at apex; glands 5, transversely oblong, 1.5 - 2 x 2 - 4 mm. Male florets: in 5 fascicles; pedicels ca 1.5 mm long; anthers subglobose; bracteoles lacinate, ca 1.5 mm long. Female floret: gynophore ca 0.5 mm long; ovary subovoid; styles free from middle, stigma shortly bifid. Fruits ovoid, trigonous, sharply keeled, 4 - 6 x 10 - 15 mm, glabrous; cocci compressed; seeds 3.5 x 2.5 mm, light brown to white.

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

*Distrib.* India: Cultivated in gardens and often occurring naturally in dry rocky areas, up to 300 m altitude. Uttar Pradesh, Bihar, West Bengal, Nagaland, Meghalaya, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Native of the Moluccas, often seen naturalised in S. & SE. Asia.

*Uses.* The fresh latex is an irritant both when taken internally and applied externally. Taken in very small quantities, it is a drastic purgative (Caius, J. Bombay Nat. Hist. 40: 290. 1938).

The juice from heated leaves is useful for earache (Mishra & Sahu, J. Econ. Taxon. Bot. 5: 743. 1984). The tribal people Chenchus of Andhra Pradesh apply latex on skin for headaches, muscle pain, wounds and ulcers.

*Notes.* Chromosome number:  $2n = 40$  (Perry, Amer. J. Bot. 30: 539. 1943).

**67. Euphorbia lactea** Haw., Syn. Pl. Succ. 127. 1812; Roxb., Fl. Ind., ed. Carey 2: 468. 1832; Boiss. in DC., Prodr. 15(2): 82. 1862; D.C.Saini & S.K.Singh in J. Econ. Taxon. Bot. 14: 97. 1990; Binojk. & N.P.Balakr., Genus Euphorbia in India 307, f. 61, t. 14. 2010.

Succulent spiny shrubs or small trees, up to 10 m tall; stems woody, up to 20 cm in diam. at base, older parts terete; branches many, crowded at apex, erect, bushy; young branches 3 (or 4) winged, ascending; wings ca 1 cm thick, wavy-margined, white-marbled or whitish-greyish at the space between the wings; podaria ca 1 cm long, slightly projected, 1 - 1.5 cm apart; sinuses between podaria ca 5 mm deep and ca 15 mm wide; spines paired, ca 3 mm long, brownish black, persistent. Leaves rarely present, alternate, sessile, scale-like, ovate to orbicular, rounded to cuneate at base, entire, obtuse at apex, 3 - 5 by 2 - 3 mm, obscurely nerved, fleshy, caducous. Flowers and fruits not seen.

*Fl. & Fr.* Period unknown.

*Distrib.* India: Usually cultivated in gardens as a fence, sometimes seen as an escape, up to 500 m altitude. Uttar Pradesh, West Bengal, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Widely cultivated in tropical Africa and Asia, origin unknown.

*Uses.* The stems, after removing the spines, pasted and placed on the forehead to cure headache (Saini & Singh, l.c.).

**68. Euphorbia neriifolia** L., Sp. Pl. 451. 1753, p. p.; Burm.f., Fl. Indica 111. 1768; Hook.f., Fl. Brit. India 5: 255. 1887; Binojk. & N.P.Balacr., Genus Euphorbia in India 310, f. 62, tt. 16 & 17. 2010. *E. ligularia* Roxb. [Hort. Bengal. 36. 1814, nom. nud.] ex Buch.-Ham. in Trans. Linn. Soc. London 14: 285. 1825, nom. illeg.; Roxb., Fl. Ind., ed. Carey 2: 465. 1832; T.Cooke, Fl. Bombay 2(3): 569. 1906.

Asm.: *Hiju*; Beng.: *Mansa, Siji*; Guj.: *Thor*; Hindi: *Munsasej, Sehund, Thuar*; Mal.: *Kalli*; Mar.: *Mingut*; Punj.: *Gangichu*; Tam.: *Kalli*; Tel.: *Akujemudu*.

Shrubs or small trees, erect, fleshy, up to 5 m tall, glabrous; branches crowded, jointed, cylindrical or obscurely 5-angled, twisted; podaria slightly confluent in 5 irregular rows, projected up to 8 mm length, 2–3 cm apart; spines 1 or 2, divaricate, 4–5 mm long, sharp, black, persistent. Leaves alternate, sessile or subsessile, crowded at ends of branches, oblong-obovate, oblanceolate or subspathulate, cuneate at base, entire, rounded, obtuse or acute at apex, 6–25 x 2–4 cm, fleshy, shiny dark green above, pale beneath, deciduous; petioles 1–5 mm long. Cyathia solitary, in diads or triads, the central one male, sessile, lateral ones bisexual, pedunculate; peduncles ca 5 mm long; involucre cup subtended by 2 ovate ca 2.5 x 2 mm bracts; lobes 5, suborbicular; glands 5, transversely oblong, ca 2 x 4 mm. Male florets: in 4 or 5 fascicles of 3 or 4 flowers each; pedicels ca 1 mm long; anthers oblong; bracteoles wedge-shaped, fimbriate at apex, ca 1 mm long, covering the male florets when young. Female floret: gynophore ca 3 mm long; ovary obscurely 4 or 5 angled; styles connate up to middle; stigma papillose. Fruits deeply trilobed, 5–8 mm in diam., smooth, glabrous; seeds globose, ca 3 mm in diam., smooth; caruncle small, white.

*Fl. & Fr.* Dec. - June.

*Distrib.* India: Dry tropical thorny scrubs and rocky hill slopes, at 200–1500 m altitudes. Common. Punjab, Haryana, Uttar Pradesh, West Bengal, Tripura, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Goa & Daman, Karnataka, Kerala and Tamil Nadu.

W. Tropical Asia, S. & SE. Asia, Myanmar to W. Indonesia.

*Uses.* The milky latex is purgative, rubefacient, expectorant, and useful as cathartic and deobstruent in visceral obstructions and dropsical affections, consequent on long continued fever. The juice is useful in earache. The milky latex and the root enjoy an almost universal repute as remedy in snakebite (Caius, J. Bombay Nat. Hist. Soc. 40: 287. 1939).

Tribal people of Madhya Pradesh also use plant latex to remove warts and cutaneous eruptions (Mishra & Sahu, J. Econ. Taxon. Bot. 4: 792. 1984).

*Notes.* Pollen grains medium, prolate, spheroidal, P/E: 40/38  $\mu\text{m}$ , trizonocolporate, fossaperturate (Daisy Thomas, Unpublished thesis, Pune Univ. 1986); prolate, P/E: 50-54/36-40  $\mu\text{m}$  (Anand et al., J. Econ. Taxon. Bot. 3: 57. 1982).

Chromosome numbers:  $2n = 90$  (Choda & Mehra, Curr. Sci. 41: 76. 1972;  $2n = 60$  (Datta, Taxon 16: 345. 1967);  $2n = 80$  (Gill et al., Taxon 19: 608. 1970).

**69. *Euphorbia nivulia*** Buch.-Ham. in Trans. Linn. Soc. London 14: 286. 1825; Hook.f., Fl. Brit. India 5: 255. 1887; Binojk. & N.P. Balakr., Genus Euphorbia in India 315, f. 63, t. 18. 2010. *E. neriifolia* auct. non L., 1753: Roxb., Fl. Ind., ed. Carey 2: 467. 1832; Duthie, Fl. Gangetic Plain 3: 76. 1903.

Beng.: *Siji*; Guj.: *Thorkantalo*; Hindi: *Sehund, Thor, Sij, Senhur*; Kan.: *Yelli-kalli*; Mal.: *Ela-kalli, Kalli-pala*; Mar.: *Kaudenivdung, Newrang, Nivdung*; Tam.: *Ila-kalli, Manchevi, Naga-kalli, Nanangalli*; Tel.: *Akukalli, Jambada*.

Shrubs or small trees, up to 10 m tall; main stem woody; branches whorled, subterete; podaria spirally arranged, conical, projecting, brown or black; spines 2, divaricate, 1 – 1.5 cm long, straight, hard, sharp. Leaves alternate, subsessile, crowded at ends of branches, oblong-obovate, oblanceolate to subspathulate, cuneate at base, entire, obtuse-mucronate at apex, 7 - 15 x 2 - 8 cm, fleshy, glabrous, deciduous; midnerve stout and prominent beneath, lateral nerves indistinct; petioles up to 2 cm long. Cyathia in axils of fallen leaves, solitary, in diads or triads, the primary and secondary peduncles ca 2.5 cm long, yellow; involucre cup-shaped, ca 6 x 5 mm; bracts 2, broadly ovate, ca 3 x 2 mm; lobes 5, broadly orbicular, lacinate along margins; glands 5, broadly oblong, ca 4 x 3 mm, yellow. Male florets: in 5 fascicles of 6 or 7 flowers each; pedicels ca 3 mm long; anthers subglobose; bracteoles fimbriate, ca 1.5 mm long. Female floret: gynophore ca 1 mm long; ovary subglobose; styles connate up to middle, each minutely bifid at tip; stigma papillose. Fruits globose, trigonous, ca 5 mm in diam., glabrous; cocci compressed, keeled; seeds ovoid or sub-quadrangular, ca 4 x 3 mm, smooth.

*Fl. & Fr.* Dec. - March.

*Distrib.* India: Dry rocky areas in wild and cultivated as fence, up to 1000 m altitude. Punjab, Haryana, Delhi, Rajasthan, Gujarat, Madhya Pradesh, Uttar Pradesh, Bihar, West Bengal, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Pakistan, Bangladesh, Myanmar and Sri Lanka.

*Uses.* The juice of the leaves is useful as purgative and diuretic. It is mixed with Neem oil, and applied externally in rheumatism. The warm juice is a good cure for earache. Caius (J. Bombay Nat. Hist. Soc. 40: 287. 1938) reports that the pulp of the stem mixed with green ginger is given to people bitten by mad dogs. Stem bark is powdered and mixed with goat milk and jaggery, and the paste plastered over bone fractures. Latex applied on ulcerous wounds by some tribes of Andhra Pradesh. Root powder and milky latex administered orally for snakebite; the latex is useful for mumps.

*Notes.* Pollen grains medium, prolate, spheroidal, P: E 44:40  $\mu\text{m}$ , 3-zonocolporate, peritreme (Daisy Thomas, Unpublished thesis, Pune Univ. 1986).

Chromosome number:  $2n = 60$  (Choda & Mehra, Curr. Sci. 41: 76. 1972; Mehra & Choda, Cytologia 43: 218. 1978).

**70. *Euphorbia royleana*** Boiss. in DC., Prodr. 15(2): 83. 1862; Hook.f., Fl. Brit. India 5: 247. 1887; Binojk. & N.P.Balakr., Genus *Euphorbia* in India 319, f. 64. 2010. *E. pentagona* Royle, Ill. Bot. Himal. Mts. 329, t. 82, f. 1. 1836, non Haw., 1812.

Hindi: *Chulu, Sihund, Thor*; Punj.: *Thar, Sali*; Sans.: *Nisrinsapatra*.

Shrubs, erect, 2 - 6 m tall; main stems up to 0.5 m in diam., terete; branches crowded at apex, 5 (6 or 7)-winged, intervening spaces between the wings flat; margins of wings wavy; podaria at the crest of undulations of wings, slightly projected; spines 2, divaricate, pointing downwards, 2 - 4 mm long. Leaves sessile, obovate or oblanceolate, sub-cuneate at base, entire, acute to subacute at apex, 4 - 9 x 2 - 4 cm, glabrous, fleshy, early deciduous; lateral nerves ca 9 pairs, obscure. Cyathia solitary, 2 or 3 together arising from internodal sinuses; peduncle ca 5 mm long; bracts ovate, acuminate; involucre turbinate, 3 - 4 x 4 - 5 mm; lobes 4, broad, rounded, fimbriate; glands 5, transversely oblong, ca 3 x 1.5 mm, yellowish. Male florets: pedicels ca 1 mm long; anthers subglobose; bracteoles lacinate, ca 2 mm long. Female floret: gynophore ca 1 mm long; ovary subovoid; styles free from middle, stigma shortly bifurcate. Fruits subglobose, ca 6 mm in diam., 3-lobed, lobes compressed, greenish grey; seeds globose, ca 3 mm in diam., striate, brown to black, ecarunculate.

*Fl. & Fr.* Feb. - May.

*Distrib.* India: Dry rocky slopes, up to 500 m altitude. Himachal Pradesh, Uttarakhand, Punjab, Rajasthan, Uttar Pradesh, Assam, Arunachal Pradesh, Meghalaya, Nagaland and Tripura.

Pakistan, Bhutan, Myanmar and China.

*Uses.* The milky latex has cathartic and anthelmintic properties (Caius, J. Bombay Nat. Hist. Soc. 40: 288. 1938). Plant used as fish poison (Chopra, et al., Gloss. Indian Med. Pl. 114. 1956). Latex is applied to cuts and burns, and is also used to stop bleeding caused by injuries (Jain, J. Econ. Taxon. Bot. 5: 809. 1984). However, the latex is injurious to eyes and may cause dermatitis in some people.

*Notes.* Chromosome number:  $n = 60$  (Choda & Mehra, Curr. Sci. 41: 76. 1972; Mehra & Choda, Cytologia 43: 218. 1978; Gill et al., New Botanist 8: 38. 1981).

**71. *Euphorbia santapau*** A.N.Henry in Bull. Bot. Surv. India 6: 329. 1964 (1965); Anonymous in *Euphorbia J.* 5: colour photo on page 145. 1988; Binojk. & N.P.Balakr., Genus *Euphorbia* in India 323, f. 65, t. 21. 2010.

Mal. & Tam.: *Kalli*.

Shrubs or small trees, succulent, glabrous, up to 5 m tall; stems woody, terete; branches numerous, curved upwards, articulated, 5 - 10-winged; wings thin, lobulate; podarium on each lobe of wings, slightly projecting, blackish brown; spines 2, divaricate, 2 - 7 mm long, brown. Leaves sessile or subsessile, ovate or suborbicular, cuneate at base, entire, obtuse or apiculate at apex, 3 - 4 x 2 - 3 mm, fleshy, early deciduous. Cyathia solitary, near the apices of branches, greenish yellow; peduncles 2 - 4 mm long, stout, pink; bracts 2, opposite, below the involucre, triangular, pink; involucre turbinate, 4 - 9 mm across; lobes 5 - 8, ca 2 mm diam.; glands 5 - 8, transversely oblong, fleshy, spongy-pitted above. Male florets: in 5 - 8 fascicles; pedicels ca 2 mm long; anthers subglobose; bracteoles obcuneate, fimbriate at apex, covering the male florets.

Female floret: gynophore ca 5 mm long, pinkish; ovary trigonous, glabrous, pink; styles connate up to middle; stigma 2-lobed, papillose. Fruits ovoid, 7 - 8 mm in diam., separating into 3 bivalved cocci, pale pink; seeds ovoid, ca 3 mm in diam., smooth, brown; caruncle yellowish brown.

*Fl. & Fr.* Dec. - March.

*Distrib.* India: Tropical wet evergreen forests, along crests of hillocks, among big rocks, between 1500 to 2000 m altitudes. Kerala and Tamil Nadu.

Endemic.

*Uses.* Kani tribes of southern Western Ghats apply the milky latex on skin diseases including scabies.

**72. *Euphorbia susan-holmesiae*** Binojk. & R.Gopalan in Cact. Succ. J. (Los Angeles) 65: 277, f. 1. 1993; Binojk. in Cact. Succ. J. (Los Angeles) 66: 169 - 170, f. 2. 1994; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 325, f. 66, t. 22. 2010.

Tam.: *Kalli*.

Shrubs or small trees, up to 3 m high; main stem terete; branches crowded at apex, slender, usually 4-winged, rarely 3 or 5-winged, less than 4 cm thick, usually 4-winged, rarely 3 or 5-winged, with flat intervening spaces between wings; podaria slightly projecting, brown; spines 2, divaricate, 2 - 4 mm long. Leaves present only on young branches, sessile, orbicular, entire, obtuse, 2 - 5 x 2 - 4 mm, fleshy, early caducous. Cyathia above the spines, either in triads or solitary, subsessile; primary peduncles 1 - 3, above the spines, 3 - 5 mm long; secondary peduncles 2 - 4 mm long; involucre cupular, 3 - 3.5 x 3 - 4 mm; bracts 2, triangular, fimbriate at apex, ca 2 x 1.2 mm; lobes 5, suborbicular, ca 1 x 1.2 mm; glands 5, transversely oblong, ca 1 x 2 mm, yellow. Male florets: in 5 fascicles of 3 - 6 florets each, covered by ca 1.5 mm long lacinate bracteoles; pedicels ca 1 mm long; anthers subglobose;. Female floret: gynophore 2 - 4 mm long; ovary globose, ca 2 mm in diam., glabrous; styles ca 1 mm long, connate at base, each bifid at apex; stigma plumose. Fruits subglobose, 3-winged, 3 - 4 mm across; cocci 3, acutely keeled, bivalved, glabrous, slightly pinkish; seeds subglobose, ca 2.5 x 2 mm.

*Fl. & Fr.* July - Sept. and Dec. - April.

*Distrib.* India: Scrub jungles and semievergreen forests, often on shallow soil over rocks, associated with *E. antiquorum* and *E. tortilis*, at 250 to 1100 m altitudes. Tamil Nadu (Tirunelveli, Nilgiri and Dharmapuri Districts).

Sri Lanka.

**73. *Euphorbia tortilis*** Rottler ex Ainslie, *Materia Indica* 2: 424. 1826; Hook.f., *Fl. Brit. India* 5: 256. 1887; Mabb. in *Taxon* 26: 536. 1977; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 328, f. 67. 2010.

Hindi: *Vilankalli*; Mal.: *Murukalli*; Sans.: *Vajra-tunda*; Tam.: *Thirukukalli*; Tel.: *Pedda-jamadu*.



Shrubs or small trees, up to 3 m tall; stems branched; branches jointed, spirally twisted, 3-winged or 3-angled; podaria ca 3 mm projecting; spines 2, divaricate, 4 - 7 mm long, hard, black or brown. Leaves tiny, sessile or subsessile, ovate-suborbicular, obtuse at base, entire, obtuse to subacute at apex, 4 - 6 x 4 - 5 mm, glabrous, fleshy, early caducous; nerves indistinct. Cyathia in fascicles, triads or solitary; primary peduncles in fascicles, ca 5 mm long; secondary peduncles ca 3 mm long; bracts broadly triangular, obtuse, ca 2 x 2.5 mm; involucre cup-shaped, ca 4 x 3 mm; lobes 5, laciniate-fimbriate at apex; glands 5, transversely oblong or suborbicular, fleshy, ca 2 x 1.5 mm, yellow. Male florets: in 5 fascicles of 5 - 9 flowers each; pedicels ca 2 mm long, glabrous; anthers subglobose; bracteoles broad spathaceous, deeply laciniate-fimbriate at apex, ca 2.5 mm long. Female floret: gynophore ca 1 mm long, glabrous; ovary globose, ca 4 mm in diam., glabrous; styles connate; stigma repand. Fruits 5 - 7 mm in diam., sharply keeled; seeds subglobose, obtusely tetragonous, ca 2 x 1.5 mm, pale black.

*Fl. & Fr.* Sep. - Nov.; Feb. - May.

*Distrib.* India: On small hillocks and plains in thorny forests and scrub jungles. Common. Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Uses.* The milky latex is acrid, vesicant, and used against rheumatic pain and skin diseases by the tribes Irulas and Paniyars of Nilgiri and Coimbatore districts.

**74. *Euphorbia trigona*** Mill., Gard. Dict., ed. 8: Euphorbia no. 3. 1768; Haw., Syn. Pl. Succ. 127. 1812; Boiss. in DC., Prodr. 15(2): 82. 1862; Hook.f., Fl. Brit. India 5: 256. 1887 (as *E. trigona* Haw.); Binojk. & N.P.Balacr., Genus Euphorbia in India 331, f. 68. 2010.

Kan.: *Mandagalli*; Mal.: *Kallimullu*; Sans.: *Vajra-vriksha*; Tam.: *Kattimantu*, *Palkalli*; Tel.: *Attimandu*, *Kundigi*.

Shrubs, up to 2 m high, succulent, green or reddish green; main stems semiterete, up to 10 cm in diam.; branches many, ascending, appressed to stems, striate upwards, triangular, 3-winged, white-marbled in between the wings; podaria papillate, ca 0.5 x 1 cm, ca 1 cm apart; spines 2, divaricate, straight, 2 - 3 mm long, brown, persistent. Leaves elliptic to obovate-elliptic, cuneate at base, entire, subacute to acute-apiculate at apex, 1 - 4 x 0.5 - 2 cm, green to reddish beneath, persistent; petioles 1 - 3 mm long. Flowers and fruits not seen.

*Fl. & Fr.* Period unknown.

*Distrib.* India: Usually seen as a garden plant. Andhra Pradesh, Karnataka, Tamil Nadu and Andaman & Nicobar Islands.

Thailand, ?Sri Lanka.

*Notes.* There are two forms; in one, the whole plant is green and in the other, the whole plant is red.

**75. *Euphorbia vajravelui*** Binojk. & N.P.Balacr. in Cact. Succ. J. (Los Angeles) 63: 229. 1991; Rajendran et al. in J. Econ. Taxon. Bot. 233 - 235, f. 1. 2002; Binojk. & N.P.Balacr., Genus Euphorbia in India 334, f. 69, t. 24. 2010.

Mal. & Tam. *Kalli*.

Shrubs or small trees, up to 10 m tall; stems 4 or 5-angled; branches flat, 2-winged in juvenile stages, but 4 or 5-winged when mature; wings thin, wavy-margined; podarium slightly projecting; spines 2, divaricate, 2 - 3 mm long. Leaves sessile or subsessile, broadly ovate to suborbicular, obtuse to subtruncate at base, entire, obtuse or subacute at apex, 4 - 6 x 3 - 5 mm, fleshy, indistinctly nerved. Cyathia solitary or in triads, if in triads, the middle one sessile with only male florets; primary peduncles 4 - 5 mm long; secondary peduncles 6 - 8 mm long; bracts broadly ovate, ca 3 mm long, yellowish; involucre cupular, ca 5 x 5 mm; lobes 5, orbicular, ca 2 mm across, lacerate along apical margin; glands 4 or 5, transversely oblong, ca 2 x 4 mm, fleshy, spongily pitted, pale yellow. Male florets: in 5 fascicles, each 5- or 6-flowered; pedicels ca 1 mm long, glabrous; anthers subglobose; bracteoles obconic, lacerate, ca 3 x 4 mm. Female floret: gynophore ca 2 mm long; ovary ovoid, ca 3 mm long; styles connate up to middle, stigma papillose. Fruits subglobose to ovoid, 5 - 7 mm in diam., separating into 3 bivalved, 1-seeded cocci from a persistent columella; seeds ovoid, ca 3 x 2 mm, black.

*Fl. & Fr.* Dec. - April.

*Distrib.* India: Evergreen forests, above 800 m altitude. Southern W. Ghats of Kerala and Tamil Nadu.

Endemic.

*Uses.* The tribal people called Kanis of southern Western Ghats apply the milky latex on domestic animals to stop loss of hair.

### Subgenus 7. **Lacanthis** (Raf.) M.G.Gilbert

Herbs or undershrubs, dwarf, sometimes geophytic; stems succulent, terete or obscurely angular, spiny; spine-shield absent. Leaves well developed, alternate, mostly persistent, sometimes caducous; stipules mostly forming well-developed spines, rarely with additional smaller spinescent enations. Cyathia axillary or subterminal cymes, on long peduncles; cyathial bracts larger than involucre, brightly coloured, petaloid; cyathial glands without appendages. *Seeds* cylindrical-subglobose, sub-tetragonous, ecarunculate.

*Distrib.:* Mainly in Africa and Madagascar. In Madagascar, there are about 80 endemic species belonging to this subgenus, which accounts to more than 70% of the *Euphorbia* species of that island. One species introduced into other parts of the world, usually cultivated in gardens, sometimes an escape.

**76. *Euphorbia mili*** Des Moul. in Bull. Hist. Nat. Soc. Linn. Bordeaux 1: 25, pl. 1. 1826; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 338, f. 70. 2010. *E. splendens* Bojer ex Hook. in Bot. Mag. 56: t. 2902. 1829; Boiss. in DC., Prodr. 15(2): 79. 1862; T.Cooke, Fl. Bombay 2: 576. 1907 (rep. ed.3: 66. 1958); Gamble, Fl. Madras 1278. 1925 (rep. ed.2: 894. 1957). *E. bojeri* Hook., Bot. Mag. 63: t. 3527. 1836; R.Parker, Forest Fl. Punjab 447. 1918.

Herbs or undershrubs, up to 1.5 m high; stems branched, woody; branches terete or obtusely 5 or 6 angled, 1 - 2 cm in diam., semi-succulent; spines not on podaria, in spirals or in distinct rows, solitary or in compactly arranged groups, 1 - 2.5 cm long, broad at base, pointed upwards. Leaves alternate or in distinct rows, subsessile, ovate-elliptic, subspathulate or

spathulate, attenuate or rounded at base, entire, subacute, apiculate or retuse at apex, 1.5 – 5 x 1 – 2 cm, fleshy, persistent; nerves hardly visible. Cyathia axillary or terminal, several in dichasial cymes; primary peduncles 1 - 3 cm long, secondary peduncles 0.5 - 1 cm long; bracts 2, opposite, ovate-lanceolate, 3 - 5 mm long; involucre turbinate, ca 3 mm across; lobes 5, broadly triangular toothed; glands 5, broadly oblong, ca 2 x 1 mm, fleshy; involucral bracts 2, below cyathia, subperfoliate, broadly ovate, 1 - 1.5 x 1 - 1.5 cm, bright red or crimson, jointed to the base of involucre. Male florets: in 4 or 5 fascicles of 5 or 6 flowers in each; pedicels ca 2 mm long; anthers subglobose; bracteoles ca 3 mm long, deeply laciniate. Female floret: gynophore ca 2 mm long; ovary subglobose, ca 2 mm in diam.; styles connate up to middle, each bifid, recurved, fimbriate. Fruits subglobose, ca 4 mm in diam., pinkish; keels canaliculate or not; seeds cylindrical-subglobose, obscurely 4-angled.

*Fl. & Fr.* Usually throughout the year or depending upon the habitat.

*Distrib.* India: Garden plant, rarely seen as an escape. Grows well in humid areas, at 200 - 1500 m altitudes. Throughout the country, more common in cool hill stations.

Native of Madagascar, introduced into several Old World tropical countries.

*Notes.* Pollen grains prolate, ca 38.5/ca 31.0  $\mu\text{m}$ , colpate, reticulate (Nandi et al., Trans. Bose Res. Inst. 48: 65. 1985); tricolpate, shape in equatorial view prolate spheroidal to slightly subprolate, P/E = 1.10/1.23  $\mu\text{m}$ . (G.L. Webster & Elghobary, Ann. Assoc. Palinol. Leng. Esp. 2: 75-86. 1985).

Chromosome number:  $n = 20$  (Mehra & Choda, Curr. Sci. 41: 76. 1972; Choda & Mehra, Cytologia 43: 223. 1978).

### Subgenus 8. *Poinsettia* (Graham) House

Herbs, shrubs or small trees; stems weak or woody, branched or not. Leaves alternate, heterophyllous, petiolate; floral leaves fully or partially red, yellow, pink or pale green. Cyathia terminal, in dichasial or pleiochasial cymes; glands 1 or rarely 3 or 4; limb absent. Male florets: in 3 or 4 fascicles with bracteoles. Female floret: gynophore long; styles connate or free. Seeds ovoid, tuberculate or rarely smooth, ecarunculate.

Majority in the New World and a few are introduced and naturalised in Asia and other parts of Old World, ca 12 species; 3 species (one cultivated only) in India.

**77. *Euphorbia cyathophora*** J.Murr., Commentat. Soc. Regiae Sci. Gott. 7: 81. 1786; Rani in K.M.Matthew, Fl. Tamilnadu Carnatic 2: 1430. 1983; Binojk. & N.P.Balakr., Genus *Euphorbia* in India 351, f. 73. 2010. *E. heterophylla* auct. non L. 1753; Prain, Bengal Pl. 2: 924. 1903; T. Cooke, Fl. Bombay 2(3): 576. 1906; Gamble, Fl. Madras 2(7): 1278. 1925 (repr. ed. 2: 894. 1957), in adnot.; Haines, Bot. Bihar Orissa 1: 144. 1925. *E. heterophylla* L. var. *cyathophora* (J. Murr.) Griseb. Fl. Brit. W. Indies 45, 54. 1859; Boiss. in DC., Prodr. 15(2): 72. 1862. *Poinsettia cyathophora* (J.Murr.) Bartl. Index Seminum [Gottingen] 1839: 6. 1839; Mabb. in Taxon 32(1): 86. 1983.

Herbs, annual or sub-perennial, erect, up to 1 m high; stems simple or branched, woody below, terete or sub-angular, sparsely hairy. Leaves alternate below, opposite above, polymorphous; lower leaves ovate, the middle leaves panduriform, the upper leaves elliptic-lanceolate, red or pale red, acute or cuneate at base, entire or irregularly denticulate, acute at

apex, 3 - 8 x 2 - 4 cm; lateral nerves 9 - 15 pairs, prominent, sparsely puberulous beneath; petioles 1 - 3 cm long, canaliculate; stipules sessile, gland-like, brownish, caducous. Cyathia in terminal clustered pseudodichasia, each forking ca 4 times; basal bracts similar to leaves with bright orange red blotch at base; upper bracts smaller, lanceolate, red; peduncle 2 - 3 mm long; involucre campanulate, ca 3 x 2 mm, glabrous; lobes 5, ovate or oblong, fimbriate; gland 1, peltate, saccate, with elliptic-oblong mouth, ca 1.5 x 1 mm, bilabiate. Male florets: in 3 or 4 fascicles of 5 or 6 flowers each; pedicels ca 1.5 mm long; anthers subglobose; bracteoles filiform, ca 2 mm long. Female floret: gynophore ca 4 mm long; ovary subglobose, ca 2.5 mm in diam.; styles ca 1 mm long, connate at base; stigma capitate. Fruits ca 4 mm in diam., glabrous or sparsely puberulous; pedicels 2.5 - 3 mm long; seeds ovoid-cylindric, 2.5 - 3 x 2 - 2.5 mm, pustulate, greyish black or dark brown.

*Fl. & Fr.* April - Nov.

*Distrib.* India: Usually a garden plant, and also seen as an escape, easily spreading. In almost all states.

Native of East U.S.A. and Mexico. Introduced into cultivation and becoming naturalized in many parts of the Old World Tropics.

*Notes.* Pollen grains medium, spheroidal to prolate spheroidal, P: E 24:23  $\mu\text{m}$  trizonocolporate (Daisy Thomas, Unpublished thesis, Pune Univ. 1986).

Chromosome numbers:  $n = 28$  (Choda & Mehra, *Curr. Sci.* 41: 76. 1972; Brunel & Laplace, *Taxon* 26: 559. 1977);  $n = 19$  (Mehra & Choda, *Cytologia* 43: 218. 1978);  $2n = 56$  (Kothari et al., *Taxon* 29: 716. 1980).

**78. *Euphorbia heterophylla* L., Sp. Pl. 453. 1753; Binojk. & N.P. Balakr., Genus Euphorbia in India 355, f. 74. 2010. *E. geniculata* Ortega, Nov. Pl. Rar. Descr. Dec. 2: 18. 1797; Hook.f., Fl. Brit. India 5: 239. 1887. *E. prunifolia* Jacq., Pl. Rar. Hort. Schoenbr. 3: 15, t. 277. 1798; Hook.f., l. c. 5: 266. 1887, in adnot. *Poinsettia heterophylla* (L.) Klotzsch & Garcke in Monatsb. Preuss. Akad. Berlin 1859: 253. 1859.**

Hindi: *Doohi*; Mar.: *Dudani*.

Herbs, annual, erect, up to 1 m high; stems terete, hollow, puberulous when young, glabrous when old. Leaves alternate below, opposite or rarely whorled above, elliptic to oblong or elliptic-oblong, acute at base, entire or denticulate, acute or obtuse, 3 - 8 x 2 - 5 cm; floral leaves smaller; lateral nerves 10 - 12 pairs, distinct beneath; petioles 2 - 4 cm long; stipules scaly, sessile, ca 1 mm long, glandular, deciduous. Cyathia in terminal clusters; peduncles 4 - 5 mm long, glabrous; involucre campanulate, 3 - 5 x 2 - 3 mm, glabrous; lobes triangular, laciniate; glands 1 - 2 (- 3), extra-involucral, stipitate, turbinate, with circular mouth, 0.4 - 0.5 x 0.3 - 0.4 mm. Male florets: in 2 or 3 fascicles of 5 or 6 flowers each; pedicels ca 2 mm long; bracteoles filiform, ca 2 mm long; peripheral bracteoles laciniate, adnate to involucral wall; anthers subglobose. Female floret: gynophore ca 4 mm long; ovary glabrous, styles ca 1 mm long, connate at base, bifid at apex; stigma capitate. Fruits subglobose, 4 - 5 x 4.5 - 5.5 mm, smooth, glabrous; seeds 3-angled, oblong-ovoid, truncate at base, 2 - 3 x 1.5 - 2.5 mm, transversely wrinkled, bluntly tuberculate, pale brownish black.

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

*Distrib.* India: Weed in farms and gardens, preferring moist areas, up to 2500 m altitude and spreading easily. Throughout the country, including Andaman & Nicobar Islands.

Native of Tropical and Subtropical America. Widely seen in Old World Tropics.

*Uses.* Leaves and latex are useful in skin diseases (Saini & Singh, J. Econ. Taxon. Bot. 14: 97. 1990).

*Notes.* Pollen grains subprolate, P:E 56:42  $\mu\text{m}$  (Anand et al., J. Econ. Taxon. Bot. 3: 57. 1982); Medium, prolate spheroidal P: E 32:34  $\mu\text{m}$ , trizonocolporate (Daisy Thomas, l. c. 1986).

Chromosome numbers:  $2n = 28$  (Krishnappa & Reshme, Taxon 29: 537. 1980);  $n = 14$  (Datta, Taxon 16: 345. 1967; Choda & Mehra, Curr. Sci. 41: 76. 1972 and Mehra & Choda, Cytologia 43: 218. 1978).

**79. *Euphorbia pulcherrima*** Willd. ex Klotzsch, Allg. Gartenzeitung 2: 27. 1834; Boiss. in DC., Prodr. 15(2): 71. 1862; Prain, Bengal Pl. 2: 924. 1903; Duthie, Fl. Gangetic Plain 3: 189. 1903; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 360, f. 75, t. 19. 2010. *Poinsettia pulcherrima* (Willd. ex Klotzsch) Graham in Edinburgh New Philos. J. 20: 412. 1836; Hook.f., Fl. Brit. India 5: 239. 1886.

Beng.: *Lalpata*; Mal.: *Christmas-chedi*; Nep.: *Lalpatti*.

Shrubs, up to 3 m high; stems subwoody, up to 6 cm thick, branched from base. Leaves alternate, elliptic-ovate or dentate-panduriform, cuneate or subobtusate at base, entire to undulate along margins, acute, 5 - 12 x 3 - 7 cm, sparsely hairy above, densely pubescent below; lateral nerves 12 - 18 pairs; petioles 3 - 6 cm long; petioles 3 - 6 cm long, reddish green; floral leaves alternate or whorled, elliptic to elliptic-lanceolate, acute, 3 - 11 x 1 - 5 cm, bright red or pale yellow, usually glabrous; petioles 1 - 3 cm long; stipules sessile, small, glandular, caducous. Cyathia in terminal dichotomous pseudodichasia; peduncles 2 - 5 mm long; involucre turbinate, 5 - 7 x 6 - 9 mm; lobes broadly oblong, lacerate, crimson along margin; gland solitary, cupular, 2 - 4 x 3 - 6 mm, yellowish green. Male florets in 5 fascicles of 8 - 12 flowers in each; pedicels 3 - 4 mm long, filaments red; anthers subglobose; bracteoles 4 - 6 mm, lacinate, crimson at apex. Female floret: gynophore 5 - 8 mm long; ovary subobovoid, ca 4 x 3 mm; styles ca 4 mm long, connate up to middle, each bipartite; stigma simple. Fruits on exserted and deflexed red pedicels, subglobose, trilobate, 1 - 1.5 x 0.5 - 1 cm, smooth, glabrous; seeds ovoid, 7 - 10 x 6 - 9 mm, pale grey, ecarunculate.

*Fl. & Fr.* Dec. - March.

*Distrib.* India: Cultivated as ornamental garden plant, in almost all states.

Native of Mexico, cultivated in tropics and subtropics.

*Uses.* Tribal people of Sikkim apply the latex to wounds (Krishna & Singh, J. Econ. Taxon. Bot. 9: 5. 1987).

*Notes.* Pollen grains medium, spheroidal, P:E 30:30  $\mu\text{m}$ , trizonocolporate (Daisy Thomas, l. c. 1986).

Chromosome numbers:  $2n = 28$  (Moyer, Bot. Gaz. 95: 682. 1934; Choda & Mehra, Curr. Sci. 41: 76. 1972; Mehra & Choda, Cytologia 43: 219. 1978);  $2n = 44$  (Kothari et al., Taxon 29: 716.

1980).

A variant with pale yellow or yellow upper leaves (var. *alba*) is sometimes cultivated in Indian gardens. No earlier report of this variety is seen.

### Subgenus 9. *Rhizanthium* (Boiss.) L.C.Wheeler

Geophytes with tuberous elongated underground main roots; plants hysteroanthous (leafless when in flower); stems not developed above the ground; main taproots 5 - 70 cm long, branched or not. Leaves radical, in rosettes, petiolate, ovate, obovate to oblanceolate. Cyathia in diads or triads; primary peduncles 1 - 6 together from the apex of the rootstock, 2 - 8 cm long. Fruits keeled, compressed; seeds globose or ovoid.

Mainly in Africa and Asia, ca 10 species; 3 species in India.

**80. *Euphorbia fusiformis*** Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 62. 1825; Hook. f., Fl. Brit. India 5: 257. 1887; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 364, f. 76 a - f. 2010. *E. acaulis* Roxb. [Hort. Bengal. 36. 1814, nom. nud.] Fl. Ind., ed. Carey 2: 472. 1832; Duthie, Fl. Gangetic Plain 3: 74. 1906.

Herbs, glabrous; rootstock stout, cylindrical, 10 - 70 x 5 - 15 cm. Leaves radical, oblanceolate or elliptic-lanceolate, attenuate at base, entire or curled along margins, acute, subacute, acuminate or obtuse at apex, 7 - 20 x 1.5 - 4 cm, glabrous; midnerve distinct; lateral nerves indistinct; petioles 2 - 5 cm long. Cyathia in diads or triads, appearing before leaves; primary peduncles 1 - 3 from the apex of the rootstock, more than 5 cm long; secondary or tertiary peduncles 2 - 5 cm long; involucre turbinate, ca 3 mm across; lobes 5, subobovate, lacinate along apical margin; glands 4, transversely oblong, ca 1 x 1.5 mm; bracts ovate-lanceolate or triangular, obtuse or acute-mucronate. Male florets: in 3 or 4 fascicles, each with 4 - 6 flowers; pedicels ca 1.5 mm long; anthers subglobose; bracteoles lacinate. Female floret: gynophore 2 - 4 mm long; ovary subglobose; styles connate at base; stigma papillose. Fruits 4 - 6 mm long, 6 - 8 mm across, with compressed cocci; pedicels ca 1 cm long; seeds broadly ovate to globose, 2 - 3 x 1.5 - 2.5 mm, whitish variegated.

#### KEY TO THE VARIETIES

- 1 a. Leaves oblanceolate, acute to acuminate and mucronate at apex; cyathial pedicels usually long, up to 4.5 cm long; involucral bracts ovate-lanceolate, obtuse; seeds ovoid or oblong

**80.1. var. *fusiformis***

- b. Leaves obovate, obtuse to rounded and often mucronate at apex; cyathial pedicels short, up to 5 mm long; involucral bracts triangular, acute-mucronate; seeds globose

**80.2. var. *khandallensis***

#### **80.1. var. *fusiformis***

Hindi: *Banamuli*; Mar.: *Sherudd*; Tel.: *Palagadda*.

*Fl. & Fr.* Feb. - May. Leaves appear during rainy season and inflorescences after the shedding of leaves.

*Distrib.* India: Hills and hill slopes of moist deciduous forests, at 500 to 1000 m altitudes. Orissa, Bihar, Uttar Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu.

Nepal.

*Uses.* An extract from tuber mixed with the latex of plant is applied on breasts for desolidifying and for increased lactation.

*Notes.* Pollen grains are medium, prolate spheroidal, P: E 32: 30  $\mu\text{m}$ , trizonocolporate, pleurotreme (Daisy Thomas, Unpublished thesis, Pune Univ. 1986).

**80.2. var. *khandallensis*** (Blatt. & Hallb.) Binojk. & N.P. Balakr. in Fam. Euphorb. India 280. 2007 & Genus Euphorbia in India 368, f. 76 g–h. 2010. *Euphorbia khandallensis* Blatt. & Hallb. in J. Indian Bot. Soc. 2: 48, f. 3. 1921; Santapau in Rec. Bot. Surv. India 16(1): 242. 1953 & in Bull. Bot. Soc. Bengal 8: 3. 1954.

Mar.: *Khirkanda*.

*Fl. & Fr.* Jan. - May.

*Distrib.* India: Moist deciduous forests at ca 1000 m altitude. Rare. Maharashtra, Andhra Pradesh and Tamil Nadu.

Endemic.

*Uses.* Milky latex is useful for eye troubles in buffaloes (Santapau, Rec. Bot. Surv. India 16(1): 242. 1953).

**81. *Euphorbia meenae*** S.Carter in Cact. Succ. J. (Los Angeles) 72: 210, ff. 5 & 6. 2000; Binojk. & N.P. Balakr., Genus Euphorbia in India 370. 2010.

Geophyte, hysteroanthous; main roots fleshy, tuberous, elongated, turbinate at apex, ca 20 x 5 cm; stems 1–3, subterranean, ca 2 cm thick, up to 3.5 cm long, often branching several times. Leaves in rosettes at ground level from stem apices, obovate, oblanceolate or occasionally obcordate, occasionally crispate along margins, up to 10 x 4 cm, fleshy, deep green with dense red patches and reddish margins; petioles 2–4 cm long. Inflorescences up to 15 cm long with cymes on up to 3 cm long peduncles, forking 3 or 4 times; bracts lanceolate, ca 5 x 4 mm, scarious. Cyathia ca 3 x 4.5 mm, cup-shaped; involucre on 3–4 mm long cyathial pedicels; glands transversely oblong, ca 2 x 1 mm, greenish yellow to brown with reddish margins; involucre lobes rounded, deeply fringed, ca 1 x 1 mm. Male florets: bracteoles flabellate, lacinate, ca 1.5 mm long; stamens with pedicels ca 2 mm long; filaments ca 0.5 mm long, red; anthers reddish yellow. Female floret: styles ca 1.5 mm long, joined for 0.3 mm with spreading thickened apices. Fruits deeply and obtusely lobed, truncate at base, ca 4 x 10 mm, on recurved up to 7 mm long pedicels.

*Fl. & Fr.* July – Sept.

*Distrib.* India: Clearings in forests, up to 1100 m altitude. Tamil Nadu (in Nilgiri Hills) and Karnataka (Bababudan Hills).

Rare and endemic.

**82. *Euphorbia nana*** Royle, Ill. Bot. Himal. Mts. 329, t. 82. 1836; Binojk. & N.P. Balakr., Genus Euphorbia in India 370, f. 77. 2010. *E. panchganiensis* Blatt. & Mc Cann in J. Proc. Asiat.

Soc. Bengal 26: 353. 1930 (1931); Santapau in Bull. Bot. Soc. Bengal 8: 4. 1954; N.P. Singh & B.G. Kulkarni in Red Data Book of Indian Pl. 3: 122, illus., 1990.

Herbs, glabrous; stems tuberous, developed as erect underground rootstock, 5 - 8 x 1 - 4 cm. Leaves appearing after flowers, radical, elliptic to oblanceolate, attenuate at base, entire or wavy along margins, acute, 3 - 10 x 2 - 5 cm, fleshy; petioles 2 - 3 cm long, slightly pinkish beneath. Cyathia in diads; primary peduncles 4 - 6 from the apex of stems, less than 3 cm long, branching up to 3 times; lower bracts triangular-lanceolate, wavy-margined, 1-nerved, white, scarious; upper bracts semi-cylindric, amplexicaul at base, acute, recurved; involucre turbinate, 3 - 6 x 4 - 5 mm; lobes 4, oblong, fimbriate, pectinate; glands 4, transversely oblong, 0.5 - 1 x 1 - 2 mm. Male florets few; pedicels ca 1.5 mm long; anthers subglobose; bracteoles spatulate, laciniate. Female floret: gynophore ca 3 mm long; ovary subglobose; styles connate up to middle, stigma papillose. Fruits subglobose, trilobed, ca 5 x 6 mm; seeds globose, ca 3 mm in diam., black to greyish.

*Fl. & Fr.* Feb. - May.

*Distrib.* India: Hill slopes in moist deciduous and evergreen forests, above 1000 m altitude. Rare. Himachal Pradesh, Uttarakhand and Maharashtra.

Endemic.

*Uses.* Tharus of Uttar Pradesh use milky latex for rheumatism and gout.

#### Subgenus 10. **Tirucalli** (Boiss.) S.Carter

Trees, shrubs or undershrubs, stem and branches terete, succulent, often striate, not spiny. Leaves short-lived, oblong, linear-oblong, entire, obtuse or acute at apex. Cyathia pseudoumbellate, crowded at the forks and tips of the branches; ray leaves inconspicuous. Fruits smooth; seeds ovoid to subglobose, smooth.

Mainly in African countries, ca 20 species; 2 species in India.

**83. *Euphorbia mauritanica*** L., Sp. Pl. 452. 1753; Binojk. & N.P. Balakr., Genus *Euphorbia* in India 343, f. 71. 2010. *E. antisyphilitica* auct. non Zucc. 1832: D.C. Saini & S.K. Singh in J. Econ. Taxon. Bot. 14: 96. 1990.

Herbs or small shrubs, 1 - 2 m high, spineless; stems many, arising from base, branched or unbranched, terete, with leaf scars towards the base which peel off when mature. Leaves alternate, sessile, linear-lanceolate, elliptic to oblong-elliptic, attenuate at base, entire, acute at apex, 1.5 - 2.5 x 0.3 - 0.5 cm, with indistinct nerves, early deciduous, fleshy; petioles ca 1 mm long. Cyathia yellowish green, terminal, solitary central male one, surrounded by 4 or 5 pedunculate bisexual ones, on 1 - 2 cm long peduncles, appearing as pseudoumbels; involucre cupular, 2 - 3 x 4 - 5 mm; bracts 2, opposite, below the involucre; lobes ovate to oblong-ovate, irregularly toothed along apical margin; glands 5 - 7, rounded or transversely oblong, 2 - 3 x 0.8 - 1 mm. Male florets: many, covered by lacinate bracteoles; pedicels ca 1 mm long; anthers subglobose; bracteoles ca 1.5 mm long. Female floret: gynophore 2 - 3 mm long; ovary ovoid, ca 2 x 1.5 mm; styles connate at base, free above, each bifid; stigma shiny velvety. Fruits ovoid, ca 5 mm long, glabrous; seeds ovoid, ca 3 x 2 mm, dark brown.



*Fl. & Fr.* Probably during most part of the year.

*Distrib.* India: Cultivated as garden plant or hedge plant in plains of many states. Often seen naturally spreading.

Tropical Africa; introduced to tropical regions of Asia and America.

*Uses.* A paste made out of roots is useful in skin diseases. The latex is also useful in skin diseases (Saini & Singh, l. c.).

**84. *Euphorbia tirucalli* L.**, Sp. Pl. 452. 1753; Hook.f., Fl. Brit. India 5: 254. 1887; Binojk. & N.P.Balacr., Genus *Euphorbia* in India 345, f. 72, t. 23. 2010.

Beng.: *Lanka-sij*; Guj.: *Dandalithora*; Hindi: *Konpal-sehund, Sair, Sehnd*; Kan.: *Bontakalli*; Mal.: *Kol-kalli, Tiri-calli, Tiru-calli*; Mar.: *Nevil, Niwala, Niwarang*; Sans.: *Trikantaka*; Tam.: *Kombu-kalli, Pachan-kalli, Tiru-kalli*; Tel.: *Chemudy, Jemudu, Sannakalli*.

Shrubs or small trees, up to 6 m high; stems woody, 10 - 80 cm in diam.; branches spreading, unarmed, terete, glabrous, bushy in appearance, apparently leafless. Leaves alternate, sessile or subsessile, shortly deflexed, linear-oblong, cuneate at base, entire, obtuse at apex, 7 - 15 x 2 - 6 mm, fleshy, sparsely hirsute or glabrous, early deciduous; stipules minute, discoid, glandular. Cyathia at the forks and tips of the branches, solitary or in small pseudo-umbellate glomerules, subsessile; involucre turbinate, ca 4 x 7 mm across; lobes 5, triangular, laciniate along margin; glands 5, peltate, circular or angular, ca 4 mm in diam. Male florets: pedicels ca 3 mm long; bracteoles filiform, laciniate, ca 2 mm long; anthers subglobose. Female floret: gynophore ca 1 mm long; ovary ca 2 x 1.5 mm, pubescent; styles connate up to middle, ca 3 mm long, each bifid at apex; stigma capitate. Fruits exserted, subglobose, ca 6 x 8 mm, sparsely crisped pubescent to glabrous; seeds ovoid, 3 - 4 mm in diam, speckled brown with dark brown ventral line; caruncle minute, white.

*Fl. & Fr.* Flowers and fruits rarely developing and remaining only for a very short time.

*Distrib.* India: Usually seen as a garden plant or grown as hedge plant, often as an escape. Throughout the country, excluding Andaman & Nicobar Islands.

Africa, Pakistan, Sri Lanka, Bangladesh, Myanmar, Vietnam, Thailand and Malesia.

*Uses.* The juice of this plant is purgative, carminative and useful in gonorrhoea, whooping cough, asthma, dropsy, leprosy, enlargement of the spleen, dyspepsia, jaundice, colic, tumours, and bladder stones. The fresh milky latex applied to the warts and in rheumatism (Caius, J. Bombay Nat. Hist. Soc. 40: 289. 1938, Mishra & Sahu, J. Econ. Taxon. Bot. 5: 792. 1984).

*Notes.* Chromosome number:  $2n = 20$  (Datta, Taxon 16: 346. 1967; Kothari, et al., Taxon 30: 512. 1981).

#### CULTIVATED SPECIES

The following are recently reported garden ornamentals under cultivation and not seen by the authors. The descriptions are extracts from literature.

**1. *Euphorbia fulgens*** Karw. ex Klotzsch in Allg. Gartenzeitung (Otto & Dietrich) 2: 26–27. 1834; Boiss. in DC., Prodr. 15(2): 68. 1862; Naik, Fl. Marathwada 787. 1998; S.R. Yadav & Sardesai, Fl. Kolhapur Dist. 431. 2002; M.R. Almeida, Fl. Maharashtra IVB: 310. 2003. Subg. **Esula**.

*Common name:* Scarlet Plume.

Small shrubs, up to 1.5 m tall; branches arching and drooping, often sprawling. *Leaves* in whorls of 4–8, elliptic-lanceolate, cuneate at base, acuminate at apex, green or brownish red. *Cyathia* numerous in terminal or axillary umbels, on long peduncles; involucre turbinate with obovate to orbicular red lobes; limbs of glands triangular, acute, red, orange, yellow, salmon pink or white tinged with pink, spreading, unequal.

*Fl.:* Jan. – March.

*Habitat:* Under cultivation in gardens (?).

*Distrib.:* INDIA: Maharashtra: Shirol, Waranager.

Atlantic Islands (Bermudas, Cuba), North America (Florida), Central America (Mexico), South America (Brazil, Uruguay).

**2. *Euphorbia grandicornis*** Goebel [Pflanzenbiol. Schilderung. 1: 62. 1889, *nom. nud.*] ex N.E.Br. in Hook. Icon. Pl. 24: t. 2531–2532, text. 1897; Anonymous in The Euphorbia J. 1: 81, photo. 1983; Fourie in The Euphorbia J. 4: 60, photo. 1987; Hunter in The Euphorbia J. 5: 23, photo. 1988; M.R. Almeida, Fl. Maharashtra IVB: 310, f. 224. 2003. *E. antiquorum* auct. plur. non L.: sensu Graham, Cat. Bombay Pl. 179. 1839. Subg. **Euphorbia**.

*Common name:* ‘Cow-horn-Euphorbia’ (English), so named because of the long spreading sharp spines.

Succulent bushy shrubs, up to 2 m tall; main stem much reduced and not projecting above the ground; aerial secondary stems much branched, deeply 3-winged, dark green, deeply constricted into rounded or ovoid segments with wavy wings bearing widely spreading sharp 2–7 cm long divaricately spreading spines which are light brown at first turning to grey with age; podaria (spine-shields) united into a continuous horny grey wavy margin. Leaves not seen. Cymes shortly peduncled, consisting of 3 vertical cyathia, yellow.

*Fl.:* April – May.

*Habitat:* A species from S. Africa, cultivated in gardens.

*Distrib.:* INDIA: Maharashtra: Amboli (Almeida 1660 in BNHS, not seen), Santacruz (opp. LIC office), Mumbai and Malad.

Native of South Africa, Swaziland, Kenya and Mozambique.

*Note:* Almeida (l. c.) cites as synonym *Schadida-Calli* Rheede, Hort. Malab. 2: 81–82, t. 42. 1679. However, Rheede bases his work exclusively on Malabar (Kerala in West Coast of

peninsular India) plants and hence it is unlikely that a species of Africa would figure in his work. Further, Rheede's figure do not show long divaricate spines as seen in this species.

**3. *Euphorbia marginata*** Pursh, Fl. Amer. Sept. (Pursh) 2: 607. 1813; Boiss. in DC., Prodr. 15(2): 63. 1862; Almeida, Fl. Maharashtra IVB: 313, photo 97. 2003. *Agaloma marginata* (Pursh) A. Love & D. Love, Bot. Not. 114: 40. 1961. Subg. **Agaloma**.

*Common name:* Snow-on-the-Mountain.

Herbs, annual, up to 60 cm high, much branched, pubescent. Leaves alternate, subsessile, dense, erect, elliptic-ovate, oblong-ovate oblong-lanceolate, rounded to subcordate and amplexicaul at base, acute, entire, 3 – 8 cm long, glaucous green to yellowish green, hairy on nerves beneath; floral leaves oblong-lanceolate, broadly white-margined, green along the midrib. Cyathia in terminal umbels, involucre campanulate, pubescent outside; glands 4, limbs of glands entire and broader than long, thickened along margins, white. Fruits subglobose, ca 5 – 6 mm across, hairy. Seeds globose-terete, light yellow to gray-brown, ca 4 by 3 mm, ecarunculate.

*Fl.:* Feb. – Sept.

*Habitat:* Cultivated in gardens. The plant needs very little water and can thrive well in poor soil with enough sunlight.

*Distrib.:* INDIA: Maharashtra.

Native of Central America (Mexico and Texas).

#### CULTIVATED GENERA

#### 42a. *Pedilanthus* Neck., nom. cons.

Neotropical genus with ca 15 species; one in India under cultivation.

*Literature.* DRESSLER, R. L. (1957). The genus *Pedilanthus* (Euphorbiaceae). Contr. Gray Herb. Harv. Univ. 182: 1 - 188. STEINMANN, V. W. (2003). The submersion of *Pedilanthus* into *Euphorbia* (Euphorbiaceae). Acta Bot. Mexicana 65: 45.

***Pedilanthus tithymaloides*** (L.) Poit. in Ann. Mus. Natl. Hist. Nat. 19: 390, t. 19. 1812; Hook.f., Fl. Brit. India 5: 239. 1887. *Euphorbia tithymaloides* L., Sp. Pl. 453. 1753.

Beng.: *Belati-sij*, *Rangchita*; Eng.: *Slipper-flower*; Mar.: *Vilayati-sheer*; Tam.: *Kannadikkalli*.

Herbs or undershrubs, up to 1.3 m high, succulent, rich in milky latex; stems flexuous, zigzag with alternate erecto-patent branches, pubescent at first, later glabrous, entirely or partially deciduous. Leaves alternate, distichous, elliptic-ovate, attenuate, rounded or obtuse at base, mostly somewhat subacute to bluntly acuminate or rarely obtuse at apex, 3.5 - 9 x 2.5 - 5 cm, finely short hairy on both surfaces, soon glabrous, brittle, often variegated with green and pink; petioles 2 - 5 mm long. Cymes sessile or shortly stalked, dense, 1 - 2.5 cm long, usually on leafless stems, terminal or on short lateral shoots, on 0.3 - 2 cm long stalks; bracts petaloid, caducous before anthesis, ca 7.5 mm long, densely hairy outside. Cyathia bright red; tube 1 - 1.3 cm long; involucre obliquely bilateral, zygomorphic; outer 2 involucre lobes 2.5 - 3 mm long,

more than half way connate; inner 3 lobes linear; glands 4, in pairs above each other, the 2 upper ones smaller; ligule oblong-linear from a broad base, entire or emarginate, 2 - 4 mm long. Male florets: ca 25; pedicels ca 1.5 mm long; anthers reniform. Female floret: solitary, raised above by an erect pedicel; ovary 3-locular, ca 1.5 mm across; styles stout, cylindrical, ca 7 mm long; stigmas 3, each bifid. Fruits not seen.

*Fl.* Aug. – March.

*Distrib.* India: Cultivated in gardens as a hedge plant, up to 1000 m altitude, in most States.

Native of tropical America, now grown in most tropical countries.

*Uses.* Stems made into a paste and applied on skin diseases and the latex applied to ringworms (Saini & Singh, J. Econ. Taxon. Bot. 14: 83 - 104. 1990).

#### 42b. *Synadenium* Boiss.

Eastern and southern tropical Africa, ca 15 species; one in India, usually cultivated as hedge plant.

*Synadenium grantii* Hook.f. in Bot. Mag. 83: t. 5633. 1867; Binojk. & N.P. Balakr. in Rheedeia 3: 136, f. 1. 1993.

**Fig. 38**

Shrubs, usually up to 3 m high; stems branched, terete, fleshy; main stem 10 - 12 cm thick. Leaves alternate, oblanceolate to obovate, cuneate at base, obtuse and apiculate at apex, entire and ciliate along margins, 10 - 15 x 5 - 7 cm; lateral nerves 14 - 20 pairs; petioles ca 5 mm long. Cyathia axillary, pseudoumbellate; peduncles sparsely hairy; primary peduncles 2 or 3 times dichotomous, ca 3 cm long; bracts oblong, ca 4 mm long, puberulous; glands connate, rim-like, entire or slightly wavy; involucre lobes 5, suborbicular, adnate to the base of the gland, broadly oblong. Male florets: in 5 fascicles of 20 - 30 florets in each; pedicels ca 1 mm long; filaments ca 0.5 mm long, red; anther-thecae divaricate, subglobose. Female floret: gynophore ca 3 mm long, projecting above the cyathial rim; ovary obovoid, ca 2 mm in diam., hairy; styles 3, connate up to middle, each deeply bifid, ca 2.5 mm long. Fruits obovoid, ca 6 x 5 mm, keeled, pinkish; seeds oblong, ca 3 x 2 mm., smooth.

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

*Distrib.* India: Usually cultivated as fence, rarely seen as an escape near villages. Almost all states in the plains.

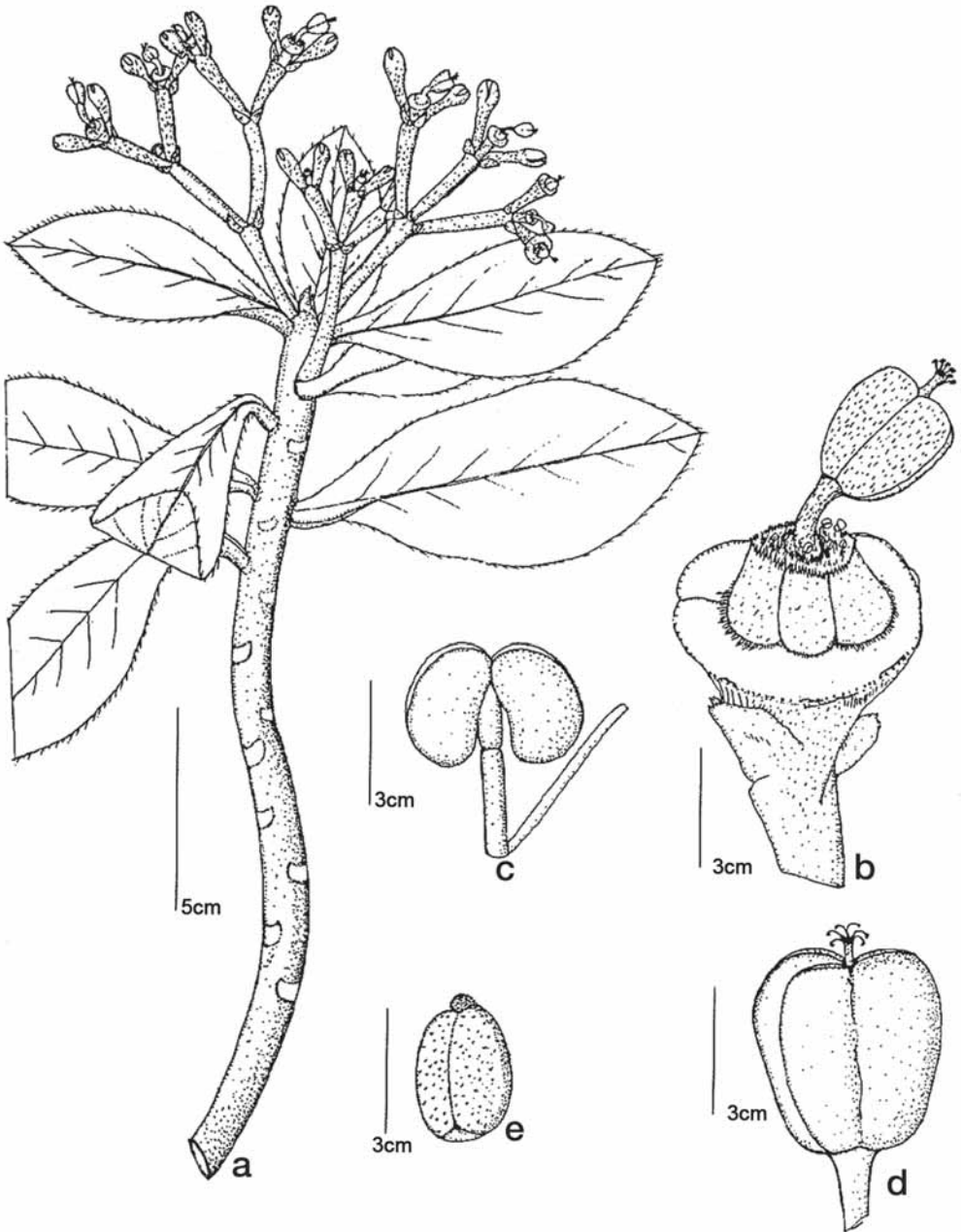
Native of tropical Africa now introduced into many Asian countries.

#### 42c. *Monadenium* Pax

This genus differs from *Synadenium* by the cyathium being bilaterally symmetrical and the gland with a gap on the lower side.

Africa, from Somalia to Transvaal, about 50 species; one in India.

*Literature.* RAO, K. S. & M. N. V. PRASAD 1989. *Monadenium heteropodum* N.E. Br. (Euphorbiaceae): an exotic in the process of naturalization in India. *Excelsa* no.14: 135 - 137, illus.



**Fig. 38.** *Synadenium grantii* Hook.f.: a. flowering twig; b. cyathium; c. male floret; d. fruit; e. seed.

**Monadenium heteropodum** (Pax) N.E.Br. in Fl. Trop. Afr. [Oliver et al.] 6(1.3): 453. 1911.  
*Euphorbia heteropoda* Pax in Bot. Jahrb. Syst. 34(3): 374. 1904.

Shrubs with underground tuberous root; stems several, arising from the rootstock, erect, cylindrical, up to 35 cm long, up to 3 cm thick, bearing rhomboid hexagonal or square tubercles and 2 or 3 minute prickles connected by a horny rim around the leaf scar, absent on older stems. Leaves fleshy, deciduous, petiolate, rhombic-spathulate, up to 3.5 x 1.2 cm, green. Inflorescence arising in the axils of tubercles, consisting of one central and two lateral involucre; bracts greenish white, ca 13 x 10 mm.

*Distrib.* Tanzania.

## Tribe 2. HIPPOMANEAE A.Juss. ex Spach (T. Chakrabarty & N. P. Balakrishnan)

Trees, shrubs or herbs, monoecious or rarely dioecious; latex usually milky, commonly acrid or toxic; indumentum simple or absent. Leaves alternate, rarely opposite, simple, usually unlobed, pinnately veined, rarely palmately veined, often with laminar or petiolar glands; stipules mostly small, sometimes absent. Inflorescences terminal or axillary, mostly spicate or racemose, sometimes paniculate, usually bisexual with one or a few female flowers at base; bracts usually biglandular. Male flowers: calyx open in bud, sometimes vestigial or absent; sepals 3 - 5, distinct or absent, imbricate or valvate; petals and disc absent; stamens 1 - 70, free or filaments connate; anthers discrete, extrorse; pollen grains 3-colporate, colpi usually marginate, sexine perforate-tectate. Female flowers: sepals 3 - 6, mostly 2 or 3, imbricate, sometimes obsolete or absent; petals and disc absent; ovary 2 or 3-locular, rarely 4 - 10, often carinate or horned; styles free or somewhat connate, unlobed. Fruits capsular or drupaceous; seeds carunculate or ecarunculate, testa dry or fleshy; endosperm copious.

Pantropical, ca 30 genera; 6 genera in India.

### KEY TO THE GENERA

- 1 a. Herbs, less than 0.5 m high; leaves linear-lanceolate, less than 1 cm wide; ovary echinate; ovules appendaged; seeds generally carunculate; testa dry **46. Microstachys**
- b. Shrubs or trees, more than 1 m high; leaves broader, ca 1.5 cm or more wide; ovary smooth; ovules not appendaged; seeds generally ecarunculate; testa dry or fleshy 2
- 2 a. Leaves entire or rarely crenulate along margins, often whitish beneath 3
- b. Leaves shallowly to distinctly serrate along margins, not whitish beneath 4
- 3 a. Leaves with gland(s) at lamina base on both sides of the midrib, visible from above; petiole apex glandless; fruit fleshy, 2-locular, indehiscent **43. Balakata**
- b. Leaves without gland(s) at lamina base on both sides of the midrib, not visible from above; petiole apex with 2 glands on both sides just below the leaf-base; fruit dry, 3-locular, regularly dehiscent **48. Triadica**
- 4 a. Young leaves and inflorescences with yellowish hairs; male flowers distinctly (2 - 3 mm long) pedicellate; fruits with up to 3 cm long pedicels and massive at least 2 mm thick pericarp **47. Shirakiopsis**
- b. Plants completely glabrous; male flowers sessile to shortly (up to 1 mm long) pedicellate; fruits with less than 5 mm long pedicels and thin less than 2 mm thick pericarp 5
- 5 a. Male and female flowers in separate elongate thyrses, often flowering on leafless twigs; female flowers/fruits at least 20 per inflorescence/infructescence; fruits irregularly and tardily dehiscent; seeds with pale fleshy arillus, not carunculate **45. Falconeria**

- b. Male and female flowers in one elongate thyrses, flowering on leafy twigs; female flowers/fruits less than 20 per inflorescence/infructescence; fruits capsular, regularly dehiscent; seeds dry with brownish or reddish fleshy surface, carunculate **44. Excoecaria**

### 43. *Balakata* Esser

Trees or shrubs, monoecious, evergreen, usually glabrous. Leaves simple, alternate, petiolate, penninerved; stipules caducous or persistent. Inflorescences terminal, simple or branched, spicate or racemose, the female flowers at the base of males when bisexual; bracts biglandular at base. Male flowers: fascicled at each bract; calyx cupular, shortly 2 or 3-lobed, splitting to base later on; petals absent; disc absent; stamens 2 or 3, free; anther-thecae distinct, parallel, dorsifixed, extrorse; pistillode absent. Female flowers: solitary per bract; calyx 3-lobed; petals absent; disc absent; ovary 2 or 3-locular; locules uniovulate; styles free or connate at base. Fruits smooth, fleshy berries, indehiscent, 2 or 3-lobed; seeds globose or ovoid, ecarunculate, persistent on columella; testa crustaceous with fleshy outer layer; endosperm fleshy; cotyledons broad, flat.

NE. India to Vietnam and throughout SE. Asia, up to parts of New Guinea, 2 species; one in India.

***Balakata baccata*** (Roxb.) Esser in *Blumea* 44: 155. 1999. *Sapium baccatum* Roxb., *Fl. Ind.*, ed. Carey 3: 694. 1832; Hook.f., *Fl. Brit. India* 5: 470. 1888. *Carumbium baccatum* (Roxb.) Kurz, *Forest Fl. Burma* 2: 412. 1877.

Asm.: *Lawa, Seleng*; Beng.: *Chota-mal*; Garo: *Sam-sim*; Kh.: *Deing-ja-lonh-ehr*; Nep.: *Ankhataruwa*.

Trees, up to 25 m tall, entirely glabrous; branches glaucous. Leaves ovate to ovate-lanceolate or elliptic to oblong-elliptic, obtuse to rounded at base, entire, caudate-acuminate at apex, (5 -) 10 - 20 (- 25) x 2 - 10 cm, membranous to thinly coriaceous, glaucous beneath; basal glands 1.5 - 2.5 mm in diam.; lateral nerves 7 - 12 pairs; petioles 2 - 8 cm long; stipules oblong-lanceolate, ca 1 mm long, early caducous. Inflorescences unisexual, terminal, crowded towards tips of twigs, spiciform-racemose panicles, up to 18 cm long, the males branched, the females less branched or almost simple; rachis bearing clusters of glands between flowers; bracts broadly ovate, up to 2 mm long. Male flowers: pedicels 1 - 3 mm long; calyx irregularly 2 or 3-lobed; lobes ovate-orbicular, ca 0.5 x 0.3 mm; stamens 2 or 3, included, free, ca 1 mm long. Female flowers: pedicels 1 - 1.5 mm long; calyx 2 or 3-lobed; lobes ovate, ca 1.5 x 1 mm; ovary ovoid, ca 1.5 x 1 mm, 2-locular, glabrous; styles 2, simple, ca 1 mm long, free; stigma revolute. Fruits didymous berries, subglobose, 9 - 12 mm in diam., 2-locular, spongy, fleshy, reddish purple, turning to purplish black; fruiting pedicels 2 - 4 mm long.

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

*Distrib.* India: Mixed evergreen forests, up to 1000 m altitude. West Bengal, Sikkim, Arunachal Pradesh, Assam, Tripura, Meghalaya and Andaman & Nicobar Islands.

Bhutan, Bangladesh, Myanmar, Indo-China, China, Thailand, Malaysia, Sumatra and Borneo.

*Uses.* The wood is useful for making packing boxes. Fruits sometimes used for flavouring. The pigeons relish the fruits.

#### 44. *Excoecaria* L.

Trees or shrubs, dioecious, rarely monoecious, glabrous with acrid milky juice. Leaves alternate or opposite, simple, petiolate, penninerved; lateral nerves closely parallel or lax and arcuate; stipules minute, fimbriate along margins, caducous. Inflorescences axillary or terminal bracteate spikes, racemes or a head; male spikes catkin-like, longer than female ones; female flowers at the base of the male spikes or in separate spikes; bracts concave, with large sessile glands beneath at base or at the sides. Male flowers: 1 - 3 in each bract, 2-bracteolate; calyx 2 or 3-lobed, imbricate; petals and disc absent; stamens 2 or 3, alternate with calyx-lobes; filaments free, exerted; anthers oblong, didymous with 2 parallel thecae, basifixed, longitudinally dehiscent; pistillode absent. Female flowers: few; calyx subequally 3-partite, thick; petals and disc absent; ovary 3-locular; each locule 1-ovuled; styles 3, shortly connate at base into a short stout column, spreading or recurved and stigmatose above. Fruits capsular rhegmas, depressed-globose, consisting of 3 cocci separating from a columella, the valves twisting elastically, sometimes with a fleshy outer layer; seeds ovoid, carunculate; testa crustaceous, marbled; endosperm fleshy; cotyledons flat.

Paleotropical, mostly in Asia, ca 35 species; 6 species indigenous and 1 species cultivated in India.

*Literature.* CHAKRABARTY, T. & M. GANGOPADHYAY (1994). A revision of *Excoecaria* L. (Euphorbiaceae) for Indian subcontinent. J. Econ. Taxon. Bot. 18: 193 - 210.

#### KEY TO THE SPECIES

- 1 a. Plants dioecious, of mangrove or littoral areas; leaves alternate, with basally two glands in the margin at either side of the petiole; male flowers in very dense catkins **2. *E. agallocha***
- b. Plants monoecious, of interior forest areas; leaves alternate or opposite, without basal glands in the margin; male flowers in open racemes or in heads 2
- 2 a. Leaves opposite or at least partly opposite 3
- b. Leaves entirely alternate 5
- 3 a. Leaves all opposite, green beneath; inflorescences with one type of flowers only, male inflorescences 3.5 - 22 cm long; fruits slightly depressed and shallowly lobed, usually larger, 1 - 6 cm in diam. 4
- b. Leaves alternate or opposite, wine-red beneath; inflorescences with basally a few female flowers and apically many male ones; male inflorescences 1 - 3 cm long; fruits much depressed and deeply lobed, smaller, up to 1 cm in diam. (cult.) ***E. cochinchinensis***
- 4 a. Branchlets mostly flattened or tetragonous; male inflorescences 3.5 - 8 cm long; fruits 1 - 3 cm in diam. **3. *E. crenulata***
- b. Branchlets mostly terete; male inflorescences 5 - 22 cm long; fruits 4 - 6 cm in diam. **5. *E. oppositifolia***
- 5 a. Leaves larger, 25 - 32 x 8 - 11 cm; petioles 3 - 4 cm long **6. *E. rectinervis***
- b. Leaves smaller, 2.5 - 16 x 1 - 5 cm; petioles 0.2 - 3 cm long 6
- 6 a. Leaves closely and regularly serrulate along margins; lateral nerves close, parallel, conspicuously raised on the upper surface; tertiary nerves closely parallel and running predominantly at right angles to the midrib; fruits 1.5 - 1.8 cm in diam. **1. *E. acerifolia***
- b. Leaves distantly repand-serrulate along margins; lateral nerves distant and arcuate, obscure or faint on the upper surface; tertiary nerves laxly reticulate; fruits up to 1 cm in diam. **4. *E. cuspidata***



**1. *Excoecaria acerifolia*** Didr. in Vidensk. Meddel. Dansk Naturhist. Foren. Kjobenhavn 1857: 129. 1857; Hook.f., Fl. Brit. India 5: 473. 1888, p. p. excl. quoad specim. montibus Khasia; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 18: 197. f. 1. 1994. *Stillingia himalayensis* Klotzsch in Bot. Ergebn. Reise Waldemar 116, t. 21. 1862.

Hindi: *Basingh*; Kum.: *Phutkia*.

Shrubs, 1 - 2 m high, evergreen; branches longitudinally angular. Leaves alternate, elliptic, oblong-lanceolate or oblanceolate, acute or subacute at base, closely acutely glandular-serrulate along margins, acuminate or caudate at apex, 3.5 - 12 x 3 - 5 cm, chartaceous to coriaceous, glabrous; lateral nerves 6 - 10 pairs, parallel to each other; petioles 2 - 10 mm long. Male inflorescences terminal, spicate, 3 - 5 cm long; bracts broadly triangular-ovate, 1 - 1.3 x 1.5 - 2 mm, entire. Flowers: sessile, 2 or 3 together; sepals 3, linear-lanceolate, 1 - 1.3 x 0.3 - 0.4 mm, entire; stamens 3, 1.8 - 2 mm long; filaments ca 1.5 mm long. Female inflorescences terminal and axillary, solitary or 2 - 3-flowered. Flowers: sessile to subsessile; sepals 3, broadly ovate, ca 1.5 x 1 mm, entire; ovary globose, ca 1 mm in diam.; styles 3, stout, 3 - 5 mm long, sometimes bifid above. Fruits somewhat depressed, 2- or 3-lobed, 1 - 1.2 x 1.5 - 1.8 cm, smooth, thin-walled; pedicels 2 - 5 mm long.

*Fl.* Mar. - July; *Fr.* June - Dec.

*Distrib.* India: Evergreen tropical to subtropical hill forests at 1000 - 2000 m altitudes. Uttarakhand (Kumaon) and Arunachal Pradesh [Kameng dist., *Panigrahi* 16037 (CAL)].

Nepal, Bhutan and China.

*Uses.* Bhutias of Kameng dist. of Arunachal Pradesh use leaves externally for rheumatism.

*Note.* Chromosome number: n = 11 (Gill & Bedi, Taxon 28: 402. 1979).

**2. *Excoecaria agallocha*** L., Syst. Nat., ed.10, 2: 1288. 1759 & Sp. Pl., ed. 2, 1451. 1763; Hook.f., Fl. Brit. India 5: 472. 1888; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 18: 198. 1994. *Stillingia agallocha* (L.) Baill., Etude Euphorb. 518. 1858.

Beng.: *Goma*, *Gengwa*, *Geneo*, *Geo-gheria*; Hindi: *Gangooa*, *Gangwa*, *Geogharia*, *Geon*; Kan.: *Harogida*, *Thilla*; Mal.: *Komatti*; Mar.: *Gewa*, *Phungali*, *Surund*; Or.: *Gowan*; Tam.: *Kampetti*, *Tillai*; Tel.: *Thilla*.

Trees, 2 - 10 m tall, evergreen, with poisonous milky juice. Leaves alternate, elliptic or narrowly so to ovate-lanceolate or oblong-lanceolate, obtuse or rounded at base, usually narrowly subcordate at extreme base, crenulate-serrulate to entire and biglandular towards base along margins, acuminate at apex, 3 - 13 x 1.5 - 5.5 cm, coriaceous, glabrous; lateral nerves 5 - 10 pairs; petioles 1 - 3 cm long, sulcate above. Male inflorescences axillary, densely spicate, 3 - 12 cm long; bracts pocket-like, 0.8 - 1.2 x 1.5 - 2 mm, entire; Flowers sessile; sepals 2 or 3, linear, ca 1 mm long; stamens 2 or 3, free, 2 - 3 mm long. Female inflorescences axillary, racemose, few-flowered, up to 5 cm long; bracts ca 1.5 x 3 mm. Flowers: pedicels 3 - 5 mm long; sepals 3, ovate-triangular, ca 2 x 1.5 mm, lacinate; ovary 3-lobed, ca 1.5 mm in diam.; styles 3, simple, 2 - 4 mm long, connate at base. Fruits depressed-tricocous, 3-lobed, 4 - 5 x 8 - 10 mm, smooth, crustaceous, glabrous; pedicels 3 - 5 mm long.

*Fl. & Fr.* March - Dec. (- Feb.).

*Distrib.* India: Along seashores, tidal forests and mangrove swamps on sandy loam, mainly in rocky places. West Bengal, Orissa, Andhra Pradesh, Maharashtra, Goa, Gujarat, Karnataka, Kerala, Tamil Nadu, Pondicherry and Andaman & Nicobar Islands.

Sri Lanka, Bangladesh, Myanmar, China, Cambodia, Vietnam, Ryu-Kyu Islands, throughout Malesia to N. Australia and the Pacific Islands.

*Uses.* Wood is useful for general carpentry, packing cases, toys, legs of bedsteads and floats for fishing nets. It is also useful for making charcoal. The latex boiled in oil used externally for treatment of ulcers, rheumatism, leprosy and paralysis. Decoction of leaves used in epilepsy and ulcers. Balu & Madhavan (J. Econ. Taxon. Bot. 19: 571 - 575. 1995) report almost 100% wound healing property in humans and animals by external application of the latex mixed with white emulsion base and made into a 10% ointment.

**3. *Excoecaria crenulata*** Wight, Icon. Pl. Ind. Orient. 5(2): 20, t. 1865. 1852; Hook.f., Fl. Brit. India 5: 473. 1888; Gamble, Fl. Madras 2(7): 1345. 1925 (repr. ed. 2: 941. 1957). *E. robusta* Hook.f., l. c. 474. 1888. *E. oppositifolia* Griff. var. *crenulata* (Wight) Chakrab. & M. Gangop. in J. Econ. Taxon. Bot. 18: 208. 1994, p. p. (excl. syn. *E. bantamensis* Müll. Arg., *E. macrophylla* J.J.Sm. et *E. borneensis* Pax & K. Hoffm.). *E. oppositifolia* sensu Thwaites, Enum. Pl. Zeyl. 269. 1861, non Griff., 1844.

Tam.: *Paalmaram, Tillai*.

Shrubs or trees, 1 - 7 (-10) m tall; latex milky, copious, poisonous; branchlets flattened or sometimes tetragonous, glabrous. Leaves opposite, elliptic, obovate to oblanceolate or oblong-lanceolate, acute or obliquely rounded at base, entire or sparsely sinuate-crenate or serrate along margins, shortly acuminate at apex, (6 - ) 10 - 25 x 2.5 - 5 cm, coriaceous to chartaceous, waxy, shiny green; lateral nerves 10 - 18 pairs; petioles (0.5 - ) 1 - 2 cm long; stipules subulate, ca 3 mm long. Male inflorescences axillary and terminal, spicate, 3.5 - 8 cm long; bracts broadly ovate, ca 1.5 x 1 mm, erose; bracteoles enclosing the flowers in bud. Flowers: sessile; sepals 3, oblong to ovate, ca 1 x 0.6 mm, irregularly toothed; stamens 3, ca 1.2 mm long. Female inflorescences axillary or terminal, solitary or spicate (up to 3 cm long) with up to 3 flowers. Flowers: pedicels 1 - 3 mm long; sepals 3, broadly ovate, ca 2 mm long, erose; ovary subglobose, ca 2 mm in diam.; styles stout, ca 5 mm long, persistent, recurved. Fruits depressed, subglobose, shallowly 3-lobed, 1 - 3 cm across; seeds broadly ovoid, mottled.

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

*Distrib.* India: Wet deciduous forests or shola forests in Western Ghats, along streams, up to 2100 m altitude. Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Notes.* Pollen 3-colporate, sexine reticulate. P = 41 µm (35 to 46), E = 34 µm (28 to 37). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery*, Pondichery).

**4. *Excoecaria cuspidata*** (Müll.Arg.) Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 14: 182. 1990 & *ibid.* 18: 205, f. 2. 1994. *E. himalayensis* (Klotzsch) Müll.Arg. var. *cuspidata* Müll.Arg. in *Linnaea* 32: 122. 1863. *E. acerifolia* Didr. var. *cuspidata* (Müll.Arg.) Müll.Arg. in DC, Prodr. 15(2): 1222. 1866. *E. acerifolia* sec. Hook.f., Fl. Brit. India 5: 473. 1888 (non Didr. 1857), p. p., quoad spec. montibus Khasia; Kanjilal et al., Fl. Assam 4: 208. 1940.

Stature unknown. Leaves alternate, narrowly elliptic-lanceolate to obovate or oblanceolate, acute at base, distantly repand-serrulate along margins, acuminate to caudate-acuminate at apex, 6 - 9 x 1 - 2 cm, thinly coriaceous; lateral nerves 6 - 10 pairs, obscure to faint above, conspicuous beneath; petioles 5 - 10 x 1 - 1.5 mm. Flowers not seen. Fruits axillary or terminal, solitary (always?), tricocous, ca 9 mm in diam., smooth, thin-walled, blackish brown when dry, on ca 5 mm long pedicels; seeds suborbicular, ca 4 mm in diam., marbled.

*Fr.* Dec.

*Distrib.* India: In primary forests between 300 to 1200 m altitudes. Very rare. Meghalaya.

No recent collection seen. The only specimen seen is: Khasi hills, Shaila, 9 Dec. 1871, C. B. Clarke 14865 (CAL).

China.

**5. *Excoecaria oppositifolia*** Griff. in *Calcutta J. Nat. Hist.* 4: 386. 1844; Hook.f., Fl. Brit. India 5: 474. 1888; Kanjilal et al., Fl. Assam 4: 208. 1940; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 18: 207. 1994. *E. arboriana* R.N.De in *Indian Forester* 69: 395. 1943.

Abor: *Gammong-asing*; Asm.: *Dudhgoch*; Cach.: *Ponsum*; Kh.: *Dieng-jam*; Mikir: *Theng-bri*.

Trees, 5 - 15 m tall. Leaves opposite, narrowly oblong to elliptic-oblong or occasionally widely elliptic, acute to obtuse at base, shallowly crenate-serrate or dentate to entire, acute to acuminate or caudate at apex, (6 -) 10 - 30 x 3 - 10 (- 15) cm, thinly coriaceous, glabrous, glossy above; lateral nerves 10 - 22 pairs; petioles 5 - 30 mm long, eglandular; stipules subulate, ca 3 mm long. Male flowers: sessile, on slender terminal and axillary, 5 - 22 cm long spikes; bracts broadly ovate, suborbicular or flabellate, denticulate or entire, 1.5 - 2 x 0.8 - 2 mm, glandular at base, 1-flowered; sepals 3, ovate-oblong to suborbicular, lacerate-dentate to erose or occasionally subentire along margins, 1 - 1.5 x 0.8 - 1.3 mm; stamens 2 - 3, 1.5 - 2 mm long. Female flowers: solitary or up to 3 in terminal or axillary inflorescences; bracts ovate, ca 1.5 x 1 mm, glandular at base; pedicels 1 - 5 mm long; sepals 3, broadly ovate to triangular, 2 - 3.5 x 1.5 - 3 mm; ovary subglobose, 1.5 - 2 mm in diam., narrowed into a robust style, 3 - 7 mm long, with 1 - 2 mm long column and 3 recurved subulate branches, each often bifid. Fruits depressed, subglobose, shallowly or sometimes deeply 3-lobed, 4 - 6 cm across.

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

*Distrib.* India: Primary forests, at low altitudes. Arunachal Pradesh, Nagaland, Assam and Meghalaya.

Bangladesh, Myanmar, Indo-China and Thailand.

*Uses.* Timber used for construction of house.

*Notes.* The acrid milky latex is violently poisonous and corrosive.

The original specimens (Novara 194, *Jelinek* 246) cited by Kurz (J. Asiat. Soc. Bengal., Pt. 2, Nat. Hist. 45(2): 148. 1876) from Great Nicobar Island were not found in CAL. There is no subsequent collection of this species from Great Nicobar Island.

**6. *Excoecaria rectinervis*** (Kurz) Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 45(2): 148. 1876; Hook.f., Fl. Brit. India 5: 473. 1888; Pax & K. Hoffm. in Engl., Pflanzenr. IV.147.v (heft 52): 165. 1912. *Actephila rectinervis* Kurz in Trimen, J. Bot. 13: 329. 1875.

Shrubs, 1 - 2.5 m high; branchlets terete, 8 - 10 mm thick. Leaves alternate, obovate to oblong-obovate, acute at base, entire, acuminate at apex, 25 - 32 x 8 - 11 cm, coriaceous, pale green when dry; lateral nerves 9 - 15 pairs, straight, prominent; petioles 3 - 4 cm long, ca 2 mm thick. Flowers not seen (inflorescences reported to be axillary and spicate, shorter than the petioles, solely male or bisexual with 1 or 2 female flowers at base; bracts said to be obcordate; stamens 2 and ovary glabrous). Fruits (only immature ones seen) on ca 3 cm long infructescences, trilocous, somewhat depressed, ca 1.2 cm in diam.; pedicels ca 1 cm long; seeds subglobose.

*Fr.* Feb.

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

Endemic.

#### CULTIVATED SPECIES

***Excoecaria cochinchinensis*** Lour., Fl. Cochinch. 2: 612. 1790; Chakrab. & M. Gangop. in J. Econ. Taxon. Bot. 18: 199. 1994. *Antidesma bicolor* Hassk., Cat. Hort. Bot. Bogor. 81. 1844. *Excoecaria bicolor* (Hassk.) Zoll. ex Hassk. in Retzia 1: 158. 1855; Gamble, Fl. Madras (repr. ed.) 2: 941. 1957.

Beng.: *Late-gneo.*

Shrubs, monoecious, up to 2 m high. Leaves all opposite or spirally arranged along thicker branchlets, oblong-lanceolate to elliptic-lanceolate, acute or rounded at base, serrulate along margins, caudate-acuminate at apex, 4 - 16 x 1.5 - 4.5 cm, chartaceous, wine-red beneath; lateral nerves 8 - 12 pairs; petioles 2 - 6 mm long. Male inflorescences axillary, 1 - 3 cm long; Flowers: pedicels ca 2 mm long; sepals 3, linear-lanceolate, 1 - 1.3 x 0.2 - 0.4 mm; stamens 3, 1.5 - 2 mm long. Female inflorescences axillary, 2 - 3-flowered. Flowers: pedicels 1 - 2 mm long; sepals 3, triangular to subulate, 1 - 1.5 x 0.5 - 1.2 mm, lacinate; ovary 1 - 1.5 mm in diam.; styles 3, 2 - 3 mm long, laterally compressed. Fruits 3-lobed, depressed-globose, ca 1 cm across, smooth, greyish on 2 - 3 mm long pedicels.

*Fl. & Fr.* Oct. - Apr.

*Distrib.* India: Commonly cultivated in gardens, as ornamental trees. Maharashtra, Goa, Kerala, Tamil Nadu and West Bengal.

Probably native of Indo-China and China, introduced to many countries in SE. Asia.

#### 45. *Falconeria* Royle

Deciduous trees, monoecious, flowering and fruiting when leafless, with distal whorled branches. Leaves alternate, almost crowded at apex of branches, glandular-serrate along margins, penninerved; petioles with 2 glands at apex below the blade; stipules divided into 2 or 3 glandless ciliae. Inflorescences terminal, on conspicuously thicker branches, up to 17 cm long, with male and female flowers in separate thyrses of equal size. Male flowers: sessile in bud, with up to 1 mm long pedicels when flowering; bracts transversely ovate, rounded at apex, with a pair of oblong-flattened to discoid glands touching the axis of inflorescence; cymules 9 – 15-flowered; bracteoles completely divided into 2 or 3 ciliae; calyx of 2 fused sepals; stamens 2; filaments slightly longer than anthers. Female flowers: 30 – 60 per thyrse; pedicels very short; calyx 3-lobed, glandless; ovary 2- or 3-locular, smooth; style very short with 2 or 3 undivided stigmatic lobes. Fruits fleshy when young, later dry, tardily and irregularly dehiscent, 2- or 3-seeded, smooth; columella winged; seeds with thin fleshy arillus, ecarunculate.

India and Sri Lanka to Vietnam, China, Thailand and Malaysia, monotypic.

***Falconeria insigne*** Royle, Ill. Bot. Himal. Mts. 354, t. 84a or 98, f. 2. 1839; Esser in Blumea 44: 162, f. 2. 1999. *F. wallichiana* Royle, l. c. 354, t. 84a or 98, f. 3. 1839. *F. malabarica* Wight, Icon. Pl. Ind. Orient. 5: t. 1866. 1852. *Excoecaria insignis* (Royle) Müll. Arg. in DC., Prod. 15(2): 1212. 1866. *Carumbium insigne* (Royle) Kurz, Rep. For. Veg. Pegu, App. A, 114. 1875 & Forest Fl. Burma 2: 412. 1877. *Sapium insigne* (Royle) Trimen, Syst. Cat. Fl. Pl. Ceylon 83. 1885; Hook. f., Fl. Brit. India 5: 471. 1888. *Sapium insigne* var. *malabaricum* (Wight) Hook. f., l. c. 472. 1888.

Asm.: *Mah-kola*; Hindi: *Khirmi*, *Lendwa*; Kan.: *Kurda*; Kon.: *Uso*; Mar.: *Dudla*; Tam.: *Sakkarakkalli*.

Trees, dioecious, 7 - 15 (- 25) m tall; juice acrid and poisonous. Leaves alternate, ovate-elliptic, oblong-lanceolate or obovate, acute to cuneate at base, crenate-serrulate along margins, acuminate or caudate at apex, 10 - 30 x 4 - 11 cm, glabrous; lateral nerves 15 - 22 pairs; petioles 3 - 8 cm long, biglandular at apex; stipules lanceolate, ca 1.5 mm long, fimbriate, glandular at base. Inflorescences appearing before leaves, terminal, rigid spikes, simple or dichotomously branched, unisexual; male spikes 15 - 20 cm long, deciduous; female spikes 7 - 15 cm long. Male flowers: in globose clusters of 10 in axils of 2 fleshy ovate green bracts, minute, sessile or on pedicels up to 0.5 mm long; calyx-lobes 2, orbicular, concave, ca 1 mm long; stamens 2, free, alternating with sepals, exserted; filaments ca 1.5 mm long; anthers scarlet-red. Female flowers: solitary, subsessile; calyx 2-lipped, with 2 or 3 ovate, long-pointed sepals; ovary ovoid to obovoid, ca 3 mm long, glabrous; styles 3, shortly recurved; stigma subsessile. Fruits capsular, ovoid, subglobose to globose, 3-lobed, 8 - 10 mm in diam., shiny, dark crimson, fleshy when young, dehiscent to leave bristle-like vascular strands in between the seeds; seeds ovoid, 5 - 6 mm in diam., yellowish brown.

*Fl. & Fr.* Dec. - June.

*Distrib.* India: Tropical and subtropical forests, usually in rocky places, up to 2000 m altitude. Himachal Pradesh, Uttarakhand, Uttar Pradesh, Bihar, West Bengal, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Orissa, Andhra Pradesh, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu.

Sri Lanka, Nepal, Bhutan, Myanmar, Laos, Cambodia, Vietnam, China, Thailand and Malaysia.

*Note.* The latex is toxic to skin and eyes.

**46. *Microstachys* A.Juss.**  
(Syn. *Sebastiania* Spreng.)

Herbs or undershrubs, perennial, monoecious, many-stemmed. Leaves alternate or distichous, petiolate, penninerved, glabrous to pilose, with a few glands at base; stipules entire or apically divided into several ciliae. Inflorescences extra-axillary spikes, each bearing a single female flower at base and many male flowers in thyrses at apical part of the spike. Male flowers: 1 - 3 in each bract; calyx minute, unequally 3-lobed or deeply 3-partite; petals and disc absent; stamens 2 - 4; filaments free or shortly connate; anther-thecae distinct, parallel. Female flowers: solitary in axil of each bract, at the base of the raceme; calyx 3-lobed or 3-partite, persistent; petals and disc absent; ovary 3-loculed; ovule 1 in each locule, pendulous; styles free or connate at base, revolute or spreading. Fruits capsular, consisting of 3 cocci separating from a columella; seeds 3, with a large persistent caruncle; testa smooth; endosperm fleshy; cotyledons flat.

Mainly Neotropical, sometimes in temperate N. America, Asia and Australasia, ca 15 species; one in India.

***Microstachys chamaelea* (L.) Müll.Arg.** in *Linnaea* 32: 95. 1893; Esser in *Blumea* 44: 176. 1999. *Tragia chamaelea* L., *Sp. Pl.* 981. 1753. *Sebastiania chamaelea* (L.) Müll.Arg. in *DC.*, *Prodr.* 15(2): 1175. 1866; Hook.f., *Fl. Brit. India* 5: 475. 1866.

Mar.: *Bhui-erandi*.

Perennial herbs to subshrubs, erect or ascending, up to 75 cm high, with milky latex; branchlets angled, puberulous. Leaves linear-lanceolate to elliptic-lanceolate, cuneate at base, minutely crenulate-dentate along margins, acute or obtuse and apiculate at apex, 1.5 - 8 x 0.4 - 1 cm; lateral nerves 15 - 30 pairs; petioles up to 3 mm long; stipules 0.5 - 2 x 0.2 - 0.5 mm, densely pilose. Inflorescences up to 3 cm long; flowers spirally arranged; bracts triangular to lanceolate. Male flowers: ca 1.5 mm across; bracts minute, completely covered by glands; calyx 5-lobed; lobes ovate, fimbriate, 1.5 - 2 mm long; stamens 3, exserted. Female flowers: solitary, axillary in upper leaf-axils or below the male flowers in the spikes, ca 1 mm across; calyx-lobes 3, ovate; ovary 3-lobed, echinate; styles 3, shortly connate, spreading, ca 2.5 mm long. Fruits ellipsoid, 3-lobed, with 2 vertical rows of soft prickles, 4 - 5 mm across, light green with a flush of red between warts; seeds oblong-ellipsoid, barrel-shaped with parallel sides, truncate at base, rounded at apex, ca 2.5 x 2 mm, brown, yellowish mottled.

*Fl. & Fr.* Throughout the year.

*Distrib.* India: A weed in cultivated land, fallow fields, on thin layer of soils on rocky places and often as forest undergrowth, roadsides, grasslands, from sandy beaches to hills, up to 1200 m altitude. Uttar Pradesh, Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Orissa, Jharkhand, West Bengal and Andaman Islands.

Africa, Sri Lanka, Myanmar, China to Malesia, Australia and Pacific Islands.

#### 47. *Shirakiopsis* Esser

Trees, monoecious with simple hairs; young leaves and inflorescences with yellowish hairs. Leaves alternate, simple, symmetric, petiolate, penninerved; lower surface with 0 - 10 marginal glands on each side; stipules ovate to triangular. Inflorescences terminal, spike-like thyrses, unbranched, bisexual or unisexual; bracts of male cymules triangular, at base with a pair of glands outside touching the axis and sometimes decurrent. Flowers: actinomorphic; calyx 3-lobed; petals and disc absent. Male flowers: (3 - ) 5 - 7 together, pedicellate; stamens 3, filament and anther of similar length; pistillode absent. Female flowers: 1 - 3 at base of staminate thyrses, sometimes absent; ovary 3-locular; ovules 1 per locule; styles 3, stigma undivided. Fruits pedicellate capsules, regularly dehiscent along septa, sometimes tardily dehiscent, smooth; pericarp massive, ca 2 mm thick, dry and woody; seeds ellipsoid, ecarunculate.

Tropical Africa and Asia, from India to Cambodia and throughout Malesia, 6 species, one in India.

***Shirakiopsis indica*** (Willd.) Esser in *Blumea* 44: 185. 1999; N.P. Balakr. & Chakrab., *Fam. Euphorb. India* 294. 2007. *Sapium indicum* Willd., *Sp. Pl.* ed. 4, 4: 572. 1805; Hook.f., *Fl. Brit. India* 5: 471. 1888; Anupama & Sivadasan in *Rheedea* 14: 29, f. 12. 2004. *Excoecaria indica* (Willd.) Müll.Arg. in *Linnaea* 32: 123. 1863 & in DC., *Prodr.* 15(2): 1216. 1866, p. p.; Chakrab. in *J. Econ. Taxon. Bot.* 6: 138. 1985.

Beng.: *Hurnabatul*.

Trees, 3 - 8 m tall, with acrid milky juice; branchlets terete, with spines and buttresses at base. Leaves narrowly oblong to oblong-elliptic, acute to obtuse at base, crenulate or serrulate along margins, acute, caudate or bluntly acuminate at apex, 4 - 15 x 2 - 4.5 cm, chartaceous to thinly coriaceous, glabrous, glossy above; lower surface with 2 - 4 glands per side; lateral nerves 5 - 22 pairs; petioles 5 - 12 mm long; stipules triangular, lacerate, early caducous. Male inflorescences racemose, dense-flowered, 4 - 10 cm long; bracts broadly deltoid or triangular, 1 - 1.3 x 1.2 - 1.5 mm; pedicels 1 - 3.5 mm long; calyx lobes broadly ovate to suborbicular, 1.5 - 2 x 1 - 1.5 mm, fimbriate and ciliate along margins; stamens 2 or 3, free or often united below into 1.5 - 2 mm long column; anthers orbicular, 0.5 - 0.8 mm across. Female inflorescences solitary; pedicels 5 - 15 mm long; bracts as in male; sepals suborbicular, fimbriate, 2 - 2.5 x 1.5 - 2 mm; ovary globose, (2 or) 3-locular, 1.5 - 2 mm in diam., glabrous; styles 7 - 10 mm long. Fruits depressed-globose, 2.5 - 3 cm in diam., almost unlobed, (2 or) 3-locular, regularly dehiscent, hard, smooth, green, becoming black; mericarps with very thick pericarp.

*Fl. & Fr.* March - July; Nov. - Jan.

*Distrib.* India: Coastal forests, along backwaters, on sandy or clayey soil. West Bengal, Kerala, Tamil Nadu (?) and Andaman & Nicobar Islands.

Sri Lanka, Bangladesh, Myanmar, China, Thailand and Malesia (excl. Philippines), up to Solomon Islands.

*Uses.* Leaves produce a greenish yellow dye. People of Sunderbans area of West Bengal use stem bark for insanity and hydrophobia.

#### 48. *Triadica* Lour.

Trees, monoecious, glabrous, evergreen. Leaves alternate, sometimes apically crowded; petioles at least half as long as blade; stipules ovate to triangular. Inflorescences terminal and in axils of uppermost leaves, simple spike-like thyrses; female flowers at base, male flowers at apices. Male flowers: in 5–8-flowered cymules; bracteoles present, undivided; bracts triangular, with a pair of spheroidal cylindrical glands touching the axis; pedicels up to 2 mm long; calyx 3–6-lobed; stamens 2 or 3; filaments longer than anthers. Female flowers: pedicellate; calyx apically to completely divided into 3 sepals, glandless or with spheroidal marginal glands; ovary 3-locular, smooth; style disarticulating at base. Fruits smooth, dry, 3-seeded, opening regularly and nearly simultaneously septically and loculicidally; septa mostly remaining with the winged columella; seeds attached to the central columella for a long time, covered with pale whitish sarcotesta, ecarunculate.

Asia, from NE. India to China and West Malesia, 3 or 4 species, 2 in India.

#### KEY TO THE SPECIES

- |  |                                     |
|--|-------------------------------------|
| 1a. Leaves ovate to elliptic, twice as long as wide      | <b>1. <i>T. cochinchinensis</i></b> |
| b. Leaves broadly ovate, less than twice as long as wide | <b>2. <i>T. sebifera</i></b>        |

**1. *Triadica cochinchinensis*** Lour., Fl. Cochinch. ed. 1, 2: 610. 1790 & ed. 2, 2: 749. 1793. *Stillingia discolor* Champ. ex Benth. in Hooker's J. Bot. Kew Gard. Misc. 6: 1. 1854. *Sapium discolor* (Champ. ex Benth.) Müll.Arg. in Linnaea 32: 121. 1863; Hook. f., Fl. Brit. India 5: 469. 1888; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 14: 183. 1990. *S. eugeniiifolium* Buch.-Ham. [in Wall., Cat. No. 7970. 1847, nom. nud.] ex Hook.f., l. c. 470. 1888, as '*eugeniaefolium*'; Kanjilal et al., Fl. Assam 4: 206. 1940.

Asm.: *Korha*; Kh.: *Dieng-soh-mrit*; Nep.: *Pipalpate, Phirphire*.

Shrubs to trees, up to 25 m tall. Leaves pinkish when young, withering blood red, ovate to elliptic, acute, cuneate to attenuate at base, acute to acuminate at apex, (2.5–) 6–13 x (1–) 2–6 cm, with a pair of basal glands, whitish-papillate to whitish-glaucous beneath, with 0–3 glands per side; lateral nerves 9–17 pairs; petioles 1–5 cm long with 2 large glands at apex; stipules 0.3–2 x 0.6–0.7 mm. Inflorescences simple dense terminal racemes, male part 2.5–5 cm long; bracts of male cymules 1–2 mm long, with glands of 1–1.5 mm diam. Male flowers: pedicel 2–3 mm long, articulate near base; calyx ca 1 mm long; stamens with 0.7–1 mm long filaments when flowering; anthers 0.4–0.5 mm long. Female flowers: up to 13 per thyrses; pedicels 2–4 mm long; calyx 1–2 mm long, sepals rarely with basi-marginal glands; style 1–3 mm long, stigmata 2–3 mm long. Fruits subglobose, circular in outline, 8–10 mm in diam., often clavate at base, rounded at apex; pericarp 0.3–0.4 mm thick; columella distinctly 3-winged, 1.5–2.5 mm, with conspicuously arching vein along margins, persistent; fruiting pedicels 2.5–6 mm long; seeds globose, 3.5–5 mm across, white or brownish when dry.

*Fl. & Fr.* May–Dec.

*Distrib.* India: Subtropical primary and secondary forests, thickets and hillsides, up to 1000 m altitude. NE. India.



Myanmar, Thailand, Indo-China, China, Malay Peninsula, Sumatra, N. Borneo, Philippines and Celebes.

*Uses.* Silk worms feed on the plant in Assam.

**2. *Triadica sebifera* (L.) Small**, Florida Trees 59. 1913 & Man. SE. Fl. 789. 1933; Esser in Blumea 44: 204. 1999. *Croton sebiferus* L., Sp. Pl. 1004. 1753 (as '*sebifer*'). *Sapium sebiferum* (L.) Roxb. [Hort. Bengal. 69. 1814, nom. nud.] Fl. Ind., ed. Carey 3: 693. 1832; Hook.f., Fl. Brit. India 5: 470. 1888.

Beng.: *Bilati-sissoo*, *Manchina*; Eng.: Chinese Tallow tree; Hindi: *Vilaiti-sisham*.

Shrubs to trees, 2 - 8 m high. Leaves transversely ovate, triangular, broadly rhombate-ovate to suborbicular, cuneate to broadly rounded at base, entire, acuminate at apex, 4 - 8 x 3 - 6 cm, glabrous, 3-nerved at base; lower surface whitish-papillate and a few submarginal glands; lateral nerves 8 - 10 pairs; petioles 2 - 6 cm long, 2-glandular at apex; stipules ca 1.5 mm long. Inflorescences simple or few-branched terminal racemes, 7 - 14 cm long. Male flowers: in 10 - 15-flowered fascicles, at the apical portion of the racemes; pedicels ca 1.5 mm long; calyx cupular, truncate or 3-lobed, ca 0.5 mm across; lobes ovate, acute; stamens 2 or 3; anthers longer than broad. Female flowers: 2 - 6 per thyse, few or solitary at the base of racemes, on long pedicels; sepals 3, ovate, ca 2 mm long; ovary ovoid, ca 1.5 mm long, glabrous; styles 3, connate for half way, free above with recurved stigmata. Fruits depressed or rhomboid-globose, 3-lobed, 3-valved, 1 - 1.5 cm long, dark grey, glabrous; fruiting pedicels 6 - 15 mm long; seeds 3, depressed-globose, 6.5 - 8 mm in diam, enclosed in thick whitish wax-like persistent sarcotesta.

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

*Distrib.* India: Cultivated in warmer regions for its different uses and sometimes naturalizing.

Native to China.

*Uses* The wax surrounding the seeds is used for making candles. The leaves are used for making a black dye.

### Tribe 3. HUREAE Dumort.

Trees or shrubs, monoecious, with toxic or non-toxic latex; indumentum absent. Leaves alternate, entire, penninerved, biglandular at the base of the blade, stipulate. Inflorescences terminal or axillary, spicate; bracts somewhat adnate to the axis of inflorescence, eglandular. Male flowers: calyx 2 or 3-lobed; petals and disc absent; stamens 1 or 2, free or filaments connate; pollen grains 3-colporate, colpi somewhat marginate, sexine finely perforate-tectate. Female flowers: calyx as in male; petals and disc absent; ovary 3 - 20-locular, not appendiculate; styles unlobed, connate. Fruits capsular; seeds ecarunculate, testa dry.

Central and South America, 4 genera; one in India under cultivation.

## CULTIVATED GENUS

**Hura L.**

Neotropical genus, 2 species; one in India under cultivation.

**Hura crepitans** L., Sp. Pl. 1008. 1753; Chandrab. in A.N. Henry et al., Fl. Tamil Nadu, Ser. I. Analysis 2: 232. 1987.

Eng.: Sandbox tree; Tam.: *Mullarasanam*, *Mulbara-maram*.

Trees, 10 - 20 m tall; stems and branches densely aculeate. Leaves ovate, cordate at base, entire or distantly dentate-serrate along margins, acuminate to acute at apex, 9 - 15 x 7 - 12 cm, glabrous above, pilose on nerves beneath; lateral nerves 14 - 18 pairs, connected by numerous parallel nervules; petioles 5 - 20 cm long; stipules ovate, 9 - 15 mm long. Male flowers: terminal, spicate on 3 - 8 cm long peduncles; calyx cup-shaped, 2 - 3 mm long; stamens 11 - 30, connate into a column of 2 or 3 whorls. Female flowers: solitary, adjacent to numerous male spikes; pedicels 1.2 - 1.7 cm long, elongating to 6 cm after anthesis; calyx subglobose, tightly surrounding the ovary, 4 - 6 mm long; ovary 11 - 14-loculed, with one ovule in each; style columnar, fleshy; stigma peltate, funnel-shaped, with 11 - 14 obtuse lobes, 1.5 - 2.5 cm across, fleshy. Fruits cernuous, schizocarpic, beaked, woody, longitudinally ribbed, 4 - 5 x 8 - 9 cm; beak conical, firm, 0.8 - 1.2 cm long, falling off together with the apex of the central column; seeds strongly flattened.

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

*Distrib.* India: Cultivated. Tamil Nadu and West Bengal.

Native of South America, introduced and cultivated in many tropical countries of Asia.

Subfamily IV. **OLD FIELD IOIDEAE** Köhler & G.L. Webster  
(**T. Chakrabarty & N. P. Balakrishnan**)

Trees, shrubs or subshrubs. Leaves alternate or more commonly opposite or verticillate, simple or palmately compound, entire or dentate; stipules small, caducous or absent. Inflorescences axillary, glomerate, racemose, capitulate or paniculate. Male flowers: sepals (3 - ) 4 - 8 (- 12), imbricate, usually free; petals absent; disc intrastaminal or absent; stamens (2 - ) 3 - 30; filaments free or connate; pistillodes absent or present. Female flowers: sepals (3 - ) 4 - 8 (- 13), free; petals absent; disc annular or lobed or dissected or absent; ovary 2 - 4 (- 5)-locular; ovules 2 per locule; styles entire, stigmatoid, rarely bifid. Fruits capsular or rarely drupaceous; seeds 1 or 3 per locule, often carunculate, often carunculate; testa usually smooth and shiny; endosperm usually copious, rarely obsolete.

Mostly in Southern Hemisphere, ca 28 genera; one in India.

**46. Mischodon** Thwaites

Trees with spreading branches or shrubs, dioecious. Leaves opposite or in whorls of 3 or 4, simple, entire, coriaceous, pinnately veined; stipules persistent, adnate to petiole. Flowers: small, in axillary cymes of clusters or panicles, apetalous, pedicellate. Male flowers: sepals (2 - )

5 - 8, imbricate, free, often unequal; disc absent; stamens (5 -) 6 (- 10), opposite to sepals, free, exserted; filaments elongated, filiform; anthers dorsifixed, extrorse; pistillode present, 3-lobed. Female flowers: sepals 5 or 6, caducous; disc annular; ovary 3 - 4 (- 5)-locular, glabrous or pubescent; ovules 2 in each locule; styles slightly to distinctly connate below; stigmas flat. Fruits capsular, dry, deeply 3-lobed; cocci 2-valved; seeds ecarunculate, ovoid, shiny.

Sri Lanka, South India and Andaman Islands. Monospecific.

**Mischodon zeylanicus** Thwaites in Hooker's J. Bot. Kew Gard. Misc. 6: 300, t. 10 B. 1854 & Enum. Pl. Zeyl. 275. 1861; Bedd., Fl. Sylv. S. India t. 290. 1873; Hook.f., Fl. Brit. India 5: 344. 1887; Gamble, Fl. Madras 2(7): 1312. 1925 (repr. ed. 2: 917. 1957); V.S. Raju in J. Econ. Taxon. Bot. 5: 165. 1984; Chakrab. & N.P. Balakr. in Rheedeia 15: 140. 2005 (2006).

Trees or large shrubs, up to 20 m tall; branchlets 4-angled, pubescent; young branches and inflorescences bearing short cinnamomeous hairs. Leaves narrowly elliptic, broadly elliptic to oblanceolate, entire, narrowly obtuse to subcordate at base, rounded, obtuse to emarginate at apex, 7 - 25 x 2 - 7 cm, coriaceous, red when young; lateral nerves 10 - 15 pairs; petioles 0.5 - 1.5 (- 5) cm long. Male flowers: many, in axillary, more or less diffuse, up to 8 cm long panicles; pedicels 2 - 3.5 mm long, pubescent; sepals 3 + 3, lanceolate, ca 1.5 x 0.5 mm, glabrous but for a tuft of hairs at apex; filaments 2 - 5 mm long, villous; anthers ovoid, ca 1 x 0.6 mm, villous; pistillode truncate or lobed. Female flowers: in densely compact, axillary, up to 1 cm long fascicles or panicles; pedicels ca 1 mm long, elongating in fruit up to 2.5 cm. Fruits globose, 3-lobed, ca 1 cm across; lobes obtusely keeled, glabrous; seeds obscurely trigonous, ca 7 x 5 mm, shiny, dark brown.

*Distrib.* India: Dry evergreen forests, up to an altitude of 500 m. Tamil Nadu (Kodaikanal) and Andaman Islands.

Sri Lanka.

Subfamily V. **PHYLLANTHOIDEAE** Asch.  
(**T. Chakrabarty, M. Gangopadhyay & N. P. Balakrishnan**)

Trees, shrubs or herbs; indumentum simple or rarely branched or lepidote. Leaves alternate, spiral to distichous or very rarely opposite, usually stipulate, simple or rarely trifoliolate. Inflorescences axillary or rarely terminal, mostly racemiform or spiciform, often reduced to glomerules or flowers solitary; bracts eglandular, usually inconspicuous. Flowers: sepals 1 or 2-seriate, mostly 4 - 6, imbricate or sometimes valvate, free or connate below; petals absent or if present, then minute; disc present or absent; stamens 1 or 2-seriate, outer series opposite to sepals or all in the centre of the flower, (2 -) 4 - 8 (- 50), filaments free or united in a column; pistillode present or absent; ovary (1 -) 2 - 5 (- 20)-loculed; styles free or united at base, mostly bifid; ovules 2 in each locule, anatropous or hemitropous, sometimes with prominent nucellar beak; raphe ventral. Fruits dry capsular, with 3 or more 2-valved cocci, or less commonly baccate or drupaceous, dehiscent or rarely indehiscent; seeds ecarunculate or with rudimentary caruncles; endosperm present or absent; cotyledons flat or folded.

Pantropical, 8 tribes and 60 genera; 7 tribes and 19 genera in India.

KEY TO THE TRIBES

1 a. Leaves trifoliolate; inflorescences paniculate; styles entire

**Tribe 2. BISCHOFIEAE**

- b. Leaves simple, mostly entire; inflorescences simple racemes, spikes, narrow thyrses or axillary clusters, glomerules or heads; styles usually bifid 2
- 2a. Leaves mostly with paracytic or anomocytic stomata; flowers in axillary or terminal spikes or racemes with axis over 1 cm long; petals absent, or if present, then the inflorescences terminal; seeds with endosperm 3
- b. Leaves mostly with paracytic stomata; flowers in axillary clusters with axis usually less than 1 cm long, except in some *Phyllanthaeae*; petals present or absent; seeds with or without endosperm 4
- 3a. Leaves with tanniferous epidermal cells, not granulose-glandular; floral disc present or absent; pollen grains 3-colporate; styles bifid; fruits not winged **Tribe 1. ANTIDESMEAE**
- b. Leaves without tanniferous epidermal cells, granulose-glandular; floral disc absent; pollen grains zonoporate; styles unlobed; fruits winged **Tribe 5. HYMENOCARDIEAE**
- 4 a. Leaves often dentate; disc in male flowers intrastaminal; ovary 1 - 2-locular; fruits drupaceous **Tribe 4. DRYPETEAE**
- b. Leaves entire; disc in male flowers extrastaminal or absent; ovary 2 - 3(-6)-locular; fruits mostly capsular or baccate, less commonly drupaceous 5
- 5 a. Petals present, at least in male flowers; sepals imbricate; ovules anatropous; endosperm present or absent **Tribe 7. WIELANDIEAE**
- b. Petals absent, or if present, then sepals valvate; ovules anatropous or hemitropous; endosperm usually present 6
- 6 a. Sepals valvate; petals present, usually shorter than sepals **Tribe 3. BRIDELIAE**
- b. Sepals imbricate; petals absent, or if present then as long as sepals **Tribe 6. PHYLLANTHEAE**

**Tribe 1. ANTIDESMEAE (Sweet) Hurus.**  
**(T. Chakrabarty & M. Gangopadhyay)**

Trees or shrubs, rarely herbs, dioecious or rarely monoecious. Leaves entire, penninerved, glandular or eglandular, stipulate, with tanniferous epidermis. Inflorescences axillary or rarely terminal, amentiferous. Flowers: sepals 3 - 6, free or connate, imbricate; petals absent or reduced; disc annular, lobed or dissected. Male flowers: stamens 2 - 8, free or almost so; anthers extrorse or introrse; pollen grains mostly prolate, 3-colporate, reticulate, with 3 narrow colpi; pistillode present or absent. Female flowers: ovary 1 - 3 (-5)-locular; ovules anatropous; styles bifid or bipartite, rarely entire, sometimes dilated. Fruits capsular or drupaceous, indehiscent or tardily dehiscent; seeds mostly 1 per locule or 1 per fruit, ecarunculate; seed coat dry or fleshy; endosperm thin to copious; cotyledons mostly broader than the radicle.

Mainly paleotropical, 18 genera; 3 genera in India.

KEY TO THE GENERA

- 1 a. Leaves not glandular; stomata paracytic; disc present, annular or lobed; antherlocules somewhat pendulous; pollen grains distinctly prolate **52. Antidesma**
- b. Leaves sometimes glandular; stomata anisocytic; disc absent; anther-locules not pendulous; pollen grains globose or slightly prolate 2
- 2 a. Leaves distichous on terminal branches; petioles mostly up to 2 cm long, usually distinctly pulvinate at both ends; disc absent in male flowers; stamens 1 - 5; pistillode absent; seeds without aril **53. Aporosa**
- b. Leaves alternate; petioles mostly 2 - 15 cm long, usually only apically pulvinate; disc present in male flowers; stamens 4 - 8; pistillode present; seeds with aril **54. Baccaurea**

## 52. *Antidesma* Burm. ex L.

Shrubs or trees, dioecious, glabrous or pubescent. Leaves simple, alternate, entire, penninerved; petioles short; stipules usually narrow, sometimes conspicuous and subfoliaceous, caducous or persistent. Inflorescences terminal and axillary, rarely cauliflorous, simple or paniculate, racemose or spicate, with small flowers arising singly along the rachis; bracts small. Male flowers: sessile or shortly pedicellate; calyx shortly cupular, 3 – 5-lobed with imbricate lobes; petals absent; disc pulviniform, extra-staminal, composed of free or more or less connate glands; stamens 2 - 5, arising within the disc or between the disc glands or in the excavations of the disc, exserted; anther-thecae orbicular, distinct; connective thick; pistillode small. Female flowers: pedicellate or sometimes sessile; calyx as in male; petals absent; disc annular; ovary 1 (or 2) locular; locules biovulate; styles 3, terminal to lateral, ca 1 mm long, shortly connate at base, bifid or bilobed above, persistent. Fruits drupaceous, 3 - 15 mm long, symmetrical or oblique, indehiscent, usually laxly reticulate-alveolate, 1-seeded.

About 150 species, mainly in the Old World tropics, mostly in South-East Asia, Malesia, Australia and the Pacific, 10 species in Africa and Madagascar; 15 species in India.

*Literature.* CHAKRABARTY, T. & M. GANGOPADHYAY (2000). The genus *Antidesma* L. (Euphorbiaceae) in the Indian subcontinent. *J. Econ. Taxon. Bot.* 24: 1 - 55, ff. 1 - 23. PAX, F. & K. HOFFMANN (1922). Euphorbiaceae - Phyllanthaceae. In: A. Engler (ed.), *Das Pflanzenreich* IV.147.XV. (Heft 81): 1 - 349.

*Notes.* Hans (Taxon 22: 591 - 636. 1973) compiled the chromosome numbers of 7 species of *Antidesma* and also discussed the polyploidy in the genus (*Cytologia* 23: 321 - 327. 1970), based on  $x = 13$ , and opined that on cytological grounds, *Antidesma* cannot be removed to a separate family.

### KEY TO THE SPECIES

- |   |                                    |
|---|------------------------------------|
| 1 a. Stamens 2 or very rarely 3   | <b>1. <i>A. acidum</i></b>         |
| b. Stamens 3 – 6  | 2                                  |
| 2 a. Ovary pubescent at lower half, glabrous at upper half  | <b>5. <i>A. comptum</i></b>        |
| b. Ovary uniformly pubescent or glabrous  | 3                                  |
| 3 a. Inflorescences cauliflorous, fascicled   | 4                                  |
| b. Inflorescences terminal and axillary   | 5                                  |
| 4 a. Leaves oblong (or narrowly so) to oblong-elliptic or ovate-lanceolate, coriaceous; venation of leaves finely tessellated, forming more or less squarish reticulæ | <b>11. <i>A. puncticulatum</i></b> |
| b. Leaves obovate, elliptic-obovate to oblanceolate, chartaceous; venation of leaves not finely tessellated   | <b>3. <i>A. bhargavae</i></b>      |
| 5 a. Stipules broad and conspicuous, ovate, elliptic to orbicular, more or less persistent  | <b>12. <i>A. tetrandrum</i></b>    |
| b. Stipules narrow, linear, lanceolate or subulate, deciduous   | 6                                  |
| 6 a. Branchlets glabrous  | 7                                  |
| b. Branchlets variously pubescent   | 11                                 |
| 7 a. Axils of lower lateral nerves on the under surface of leaves with domatia or bearded with tufts of hairs; anthers large, ca 1 mm in diam.                        | <b>4. <i>A. bunius</i></b>         |
| b. Axils of lower lateral nerves on the under surface of leaves without such domatia on tufts of hairs; anthers small, up to 0.5 mm in diam.                          | 8                                  |

- 8 a. Fruits inflated; styles terminal **9. A. montanum** (p. p.)  
 b. Fruits flattened; styles subterminal (except in *A. khasianum*) 9
- 9 a. Leaves glossy, nervules very prominent on the upper surface forming a fine reticulum; fruits 4 - 5 (- 6) x 3 - 4 (- 5) mm **2. A. alexiteria**  
 b. Leaves not glossy, nervules inconspicuous or faint on the upper surfaces; fruits 7- 11 x 6 - 7 mm 10
- 10 a. Midrib of leaves shallowly channeled on the upper surface; inflorescences 5 - 16 cm long; fruits oblique, 9 - 11 mm long; styles subterminal **7. A. keralense**  
 b. Midrib of leaves flat or slightly raised on the upper surface; inflorescences up to 6 cm long; fruits symmetric, 7 - 8 mm long; styles terminal **8. A. khasianum**
- 11 a. Leaves rounded to obtuse at apex, often cordate at base **6. A. ghaesembilla**  
 b. Leaves acuminate, caudate, apiculate or at least narrowing at apex, rarely cordate (*A. velutinosum*) at base 12
- 12 a. Fruits flattened; styles subterminal to lateral 13  
 b. Fruits inflated; styles terminal 15
- 13 a. Leaves glabrous above; lateral nerves prominent on the upper surface; flowers sessile; fruits 10 - 13 x 6 - 8 mm, sessile **13. A. tomentosum**  
 b. Leaves pubescent above, at least on the midrib; lateral nerves inconspicuous or faint on the upper surface; flowers pedicellate; fruits 5 - 7 x 4 - 5 mm, pedicellate 14
- 14 a. Male inflorescences 1 - 3 cm long; bracts up to 1 mm long; infructescences 2 - 8 cm long **10. A. nigricans**  
 b. Male inflorescences 5 - 12 cm long; bracts 2 - 3 mm long, giving the inflorescences a comose appearance when young; infructescences 7 - 12 cm long **14. A. velutinosum**
- 15 a. Male flowers pedicellate **9. A. montanum** (p. p.)  
 b. Male flowers sessile **15. A. velutinum**

**1. Antidesma acidum** Retz., *Observ. Bot.* 5: 30. 1788 (as *acida*); Müll.Arg. in DC., *Prodr.* 15(2): 249. 1866. *Stilago diandra* Roxb., *Pl. Coromandel* 2: 35, t. 166. 1802 & *Fl. Ind.*, ed. Carey 3: 759. 1832. *Antidesma diandrum* Roth, *Nov. Pl. Sp.* 369. 1821; Hook.f., *Fl. India* 5: 361. 1887, p. p. *A. diandrum* (Roxb.) Spreng., *Syst. Veg.* 1: 826. 1824, nom. illeg. *Stilago lanceolaria* Roxb. [*Hort. Bengal.* 71. 1814, nom. nud.] *Fl. Ind.*, ed. Carey 3: 760. 1832. *Antidesma lanceolarium* (Roxb.) Wall., *Num. List No.* 7284. 1832; Wight, *Icon. Pl. Ind. Orient.* 3(1): 4, t. 766. 1843. *A. wallichianum* C.Presl, *Epimel. Bot.*: 235. 1849. *A. ghaesembilla* auct. non Gaertn. 1788: sensu Hook.f., l. c. 357. 1887, p. p.; Pax & K.Hoffm. in *Engl., Pflanzenr.* IV.147.xv (heft 81): 155. 1922, p. p. quoad syn. *A. acidum* Retz.

Asm.: *Abutenga, Nekham-tenga*; Beng.: *Amtua-sag, Archal, Mathagach, Mutta*; Garo: *Aburok*; Hindi: *Aamari, Amlī, Dhakki, Khatua, Sabheli-bhaja*; Kan.: *Bilikoomme, Karrihulipa, Sannagooje*; Kash.: *Amtu*; Kh.: *Chouding, Dieng-japue*; Lep.: *Kantjer*; Mal.: *Areepazham*; Mar.: *Ghondurili*; Mik.: *Ing-sun-arong*; Nep.: *Archal*; Or.: *Kundui, Manmuri, Nuniari*; Sant.: *Matha-arak*; Tam.: *Asaripuli, Keathekkayyaa*; Tel.: *Pella-gumudu*; Urdu: *Nuniari*.

Shrubs, 1 - 3 m high or rarely trees up to 15 m tall, deciduous. Leaves obovate to oblanceolate or oblong to elliptic, cuneate or acute at base, acute to apiculate at apex, (2 -) 5 - 12 (- 16) x 1.5 - 7 cm, membranous to chartaceous, glabrous above, sparsely pilose on midrib or occasionally tomentellous beneath; lateral nerves 3 - 8 pairs; petioles 1 - 5 (- 10) x 0.6 - 2 mm. Male inflorescences axillary and terminal, simple, 1 or 2 (- few)-branched, 2 - 12 cm long; bracts 0.5 - 1 mm long, ciliate. Male flowers: pedicels 0.5 - 1.5 mm long; calyx cup-shaped, 0.8 - 1 x 1 -

1.3 mm; segments 4 or 5, deltoid or suborbicular, ca 0.3 x 0.5 mm; disc cushion-shaped, enclosing the bases of filaments, pubescent; stamens 2, 1.2 - 2.5 mm long; anthers ca 0.6 mm broad. Female inflorescences simple or rarely once-branched, 2 - 5 cm long; bracts as in male. Female flowers: pedicels 0.5 - 1.5 (-3) mm long; calyx urceolate, 1 - 1.5 x ca 1.2 mm; segments 4, triangular or deltoid, ca 0.5 mm long; disc annular; ovary ovoid, ca 1 x 1 mm, glabrous; styles terminal, 0.5 - 1 mm long. Fruits ellipsoid to suborbicular or often broadly oblong, somewhat laterally compressed, with short terminal persistent style at apex, 4 - 6 x 3 - 5 mm, glabrous, often white pustulate; fruiting pedicels 2 - 3 mm long.

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

*Distrib.* India: Common throughout India (excl. Andaman & Nicobar Islands) in evergreen or deciduous forests, borders of forests, scrubs, foothills and tropical Himalayan forests, Sal and bamboo forests, up to 1200 m in S. & NE. India and 1500 m on the Himalayas.

Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, Thailand, S. China, Indo-China and Java. Absent in Sri Lanka and Malesia (except Java).

*Uses.* The fruits are edible. The leaves are used in curry.

**2. *Antidesma alexiteria*** L., Sp. Pl. 1027. 1753, p. p.; Lam., Encycl. 1: 206. 1783; Hook.f., Fl. Brit. India 5: 359. 1887; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 24: 11. f. 2. 2000. *A. zeylanicum* Lam., l. c. 207. 1783 (as '*zeylanica*'); Gamble, Fl. Madras 2(7): 1297. 1925 (repr. ed. 2: 908. 1957).

Sinh.: *Hinembilla*.

Shrubs or trees, 1 - 8 m tall; branchlets apparently verticillate, glabrous. Leaves elliptic to elliptic-lanceolate or oblong-elliptic, acute or often rounded at base, acuminate to apiculate at apex, 3.5 - 10 (- 15) x 1.5 - 3 (- 4.5) cm, chartaceous to thinly coriaceous, glossy, glabrous; lateral nerves 5 - 12 pairs; petioles 1.5 - 5 x 0.5 - 1 mm, glabrous; stipules caducous. Male inflorescences terminal and axillary spikes, 2 or 3-together, simple or once branched, 3 - 6 cm long, lax-flowered; flowers subsessile; calyx ca 0.5 x 1.5 mm; lobes (3 -) 4 or 5, orbicular to deltoid, ca 0.5 x 0.5 mm, hairy; disc button-like; stamens 3, ca 1.5 mm long, inserted in the excavations of the disc; anther-thecae orbicular, ca 0.4 mm across. Female inflorescences terminal and axillary, 1 or 2 together, simple or sometimes branched, 2 - 6 cm long; flowers subsessile; calyx ca 0.7 x 1 mm; lobes 4, triangular or deltoid; ovary ovoid, ca 1 x 0.6 mm, glabrous; styles 2 or 3, ca 0.5 mm long, bifid, subterminal. Fruits gibbously-suborbicular turgid, lenticular or broadly obliquely ellipsoid, 4 - 5 (- 6) x 3 - 4 (- 5) mm, irregularly alveolate, often white pustulate, glabrous; style subterminal; fruiting pedicels ca 1 x 0.5 mm.

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

*Distrib.* India: Common in evergreen forests, between 100 and 1200 m altitudes. Kerala and Tamil Nadu.

Sri Lanka.

**3. *Antidesma bhargavae*** Chakrab. & N.P.Balacr. in J. Econ. Taxon. Bot. 26: 524, t. 1. 2002.

Shrubs or trees, 3 - 8 m tall; branchlets tomentose or hirtellous, glabrous in age. Leaves

obovate, obovate-elliptic to oblanceolate, rounded, acute or subacute at base, apiculate to acuminate or acute-mucronate at apex, 5 – 10 x 3 – 5 cm, chartaceous, pilose on major nerves and scabrid to glabrous elsewhere above, tomentellous on major nerves and scattered pilose elsewhere beneath; lateral nerves 5 – 7 pairs; petioles 2 – 4 x 1 – 1.5 mm, tomentose. Inflorescences cauliflorous, on leafless branches and main trunk, racemiform, arising singly, 2 or 3 together, 3 – 6 cm long, simple or once branched, tomentellous; bracts ovate-lanceolate, ca 1 mm long. Flowers: not seen. Fruits broadly oblong-ellipsoid or slightly oblique, somewhat compressed, 5 – 6 x 3.5 – 4 mm, glabrous, alveolate, 1-seeded; styles 3, terminal or subterminal, ca 1 mm long, shortly connate at base, bifid at apex; fruiting pedicels ca 2 x 0.2 mm.

*Fr.* June – July.

*Distrib.* India: Scarce in shaded places of inland forests on sandy or clayey loam up to 100 m altitude. Andaman & Nicobar Islands (South Andaman Island).

Endemic.

**4. *Antidesma bunius* (L.) Spreng., Syst. Veg. 1: 826. 1824; Hook.f., Fl. Brit. India 5: 358. 1887, p. p. (excl. *A. thwaitesianum*); Pax & K. Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 160, f. 12 E, G. 1922, p. p. (excl. *A. thwaitesianum*). *Stilago bunius* L., Mant. Pl. 122. 1767; Roxb., Fl. Ind., ed. Carey 3: 758. 1832. *Antidesma andamanicum* Hook.f., l. c. 364. 1887.**

*Asm.*: *Bon-heloch*, *Pani-heloch*; *Eng.*: Chinese laurel, Salamander tree; *Garo*: *Bol-aborak*; *Kan.*: *Karikoomma*, *Nayikoote*; *Kh.*: *Dieng-soh-silli*; *Lep.*: *Kunchur-kung*; *Mal.*: *Ariyaporiyan*, *Cherutali*, *Noolitali*, *Neoli-tali*; *Mar.*: *Almati*; *Nep.*: *Himatchari*; *Sinh.*: *Karawala kebella*; *Tam.*: *Nolaitali*, *Nolathalli*; *Tel.*: *Anepu*, *Janupolari*.

Shrubs or trees, 1 - 12 m tall; branchlets tomentellous when young, soon glabrescent. Leaves elliptic, oblong-elliptic to obovate, acute, subacute, cuneate or rounded at base, entire to irregularly repand along margins, acuminate or apiculate at apex, 7 - 19 x 3 - 8 cm, thinly chartaceous to coriaceous, mostly glossy above, glabrous or often sparsely puberulous on midrib above towards base, glabrous beneath except for the bearded axils of the lower nerves; lateral nerves 5 - 10 pairs; petioles 3 - 10 mm long, finally glabrous. Male inflorescences terminal or often axillary, simple or sometimes once branched at the base, arising singly or sometimes 2 - 4-together, 5 - 14 cm long; bracts ovate, deltoid or lanceolate, 1 – 1.5 mm long; flowers 3 – 4 mm across, sessile or subsessile; calyx cup-shaped, ca 1 x 1 - 2 mm; lobes 3 or 4, suborbicular; disc subglobose, lobed above; stamens 3 (or 4), 2 - 3 mm long, inserted into the cavities of the disc; anther-thecae 0.8 - 1 mm across; pistillode clavate to cylindrical, ca 1 mm long. Female inflorescences terminal and axillary, simple, solitary or paired, 5 - 20 cm long; bracts deltoid, ca 1 mm long, caducous; pedicels 0.5 - 2 mm long; calyx tubular at base, 3 or 4 lobed up to midway, ca 1.5 x 1.5 mm, glabrous; lobes deltoid or triangular; disc shorter than calyx-lobes, glabrous; ovary ovoid, 1 - 1.8 x 1 - 1.3 mm, glabrous or sparsely hairy; styles terminal, ca 1 mm long, erect; stigmas 3 or 4, short, spreading, persistent. Fruits suborbicular to ovoid or widely ellipsoid, slightly compressed, 5 - 7 x 4 - 6 mm, glabrous; persistent style subterminal; fruiting pedicels 2 - 4 mm long.

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

*Distrib.* India: Moist evergreen and semievergreen forests, tropical forests, inland hill



forests, up to 1300 m altitude in S. India and 1850 m on the Himalayas. Uttarakhand, Uttar Pradesh, West Bengal, Sikkim, Assam, Meghalaya, Nagaland, Mizoram, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu and Andaman Islands.

Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, S. China, Laos, Vietnam, Thailand, Malaysia (excluding Malay Peninsula and Borneo) to New Guinea, Hawaii Islands and N. Australia.

*Uses.* Often cultivated as fruit tree. The fruits are juicy, sweetish sour and edible. The leaves are acidic when young and eaten with rice; also boiled and used in syphilitic ulcers. These are also diaphoretic. The stem and root bark have cyanophoretic properties and are poisonous. Bark of stem is used to prepare ropes. Timber made into pulp for making cardboards.

**5. *Antidesma comptum*** Tul. in Ann. Sci. Nat. Ser. III, 15: 190. 1851; Hook.f., Fl. Brit. India 5: 365. 1887. *A. lanceolatum* Tul. var. *walkeri* Tul., l. c. 196. 1851. *A. walkeri* (Tul.) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 118. 1922; A.N. Henry in Curr. Sci. 35: 106, f. 1. 1966.

Sinh.: *Thimbiliya*.

Shrubs or trees, 2–7 m tall; branches glabrous or finely pubescent. Leaves elliptic-ovate, ovate-lanceolate to linear-lanceolate, narrowed and acute at base, acuminate at apex, 2.5–21 x (1-) 2–4 cm, glabrous, glossy above; lateral nerves 4–8 pairs; petioles 4–10 mm long; stipules linear, ca 3 mm long, deciduous. Inflorescences terminal or at ends of short lateral branches, simple or branched, 2–3.5 cm long. Flowers sessile or very shortly pedicelled; pedicels up to 1.2 mm long, subglabrous; bracts ovate, minute; calyx minute, orbicular, 3 or 4-toothed, rusty tomentose, shallow in male, concave in female; disc entire or shallowly lobed, glabrous; stamens usually 4; filaments ca 1 mm long; ovary glabrous above, fulvous pubescent below; styles 2, deeply bifid. Fruits globose or ovoid, ca 6 x 4–5 mm; style terminal.

*Fl. & Fr.* Oct. – April.

*Distrib.* India: Evergreen forests, at 700–1300 m altitudes. Rare. Tamil Nadu (Tirunelveli Dist.).

Sri Lanka.

*Notes.* The peculiarity of this species is that the ovary is pubescent at lower half but glabrous at upper half, a character not found in any other species in this genus.

**6. *Antidesma ghaesembilla*** Gaertn., Fruct. Sem. Pl. 1: 189, t. 39, f. 5. 1788 (as '*ghesaembilla*'); Hook.f., Fl. Brit. India 5: 357. 1887, p. p. *A. pubescens* Roxb., Pl. Coromandel 2: 35, t. 167. 1802. *A. paniculatum* Roxb. ex Willd., Sp. Pl. ed. 4, 4(2): 764. 1806.

Asm.: *Heloch*; Beng.: *Khudi-jam*, *Timtoa*; Eng.: Black currant tree; Hindi: *Umtoa*; Kan.: *Pullapurasi-gida*; Kon.: *Jomdri*; Lep.: *Chipli*; Mar.: *Jondhra*; Mik.: *Theng-merok-arong*; Nep.: *Chipli*; Or.: *Jamula*; Sinh.: *Buembilla*; Tel.: *Janupulisaru*, *Kathupulitsi*, *Polari*, *Pulsur*; Urdu: *Nuniari*.

Shrubs or trees, 1–13 (-20) m tall; branchlets tomentellous, glabrescent in age. Leaves oblong, broadly oblong-elliptic to obovate, rounded to cordate or truncate at base, rounded,

obtuse, retuse or apiculate at apex, 2.5 - 14 x 1.5 - 10 cm, chartaceous to subcoriaceous, glabrous or pilose on midrib and lateral nerves above, tomentellous to thinly pilose (at least on nerves) beneath; lateral nerves 3 - 7 pairs; petioles 3 - 25 mm long; stipules linear-lanceolate or subulate, 3 - 8 mm long, deciduous. Male inflorescences terminal and axillary, usually much-branched, 5 - 15 cm long. Flowers sessile, 2 - 3 mm across; calyx deeply lobed, ca 1.2 x 1 - 2 mm; lobes 4 or 5 (- 7), deltoid-ovate, ca 0.8 x 0.5 mm; disc glands 4 - 6-lobed, free, interstaminal, obconical, ca 0.3 x 0.5 mm; stamens 4 or 5 (- 7), 1 - 2 mm long; anther-thecae ca 0.3 mm across; pistillode obconic, pubescent. Female inflorescences terminal and axillary, branched, 6 - 10 cm long. Flowers: pedicels ca 1 mm long; calyx 1 - 1.5 x 1.5 - 2 mm; lobes elliptic, ovate to linear-oblong, 0.8 - 1 x 0.2 - 0.6 mm; ovary ellipsoid to oblong-ellipsoid, often oblique, 1 - 1.5 x 0.5 - 1 mm, tomentose; styles subterminal, 0.5 - 1 mm long. Fruits subglobose, ca 8 mm across, fleshy, compressed-orbicular and 4 - 6 x 3 - 5 mm when dry, glabrous, alveolate, 1-seeded; style terminal; fruiting pedicels 1 - 1.5 mm long.

*Fl. & Fr.* Oct. - June.

*Distrib.* India: Common in deciduous forests or scrubs, often along riverbanks, up to 1400 m altitude. Throughout the country. Himachal Pradesh, Uttarakhand, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Nagaland, Tripura, Orissa, Jharkhand, Madhya Pradesh, Andhra Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka, Pakistan, Nepal, Bhutan to Myanmar, S. China, Laos, Vietnam, Thailand and throughout Malesia up to N. Australia.

*Uses.* The leaves are acidic and edible, often used for flavouring. Poultice of leaves employed for abdominal swelling and headache. The fruits are also acidic and edible. The wood is useful for construction of houses as light rafters.

**7. *Antidesma keralense*** Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 24: 23, f. 1. 2000. *A. bunius* sensu M.Mohanani & A.N. Henry, Fl. Thiruvananthapuram 428. 1994, non (L.) Spreng. 1825.

Shrubs, ca 3 m tall, entirely glabrous. Leaves elliptic to oblong-elliptic, acute or sometimes rounded at base, caudate or acuminate at apex, 7 - 13 x 2.5 - 5 cm, coriaceous; lateral nerves 8 - 12 pairs; petioles 5 - 10 mm long, 1 - 2 mm thick. Flowers: not seen. Inflorescences axillary, simple, 5 - 16 cm long; rachis appressed, yellow-puberulous to glabrous. Fruits obliquely ovoid-ellipsoid, compressed, 9 - 11 x 6 - 7 mm, black-brown when dry, alveolate; pedicels ca 1 mm long; style subterminal.

*Fr.* May.

*Distrib.* India: Rare, at about 1200 m altitude. Kerala (Chemungi, Thiruvananthapuram Dist., Mohanani 61834, Holotype in CAL).

Endemic.

**8. *Antidesma khasianum*** Hook.f., Fl. Brit. India 5: 362. 1887; Kanjilal et al., Fl. Assam 4: 168. 1940, p. p.; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 24: 23, f. 9. 2000.

Kh.: *Dieng-soh-syllih*.

Shrubs, up to 2 m high or small trees (Kanjilal et al., l. c.); branchlets glabrous, sparsely puberulous when young. Leaves oblong-lanceolate, elliptic-lanceolate or narrowly oblong-elliptic, acute or cuneate at base, acuminate or caudate at apex, 5 - 16 x 1.5 - 5 cm, chartaceous, glabrous; lateral nerves 5 - 9 pairs; petioles 2.5 - 5 x 1 - 1.5 mm, glabrous; stipules linear to subulate, 2 - 3 (- 7) mm long, deciduous. Male inflorescences terminal and axillary, solitary, paired or 3 together, 2 - 6 cm long, few-branched; bracts sub-flabellate, ca 0.5 mm long; pedicels ca 1 mm long, glabrous; calyx ca 0.6 x 1 mm, glabrous outside; lobes 3 or 4, triangular-deltoid, shallow; disc 3-lobed; stamens 3 or 4, 1 - 1.5 mm long, inserted in the disc; pistillode button-like. Female inflorescences terminal and axillary, simple or few-branched, up to 6 cm long; rachis tomentellous; pedicels ca 1 mm long; calyx ca 1 x 1 mm, glabrous; lobes 4, deltoid, shallow; ovary ovoid, ca 1 mm long, glabrous; styles terminal, ca 1 mm long, stout, recurved above. Fruits ovoid to ovoid-ellipsoid, compressed, 7 - 8 x ca 6 mm, glabrous, alveolate; style terminal; pedicels ca 3 mm long.

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

*Distrib.* India: Common in primary forests, between 1000 and 1500 m altitudes. Meghalaya and Arunachal Pradesh.

Endemic.

**9. *Antidesma montanum*** Blume, Bijdr. Fl. Ned. Ind. 1124. 1826 - 27; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 24: 26, f. 11. 2000. *A. pubescens* Roxb. var. *menasu* Tul. in Ann. Sci. Nat. Bot. Ser. III, 15: 215. 1851. *A. acuminatum* Wight, Icon. Pl. Ind. Orient. 6: 12, t. 1991. 1853; Hook.f., Fl. Brit. India 5: 363. 1887. *A. menasu* (Tul.) Müll.Arg. in DC., Prodr. 15(2): 257. 1866, p. p., tantum quoad *Hohenacker* 104, non Kurz 1877; Hook.f., l. c. 364. 1887, p. p.; T. Cooke, Fl. Bombay 2(3): 594. 1906; Gamble, Fl. Madras 2(7): 1298. 1925 (repr. ed. 2: 908. 1957); Kanjilal et al., Fl. Assam 4: 169. 1940. *A. menasu* var. *linearifolia* Hook.f., l. c. 364. 1887.

Shrubs or trees, 2 - 20 m tall; branchlets tomentose, glabrous in age. Leaves oblong, oblong-elliptic to lanceolate, acute, obtuse to rounded at base, caudate or acuminate at apex, 6 - 30 x 2 - 10 cm, chartaceous to thinly coriaceous, often glossy, glabrous or puberulous on midrib above, glabrous or tomentose to sparsely puberulous on midrib (often also on lateral nerves) beneath; lateral nerves 4 - 12 pairs; petioles (2 -) 3 - 10 x 1 - 2.5 mm; stipules caducous. Male inflorescences terminal and axillary, simple or paniculate racemes, 3 - 14 cm long; pedicels 0.5 - 2 mm long; calyx ca 0.6 x 1 - 1.5 mm; lobes 3 or 4, triangular, deltoid or ovate, deep; disc 3 or 4-lobed; stamens 3 or 4, 1 - 3 mm long; filaments inserted into the excavations of the disc; pistillode knob-like or capitate, ca 0.5 mm long. Female inflorescences terminal and axillary, simple or few-branched racemes, 5 - 10 (- 18) cm long; pedicels 0.5 - 3 mm long; calyx ca 1 x 1 - 2 mm; lobes 4, deep, triangular, deltoid or suborbicular; ovary ovoid or subglobose, 1 - 1.8 x ca 1 mm, glabrous; styles terminal, ca 1 mm long. Fruits ellipsoid to ovoid or sometimes rhomboid-ellipsoid or rarely ovoid-pyriform, 3 - 6 x 2.5 - 4 mm, glabrous, alveolate or ribbed; style terminal; pedicels 1 - 3 mm long.

#### KEY TO THE VARIETIES

1 a. Plants rheophytic; spreading shrubs, up to 3 m tall; leaves linear-lanceolate, acute at apex, or

sometimes rounded at the very tip, 4 - 10 times longer than wide, 3 - 6 x 0.4 - 1.2 cm; petioles 2 - 3 mm long, 0.7 - 1 mm wide; male inflorescences 1 - 4 cm long; female inflorescences ca 2 cm long

**9.1. var. *microphyllum***

- b. Plants not rheophytic; shrubs or trees, up to 20 m tall; leaves otherwise, acuminate at apex, 1 - 4 (-6) times longer than wide, 6 - 30 x 2 - 12 cm; petioles 2 - 6 (-15) mm long, 1 - 2 mm wide; male inflorescences 3 - 14 cm long; female inflorescences 5 - 10 (-18) cm long

**9.2. var. *montanum***

**9.1. var. *microphyllum*** (Hemsl.) Petra Hoffm. in Kew Bull. 54: 357. 1999; N.P. Balakr. & Chakrab., Fam. Euphorb. India 306. 2007. *Antidesma microphyllum* Hemsl. in Forbes & Hemsl., J. Linn. Soc., Bot., 26: 432. 1894. *A. wattii* Hook.f., Fl. Brit. India 5: 366. 1887; Pax & K. Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 163. 1922; Kanjilal et al., Fl. Assam 4: 169. 1940.

*Fl. & Fr.* July - Dec.

*Distrib.* India: Rheophyte along rivers, on rocks near streams in evergreen forests, at 300 - 1000 m altitudes. Manipur and Mizoram.

Bangladesh, Myanmar, China, Laos, Vietnam and Thailand.

*Notes.* Petra Hoffmann (Kew Bull. 54: 357. 1999) combined *A. wattii* with *A. microphyllum* Hemsl. (1894) of Myanmar, Thailand, SW. China and Indo-China and reduced the aggregate to a variety of *A. montanum* Blume. According to her, var. *microphyllum* is a small-leaved rheophytic variety of *A. montanum*.

**9.2. var. *montanum***

*Asm.:* *Pani-heloch*; *Kan.:* *Neerahanchi-mara, Kudivaala-soppa*; *Kh.:* *Dieng-soh-lang-ngiu, Dieng-pothar*; *Lep.:* *Kunchur-kung*; *Mal.:* *Putharaval*; *Nep.:* *Kalo-bilauni*; *Or.:* *Kath-jamrala*; *Tam.:* *Paei-eechchi, Kalakalatha*.

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

*Distrib.* India: Common, evergreen forests, wet deciduous forests, montane shola forests, subtropical forests, dense inland forests, littoral forests, up to 2300 m altitude. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Mizoram, Tripura, Orissa, Chhattisgarh, Madhya Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka, Bhutan, Bangladesh, Myanmar, China, Thailand, Malesia to New Guinea and N. Australia.

**10. *Antidesma nigricans*** Tul. in Ann. Sci. Nat. Bot., Ser. III. 15: 225. 1851; Hook.f., Fl. Brit. India 5: 360, 365. 1887; Kanjilal et al., Fl. Assam 4: 167. 1940, p. p. *A. oblongatum* Müll.Arg. in DC., Prodr. 15(2): 254. 1866; Hook.f., l. c. 365. 1887.

Shrubs, 1 - 2 m high; branchlets tomentellous, glabrous in age. Leaves oblong to oblong-lanceolate or often oblong-elliptic to obovate-elliptic, acute, obtuse to rounded at base, caudate or acuminate at apex, 6.5 - 18 x 3 - 7 cm, chartaceous to thinly coriaceous, tomentellous or puberulous on midrib above, sparsely pilose on midrib and often on lateral nerves beneath,

occasionally glossy; lateral nerves 6 - 13 pairs; petioles 2 - 6 x 1 - 2 mm; stipules linear-lanceolate, 3 - 5 x 0.5 - 1 mm, deciduous. Male inflorescences terminal and axillary, 3 or 4 together, simple, slender, 1 - 3 cm long; pedicels ca 1 mm long; calyx ca 0.5 x 1 mm; lobes 4 or 5, deltoid-acuminate, deep; disc depressed-globose, unlobed, entire; stamens 3 or 4, ca 1 mm long; filaments inserted in pits of the disc; anther-thecae ca 0.3 mm across. Female inflorescences terminal and axillary, usually simple, often 1 or 2 branched, 2 - 8 cm long; pedicels 1 - 1.5 mm long; calyx ca 1 x 2 mm; lobes 4, deep, triangular; ovary obliquely ellipsoid, ca 1.6 x 1.2 mm, sparsely puberulous or often glabrous; styles lateral, ca 1.2 mm long, stout, reflexed. Fruits obliquely and broadly oblong-ellipsoid, or suborbicular, compressed, 5 - 7 x 4 - 5 mm, glabrous, alveolate; style subterminal to lateral; pedicels 2 - 3 mm long.

*Fl. & Fr.* Jan. - Oct.

*Distrib.* India: Rare, in primary forests or forest floors amidst bamboo or along stream-banks, on wet alluvial soil or moist soil, between 250 and 1500 m altitudes. Arunachal Pradesh, Assam, Meghalaya, Nagaland and Mizoram.

Bangladesh and Myanmar.

**11. *Antidesma puncticulatum*** Miq., Fl. Ned. Ind., Eerste Bijv. 3: 468. 1860. *A. thwaitesianum* Müll.Arg. in DC., Prodr. 15(2): 263. 1866. *A. bunius* sensu Hook.f., Fl. Brit. India 5: 358 - 359. 1887, p. p.; Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 160 - 161. 1922, p. p., non (L.) Spreng., 1825.

Sinh.: *Karawala kebella*.

Trees, up to 12 m tall; branchlets initially puberulous, soon glabrous. Leaves oblong (or narrowly so) to oblong-elliptic or ovate-lanceolate, rounded or acute at base, slightly incurved along margins, acuminate at apex, 8 - 20 x 2.5 - 9 cm, coriaceous, glossy above, glabrous; lateral nerves 5 - 8 pairs; minor venation forming prominent tessellated reticula; petioles 5 - 25 mm long, pulvinate at apex, glabrous. Male inflorescence cauliflorous, simple, fascicled, spicate, slender, 2 - 7 cm long; rachis scattered puberulous; flowers sessile; calyx ca 0.8 x 1 mm; lobes triangular or suborbicular, ca 0.5 x 0.8 mm; disc lobulate, ca 0.8 mm in diam., encircling the bases of filaments; stamens 3 - 4, 1.5 - 2 mm long; anther-thecae ca 0.3 mm across; pistillode tubular, 3-fid, ca 0.3 mm long. Female inflorescences same as in male; pedicels 1 - 1.5 mm long; calyx ca 0.8 x 1.2 mm, glabrous; lobes 3 or 4, suborbicular; ovary subglobose, ca 1 mm in diam., glabrous; styles terminal, ca 1 mm long. Fruits flattened or compressed, broadly ellipsoid, oblong-ellipsoid, quadrate-orbicular or ovoid, 6 - 8 x 4 - 6 mm, glabrous, alveolate; style terminal; pedicels 1 - 2.5 mm long.

*Fl. & Fr.* April - July.

*Distrib.* India: Inland forests, at low altitudes, common. Andaman Islands.

Sri Lanka, Myanmar, Thailand, Indo-China, Malaysia, Sumatra, Borneo and Philippines.

**12. *Antidesma tetrandrum*** Blume, Bijdr. Fl. Ned. Ind. 1124. 1826 - 27; Chakrab. & A.K.Roy in J. Econ. Taxon. Bot. 5: 168. 1984.

Trees, 10 - 20 m tall; branchlets tomentellous to glabrous. Leaves oblong to oblong-

elliptic or widely so, rounded, obtuse or acute at base, acuminate at apex, 9 - 25 x 3 - 10 cm, thinly coriaceous to membranous, glabrous or sparsely pilose on midrib above, sparsely pilose on major nerves beneath; lateral nerves 7 - 12 pairs; petioles 5 - 25 mm long; stipules foliaceous, broadly ovate, elliptic, orbicular or spatulate, 6 - 20 x 4 - 14 mm, persistent. Male inflorescences terminal and axillary, few-branched, 5 - 10 cm long; pedicels 0.5 - 1.5 mm long; calyx ca 1 x 1.5 mm, puberulous; lobes 4, deep, deltoid, acute; disc lobulate, the lobules enclosing the bases of filaments; stamens 4 - 6, ca 2 mm long; anther-thecae ca 0.3 mm across; pistillode turbinate. Female inflorescences terminal, ca 8 cm long, few-branched, scattered fulvous to glabrous; flowers not seen. Fruits obliquely oblong, compressed, 3 - 4 x 2 - 3.5 mm, puberulous to glabrous, alveolate; style lateral; calyx ca 2 mm in diam., with 4 broadly triangular lobes; pedicels ca 2 mm long.

*Fl. & Fr.* Apr. - Dec.

*Distrib.* India: Common in inland hill forests or dense mixed forests on rocky loam, up to 100 m altitude. Nicobar Islands.

Sumatra, Java and Lesser Sunda Islands.

**13. *Antidesma tomentosum*** Blume, Catalogus 109. 1823 as '*tomentosa*' & Bijdr. Fl. Ned. Ind. 1126. 1827. *A. persimile* Kurz in Trimen, J. Bot. 13: 330. 1875 & in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 45(3): 147. 1876; Hook.f., Fl. Brit. India 5: 365. 1887 (as '*perserrula*').

Shrubs or trees, 2 - 5 m tall; branchlets reddish tomentellous. Leaves oblong-elliptic or narrowly so to ovate-oblong, rounded, subacute or unequal at base, caudate at apex, 15 - 30 x 5 - 11 (-15) cm, coriaceous, glossy, glabrous above, tomentellous or pilose on nerves beneath; lateral nerves 10 - 15 pairs; petioles 5 - 12 mm long; stipules linear or narrowly subulate, 5 - 20 x 2 - 4 mm. Male inflorescences axillary, simple, 10 - 20 cm long, spicate; rachis tomentellous; bracts narrowly elliptic, ca 1 mm long; flowers dense, sessile; calyx ca 1 x 1.8 mm; lobes 4 or 5, suborbicular; disc annular, with a stipe, pilose along margins; stamens 3 - 5, unequal, 1.2 - 2 mm long; anther-thecae ca 0.5 mm across; pistillode subglobose. Female flowers: axillary, simple or rarely branched, 10 - 30 cm long; rachis ferruginous-pubescent. Flowers sessile, ca 1.5 mm long; bracts deltoid, ca 1.5 mm long; calyx ca 1 mm long, lobes 5, free; lobes 4 or 5, ovary densely appressed-pubescent; stigmas 3 - 8. Infructescences in axils of fallen leaves, simple, 15 - 20 cm long, pendulous. Fruits sessile (also pedicelled in extra-Indian examples), obliquely ovoid, compressed, 10 - 13 x 6 - 8 mm, ribbed, appressed puberulous; style terminal or subterminal; calyx patelliform, ca 2 mm across, 4-lobed with deltoid and ca 0.5 mm long lobes.

*Fl. & Fr.* Apr. - Nov.

*Distrib.* India: Common in mixed forests, littoral forests, inland forests, often near streams, on rocky loam at low altitudes. Nicobar Islands.

Thailand, Malaysia, Indonesia, Philippines and Celebes.

**14. *Antidesma velutinum*** Blume, Bijdr. Fl. Ned. Ind. 1125. 1826 - 27; Hook.f., Fl. Brit. India 5: 356. 1887; Chakrab. & M. Gangop. in J. Econ. Taxon. Bot. 24: 44, f. 21. 2000. *A. roxburghii* Wall. ex Tul. in Ann. Sci. Nat. Bot., Ser. III, 15: 234. 1851; Hook.f., l. c. 357. 1887; Kanjilal et al., Fl. Assam. 4: 166. 1940. *Stilago tomentosa* Roxb., Fl. Ind., ed. Carey 3: 757. 1832, non *Antidesma tomentosum* Blume, 1823.

Shrubs or trees, 1 - 13 m tall; branchlets villous or tomentellous. Leaves narrowly oblong, oblong-elliptic, obovate-elliptic to broadly obovate, acute, obtuse, rounded to narrowly cordate at base, caudate or acuminate at apex, (8 -) 10 - 26 x (2 -) 4 - 12 cm, thinly coriaceous to chartaceous, villous to sparsely pubescent only on major nerves above, pilose to tomentose all over or villous, hirsute or pilose only on major nerves beneath; petioles 2.5 - 10 (-25) mm long, 1.5 - 3 mm thick. Male inflorescences terminal and axillary, simple, often tending to be aggregated into terminal pseudo-panicles, solitary, paired or 3 together, 5 - 12 cm long, dense-flowered; bracts linear, 2 - 3 mm long, long-pilose and giving comose appearance to the young inflorescences. Flowers: pedicels ca 0.5 mm long; calyx ca 1 x 1.5 - 2.5 mm; lobes 4 - 6, deep, linear, lanceolate or subulate; disc plano-convex, ca 1 mm in diam.; stamens 4 - 5 (-7), 2 - 3 mm long; filaments embedded into pits of the disc; pistillode columnar, ca 0.5 mm long. Female inflorescences terminal and axillary, simple or once branched near base, solitary or in pairs, 8 - 21 cm long, dense-flowered. Flowers: pedicels 0.5 - 3 mm long; calyx ca 1 x 1.5 - 2 mm; lobes 5 or 6, linear-lanceolate, ca 1 mm long; or sometimes 3 or 4, suborbicular and ca 0.5 mm across; ovary subglobose or ovoid, ca 1.2 mm in diam., tomentose or villous; styles slightly lateral, stout, 1 - 1.5 mm long, bifid halfway or almost to base or sometimes only notched at the tips, recurved. Fruits suborbicular to lenticular, compressed, 5 - 7 x 4 - 5 mm, puberulous or glabrous in age, alveolate; style subterminal to lateral; pedicels 0.5 - 5 mm long.

*Fl.* Nov. - July; *Fr.* Dec. - Sept.

*Distrib.* India: Evergreen primary forests, up to 1500 m altitude. Assam, Arunachal Pradesh, Nagaland and Tripura.

Bangladesh, Myanmar, Thailand, Laos, Malaysia, Java, Sumatra, Anambas and Natuna Islands.

**15. *Antidesma velutinum*** Tul. in Ann. Sci. Nat. Bot., Ser. III. 15: 223. 1851; Hook.f., Fl. Brit. India 5: 361. 1887; Chakrab. & M. Gangop. in J. Econ. Taxon. Bot. 24: 48, f. 22. 2000. *A. cf. acuminatum* sensu Chakrab. & N.P. Balakr. in J. Econ. Taxon. Bot., Addit. Ser. 9: 17. 1992, non Wight, 1853.

Shrubs or trees, 2 - 10 m tall; young shoots densely velutinous; branchlets velutinous or tomentose. Leaves elliptic to oblong-elliptic, acute, obtuse to rounded at base, acuminate or caudate or apiculate at apex, 5 - 18 x 2 - 8.5 cm, chartaceous to thinly coriaceous, sometimes glossy, tomentose on major nerves to subglabrous above, thinly tomentellous or pilose on major nerves beneath; lateral nerves 4 - 8 pairs; petioles 2 - 7 mm long; stipules linear or subulate, 3 - 7 x 1 - 1.5 mm, deciduous. Male inflorescences terminal and axillary, solitary, paired or 3 together, simple or few-branched, often aggregated into pseudo-panicles at the ends of branchlets, 5 - 10 cm long; flowers sessile to subsessile; calyx ca 0.6 x 1.2 mm, pilose outside; lobes 4, shallow, broadly triangular or suborbicular; disc 3-lobulate; stamens 3 or 4, 1 - 2 mm long; filaments inserted into pores at the corners of the disc; pistillode peltate. Female inflorescences terminal and axillary, solitary, paired or 3 together, simple or once-branched near base, 3 - 12 cm long; pedicels 0.5 - 1 mm long; calyx ca 1 x 1.5 - 2 mm, glabrous except the pilose tips of the segments; lobes 4, deep, deltoid, triangular or broadly ovate; ovary ovoid, 1 - 1.5 x 1 - 1.5 mm, appressed pilose or glabrous; styles terminal, ca 1 mm long, stout, recurved. Fruits ovoid, ovoid-ellipsoid or conic-ovoid, 5 - 8 x 3 - 5 mm, not compressed, glabrous, alveolate; style terminal; pedicels 0.5 - 1.5 mm long.

*Fl.* March - June; *Fr.* June - Nov.

*Distrib.* India: Near coasts, mixed forests, inland forests, at low altitudes, common. Andaman Islands.

Bangladesh, Myanmar, Cambodia, Thailand and Peninsular Malaysia.

### 53. *Aporosa* Blume

Shrubs or trees, dioecious, glabrous or with simple hairs. Leaves alternate, entire or sometimes sinuate-denticulate and glandular-notched along margins, often sprinkled with minute coloured dots, penninerved; petioles frequently pulvinate-geniculate, usually with a pair of circular sessile glands at the apex on the upper surface; stipules caducous or sometimes enlarged and persistent. Male inflorescences axillary, arising singly or few-together, spicate, dense-flowered, catkin-like; bracts broad, ciliate. Flowers: minute; sepals 3 or 4 (- 6), shortly connate at base, imbricate; petals absent; disc absent; stamens 2 or 3, free, exerted; anthers didymous, suborbicular, basifixed, longitudinally dehiscent; connectives narrow; pistillode minute or obsolete. Female inflorescences axillary, few-flowered, more or less fasciculate or spicate (mostly up to 3 cm long), in the latter case sometimes only one flower at the apex of the rachis developing into a fruit. Flowers: minute, sessile or occasionally pedicellate; sepals as in male, deciduous; petals absent; disc absent; ovary glabrous or pubescent, (1 -) 2 or 3 locular; locules biovulate; stylar column absent or up to 2 mm long; stigmas lacerate-papillose. Fruits capsular, unlobed, 2 or 3 locular, globose to ovoid or ellipsoid or fusiform, thin or thick-walled and fleshy, 2- or 3-valved, often tardily dehiscent; seeds 1 - 2 per fruit, ecarunculate, on a central core with fleshy jacket, ellipsoid or suborbicular in outline, often plano-convex; albumen fleshy; cotyledon broad, flat.

Indo-Malesia, extending to Solomon Islands, about 90 species; 7 species in India.

*Literature.* CHAKRABARTY, T & M. GANGOPADHYAY (1993). A revision of *Aporosa* Bl. (Euphorbiaceae) for Indian subcontinent. *J. Econ. Taxon. Bot.* 17: 155 - 171. SCHOT, A. M. (1995). A synopsis of taxonomic changes in *Aporosa* Blume (Euphorbiaceae). *Blumea* 40: 449 - 460.

*Notes.* The original spelling of the generic name *Aporosa* (Blume 1825: 514) is adopted here, following Schot (*Blumea* 40: 449. 1995), replacing *Aporusa* (Blume 1826: 6).

The haploid chromosome number (n) in *A. octandra* is 26 (Mehra & Hans, *Taxon* 18: 310 - 315. 1969).

According to Punt (*Wentia* 7: 1 - 116. 1962) the pollen grains are tricolporate, prolate spheroidal, ca 17.5 µm in diameter at equatorial axis, tectate and psilate. The colpi transversalis are small with parallel edges. The grains are similar to those of *Baccaurea* Lour.

#### KEY TO THE SPECIES

- |   |                                  |
|---|----------------------------------|
| 1 a. Ovary and fruits with numerous long linear-subulate soft processes | <b>1. <i>A. bourdillonii</i></b> |
| b. Ovary and fruits devoid of such processes                            | 2                                |
| 2 a. Ovary glabrous   | 3                                |
| b. Ovary pubescent  | 4                                |



- 3 a. Capsules ovoid to oblong, smaller (10–15 x 7–8 mm); leaves narrow, oblongelliptic, acuminate at apex, mostly green above when dry **7. A. wallichii**  
 b. Capsules fusiform or ellipsoid, larger (15–20 x 8–10 mm); leaves broadly obovate to widely elliptic or suborbicular, not acuminate at apex, brown or coppery when dry **3. A. fusiformis** (p. p.)
- 4 a. Female flowers and fruits pedicellate (pedicels 3–7 mm long) **2. A. cardiosperma**  
 b. Female flowers with up to 1 mm long pedicels; fruits sessile 5
- 5 a. Leaves pubescent beneath **6. A. octandra** (p. p.)  
 b. Leaves glabrous beneath 6
- 6 a. Ovary and fruits 3-locular 7  
 b. Ovary and fruits (1 -) 2-locular 8
- 7 a. Leaves narrow, acuminate at apex, chartaceous; tertiary nerves prominent on the upper surface **4. A. indo-acuminata** (p. p.)  
 b. Leaves broad, rounded, obtuse, retuse or apiculate at apex, coriaceous; tertiary nerves inconspicuous on the upper surface **3. A. fusiformis** (p. p.)
- 8 a. Leaves becoming black beneath on drying; petioles 1–3 cm long **5. A. nigricans**  
 b. Leaves becoming yellowish, greyish or brown on both sides when drying; petioles usually 5–15 mm long, rarely up to 30 mm long (*A. octandra*) 9
- 9 a. Branchlets slender (up to 3 mm thick); leaves chartaceous; petioles slender (up to 1 mm thick); male inflorescences up to 1 cm long; fruits 8–10 (-16) mm long **4. A. indo-acuminata** (p. p.)  
 b. Branchlets robust (up to 7 mm thick); leaves coriaceous; petioles stout (1–3 mm thick); male inflorescences 1–7 cm long; fruits 10–20 mm long 10a. Male inflorescences 1–3 cm long; hairs on ovary caducous; fruits glabrous, fusi form or ellipsoid **4. A. fusiformis** (p. p.)  
 b. Male inflorescences 2–7 cm long; hairs on ovary persistent; fruits brownish tomentellous to villous, sometimes subglabrous, ovoid, obovoid or subglobose **6. A. octandra** (p. p.)

**1. *Aporosa bourdillonii*** Stapf in Hooker's, Icon. Pl. 23: t. 2204. 1894; Gamble, Fl. Madras 2(7): 1309. 1925 (repr. ed. 2: 916. 1957).

Mal.: *Malamvetti*.

Shrubs or trees, 3–8 m tall; branchlets initially pilose, finally glabrous. Leaves oblong to elliptic-oblong or narrowly so, rounded or acute at base, entire along margins, acuminate or caudate at apex, 10–17 x 3–5.5 cm, chartaceous to thinly coriaceous, glabrous above, sparsely pilose on midrib and lateral nerves beneath; lateral nerves 6–9 pairs; petioles 10–20 mm long. Male inflorescences up to 1 cm long; sepals 3, ovate-oblong, ca 1 x 0.5 mm; stamens 2 or 3, ca 1.2 mm long. Female inflorescences arising singly or a few together; peduncles 5–10 mm long, 1-flowered (at the apex); bracts at intervals on axis, sepaline; sepals 4, oblong-lanceolate, 4–5 x 1.5–2 mm; ovary ovoid, 4–5 mm in diam., 3-locular, with numerous linear-subulate processes (up to 2 mm long, hirtellous); styles 3, 4–7 mm long, bifid, thick, hirtellous. Fruits ovoid, 15–20 x 15–20 mm, 3-locular; processes linear, up to 3 mm long, hirtellous.

*Fl. & Fr.* Dec. – April.

*Distrib.* India: Rare. In evergreen forests of Western Ghats, at low altitudes. Kerala.

Endemic.

**2. *Aporosa cardiosperma*** (Gaertn.) Merr. in J. Arnold Arbor. 35: 139. 1954; A.M.Schot in Blumea 40: 451. 1995. *Croton cardiospermus* Gaertn., Fruct. Sem. Pl. 2: 120, t. 107, f. 11. 1790. *Scepa lindleyana* Wight, Icon. Pl. Ind. Orient. 2: 5, t. 361. 1840. *Aporosa lindleyana* (Wight) Baill., Etude Euphorb. 645. 1858; Hook.f., Fl. Brit. India 5: 349. 1887; Gamble, Fl. Madras 2(7): 1309. 1925 (repr. ed. 2: 916. 1957). *A. sphaerocarpa* Müll.Arg. in Flora 47: 519. 1864 & in DC., Prodr. 15(2): 473. 1866.

Goa: *Sali, Salaei*; Kan.: *Akarkal, Sali, Sarali, Sulla*; Kon.: *Sal*; Mal.: *Kotili, Vetti*; Mar.: *Ukveti*; Sans.: *Valaka*; Tam.: *Vittil, Vettikan*.

Trees, 4–20 m tall; branchlets glabrous. Leaves elliptic-oblong or broadly ovate-oblong, rounded, obtuse or acute at base, acuminate at apex, entire along margins, 8–19 x 3.5–9 cm, thinly or often stiff-coriaceous; lateral nerves 7–10 pairs; petioles 5–20 mm long, glabrous; stipules ovate, ciliate. Male flowers: on 1–3.5 cm long inflorescences; calyx 4 (-6)-lobed; lobes ovate-oblong, 1–1.5 x 0.4–0.5 mm, glabrous; stamens 2 or 3, 1–1.5 mm long. Female flowers: on 5–12 mm long racemes or in fascicles; pedicels 3–5 mm long; sepals 4, broadly ovate-deltoid to suborbicular, 1.5–2 x 1.3–1.5 mm, glabrous; ovary fusiform, 2 or 3-locular, 2–3 x 2–2.5 mm, densely pilose; styles 2 or 3, connate into 1.5–2 mm long column, puberulous; stigmas 1–2 mm broad. Fruits globose or ovoid, pointed with the persistent style, (7-) 10–15 mm across, thin-walled, smooth, initially puberulous, finally glabrous; fruiting pedicels 5–7 mm long; seeds suborbicular, plano-convex, ca 5 mm across.

*Fl. & Fr.* Feb. – Nov.

*Distrib.* India: Common in deciduous or evergreen forests, or open rocky grounds, frequently along rivers, up to 1100 m altitude. Goa, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Uses.* Frequently planted in Arecanut grooves for leaf-mould. The fruits are edible. A decoction of the root is said to cure jaundice, fever and headache (in Kerala). The timber is useful for building purposes.

*Note.* The pedicellate fruits are sufficient to distinguish this species.

**3. *Aporosa fusiformis*** Thwaites, Enum. Pl. Zeyl. 288. 1861; Hook.f., Fl. Brit. India 5: 351. 1887; Gamble, Fl. Madras 2(7): 1309. 1925 (repr. ed. 2: 916. 1957).

Shrubs or trees 2–8 m tall; branchlets glabrous. Leaves obovate or broadly so to suborbicular or sometimes broadly elliptic, rounded to obtuse or narrowly cuneate to acute at base, entire and often minutely glandular-notched along margins, apiculate or obtuse to rounded or retuse at apex, (3-) 5–18 x (1.5-) 3–8 cm, thinly to stiffly coriaceous, glabrous, often glossy above; lateral nerves 4–7 pairs; petioles 5–15 (-25) mm long, glabrous. Male inflorescences clustered, 1–3 cm long; bracts subreniform; sepals 4 or 5, triangular to oblong, 1–1.2 x 0.4–0.6 mm; stamens 2 or 3, 2.5–3 mm long. Female inflorescences fasciculate; sepals suborbicular, ca 1.5 x 1.5 mm; ovary ovoid-ellipsoid, 2 (-3)-locular, densely puberulous, soon glabrous; styles 2 (or 3), 3–3.5 mm long; basal column 1–1.5 mm long; stigmas 2-lobed. Fruits ellipsoid or fusiform, shortly beaked, 15–20 x 8–10 mm, glabrous, thin-walled or sometimes slightly fleshy; seeds oblong, subconvex, ca 8 mm long.

*Fl. & Fr.* March - June.

*Distrib.* India: Rare. Evergreen hill forests, from 600 to 1400 m altitudes. Tamil Nadu and Kerala.

Sri Lanka.

**4. *Aporosa indo-acuminata*** Chakrab. & N.P.Balacr., **sp. nov.** *A. acuminatae* Thwaites affinis, a qua tamen differt floribus femineis 2 - 5 ad axillam folium, fructibus parvioribus, bilocularibus, tenuiparietibus et regulatim dehiscentibus.

*Type:* India, Kerala, Idukki dist., Poongavanam – Sabarimala, 15 Feb. 1981, *N.C. Nair* 70204 (CAL – Holotype); Isotype in MH.

Allied to *A. acuminata* Thwaites, differing mainly in the female flowers 2 – 5 per leaf-axil, and smaller, bilocular, thin-walled, regularly dehiscent fruits.

*A. acuminata* sensu auct. plur., non Thwaites, 1861: Hook.f., *Fl. Brit. India* 5: 348. 1887, p. p., tantum quoad spec. cit. 'Tinnevely, *Beddome*'; Bourd., *For. Trees Travancore* 473. 1908; Pax & K.Hoffm. in *Engl., Pflanzenr. IV.147.xv* (heft 81): 102. 1922, p. p., quoad spec. cit. 'Travancore, Kulkuntal, *Meebold* 13241'; Gamble, *Fl. Madras* 2(7): 1309. 1925 (repr. ed. 2: 916. 1957); N.R.Mandal & Panigrahi in *Bull. Bot. Surv. India* 26: 42. 1984 (publ. 1985), p. p., excl. quoad distrib. 'Sri Lanka'; Vajr., *Fl. Palghat Dist.* 421. 1990; Chakrab. & M.Gangop. in *J. Econ. Taxon. Bot.* 17: 158, f. 1A. 1993, p. maj. p., excl. typo et quoad spec. cit. 'Sri Lanka, *Cramer* 4399'; M.Mohan & A.N.Henry, *Fl. Thiruvananthapuram* 407. 1994; Philcox in Dassan. & Clayton, *Rev. Handb. Fl. Ceylon* 11: 269. 1997, p. p., tantum quoad distrib. 'Southern India'; N.P.Balacr. & Chakrab., *Fam. Euphorb. India* 310. 1970, p. p., excl. quoad distrib. 'Sri Lanka'.

Mal.: *Nirvetti, Swarnavetti*; Tam.: *Cheruseru, Vettimarom*.

Shrubs or trees, 2 – 10 m high; branchlets greenish, brown or greyish, terete, 1 – 3 mm thick, glabrous. Leaves elliptic, narrowly oblong, oblong-elliptic to lanceolate or sometimes oblanceolate, cuneate or acute at base, entire or occasionally slightly undulate and sometimes minutely glandular-notched along margins, caudate-acuminate (acumen 5 – 20 mm long) at apex, 6 – 14 x 2 – 5 cm, chartaceous, glabrous, pale green to pale brown when dry; lateral nerves 6 – 10 per side, faint above, prominent beneath; tertiary nerves conspicuous beneath, reticulate; nervules prominent beneath; petioles 5 – 15 x 0.5 – 2 mm, glabrous. Male inflorescences axillary, spicate, up to 1 cm long, dense-flowered; bracts broadly ovate, ca 0.8 mm long, pubescent, ciliate along margins; flowers sessile; sepals 3, oblong, subacute, 1 – 1.3 x 0.4 – 0.6 mm, glabrous; stamens 2, 1 - 1.2 mm long; filaments slender; anthers suborbicular, ca 0.5 mm across. Female inflorescences axillary, 2 – 5-flowered; rachis 2 – 3 mm long, puberulous; bracts deltoid, ca 0.5 mm long, puberulous outside; flowers sessile; sepals 3, triangular, 1 – 1.3 x 0.8 – 1.2 mm; ovary ovoid-oblong, 1.5 - 2.5 x 1 - 1.5 mm, densely tawny-pilose or hirtellous, 2-locular; stigmas 2 – 3, ca 1 mm long, bifid. Fruits ovoid to globose, 7 – 10 x 7 – 10 mm, 2-locular, puberulous to glabrous, thin-walled, green, brown or blackish when dry, regularly dehiscent; seeds pyriform, 7 – 8 mm long, 2-lobed, dark red.

*Fl. & Fr.* Sept. - June.

*Distrib.* India: Common in evergreen forests, frequently along streams, between 200 and 1800 m altitudes. Kerala and Tamil Nadu.

Endemic.

**5. *Aporosa nigricans* Hook.f., Fl. Brit. India 5: 347. 1887.**

Shrubs to trees, up to 18 m high; young branches sparsely puberulous. Leaves elliptic, rounded to acute at base, acuminate to cuspidate at apex, undulate to crenate or serrate along margins, 12 - 25 x 5 - 14 cm, chartaceous; basal glands small, indistinct; marginal glands distinct; glabrous above, sparsely hirsute beneath; lateral nerves 8 - 11 pairs; petioles 1 - 3 cm long, distinctly pulvinate; stipules caducous. Inflorescences axillary. Male inflorescences 1 - 6 together, 1 - 3 cm long; peduncles absent or up to 2 mm long; bracts triangular, ca 1 mm long; glomerules with 14 - 20 densely set flowers; pedicels ca 0.2 mm long; sepals (3) 4 (5), obovate, 0.5 - 0.8 mm long; stamens 2, 0.3 - 0.6 mm long; anthers ca 0.2 mm long; pistillode minute. Female inflorescences 1 - 3 together, 2 - 9 mm long; flowers up to 9, densely arranged along rachis; bracts triangular, 0.8 - 1.6 mm long; pedicels up to 1 mm long; sepals (3 or) 4, ovate, patent, 1 - 2 mm long; ovary 2-locular, densely tomentose; stigmas sessile to slightly raised, 0.5 - 1.5 mm long, divided. Fruits ovoid, 10 - 12 x 9 - 12 mm, with yellowish-whitish sutures, sparsely hairy, not fleshy; septae and column sericeous (sparsely and mostly along margins); seeds 6 - 8 x 3 - 4 mm.

*Fl. & Fr.* Period unknown.

*Distrib.* India: Primary, secondary, cleared or open forest, margins of swamp forests, on roadsides, hillsides, etc., up to 600 m. Nicobar Islands.

Thailand, Malay Peninsula (type), Sumatra, Borneo.

**6. *Aporosa octandra* (Buch.-Ham. ex D. Don) A.R. Vickery in Enum. Fl. Pl. Nepal 3: 193. 1982. *Myrica octandra* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 56. 1825. *Alnus dioica* Roxb., Fl. Ind., ed. Carey 3: 580. 1832. *Scepa villosa* Lindl., Nat. Syst. Bot., ed. 2: 441. 1836. *Lepidostachys roxburghii* Wall. ex Lindl., Nat. Syst. Bot., ed. 2, 441. 1836. *Aporosa villosa* (Lindl.) Baill., Etude Euphorb. 645. 1858; Hook.f., Fl. Brit. India 5: 345. 1887. *A. roxburghii* (Wall. ex Lindl.) Baill., l. c. 645. 1858; Kanjilal et al., Fl. Assam 4: 162. 1940, p. p. *A. dioica* (Roxb.) Müll. Arg. in DC., Prodr. 15(2): 472. 1866; Haines, Bot. Bihar Orissa 2: 137. 1921. *A. lindleyana* (Wight) Baill. var. *macrostachya* Müll. Arg. in Flora 47: 519. 1847 & in DC., Prod. 15(2): 473. 1866. *A. glabrifolia* Kurz in Trimen, J. Bot. 13: 330. 1875 & in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 45(3): 147. 1876; Hook.f., l. c. 349. 1887. *A. villosula* Kurz in J. Asiat. Soc. Bengal, Pt. 2. Nat. Hist. 42(2): 23. 1873 & Forest Fl. Burma 2: 362. 1877; Hook.f., l. c. 347. 1887; C.E. Parkinson, Forest Fl. Andaman Isl. 237. 1923.**

*Asm.*: Bara-heloch, Khokora; *Beng.*: Kokra; *Lus.*: Sontul; *Mani.*: Tinsibi; *Mik.*: Tamsir-arong; *Nep.*: Asare, Barakaunli, Chiplikhari, Hare-kusum, Kaghilai; *Or.*: Ban-char, Mossn.

Shrubs or trees, 2 - 12 m tall; branchlets villous to glabrous. Leaves narrowly to broadly oblong to elliptic or lanceolate or broadly ovate to ovate-elliptic, acute, obtuse to rounded or truncate to cordate at base, entire to sinuate-crenate or coarsely denticulate along margins, acuminate or sometimes caudate or often acute to obtuse or apiculate at apex, 6 - 25 x 2.5 - 12 cm, coriaceous or chartaceous, glossy, glabrous or villous on midrib above, villous or tomentellous to glabrous beneath; lateral nerves 5 - 10 pairs; petioles 4 - 30 mm long. Male inflorescences 2

- 7 cm long; sepals 4, ovate-triangular to oblong, 1 - 1.5 x ca 1 mm; stamens 2, ca 1 mm long. Female inflorescences axillary or rarely cauliflorous, fasciculate or on peduncles (up to 2 cm long); sepals 4, oblong, elliptic, triangular or ovate, 1.2 - 3 x 0.8 - 2 mm; ovary ovoid or ellipsoid, 1.5 - 3 mm in diam., villous, (1 -) 2-locular; style-column 1 - 2 mm long; stigmas 2, flabellate, bilobed. Fruits ovoid, obovoid to occasionally subglobose or rarely conical, 10 - 18 x 7 - 13 mm, (1 -) 2-locular, thin-walled, tomentellous to glabrous, drying brown to black; seeds 1 or 2, plano-convex, 6 - 10 x 4 - 7 mm, black.

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

*Distrib.* India: Subtropical evergreen forests, mixed forests, primary forests, grasslands, on sandy, clayey or rocky soil, up to 1200 m altitude. Uttarakhand, West Bengal, Sikkim, Assam, Meghalaya, Nagaland, Manipur, Mizoram, Tripura, Orissa and Andaman & Nicobar Islands.

Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, China, Laos, Cambodia, Vietnam, Thailand, Java, Sumatra, Borneo and Sulawesi.

*Uses.* The plant yields fodder. Timber used for construction of houses. Bark yields a red dye. A decoction of leaves used to dye clothes black in NE. India. The fruits are edible.

**7. *Aporosa wallichii*** Hook.f., Fl. Brit. India 5: 350. 1887; Prain, Bengal Pl. 2: 939. 1903; Kanjilal et al., Fl. Assam 4: 163. 1940. *A. aurea* Hook.f., l. c. 351. 1887, p. p.; Prain, l. c. 939. 1903; Kanjilal et al., l. c. 164. 1940.

Garó: *Cham chajja*; Kh.: *Dieng-shi-ip*; Mik.: *Tansil-arong*.

Trees, 5 - 9 m tall; young shoots tawny puberulous; branchlets glabrous. Leaves narrowly oblong-elliptic to elliptic-lanceolate, acute, obtuse to rounded at base, entire to crenulate-serrulate and sometimes glandular-notched along margins, acuminate or rarely obtuse at apex, 8 - 20 x 2 - 5 (- 6) cm, chartaceous or often thinly coriaceous, glabrous; lateral nerves 5 - 10 pairs; petioles 5 - 25 mm long; stipules narrowly ovate, 5 - 7 x 2 - 3 mm, caducous. Male inflorescences 2 - 5 cm long; bracts triangular, 0.7 - 1.5 mm long; sepals 3 or 4, ovate-triangular or oblong, ca 1 x 0.5 mm; stamens 2 or 3, 1.5 - 2 mm long. Female inflorescences fasciculate; bracts triangular, 0.8 - 1.2 mm long; sepals 3 or 4, triangular, 1.5 - 2 x 0.6 - 1.2 mm; ovary ovoid or flask-shaped, ca 2 x 1.5 mm, 2-locular, glabrous; stylar column 1.5 - 2 mm long; stigmas 2, ca 1 mm broad. Fruits ovoid to oblong, 10 - 15 x 7 - 8 mm, thin-walled, 2-locular, glabrous, drying brown to black; seeds ellipsoid, 7 - 10 x 3 - 5 mm, bilobed, black.

*Fl. & Fr.* Dec. - May.

*Distrib.* India: Dry evergreen or deciduous forests. Meghalaya and Tripura.

Bangladesh, Myanmar and Thailand.

#### **54. *Baccaurea* Lour.**

Shrubs or trees, dioecious, up to 20 m tall, with simple, branched, or stellate hairs. Leaves alternate, mostly crowded at apices of branches, penninerved; petioles pulvinate at apex, mostly geniculate; stipules usually caducous. Male inflorescences axillary or cauli- or ramiflorous, usually fascicled, very narrowly thyriform, sometimes apparently racemiform or catkin-like, erect or pendulous; bracts small, often conduplicate, sometimes adnate to peduncles or encircling

their bases. Flowers: pedicellate; sepals (3 -) 4 or 5, free, imbricate; petals absent; stamens 4 - 8, free; anthers basifixed; disc glands minute or obsolete, interstaminal, free or connate; pistillode present, peltate at the apex. Female inflorescences axillary, cauli- or ramiflorous, usually few together or often arising singly, racemose, short and erect or elongated and pendulous; bracts ovate to lanceolate. Flowers: pedicels articulated; sepals 4 or 5, free, imbricate, caducous; petals absent; disc absent; staminodes absent; ovary 2 - 5-locular; locules biovulate; style minute or obsolete; stigmas 2 - 5, flabellate or peltate, reflexed. Fruits capsular, fleshy and indehiscent or tardily dehiscent or dry and dehiscent, 2 - 5-locular; seeds broad, usually flattened, often enclosed in a fleshy outer layer.

Indo-Malesia, extending to the W. Pacific Islands, ca 56 species; 3 species indigenous to India and one cultivated.

*Literature.* CHAKRABARTY, T & M. GANGOPADHYAY (1997). The genus *Baccaurea* (Euphorbiaceae) in the Indian subcontinent. *J. Econ. Taxon. Bot.* 21(3): 525 - 534.

#### KEY TO THE SPECIES

- 1 a. Female inflorescences and infructescences 2 - 5 cm long; fruits 8 - 15 x 6 - 9 mm, bilocular, readily dehiscent **2. B. javanica**
- b. Female inflorescences and infructescences 10 - 40 cm long; fruits 15 - 35 x 10 - 35 mm, trilocular, indehiscent or tardily dehiscent 2
- 2 a. Leaves narrowly heart-shaped or cordate at base; stipules 5 - 10 mm long, 1.5 - 3.5 mm wide (cult.) **B. motleyana**
- b. Leaves cuneate, attenuate or acute not cordate at base; stipules 1.5 - 6 mm long, 1 - 2.5 mm wide 3
- 3 a. Leaves membranous to chartaceous, sparsely furfuraceous above and beneath, often brittle when dry; tertiary nerves distant or lax, mostly branched; male inflorescences very slender (rachis up to 0.8 mm thick at base) with up to 0.5 mm long lateral branches, sparsely papillose-puberulous; sepals glabrous or sparsely puberulous **1. B. courtallensis**
- b. Leaves coriaceous, not furfuraceous, not brittle when dry; tertiary nerves closely parallel, mostly unbranched; male inflorescences stouter (rachis mostly 1 - 1.3 mm thick at base), with longer (up to 2 mm long) lateral branches, densely papillose puberulous; sepals densely puberulous **3. B. ramiflora**

**1. *Baccaurea courtallensis*** (Wight) Müll.Arg. in DC., Prodr. 15(2): 459. 1866; Hook.f., Fl. Brit. India 5: 367. 1887; Gamble, Fl. Madras 2(7): 1310. 1925 (repr. ed. 2: 916. 1957). *Pierardia courtallensis* Wight, Icon. Pl. Ind. Orient. 5: t. 1912. 1852. *P. macrostachya* Wight, l. c. t. 1913. 1852. *Baccaurea sapida* sensu Bedd., Fl. Sylv. S. India t. 280. 1872, non (Roxb.) Müll.Arg. 1866.

Kan.: *Koli-kuki*; Mal.: *Mottithuri*; *Muttapazham*, *Muttathuri*, *Muttikeipu*; Tam.: *Mootapalam*, *Muttithuri*.

Trees, 5 - 15 m tall; young shoots furfuraceous; branchlets glabrous. Leaves cuneate-obovate to oblong or elliptic, cuneate, attenuate or acute at base, entire to shallowly crenulate-denticulate along margins, acuminate or caudate at apex, 7 - 30 x (1.5-) 3 - 8.5 cm, membranous to chartaceous, scattered white furfuraceous above and beneath; lateral nerves 4 - 7 pairs; petioles (1-) 2 - 6 cm long, 1 - 2 mm thick; stipules lanceolate, 3 - 5 mm long, caducous. Male inflorescences rami- or cauliflorous, in fascicles or tufts, often forming rings around the branches, 3 - 12 (- 17) cm long; rachis slender, papillose-puberulous; lateral branches up to 0.5 mm long, 3 - 5-flowered; bracts lanceolate, 0.5 - 2.5 x 0.3 - 0.5 mm, free, conduplicate and encircling bases of lateral

branches. Flowers: pedicels 0.5 - 1.5 mm long; sepals 4 or 5, linear, oblong, elliptic to suborbicular, 1.5 - 2 x 0.5 - 1 mm; stamens 4 - 6, ca 1 mm long. Female inflorescences cauli- or ramiflorous, 10 - 40 cm long; rachis slender, puberulous; bracts lanceolate, 1 - 1.5 mm long. Flowers: pedicels 1.5 - 3 mm long, 2 - 9 mm in fruits; sepals 4 or 5, linear, oblong to oblong-elliptic, 2.5 - 3 x 0.6 - 1.5 mm; ovary ovoid or subglobose, 2 - 3 x 1.5 - 3 mm, 3-locular, velutinous or felted; stigmas 3, flabellate, 1 - 1.5 mm broad. Fruits subglobose, ovoid, ellipsoid or obovoid, 15 - 30 x 15 - 25 mm, 3-locular, thick-walled, often with 6 longitudinal ribs, pale yellow when ripe, brown when dry, often verrucose, evanescently pubescent, tardily dehiscent.

*Fl.* Feb. - June; *Fr.* March - Oct.

*Distrib.* India: Common in evergreen forests, up to 900 m altitude. Orissa, Karnataka, Tamil Nadu and Kerala.

*Uses.* The fruits are edible.

*Notes.* Pollen 3-colporate, sexine micro-reticulate. P = 17  $\mu$ m (15 to 20), E = 13  $\mu$ m (12 to 18). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery*, Pondicherry).

**2. *Baccaurea javanica*** (Blume) Müll.Arg. in DC., Prodr. 15(2): 465. 1866. *Adenocrepis javanica* Blume, Bijdr. Fl. Ned. Ind. 579. 1826. *Baccaurea sumatrana* auct. non (Miq.) Müll.Arg. 1866; Chakrab. & Vasudeva Rao in J. Econ. Taxon. Bot. 5: 957. 1984; Chakrab. & N.P.Balacr. in J. Econ. Taxon. Bot., Addit. Ser. 9: 24, f. 4. 1992.

Shrubs or trees, 2.5 - 25 m tall; branchlets glabrous. Leaves cuneate-obovate to oblanceolate or oblong-elliptic, cuneate or attenuate at base, entire, caudate-acuminate or apiculate at apex, 6 - 19 x 1.5 - 7 cm, chartaceous, glabrous; lateral nerves 4 - 7 pairs; petioles 1 - 4 cm long, glabrous; stipules 1 - 6 x 1 - 2 mm. Male inflorescences borne on current year's shoots, 2.5 - 5 cm long; lateral branches minute, ca 3-flowered; bracts lanceolate, 1 - 2.5 mm long, free. Flowers: pedicels 1.5 - 2.5 mm long; sepals 3 or 4, oblong-elliptic to obovate, 1 - 1.5 x 0.6 - 1 mm; stamens 4 - 6, ca 1 mm long. Female inflorescences arising from the axils of the leaves of current year's shoots, 2 - 5 cm long, erect. Flowers: pedicels 1 - 3 mm long, 2 - 5 mm in fruits, papillose; sepals 4, oblong to oblanceolate, 3 - 6 x 1 - 2 mm; ovary ovoid or obovoid, ca 1.5 x 1 mm, 2-locular, densely puberulous; style obsolete; stigmas 2, ca 0.3 mm broad. Fruits ellipsoid, ovoid or subglobose, 8 - 15 x 6 - 9 mm, bilocular, crustaceous, evanescently puberulous, dehiscent; style ca 0.5 mm long, persistent stigmas.

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

*Distrib.* India: Inland forests or their edges, frequent along streams, at low altitudes, scattered. Nicobar Islands.

Malay Peninsula, Sumatra, Java, Borneo and Celebes.

**3. *Baccaurea ramiflora*** Lour., Fl. Cochinch. 661. 1790. *Pierardia sapida* Roxb. [Hort. Bengal. 28. 1814, nom. nud.] Fl. Ind., ed. Carey 3: 254. 1832. *Baccaurea sapida* (Roxb.) Müll.Arg. in DC., Prodr. 15(2): 459. 1866 (p. p. excl. syn. *B. microstachya*); Hook.f., Fl. Brit. India 5: 371. 1887, p. p.; C.E.Parkinson, Forest Fl. Andaman Isl. 239. 1923; Kanjilal et al., Fl. Assam 4: 161. 1940.

Abor.: *Bureh*; Asm.: *Leteku, Latok-tenga*; Beng.: *Latka, Kusum-tenga*; Cach.: *Kusmari-phang*; Garo.: *Kojuka*; Hindi: *Khattaphal*; Kh.: *Dieng-soh-ramding*; Lep.: *Sambhyo-kung, Sumbing*; Lush.: *Pangkai*; Manip.: *Moktok*; Mik.: *Dampiya-arong*; Nep.: *Kusum*; Sylh.: *Bhubi*; Tripura: *Bhubi, Iphek*.

Trees, 3 - 15 m tall. Leaves cuneate-obovate to elliptic-obovate or elliptic to oblong-elliptic, acute to obtuse at base, entire to repand-denticulate along margins, acuminate at apex, 8 - 34 x 3 - 10 cm, coriaceous, glabrous above, glabrous or often with sparsely pubescent midrib beneath, sometimes glossy; lateral nerves 5 - 9 pairs; petioles 2 - 8 cm long; stipules lanceolate, 4 - 6 mm long, caducous. Male inflorescences on older branches and trunks, fascicled, 4 - 12 cm long; bracts lanceolate to linear, 1 - 1.5 mm long; pedicels 1 - 3 mm long; stamens 4 - 8, ca 0.8 mm long. Female inflorescences cauli- or ramiflorous, few together, 15 - 30 cm long, pendulous; bracts lanceolate, 2 - 6 mm long; pedicels 1 - 3 mm long; sepals 4 or 5, broadly oblong-elliptic or spatulate, 2 - 4 (-6) x 1 - 2 mm, densely papillose-puberulous; ovary subglobose or ovoid, 1.5 - 2 mm in diam., 3-locular, sericeous or velutinous; stigmas 3, discoid or flabellate, ca 5 mm broad. Fruits globose, broadly ovoid or ellipsoid, 20 - 35 x 15 - 35 mm, 3-locular, thick-walled, yellow when ripe, verrucose or often smooth, sparsely puberulous, tardily dehiscent; pedicels 2 - 6 mm long.

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

*Distrib.* India: Subtropical forests, wet evergreen forests, inland forests, from sea level up to 1200 m altitude. West Bengal, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Mizoram, Tripura, Orissa and Andaman Islands.

Bhutan, Bangladesh, Myanmar, China, Cambodia, Laos, Vietnam, Thailand and Malay Peninsula.

*Uses.* The fruits are sour and very tasty, eaten with relish in Andaman Islands. Often cultivated for the edible fruits, which finds use in preparation of wine. Mikirs of NE. India use the juice of the fresh bark in constipation. . Bark used as a mordant for dyeing clothes in Bhutan. For details about the chemistry of the bark and fruits, see Wealth of India, 1988.

*Note.* Chromosome number: n: 13 (Hans, Taxon 22: 609. 1973).

#### CULTIVATED SPECIES

***Baccaurea motleyana*** (Müll.Arg.) Müll.Arg. in DC., Prodr. 15(2): 461. 1866; Hook.f., Fl. Brit. India 5: 371. 1887 Chakrab. & M. Gangop. in J. Econ. Taxon. Bot. 21: 53. 1997. *Pierardia motleyana* Müll.Arg. in Flora 47: 516. 1864.

Trees, 6 - 10 m tall; branchlets tomentellous. Leaves oblong to elliptic or obovate-elliptic, rounded or shallowly cordate at base, acuminate at apex, 15 - 35 x 6 - 16 cm, chartaceous, glabrous above, tomentellous to scattered pilose beneath; lateral nerves 12 - 16 pairs; petioles 3 - 12 cm long; stipules 5 - 10 mm long. Male inflorescences cauliflorous, few-together, 8 - 20 cm long; lateral branches up to 2 mm long, 3 - 5-flowered; bracts lanceolate, 1 - 1.5 mm long. Male flowers: green-yellow; pedicels ca 1.5 mm long; sepals 4, triangular, ovate or oblong, 1.5 - 2 x 0.8 - 1.3 mm, papillose-puberulous; stamens 4 - 6, ca 1 mm long. Female flowers: not seen (the inflorescences reported to be cauli- and ramiflorous, up to 25 cm long). Fruits globose, ovoid to



ellipsoid, 3-seeded berries, 22 – 45 x 15 – 25 mm, glabrous to densely hairy outside, glabrous inside, greenish yellow to white; fruiting pedicels 5 – 10 mm long; seeds ellipsoid, laterally flattened, 13 – 20 x 9 – 14 x 2.5 – 4 mm; arillode translucent white, rarely purple.

*Fl. & Fr.* April – Aug.

*Distrib.* India: Kerala (specimen from cultivated plant, Quilon Dist., *Bourdillon* 226 in CAL). No other specimen seen.

Sri Lanka (cult.), Thailand, Malay Peninsula (cult.), Sumatra, Borneo, Moluccas and Java (cult.).

Tribe **2. BISCHOFIEAE** (Müll.Arg.) Hurus.  
(N. P. Balakrishnan & T. Chakrabarty)

Distinct from all other Euphorbiaceae by the trifoliolate leaves. Airy Shaw (Kew Bull. 18: 249 - 272. 1965) separates it as a family Bischofiaceae, suggesting its close relationship with Staphyleaceae. However, evidences from embryology (Bhatnagar & Kapil, Phytomorphology 23: 264 - 267. 1974) and foliar micromorphology and architecture (Levin, Ann. Missouri Bot. Gard. 73: 29 - 85 & 86 - 98. 1986; Syst. Bot. 11: 515 - 530. 1986) support its retention in Euphorbiaceae.

Asia. Monogeneric.

**55. Bischofia** Blume

Trees, dioecious, deciduous, entirely glabrous. Leaves alternate, usually crowded at the ends of branchlets, digitately trifoliolate, long-petioled; leaflets obovate, cuneate-obovate, elliptic to oblong-elliptic, denticulate-serrulate along margins, caudate or acuminate or apiculate at apex, penninerved; stipules caducous. Inflorescences axillary, thyriform, paniculate or racemose, pedunculate, up to 30 cm long. Male flowers: pedicellate; sepals 5, shortly connate at base, imbricate, cucullate; petals absent; disc absent; stamens 5, free, opposite to and enclosed by sepals; anthers suborbicular or oblong, dorsifixed, longitudinally dehiscent; pistillode broad, peltate, shortly stipitate. Female flowers: pedicellate; sepals 5, imbricate, caducous; petals absent; disc absent; staminodes 5, small or absent; ovary 3 (or 4)-locular; locules biovulate; styles 3 (or 4), simple, stout. Fruits drupaceous, subglobose, indehiscent, 3 (or 4)-locular; mesocarp fleshy; endocarp thin, horny; seeds 3 - 6, turgidly trigonous-oblong.

Asia, from Sri Lanka and India to China, Malesia, Australia and the Pacific Islands, 2 species; one in India.

**Bischofia javanica** Blume, Bijdr. Fl. Ned. Ind. 1168. 1826 - 27; Hook.f., Fl. Brit. India 5: 345. 1887.

Mal.: *Cholavengai, Nira, Thirippu*; Tam.: *Milachityan, Thondi*.

Trees, 5 - 30 m tall. Leaflets 5 - 20 x 3 - 11 cm, coriaceous to chartaceous; lateral nerves 5 - 10 pairs; petioles 2 - 20 mm long, 2 - 3 mm thick; lateral petiolules 2 - 15 mm long; central petiolule 1 - 6 cm long. Male inflorescences 10 - 25 cm long; flowers red in bud, yellowish when open; pedicels 1 - 4 mm long; sepals oblong, ovate to orbicular, 1 - 2 x 0.7 - 2 mm; stamens 1 - 2 mm long; filaments 0.5 - 1 mm long; anthers ca 1 mm long. Female inflorescences 10 - 30 cm long;

bracts linear, up to 7 mm long; pedicels up to 12 mm long; sepals ovate to orbicular, 1 - 2 x 0.6 - 2 mm, caducous; ovary ellipsoid or ovoid, 2 - 3 x 1.5 - 2.5 mm; styles 3 - 6 mm long. Fruits 6 - 10 x 7 - 12 mm, rugose; pedicels 10 - 15 mm long; seeds ca 4 x 3 mm.

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

*Distrib.* India: Deciduous or semievergreen forests, up to 2000 m altitude. Himachal Pradesh, Uttarakhand, Uttar Pradesh, West Bengal, Sikkim, Assam, Meghalaya, Mizoram, Tripura, Orissa, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Andaman Islands.

Bhutan, Bangladesh, Myanmar, Thailand, Ryu-kyu Islands, China, throughout Malesia to Polynesia.

*Note.* Pollen 3-colporate, sexine micro-reticulate. P = 25 µm (23 to 28). E = 24 µm (22 to 26). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery, Pondichery*).

Tribe 3. **BRIDELIEAE** Müll.Arg.  
(**T. Chakrabarty, M. Gangopadhyay & N. P. Balakrishnan**)

Monoecious or rarely dioecious trees or shrubs. Leaves alternate, entire, penninerved; stipules mostly deciduous. Flowers: in bracteate glomerules, axillary or in spikes. Male flowers: sepals usually 5, valvate; petals 5, imbricate or valvate, smaller than sepals, sometimes reduced; disc annular or dissected; stamens 5; filaments connate into a column; anthers introrse; pollen grains tricolporate, reticulate or striate; pistillode present. Female flowers: sepals 5, imbricate or valvate, deciduous; disc annular or cupular; ovary 2 - 3(-4)-locular; locules biovulate; ovules anatropous; styles 2- or 4-fid. Fruits capsular or drupaceous, 1 - 3-locular; seeds with endosperm; cotyledons much longer and broader than the radicle.

Old World tropics from Africa to Asia and Australia, 2 genera; both in India.

*Note.* As stated by Webster (*Ann. Missouri Bot. Gard.* 81: 33 - 144. 1994) the distinctions between the two genera are not satisfactory.

KEY TO THE GENERA

- 1 a. Lateral nerves of leaves closely parallel; tertiary nerves predominantly percurrent; ovary mainly with 2 carpels (rarely 3); fruits drupaceous or rarely capsular, unlobed, 1- or 2-locular with 1 or 2 seed/s per locule **56. Bridelia**
- b. Lateral nerves of leaves rather lax; tertiary nerves predominantly reticulate to scalariform; ovary mainly with 3 carpels (rarely 2 or 4); fruits capsular, lobed, mainly 3-locular with 2 seeds per locule **57. Cleistanthus**

**56. Bridelia** Willd., nom. & orth. cons.

Shrubs or trees, sometimes scandent or climbing, monoecious, usually pubescent with simple hairs, sometimes glabrous. Leaves simple, alternate, symmetric, often smaller towards apices of twigs, mostly entire or sometimes shallowly crenate along margins, often glossy above and glaucous beneath, penninerved; lateral nerves usually close, straight and parallel, terminating at margins into the marginal veins or joining the super-adjacents forming loops, occasionally both types mixed; tertiary nerves mostly percurrent and unbranched or forked,

sometimes scalariform; nervules reticulate; petioles up to 15 mm long; stipules usually deciduous. Inflorescences axillary, glomerulate, arising along main leafy branches, sometimes on lateral small-leaved or leafless branchlets, or in terminal leafless panicles. Male flowers: sessile or shortly pedicellate; sepals 5, shortly connate at base, valvate, triangular to ovate; petals 5, alternate to sepals, small, free, thin; disc thick-disciform; stamens 5; filaments connate below into a column, free and spreading above; anthers ovoid to ellipsoid-oblong, basifixed or dorsifixed, introrse, longitudinally dehiscent; pistillode at the apex of the column, small. Female flowers: sessile or shortly pedicellate; calyx and petals as in male; disc annular, with additional thin tubular inner disc, enclosing the ovary, latter splitting into scales during fruiting; ovary 1 or 2-locular, biovulate; ovules anatropous; styles 2, free or shortly connate at base, bifid above. Fruits drupaceous, globose or ellipsoid, 1 or 2-locular, unlobed or shallowly bilobed; mesocarp fleshy; endocarp hard; seeds 1 or 2 per fruit, often with a longitudinal groove; testa smooth; embryo straight to curved; cotyledons foliaceous; endosperm fleshy or membranous.

Old World, mainly Asian, ca 50 species; 10 species in India.

*Literature.* DRESSLER, S. (1996). The genus *Bridelia* (Euphorbiaceae) in Malesia and Indochina. *Blumea* 41(2): 263 - 331. CHAKRABARTY, T., M. GANGOPADHYAY & N. P. BALAKRISHNAN (2002). A revision of the genus *Bridelia* Willd. (Euphorbiaceae) for the Indian subcontinent. *J. Econ. Taxon. Bot.* 26: 311 - 330.

#### KEY TO THE SPECIES

- |  |                                     |
|--|-------------------------------------|
| 1 a. Flowers 6 - 12 mm in diam.  | <b>8. <i>B. stipularis</i></b>      |
| b. Flowers up to 5.5 mm in diam.   | 2                                   |
| 2 a. Lateral nerves of leaves terminating directly at the margins  | 3                                   |
| b. Lateral nerves of leaves not terminating directly at the margins  | 8                                   |
| 3 a. Fruits with 3 - 4 mm long pedicels; inflorescences mostly borne on terminal and leafless branches (up to 35 cm long)  | <b>6. <i>B. retusa</i></b>          |
| b. Fruits sessile to subsessile; inflorescences borne on main leafy branches   | 4                                   |
| 4 a. Fruits 1-locular  | 5                                   |
| b. Fruits 2-locular  | 6                                   |
| 5 a. Branchlets glabrous; leaves glabrous, glaucous beneath; bracts characteristically brown to orange brown when dry and almost hyaline   | <b>10. <i>B. verrucosa</i></b>      |
| b. Branchlets tomentellous; leaves pilose on nerves beneath, not glaucous; bracts not as above   | <b>1. <i>B. assamica</i></b>        |
| 6 a. Leaves cuneate-obovate to rhombate; lateral nerves predominantly bifurcating mid way, most of them joining the superadjacents forming loops or a few (ca 20%) terminating directly at margins | <b>3. <i>B. montana</i></b> (p. p.) |
| b. Leaves mostly oblong to elliptic or narrowly so, sometimes tending to be obovate; lateral nerves predominantly unbranched and always terminating directly at margins                            | 7                                   |
| 7 a. Leaves glabrous, mostly rounded, obtuse or subacute at apex; nerves conspicuously raised on the upper surface   | <b>5. <i>B. ovata</i></b>           |
| b. Leaves often tomentellous beneath (var. <i>tomentosa</i> ), acute, attenuate or shortly acuminate at apex; nerves inconspicuous or much less prominent on the upper surface                     | <b>9. <i>B. tomentosa</i></b>       |
| 8 a. Fruits pedicellate  | 9                                   |
| b. Fruits sessile  | 10                                  |
| 9 a. Plants pubescent; tertiary nerves of leaves inconspicuous to prominent on the upper surface, conspicuous beneath; ovary 1-loculed; fruits 1-locular   | <b>2. <i>B. glauca</i></b>          |

b. Plants glabrous; tertiary nerves of leaves prominent to very prominent on the upper surface, inconspicuous to faint beneath; ovary 2-locular; fruits 2-locular or by abortion 1-locular

- 10 a. Ovary and fruits 2-locular  
b. Ovary and fruits 1-locular

7. **B. sikkimensis**

3. **B. montana** (p. p.)

4. **B. nicobarica**

**1. Bridelia assamica** Hook.f., Fl. Brit. India 5: 269. 1887; Jabl. in Engl., Pflanzenr. IV.147.VIII (Heft 65): 85. 1915; Kanjilal et al., Fl. Assam 4: 145. 1940.

Asm.: *Barhaila*, *Soraiguti-koa*.

Shrubs or trees, 3 - 6 m tall; branchlets tomentellous when young, glabrescent in age. Leaves narrowly to broadly elliptic to obovate-elliptic or oblong-oblongate, acute to subacute or rounded or sub-cuneate at base, entire or often shallowly and irregularly crenulate along margins, caudate or acuminate at apex, 10 - 32 x 4.5 - 14.5 cm, stiffly chartaceous, glabrous above, sparsely pilose on nerves or rarely glabrous beneath; lateral nerves 10 - 18 pairs, terminating directly at the margins into the marginal veins; petioles 8 - 12 (- 20) mm long. Inflorescences borne on the main leafy branches, ca 6 mm in diam. (when the fruits are fallen); bracts broadly ovate, ca 0.4 mm long. Flowers: not seen. Fruits sessile, broadly ovoid to ellipsoid, 8 - 10 x 5 - 7 mm (ca 25 mm long according to J.D. Hooker, l. c.), unlobed, smooth, 1-locular, black or dark grey when dry; stylar beak ca 1 mm long; sepals triangular-acuminate, ca 2.5 x 1 mm, glabrous; seed with a longitudinal groove.

Fr. Oct. - March.

*Distrib.* India: Primary forests, often along riverbanks, between 500 - 1000 m altitudes, scarce. Arunachal Pradesh, Assam and Nagaland.

Bangladesh.

**2. Bridelia glauca** Blume, Bijdr. Fl. Ned. Ind. 597. 1826. *B. pubescens* Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 241. 1874 & Forest Fl. Burma 2: 367. 1877; Hook.f., Fl. Brit. India 5: 270. 1887; Prain, Bengal Pl. 2: 928. 1903; Kanjilal et al., Fl. Assam 4: 145. 1940.

Shrubs or trees, 3 - 15 m tall; branchlets tomentose when young, puberulous or pilose to glabrous in age. Leaves elliptic to oblong or lanceolate-elliptic to lanceolate-oblong, sometimes broadly elliptic-oblong to obovate, acute or sometimes obtuse or rounded or subequal at base, entire, caudate or acuminate at apex, 6.5 - 20 (- 26) x 3 - 9 (- 11) cm, chartaceous or often membranous, often glossy and glaucous, glabrous above, tomentellous or sparsely pilose on major nerves or rarely subglabrous beneath; lateral nerves 6 - 12 (- 16) pairs, not terminating at margins but jointing the superadjacents forming loops (brochidodromous); petioles 4 - 10 mm long, pilose to glabrous. Inflorescences borne on main leafy branches, bisexual, many-flowered, 8 - 10 mm in diam.; bracts triangular, up to 1 mm long, puberulous. Male flowers: pedicels 2 - 3 mm long; calyx 4 - 5 mm in diam.; sepals tomentellous outside; petals suborbicular, flabellate or obcordate, up to 1 mm long; disc patelliform, ca 2.5 mm in diam.; staminal column ca 1 mm long; filaments ca 0.5 mm long; anthers broadly oblong, ca 0.6 mm long. Female flowers: pedicels 1 - 2 mm long; calyx 4 - 4.5 mm in diam., sepals broadly triangular or ovate-triangular, 2 - 2.5 x 1 - 1.8 mm, tomentellous outside; petals as in male; outer disc ca 2.5 mm in diam., inner disc shortly cupular, ca 0.5 mm long, covering the ovary; ovary ovoid or conoid, ca 0.5 x 1 mm, glabrous; styles 1 - 1.5 mm long, erect, connate below for half way, shortly bifid above. Fruits ovoid to oblong, 8 - 12 x 5 - 8 mm, 1-locular, 1-seeded, glabrous, red, brownish black when dry.

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

*Distrib.* India: Common in subtropical deciduous forests or moist evergreen forests, up to 1600 m altitude. Andhra Pradesh, Bihar, West Bengal, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Mizoram and Tripura.

Nepal, Bhutan, Myanmar, S. China to SE. Asia, Malesia to Bismarck Archipelago.

*Note.* Chromosome number:  $2n = 26$  for *B. pubescens* (Mehra and Hans, Taxon 18: 310. 1969).

**3. *Bridelia montana*** (Roxb.) Willd., Sp. Pl. ed. 4, 4: 978. 1806; Hook.f., Fl. India 5: 269. 1887; p. p.; Duthie, Fl. Gangetic Plain 2: 86. 1905; Haines, Bot. Bihar Orissa 2: 120. 1921; Gamble, Fl. Madras 2(7): 1281. 1925 (repr. ed. 2: 896. 1957). *Clutia montana* Roxb., Pl. Coromandel 38, t. 171. 1798 (as '*Cluytia*'). *Bridelia hamiltoniana* Wall. ex Müll.Arg. in Linnaea 34: 77. 1865 & in DC., Prodr. 15(2): 500. 1866, p. p.; excl. var. *glabra*; Hook.f., l. c. 271. 1887. *B. montana* var. *hamiltoniana* (Wall. ex Müll.Arg.) Haines, l. c. 120. 1921.

Tel.: *Pantenga*.

Shrubs, up to 3.5 m tall, entirely glabrous. Leaves cuneate-obovate, obovate-oblong to rhombate, sometimes suborbicular or sublyrate, cuneate or acute at base, entire, rounded, obtuse, apiculate or sometimes acuminate at apex, 4 - 12 x 2 - 5.5 cm, chartaceous to thinly coriaceous; lateral nerves 4 - 10 pairs, mostly bifurcating midway, joining the superadjacents forming loops, sometimes (ca 20% unbranched secondaries or one of the bifurcated branches) terminating directly at the marginal veins; petioles 3 - 5 mm long; stipules linear-subulate to filiform, 2.5 - 7 x 0.3 - 1 mm. Inflorescences on main leafy branches, 5 - 8 mm in diam., mostly bisexual; bracts broadly triangular to deltoid, ca 2.5 mm long. Male flowers: sessile or pedicels up to 0.5 mm long; calyx ca 2.5 x 3 - 4 mm; sepals triangular, 1.5 - 2 x 1 - 1.5 mm; petals flabellate, ca 1 x 1.5 mm; disc flat, entire, ca 1.5 mm in diam.; stamens 1.5 - 1.8 mm long; column 0.5 - 0.8 mm long; filaments ca 0.5 mm long. Female flowers: sessile to subsessile; calyx 3 - 3.5 mm in diam., sepals rarely 6, triangular-oblong, ca 2 x 1 mm; petals 0.5 - 2 mm long; outer disc patelliform, ca 1.5 mm in diam., inner disc urceolate, lobulate, covering the ovary; ovary subglobose or ovoid, ca 1 x 1.2 mm, 2-locular; styles ca 1 mm long, almost free, deeply bifid. Fruits sessile to subsessile, subglobose, 4 - 9 x 5 - 10 mm, shallowly to prominently bilobed, 2-seeded or often 1-seeded by abortion; fruiting calyx ca 4 mm in diam.

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

*Distrib.* India: Edges and outskirts of forests, up to 1000 m altitude, common. Uttar Pradesh, Jharkhand, West Bengal, Orissa, Madhya Pradesh, Chhattisgarh, Maharashtra and Karnataka.

Endemic.

*Note.* Chromosome number:  $2n = 26$  (Mehra & Hans, Taxon 18: 310. 1969).

**4. *Bridelia nicobarica*** Chakrab. & Vasudeva Rao in J. Econ. Taxon. Bot. 5: 945. 1984. *B. insulana* auct. non Hance 1877: Dressler in Blumea 41: 315. 1996, p. p. tantum quoad syn. *B. nicobarica*.

Trees, 3 - 5 m tall; branchlets initially appressed pubescent, soon glabrous. Leaves oblong to elliptic, acute to obtuse at base, entire and often slightly reflexed along margins, apiculate to acuminate at apex, 4.5 - 10 x 1.5 - 4.5 cm, coriaceous, glabrous and glossy above, appressed pubescent beneath; lateral nerves 5 - 9 pairs, anastomosing a little away from the margins; petioles 4 - 10 mm long, appressed pubescent. Glomerules ca 5 mm in diam., borne on main leafy branches; bracts orbicular-deltoid, 0.6 - 1 mm long. Flowers: not seen. Fruits (slightly immature ones seen), sessile to subsessile, ovoid to ellipsoid, 13 - 15 x 8 - 9 mm, glabrous, smooth, 1-locular, 1-seeded, black when dry; fruiting calyx 3.5 - 4.5 mm in diam.; tube turbinate, yellow or tawny tomentellous; persistent sepals triangular, acute, 1 - 1.5 x ca 1 mm, tomentellous outside.

*Fr.* Feb. - March.

*Distrib.* India: Scarce, coastal scrub forests on clayey soil at sea level. Nicobar Islands (Car Nicobar).

Endemic.

**5. *Bridelia ovata*** Decne. in Nouv. Ann. Mus. Hist. Nat. 3: 484. 1834; Hook.f., Fl. Brit. India 5: 274. 1887. *B. kurzii* Hook.f., l. c. 272. 1887. *B. curtisii* Hook.f., l. c. 273. 1887. *B. ovata* var. *curtisii* (Hook.f.) Airy Shaw in Kew Bull. 26: 229. 1972.

Scandent shrubs, woody climbers or trees, up to 10 m tall, entirely glabrous. Leaves narrowly to broadly oblong, oblong-elliptic to elliptic, acute, obtuse to rounded or occasionally subcordate at base, entire to crenulate along margins, rounded, obtuse to subacute or apiculate at apex, 4 - 15 x 2 - 7 cm, chartaceous to coriaceous, often glossy above and glaucescent beneath; lateral nerves (5 -) 8 - 15 (-20) pairs, mostly unbranched, terminating at margins into the marginal nerve; petioles 2 - 9 mm long. Inflorescences on main leafy branches, bisexual. Male flowers: pedicels ca 1.5 mm long; calyx 3 - 5 mm in diam., sepals triangular, 1.5 - 2.5 x 1 - 1.5 mm; petals ovate-orbicular or spatulate, 0.5 - 1 x 0.5 - 1 mm; disc ca 2 mm in diam., staminal column ca 1 mm long; filaments ca 0.6 mm long; anthers oblong-ellipsoid, ca 0.6 mm long; pistillode conical or ovoid, bilobed at apex, ca 0.8 mm long. Female flowers: sessile; calyx 4 - 5 mm in diam., sepals and petals as in male; outer disc ca 2 mm in diam., inner disc tubular, covering the ovary; ovary subglobose, ca 1 mm in diam., bilocular; styles ca 1 mm long, almost free, deeply bifid above. Fruits subsessile, subglobose or ovoid-subglobose, 5 - 9 mm in diam., slightly bilobed, blackish when dry; seeds 2.

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

*Distrib.* India: Common, from coastal forests to inland forests on rocky or sandy soil, up to 200 m altitude. Andaman & Nicobar Islands.

Myanmar, Thailand, Malaysia, Java and Lesser Sunda Islands.

**6. *Bridelia retusa*** (L.) A.Juss., Euphorb. Gen. 109, t. 7, f. 22. 1824; Dressler in Blumea 41. 289. 1996; Chakrab. et al. in J. Econ. Taxon. Bot. 26: 320. 2002; N.P.Balacr. & Chakrab., Fam. Euphorb. India 319. 2007. *Clutia retusa* L., Sp. Pl. 1042. 1753 & ed. 2, 1475. 1763; Willd., Sp. Pl. ed. 4, 4(2): 883. 1806. *Bridelia retusa* (L.) Spreng., Syst. Veg. 3: 48. 1826, pro comb. nov.; Bedd.,

Fl. Sylv. S. India t. 260. 1872; Hook.f., Fl. Brit. India 5: 268. 1887. *Chytia squamosa* Lam., Encycl. 2: 54. 1786. *C. spinosa* Roxb., Pl. Coromandel 2: 38, t. 172. 1802. *Bridelia spinosa* (Roxb.) Willd., Sp. Pl. ed. 4, 4: 979. 1806, p. p., excl. specim. in B-WILLD No. 18957, non Hort. ex DC., 1833, nec Wight, 1852: Roxb., Fl. Ind., ed. Carey 3: 735. 1832. *B. crenulata* Roxb., Fl. Ind., ed. Carey 3: 734. 1832; N.P. Balakr. in Bull. Bot. Surv. India 3: 39. 1961. *B. amoena* Wall. ex Baill., Etude Euporb. 584. 1858; Müll.Arg. in DC., Prodr. 15(2): 493. 1866. *B. hamiltoniana* Wall. ex Müll.Arg. var. *glabra* Müll.Arg. in Linnaea 34: 77. 1865 & in DC., Prodr. 15(2): 501. 1866. *B. retusa* (L.) A. Juss. var. *squamosa* (Lam.) Müll.Arg., l. c. 493. 1866; Hook.f., l. c. 268. 1887. *B. retusa* (L.) A. Juss. var. *roxburghiana* Müll.Arg. in DC., Prodr. 15(2): 493. 1866, nom. superfl.; Hook.f., l. c. 268. 1887. *B. retusa* (L.) A. Juss. var. *glabra* Gehrm. in Bot. Jahrb. Syst. Syst. 41, Beibl. 95: 30. 1908. *B. squamosa* (Lam.) Gehrm., l. c. 30. 1908; Jabl., l. c. 70. 1915; Haines in J. Bot. 59: 190. 1921. *B. roxburghiana* (Müll.Arg.) Gerhm., l. c. 30. 1908, nom. superfl.; Voigt, l. c. 155. 1845; Hook.f., l. c. 268. 1887. *B. cinerescens* Gehrm., l. c. 30. 1908; Gamble, l. c. 1280. 1925. *B. retusa* (L.) A. Juss. var. *stipulata* Gerhm., l. c. 30. 1908. *B. retusa* (L.) A. Juss. var. *pubescens* Gerhm., l. c. 30. 1908. *B. squamosa* var. *meeboldii* Gerhm., l. c. 30. 1908. *B. airy-shawii* P.T. Li in Acta Phytotax. Sin. 20: 117. 1982, nom. superfl.

Asm.: *Kunhir, Kuhir*; Burm.: *Seikuhi, Leik-gyi, Tseip-che*; Cach.: *Thijigrey-phang*; Hindi: *Ekdania, Gondui, Kaj, Karghatia, Kasal, Kassi, Khaja*; Kan.: *Asana*; Kh.: *Diengrishan*; Mal.: *Komathi, Mukkayini, Mulluvenga*; Mar.: *Asana*; Mik.: *Tuntung-arong*; Nep.: *Gaayo, Kuhin*; Or.: *Kosi*; Tam.: *Moarivegai, Mullu-maruthu*; Tel.: *Bontha-yepi, Koramaddi, Verri karaka*; Urdu: *Kosi*.

Shrubs or trees, 2 - 15 (- 25) m tall; branchlets glabrescent in age. Leaves narrowly to broadly oblong, elliptic to obovate, rounded, subcordate, obtuse to acute at base, entire to shallowly crenate along margins, rounded, retuse, obtuse or acute at apex, 5 - 28 x 2 - 11 cm, thinly to stiffly coriaceous, often glossy above and glaucous beneath, glabrous or sparsely puberulous on midrib above; lateral nerves 12 - 24 pairs, terminating at the margins; petioles 5 - 15 mm long; stipules lanceolate to linear-lanceolate, 5 - 15 x 2 - 4 mm. Inflorescences on terminal leafless panicles (up to 35 cm long) or lateral leafless branches or on main leafy branches, mostly unisexual, 7 - 10 mm in diam. Male flowers: pedicels 1.5 - 2 mm long; calyx 3.5 - 6 mm in diam., sepals triangular, 1.5 - 2.5 x 1 - 1.6 mm; petals suborbicular, toothed or lobed, ca 1 x 1 mm; disc flat, ca 2 mm in diam., entire; staminal column ca 1.5 mm long; filaments ca 1 mm long; anthers ovoid, ca 0.8 mm long; pistillode conic, ca 1 mm long. Female flowers: pedicels 0.5 - 2 mm long, scattered pilose to glabrous; calyx 4 - 5.5 mm in diam.; sepals narrowly triangular-acuminate, ca 2 x 1 - 1.5 mm; petals suborbicular or oblong, undulate, 1 - 2 mm across; outer disc disciform, up to 2.5 mm in diam., inner disc conical-cupular; ovary ovoid, depressed, 1.5 - 2 mm in diam., 2-locular; styles 0.8 - 1.5 mm long, shortly connate below and shortly bifid above. Fruits subglobose, slightly depressed, 5 - 8 x 6 - 9 mm, short beaked at apex, shallowly 2-lobed, glabrous, 2-locular; seeds 2; pedicels 2 - 4 mm long; fruiting calyx up to 7 mm in diam.

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

*Distrib.* India: The commonest Indian species of *Bridelia*, in deciduous forests, mixed forests, dry forests, riverbanks, rocky places, scrub, subtropical forests, up to 2000 m in S. India, 600 m in Central & E. India, 1600 m on Himalayas and 1000 m in NE. India. Throughout the country except in Andaman & Nicobar Islands.

Sri Lanka, Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, S. China, Indo-China, Thailand and Sumatra.

*Uses.* Wood dull red, used for construction, agricultural implements and fuel.

**7. *Bridelia sikkimensis*** Gehrm. in Engl., Bot. Jahrb. Syst. 41, Beibl. 95: 34. 1908; Kanjilal et al., Fl. Assam 4: 147. 1940; D.G.Long in Grierson & D.G.Long, Fl. Bhutan 1(3): 768. 1987, p. p. excl. syn. *B. sikkimensis* var. *minuta* Gehrm., l. c. 34. 1908. *B. cuneata* Gehrm., l. c. 34. 1908; Kanjilal et al., l. c. 146. 1940. *B. montana* sensu Hook.f., Fl. Brit. India 5: 269. 1887, p. p. (the Khasia plants only).

Shrubs or small trees, up to 5 m tall, entirely glabrous. Leaves obovate, cuneate-obovate, obovate-oblong, obovate-elliptic or broadly so, rounded, obtuse or acute at base, entire, apiculate to acuminate or caudate at apex, 6 - 23 x 3.5 - 12 cm, chartaceous to thinly coriaceous, often glaucous beneath; lateral nerves 7 - 15 pairs, branching near margins and forming loops with the superadjacents; branchlets from the loops terminating at margins into the marginal nerves (brochidodromous); petioles 4 - 11 mm long. Inflorescences arising on main leafy branches, 4 - 11 mm in diam., unisexual, the females few-flowered. Male flowers: pedicels 1 - 1.5 mm long; calyx 3.5 - 4 mm in diam.; sepals, ca 1 x 1 mm; petals spatulate or oblong, ca 0.5 mm long; disc disciform, flat, 1 - 3 mm in diam.; staminal column ca 0.5 mm long; filaments ca 0.5 mm long; anthers ellipsoid, ca 0.6 mm long; pistillode small. Female flowers: pedicels 1 - 2 mm long; calyx 3 - 5 mm in diam.; sepals triangular to ovate-triangular, 1.3 - 2 x 0.8 - 1.3 mm; petals spatulate, obovate or suborbicular, ca 1 x 0.7 mm; outer disc ca 2.5 mm in diam., inner disc cupular, almost enclosing the ovary; ovary subglobose, 1 - 1.5 mm in diam., glabrous, 2-locular; styles 1 - 1.5 mm long, connate below into a column (ca 0.5 mm long), shortly to deeply bifid above. Fruits oblong to ellipsoid, 5 - 7 x 3 - 4 mm, slightly bilobed, 2-locular or by abortion 1-locular; seed 1,

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

*Distrib.* India: Margins of subtropical and warm broad-leaved forests (Long, l. c. 1987), at 200 - 1600 m altitudes. West Bengal, Sikkim, Arunachal Pradesh and Meghalaya.

Bhutan and Bangladesh.

**8. *Bridelia stipularis*** (L.) Blume, Bijdr. Fl. Ned. Ind. 597. 1826; Hook.f., Fl. Brit. India 5: 270. 1887, p. p.; Prain, Bengal Pl. 2: 928. 1903; Duthie, Fl. Gangetic Plain 2: 87. 1905; Haines, Bot. Bihar Orissa 2: 120. 1921; Gamble, Fl. Madras 2(7): 1281. 1925 (repr. ed. 2: 896. 1957); Kanjilal et al., Fl. Assam 4: 147. 1940. *Clutia stipularis* L., Mant. Pl. 127. 1767. *C. scandens* Roxb., Pl. Coromandel 2: 39, t. 173. 1802 (as *Cluytia*). *Bridelia scandens* (Roxb.) Willd., Sp. Pl. ed. 4, 4: 979. 1806.

Mal.: *Cheru-kapanachi*, *Kottam*; Nep.: *Khaji*, *Lahara-gayo*, *Kasreto*; Oudh.: *Madlatah*, *Udnergupa*.

Stragglers, scandent shrubs, woody climbers or small trees, 3 - 5 m tall; tomentellous or velutinous. Leaves oblong to elliptic or broadly so to obovate-elliptic, rounded, acute or occasionally subcordate at base, entire to shallowly crenate along margins, acute to apiculate or acuminate at apex, 5 - 20 x 2.5 - 10 cm (the leaves towards tips of branches or subtending inflorescences much smaller, ca 2 x 0.5 cm), chartaceous, sometimes glaucous beneath; lateral nerves 7 - 15 pairs; petioles 4 - 9 mm long; stipules linear-lanceolate or triangular-filiform, 4 - 10



x 1 - 3 mm. Inflorescences arising on lateral leafy or small-leaved branchlets (up to 30 cm long), also on main leafy branches, unisexual, 10 - 15 mm in diam. Male flowers: pedicels up to 1 mm long, puberulous; calyx 6 - 9 mm in diam.; sepals triangular, 3 - 4.5 x 1.5 - 2.5 mm; petals spatulate, 1 - 2 x 1 - 2 mm; disc flat, ca 4.5 mm in diam.; staminal column ca 2 mm long; filaments ca 1 mm long; anthers ellipsoid, ca 1 mm long; pistillode ovoid, ca 1 mm long. Female flowers: sessile or pedicellate (pedicels up to 1 mm long); calyx 6 - 12 mm in diam.; sepals triangular, 3 - 6 x 2 - 3 mm; petals spatulate or oblanceolate, 1 - 3 x 1 - 2 mm; outer disc flat, 3 - 5.5 mm in diam.; ovary ovoid, 1.5 - 2 x 1.5 - 2 mm, glabrous, 2-locular; styles 1.5 - 2 mm long, with or without a short column at base, bifid above. Fruits ellipsoid, oblong-ellipsoid, oblong, conic, semiterete, subglobose or squarish subglobose, truncate or rounded at apex, 5 - 13 x 5 - 11 mm, slightly to prominently bilobed, 2-locular; pedicels absent or up to 1 mm long; seeds ovoid, dorsally keeled, ventrally sulcate, 6 - 7 x 3 - 5.5 x 2 - 3.5 mm, reddish brown.

*Fl.* Sept. - Jan.; *Fr.* Nov. - April.

*Distrib.* India: Deciduous forests, mixed evergreen forests, sal forests, up to 1200 m altitude, common. Almost throughout the country including Andaman Islands.

Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, Thailand, S. China, Taiwan, Malay Peninsula, W. Malesia, Philippines to Lesser Sunda Islands.

*Note.* Chromosome numbers:  $2n = 26$  for *B. scandens* (Kishnappa & Reshme in Taxon 29: 533 - 547. 1980);  $2n = 26$  for *B. stipularis* (Datta in Taxon 16: 341 - 350. 1967).

**9. *Bridelia tomentosa*** Blume, Bijdr. Fl. Ned. Ind. 597. 1826; Hook.f., Fl. Brit. India 5: 271. 1887; Prain, Bengal Pl. 2: 928. 1903; Haines, Bot. Bihar & Orissa 2: 120. 1921; C.E.Parkinson, Forest Fl. Andaman Isl. 234. 1923; Gamble, Fl. Madras 2(7): 1281. 1925 (repr. ed. 2: 896. 1957); Kanjilal et al., Fl. Assam 4: 146. 1940. *B. lancifolia* Roxb. [Hort. Bengal. 70. 1814, nom. nud.] Fl. Ind., ed. Carey 3: 737. 1832 (as *lancaefolia*). *B. tomentosa* var. *lancifolia* (Roxb.) Müll.Arg. in DC., Prodr. 15(2): 502. 1866.

Shrubs (often scandent) or trees, 2 - 12 m tall. Leaves narrowly oblong-elliptic, lanceolate-elliptic, oblong-lanceolate or narrowly obovate-oblong, acute, obtuse to rounded at base, entire, acute, attenuate, apiculate to acuminate at apex, 2.5 - 13 x 1 - 5.5 cm, coriaceous, chartaceous or sometimes membranous, often glaucous beneath, glabrous or sparsely puberulous on midrib above, glabrous or tomentellous to sparsely pilose (on major nerves) or pubescent beneath; lateral nerves 7 - 14 pairs, terminating at margins into the marginal vein; petioles 2 - 6 mm long; stipules linear-lanceolate, 3 - 5 x 0.5 - 1.2 mm, caducous. Inflorescences arising on main leafy branches, unisexual, ca 10-flowered, ca 5 mm in diam. Male flowers: sessile; calyx ca 3 mm in diam.; sepals triangular, ca 1 x 0.6 mm, glabrous; petals spatulate to orbicular-obovate, ca 0.5 mm long; disc discoid, ca 1 mm in diam.; staminal column ca 0.6 mm long; filaments ca 0.5 mm long; anthers ellipsoid-oblong, ca 0.5 mm long; pistillode conical ovoid, ca 0.5 mm long. Female flowers: sessile; calyx 3 - 4 mm in diam.; sepals triangular, 1 - 1.5 x 0.8 - 1 mm, glabrous; petals orbicular-obovate or suborbicular, ca 0.5 x 0.5 mm; outer disc ca 2 mm across; inner disc cupular, ca 0.6 mm long; ovary subglobose, ca 1 mm in diam., glabrous, 2-locular; styles ca 0.5 mm long, free, deeply bifid. Fruits sessile, globose or subglobose, 4.5 - 7 mm in diam., 2-locular, 2-seeded, slightly bilobed, glabrous.

## KEY TO THE VARIETIES

- |  |                                     |
|--|-------------------------------------|
| 1 a. Leaves coriaceous   | <b>9.2. var. <i>nayarii</i></b>     |
| b. Leaves chartaceous  | 2                                   |
| 2 a. Leaves thinly brown-tomentose to sparsely pubescent beneath | <b>9.3. var. <i>tomentosa</i></b>   |
| b. Leaves glabrous beneath                                       | <b>9.1. var. <i>glabrescens</i></b> |

**9.1. var. *glabrescens*** Benth. in Hooker's J. Bot. Kew Gard. Misc. 6: 8. 1854; Dressler in Blumea 41: 302. 1996. *Bridelia glabrifolia* Merr., Enum. Philipp. Fl. Pl. 2: 422. 1923. *B. tomentosa* var. *glabrifolia* (Merr.) Airy Shaw in Kew Bull. 31: 383. 1976 & 35: 603. 1980; Chakrab. & N.P. Balakr. in J. Econ. Taxon. Bot., Addit. Ser. 9: 38. 1992, excl. syn. *B. nayarii*.

*Fl. & Fr.* Nov. - May.

*Distrib.* India: Coastal forests, scrub, inland forests, on sandstone or sandy or clayey loam, at sea level. Andaman & Nicobar Islands.

Found all over the range of the species (vide Dressler, l. c.), but excluding mainland India.

**9.2. var. *nayarii*** (P. Basu) Chakrab. et al. in J. Econ. Taxon. Bot. 26: 328. 2002. *Bridelia nayarii* P. Basu in J. Econ. Taxon. Bot. 7: 634. 1985 (1986); Dressler in Blumea 41: 324. 1996.

*Distrib.* India: Coastal forests and scrubs, at sea level. Nicobar Islands.

Myanmar.

**9.3. var. *tomentosa***

Nep.: *Muse-gayo*.

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

*Distrib.* India: Deciduous forests, scrub, evergreen forests, subtropical forests (Himalayas), on sandy or clayey soil, up to 600 m altitude, common. Andhra Pradesh, Orissa, Uttar Pradesh, Jharkhand, West Bengal, Assam, Meghalaya, Tripura, and Andaman & Nicobar Islands.

Bhutan, Bangladesh, Myanmar, S. China, Formosa, throughout Malesia to N. Australia.

**10. *Bridelia verrucosa*** Haines in J. Bot. 59: 189, 193. 1921 & Bot. Bihar Orissa, Pt. 2: 119. 1921; Kanjilal et al., Fl. Assam 4: 144. 1940, p. p. excl. syn. *B. montana* sensu Hook. f., Fl. Brit. India 5: 269. 1887, p. p. (Jharkhand specimens), non (Roxb.) Willd., 1805. *B. sikkimensis* sensu D. G. Long in Grierson & D. G. Long, Fl. Bhutan 1(3): 768. 1987, p. p., quoad syn. *B. verrucosa* Haines, non Gehrm. 1908.

Shrubs or trees, 2.5 - 5 m tall; young shoots reddish velutinous, otherwise almost entirely glabrous. Leaves obovate (or broadly so), cuneate-obovate, orbicular-obovate or oblong-elliptic to suborbicular, acute, obtuse, rounded or cuneate at base, entire to undulate along margins, rounded, apiculate or emarginate at apex, 7 - 16 x 3.5 - 10.5 cm, thinly coriaceous, sometimes glossy, mostly glaucous beneath; lateral nerves 10 - 19 pairs, terminating at margins into marginal vein; petioles 4 - 11 mm long; stipules not seen. Inflorescences on main leafy branches, 5 - 10 mm across, dense-flowered, unisexual; bracts broadly ovate-oblong or triangular,

1- 1.5 x 1 - 1.2 mm, pilose to glabrous, characteristically brown to orange brown when dry and almost hyaline. Male flowers: sessile; calyx 3 - 4 mm across; sepals oblong, linear-oblong or oblanceolate, 1.6 - 2 x ca 1 mm; petals oblong-elliptic, spatulate-obovate to oblanceolate, 1 - 1.5 x 0.7 - 1 mm; disc ca 1 mm in diam., staminal column 0.5 - 1 mm long; filaments ca 0.5 mm long; anthers ovoid, ca 0.6 mm long; pistillode ovoid, ca 0.5 mm long. Female flowers: sessile; calyx 3 - 5 mm in diam.; sepals linear-oblong or triangular-oblong, 2 - 2.5 x ca 1 mm; petals spatulate, obovate or narrowly elliptic, 0.7 - 1.5 x 0.3 - 0.6 mm; outer disc ca 1.8 mm across; inner disc conic, covering the ovary; ovary subglobose, ca 1 mm in diam., glabrous, 1-locular; styles ca 1 mm long, free, bifid. Fruits sessile, subglobose, ovoid or ellipsoid, 5 - 8 x 4 - 6 mm, smooth, 1-locular; seed solitary.

*Fl. & Fr.* Jan. - Oct.

*Distrib.* India: Scarce, deciduous forests, primary forests, sub Himalayan tracts and stream sides, up to 1200 m altitude. Uttarakhand, Jharkhand, West Bengal, Sikkim and Arunachal Pradesh.

Pakistan, Nepal and Bhutan.

#### DOUBTFUL SPECIES

**Bridelia cinnamomea** Hook.f., Fl. Brit. India 5: 273. 1887. *B. griffithii* Hook.f., l. c. 272. 1887; C.E.Parkinson, Forest Fl. Andaman Isl. 234. 1923; Chakrab. & N.P.Balakr. in J. Econ. Taxon. Bot., Addit. Ser. 9: 34. 1992. Type: Malacca, *Griffith* K.D. 4883 (K - Lectotype - n. v., CAL); South Andaman, *Kurz* s. n. (K - n. v.).

Dressler (Blumea 41: 307 - 308. 1996) excluded the syntype material of *Kurz* from Andamans. He did not include Andamans while citing the distribution of the species. Chakrabarty & Balakrishnan (1992) had already mentioned that the occurrence of the species in the Andaman Islands requires clarification through the study of the *Kurz*'s material.

#### 57. **Cleistanthus** Hook.f. ex Planch.

Monoecious shrubs or trees, glabrous or pubescent with simple hairs. Leaves simple, alternate, usually bifarious, symmetric, petiolate, stipulate, entire, often glossy above and glaucous beneath, penninerved. Inflorescences axillary, fasciculate-glomerulate, borne on main leafy branches or sometimes on special leafless or small-leaved branchlets; bracts up to 2 mm long. Male flowers: sessile or shortly pedicelled, calyx tube shortly obconical, segments (sepals) 5, valvate; petals 5, free, alternate to sepals; disc annular or shortly cupular; stamens 5; filaments connate below into a column, free and spreading above; anthers longitudinally dehiscent; pistillode small, at the apex of the column, trifid or trilobed. Female flowers: sessile or sometimes pedicellate, occasionally with a gynophore; calyx and petals as in male; disc annular, cupular or urceolate; ovary often enclosed by disc, 3-locular; locules biovulate; ovules anatropous; styles 3, usually shortly connate below into a column, simple or bifid above. Fruits capsular, sessile or shortly pedicellate, subglobose or depressed, tricocous with 3 bivalved cocci (rarely tetralocular); seeds trigonous, exarillate and ecarunculate; cotyledons thin and flat or thick and fleshy; endosperm copious or sparse.

Old World tropics, from Africa to Asia, Australia and Melanesia, ca 148 species; 7 species in India.

*Literature.* CHAKRABARTY, T., GANGOPADHYAY, M. & N. P. BALAKRISHNAN (2002). The genus *Cleistanthus* Hook.f. ex Planch. (Euphorbiaceae) in the Indian subcontinent. J. Econ. Taxon. Bot. 26: 331 - 345.

#### KEY TO THE SPECIES

- 1 a. Leaves rounded, retuse or apiculate at apex; fruits 18 - 22 x 17 - 22 mm **3. C. collinus**
- b. Leaves acuminate or caudate at apex; fruits 3 - 12 x 4 - 15 mm 2
- 2 a. Fruits stipitate (with a gynophore); leaves densely and finely appressed golden brown, coppery or silvery sericeous beneath **5. C. myrianthus**
- b. Fruits not stipitate; leaves not sericeous beneath, glabrous or pilose or hirsute on the nerves or tomentose beneath 3
- 3 a. Stipules 5 - 10 mm long 4
- b. Stipules 1- 5 mm long 6
- 4 a. Leaves scattered pilose or hirsute on major nerves beneath; inflorescences arising on main leafy branchlets (S. India) **4. C. malabaricus**
- b. Leaves glabrous or sparsely pilose on midrib beneath; inflorescences arising on special small-leaved branchlets (Andaman and Nicobar Islands) 5
- 5 a. Branchlets and petioles glabrous; leaves coriaceous, apical cauda 5 - 10 mm long; lateral nerves 5 - 7 per side; fruits glabrous, sessile **1. C. andamanicus**
- b. Branchlets and petioles pubescent; leaves chartaceous to subcoriaceous; apical cauda 10 - 30 mm long; lateral nerves 7 - 10 per side; fruits puberulous, shortly pedicellate **2. C. balakrishnanii**
- 6 a. Inflorescences borne on special small leaved or leafless branchlets; fruits depressed, 5 - 12 x 10 - 15 mm, sessile **6. C. patulus**
- b. Inflorescences borne on main leafy branches; fruits subglobose, 3 - 5 x 4 - 6 mm, pedicellate (pedicels 1.5 - 2 mm long) **7. C. travancorensis**

**1. *Cleistanthus andamanicus*** N.Balach., Gastmans & Chakrab. in Rheedea 20: 32, f. 1. 2010. *Drypetes ovalis* sensu N. Balach. & Gastmans in J. Bombay Nat. Hist. Soc. 103: 140, 2006, pro parte, tantum quoad spec. cit. '*N. Balachandran 736*', non (J.J.Sm.) Pax & K. Hoffm., 1922. *Cleistanthus robustus* sensu Sumathi, Jayanthi, Karthig. & D.Naras. in Rheedea 19: 70, f. 2. 2009, non Müll.Arg. 1866.

Shrubs, 3 - 4 m high; bark brown; branchlets brown, flattened and striate towards apices, terete below, 1 - 4 mm thick, glabrous. Leaves oblong, oblong-elliptic to ovate-elliptic, 5 - 15 x 2.5 - 7 cm, rounded, obtuse to subacute at base, slightly decurrent to petioles, entire along margins, acuminate (acumen 5 - 10 mm long) at apex, coriaceous, glabrous, remaining green above when dry, paler and often glaucescent beneath; midrib slightly raised above, raised beneath; lateral nerves slender, 4 - 7 per side, faint, arcuate, anastomosing near margins; tertiary nerves faint, laxly reticulate; nervules inconspicuous; petioles 3 - 8 x 1 - 2 mm, semiterete, rugose, glabrous; stipules linear-subulate, ca 5 mm long, deciduous. Male flowers: not seen. Female flowers: axillary or occasionally slightly supra-axillary, fasciculate or solitary, subsessile; calyx 2.5 - 4 mm long fulvous-pilose or sericeous outside, glabrous inside; tube shortly obconic, segments (sepals) 5, ovate-triangular or broadly triangular, 1.5 - 3 x 1 - 1.5 mm; petals 5, obovate, 2 - 3 x 1 - 1.5 mm, emarginate; ovary subglobose, ca 1.5 mm in diam., ochraceous-sericeous; styles 3, ca 1 mm long, bifid at apex. Fruits sessile to subsessile, somewhat depressed, ca 7 x 10 mm, 3-lobed, glabrous, dark brown when dry; seeds suborbicular or broadly ovoid-oblong, ca 5 x 4 mm, somewhat flattened, brown when dry.

*Fl. & Fr.* March – April.

*Distrib.* India: Deciduous and stunted evergreen forests up to 600 m altitude. Scarce. Andaman Islands.

Endemic.

**2. *Cleistanthus balakrishnanii*** Chakrab. in J. Econ. Taxon. Bot. 5: 951. 1984; Chakrab. & N.P. Balakr. in J. Econ. Taxon. Bot. Addit. Ser. 9: 46. 1992.

Shrubs or trees, 2 - 8 m tall; branchlets villous when young, glabrescent in age. Leaves narrowly elliptic to lanceolate or narrowly oblong-elliptic, acute or sometimes obtuse to rounded at base, entire, caudate-acuminate at apex, 6 - 19 x 2 - 5 cm, chartaceous to subcoriaceous, glabrous (except midrib); lateral nerves 7 - 10 pairs; petioles 4 - 9 mm long; stipules subulate-acicular, 5 - 8 mm long, subpersistent. Inflorescences many-flowered, bisexual, borne on special small-leaved branchlets (elongating later on). Male flowers: pedicels ca 2 mm long; calyx 2.5 - 3.5 x 3 - 4 mm; tube tomentellous; sepals triangular, 1.5 - 2 x 1 - 1.5 mm; petals unguiculate-flabellate, 0.7 - 1 mm long, glabrous; disc shortly cupular; stamens 2.5 - 3.5 mm long; column 1.5 - 2.5 mm long; anthers broadly oblong or ovoid, ca 1 mm long; pistillode ca 1 mm long. Female flowers: pedicels ca 1 mm long; calyx 3 - 4 x 3 mm; tube tomentellous; sepals triangular or oblong, 1.5 - 2.5 x 1 - 1.8 mm; petals unguiculate-flabellate, ca 1 mm long; disc cupular; ovary trigonous-globose, ca 2 mm in diam., densely sericeous; styles ca 1 mm long, simple, almost free, spreading. Fruits somewhat depressed, ca 10 mm in diam., prominently 3-lobed, scattered ochraceous puberulous, green.

*Fl. & Fr.* April - Sept.

*Distrib.* India: Scrubs along the edges of inland forests on clayey or rocky soil, at about 20 m altitude. Rare. Nicobar Islands (Great Nicobar).

Endemic.

**3. *Cleistanthus collinus*** (Roxb.) Benth. ex Hook.f., Fl. Brit. India 5: 274. 1887. *Clutia collina* Roxb., Pl. Coromandel 2: 37, t. 169. 1802 (as '*Cluytia*') & Fl. Ind., ed. Carey 3: 732. 1832. *Andrachne orbiculata* Roth, Nov. Pl. Sp. 364. 1821. *Amanoa collina* (Roxb.) Baill., Etude Euphorb. 582. 1858. *Lebidieropsis collina* (Roxb.) Müll.Arg. in Linnaea 32: 80. 1863. *L. orbiculata* (Roth) Müll.Arg. in DC., Prodr. 15(2): 509 - 510. 1866. *L. orbiculata* var. *collina* (Roxb.) Müll.Arg., l. c. 509. 1866.

Beng.: *Karrajuri*; Hind.: *Garari, Garrar*; Kan.: *Badeda-rige*; Mal.: *Odugu*; Or.: *Karoda*; Sant.: *Kargalli*; Tam.: *Nilaiippala, Oduvamaram, Odhuvanthalai, Oduvan, Wodayu, Wodan*; Tel.: *Kadishe, Korei, Wodesta*; Urdu: *Korada*.

Shrubs or trees, 1.5 - 15 m tall; branchlets pilose when young, soon glabrous. Leaves broadly oblong, elliptic to suborbicular or orbicular-obovate, rounded to obtuse or sometimes acute at base, entire, rounded, retuse or apiculate at apex, 3 - 11 x 1.5 - 8 cm, chartaceous to stiffly coriaceous, glabrous, sometimes glaucous beneath, often glossy; lateral nerves 4 - 7 pairs, very slender; petioles 3 - 10 mm long. Inflorescences borne on main leafy branches or short lateral branches or often on special leafless branches (up to 6 cm long), the males 3 - 5-flowered, the females ca 3-flowered; bracts broad-based subulate, 1.5 - 3 mm long. Male flowers: pedicels 1 - 2 mm long; sepals occasionally 6, triangular-oblong or lanceolate-oblong, 3 - 4 x 1 - 2 mm, pilose

outside; petals linear, ca 0.6 mm long; disc annular, ca 2 mm in diam.; staminal column ca 1.5 mm long; filaments ca 1.2 mm long; anthers oblong, 1 - 1.5 mm long; pistillode ovoid, ca 0.5 mm long. Female flowers: pedicels 0.5 - 1.5 mm long; calyx-tube ca 1 mm long; sepals triangular-lanceolate, 4 - 5 x 1 - 3 mm; petals subulate, ca 2 x 1 mm; disc shortly cupular-annular; ovary subglobose, 2 - 2.5 x 2 - 3 mm, glabrous; styles 3 - 4 mm long, almost free or basal column ca 1.5 mm long, shortly to deeply bifid above. Fruits subglobose or widely oblong, truncate at apex, shallowly 3-lobed or 3-angled, 18 - 22 x 17 - 22 mm, glossy, glabrous, with prominent reticulate venation.

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

*Distrib.* India: Dry deciduous forests, scrubs, along streams on rocky soil, up to 1400 m altitude, common. West Bengal, Bihar, Madhya Pradesh, Orissa, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Uses.* A poisonous plant. The bark, leaves and fruits employed as fish poison. Forest animals keep away from it. The bark applied in skin-diseases and for severe headache. The leaves are abortifacient. The active principle, Oduvin, a yellow white crystalline glucoside soluble in alcohol and chloroform, is a slow poison. The leaves and bark contain saponin and tannin. The wood used as house post (Wealth of India, Raw Materials 2: 230. 1950).

*Note.* Chromosome number:  $2n = 22$  (Datta, Taxon 16: 341 -350. 1967).

**4. *Cleistanthus malabaricus*** (Müll.Arg.) Müll.Arg. in DC., Prodr. 15(2): 508. 1866; Hook.f., Fl. Brit. India 5: 276. 1887; Gamble, Fl. Madras 2(7): 1283. 1925 (repr. ed. 2: 898. 1957). *Lebidiera malabarica* Müll.Arg. in Linnaea 32: 81. 1863.

Kan.: *Yettimara*.

Shrubs or small trees; branchlets villous, becoming glabrous in age. Leaves narrowly oblong-obovate to oblanceolate, narrowed and acute or rounded at base, entire along margins, apiculate to caudate or acuminate at apex, (3 -) 5 - 15 x (1 -) 2 - 4.5 cm, chartaceous or occasionally thinly coriaceous, glabrous or hirsute on midrib and often on lateral nerves above, scattered pilose or hirsute on major nerves (midrib often densely ochraceous villous) beneath, glaucous beneath; lateral nerves 5 - 10 pairs; petioles 1.5 - 5 mm long; stipules linear to filiform, 5 - 10 mm long. Inflorescences borne on main and lateral leafy branches, few-flowered. Male flowers: pedicels ca 4 mm long, sparsely puberulous; calyx ca 7 mm in diam.; sepals narrowly subulate-acuminate, ca 4 x 1 mm; petals narrowly spatulate-obovate, ca 2 x 0.8 mm; disc shortly cupuliform; staminal column ca 1 mm long; filaments ca 0.5 mm long; anthers ellipsoid, ca 0.8 mm long; pistillode trifid. Female flowers: pedicels 0.5 - 1 mm long; calyx ca 4 x 5 mm, glabrous; sepals triangular or ovate-oblong, ca 3 x 1.5 mm; petals spatulate, ca 2 x 1 mm; disc cupular; ovary subglobose, 1 - 2 mm in diam., densely and evanescently villous; styles ca 1 mm long, free, erect, shortly bifid above. Fruits somewhat depressed, 3-lobed, 4 - 5 x 8 - 9 mm, glabrous.

*Fl.* Dec. - May; *Fr.* Feb. - Oct.

*Distrib.* India: Evergreen forests of Western Ghats, between 300 to 1000 m altitudes, scarce. Maharashtra, Karnataka, Kerala and Tamil Nadu.

**5. *Cleistanthus myrianthus*** (Hassk.) Kurz, Prelim. Rep. For. Veg. Pegu, App. A: p. cx, App. B: 79, in clavi. 1875 & Forest Fl. Burma 2: 370. 1877; Hook.f., Fl. Brit. India 5: 275. 1887; C.E.Parkinson, Forest Fl. Andaman Isl. 237. 1923; Chakrab. & N.P.Balakr. in J. Econ. Taxon. Bot. Addit. Ser. 9: 46. 1992. *Nanopetalum myrianthum* Hassk., Verslagen Meded. Afd. Natuurk. Kon. Akad. Wetensch. 4: 141. 1855. *Cleistanthus oblongifolius* auct. non (Roxb.) Müll.Arg., 1866; Chakrab. et al. in J. Econ. Taxon. Bot. 26: 339. 2002, p. p., excl. specim. cit. Bangladesh; N.P.Balakr. & Chakrab., Fam. Euphorb. India 325. 2007, p. p.

Hindi (Andamans): *Lal-bali*.

Trees, 5 – 20 m high; young shoots rufous-sericeous; branchlets tomentellous, glabrous in age. Leaves elliptic, oblong to oblong-elliptic, acute, obtuse to rounded at base, caudate or acuminate at apex, 6 – 30 x 1.5 – 8 cm, coriaceous, glabrous and mostly glossy above, densely brown, silvery or coppery appressed-sericeous beneath; lateral nerves 5 - 12 per side; petioles 3 – 15 x 1 – 3 mm, scattered puberulous. Glomerules few-flowered, 5 – 10 mm across, borne on main leafy branches and leafless or small-leaved branchlets (1 - 10 cm long); bracts deltoid-ovate, ca 0.5 mm long. Male flowers: sessile, glabrous; calyx tube ca 2 x 3 mm; sepals triangular or triangular-lanceolate, 1.5 – 2.5 x 1 - 2 mm; petals flabellate-unguiculate, ca 1 x 0.8 mm; disc annular; stamens 3 – 3.5 mm long; column ca 1.5 mm long; filaments ca 1 mm long; anthers ellipsoid-oblong, ca 0.8 mm long; pistillode ovoid, trifold. Female flowers: sessile, 4 – 5 mm across, glabrous; calyx tube ca 1 x 1.5 mm; sepals triangular, 1.5 – 3 x 1 – 1.5 mm; petals flabellate, spatulate or suborbicular, ca 1 mm across; outer disc flat; inner disc cupular or subconical and covering the ovary at least halfway; ovary trigonous-globose, 1.5 - 2 mm across, glabrous, shortly stipitate; styles 1.5 - 2 mm long, bifid. Fruits subglobose, 7 - 11 x 11 - 15 mm, 3-lobed, somewhat depressed, intruded at apex, sometimes muricate, blackish when dry; stipe 2 – 6 mm long.

*Fl. & Fr.* Dec. – July.

*Distrib.* India: Common in deciduous to inland evergreen forests, often along streams on clayey or rocky soil or sandy loam at low altitudes. Andaman Islands.

Myanmar, Indo-China, Thailand, throughout Malesia to New Guinea, Solomon Islands and Australia.

*Uses.* The timber is used for house posts and beams.

**6. *Cleistanthus patulus*** (Roxb.) Müll.Arg. in DC., Prodr. 15(2): 505. 1866; Hook.f., Fl. Brit. India 5: 279. 1887. *Clutia patula* Roxb., Pl. Coromandel 2: 37, t. 170. 1802 (as *Chuytia*). *Amanoa indica* Wight, Icon. Pl. Ind. Orient. 5: 30, t. 1911. 1852. *A. patula* (Roxb.) Thwaites, Enum. Pl. Zeyl. 280. 1861, p. p.

Trees, up to 5 m tall; branchlets initially velutinous, afterwards glabrous. Leaves oblong-elliptic to oblong-lanceolate or ovate-lanceolate, acute, obtuse to rounded at base, entire along margins, acuminate or caudate and apiculate at apex, 3.5 - 13 x 1 - 5.5 cm, chartaceous to thinly coriaceous, often glossy, sometimes glaucous beneath, glabrous or sparsely puberulous on midrib (towards base) above, glabrous or sparsely pilose on midrib beneath; lateral nerves 4 - 12 pairs; petioles 2 – 5 mm long, 0.7 - 1.5 mm thick. Inflorescences few-flowered, borne or special small-leaved or leafless branchlets (2 - 8 cm long) or rarely on main leafy branches. Male

flowers: not seen (reported to be sessile with triangular, puberulous sepals and broad, puberulous petals). Female flowers: sessile to subsessile, 4 - 5 x 3 - 6 mm; calyx-tube cupular, ca 1.2 x 2 mm; sepals triangular, oblong-ovate or lanceolate, 2 - 3 x 1 - 1.5 mm; petals suborbicular, ca 1 x 1 mm; disc cupular, covering half of the ovary; ovary globose, ca 1.5 mm in diam., tomentose; styles 1.5 - 2 mm long, free, bifid up to half way. Fruits sessile, subglobose, somewhat depressed, deeply 3-lobed, usually 3-locular, 5 - 12 x 10 - 15 mm, finely and evanescently appressed golden brown pilose; seeds subglobose, ca 5 mm.

*Fl. & Fr.* Apr. - Oct.

*Distrib.* India: Dry deciduous or evergreen forests, up to 1200 m altitude, common. Odissa, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Note.* Reports indicate the presence of tetralocular fruits in this species (Kumari in Bull. Bot. Surv. India 14: 152 - 153. 1972).

**7. *Cleistanthus travancorensis*** Jabl. in Engl., Pflanzenr. IV.147.viii (Heft 65): 21. 1915; Gamble, Fl. Madras 2(7): 1283. 1925 (repr. ed. 2: 898. 1957).

Trees, 4 - 5 m tall; branchlets initially velutinous or tomentellous, finally glabrous. Leaves lanceolate-elliptic to lanceolate-oblong or narrowly oblong-elliptic to obovate-elliptic, acute, obtuse to rounded at base, entire, attenuate or acuminate at apex, 5 - 12 x 1.5 - 6 cm, chartaceous to thinly coriaceous, glabrous above, glabrous or sparsely pilose on midrib (towards base) beneath; lateral nerves 5 - 11 pairs; petioles 2 - 3 mm long; stipules filiform, 1 - 5 mm long, puberulous. Inflorescences arising on main and lateral 2 - 5 cm long leafy branches, few-flowered. Male flowers: not seen (reported to be ca 3.5 mm long in bud, glabrous or sparsely pilose outside; petals orbicular-ovate; pistillode trifid). Female flowers: subsessile, ca 5 mm in diam.; calyx-tube obconic, ca 1 x 2 mm; sepals triangular, 2 - 2.5 x 1 - 1.4 mm; petals spatulate or flabellate, 1 - 1.5 mm long; disc annular; ovary subglobose, ca 2 mm in diam., villous or glabrous; styles 1 - 1.5 mm long, free, shortly bifid above. Fruits subglobose, 3-lobed, 3 - 5 x 4 - 6 mm, smooth, glabrous, pinkish green when fresh, brown or black when dry; persistent column 2 - 3 mm long; pedicels 1.5 - 2 mm long.

#### KEY TO THE VARIETIES

- |   |  |
|---|--|
| 1 a. Stipules 1 - 3 mm long; ovary glabrous | <b>6.1. var. <i>sankunnianus</i></b>   |
| b. Stipules 3 - 5 mm long; ovary villous    | <b>6.2. var. <i>travancorensis</i></b> |

**7.1. var. *sankunnianus*** (Sivar. & Balach.) P.S.Udayan & Chakrab., **comb. et stat. nov.** *Cleistanthus sankunnianus* Sivar. & Balach. in Kew Bull. 40: 121, f. 1. 1985; Chakrab. et al. in J. Econ. Taxon. Bot. 26: 344. 2002; P.S.Udayan & Balach. in Bull. Bot. Surv. India 48: 217. 2006; N.P.Balakr. & Chakrab., Fam. Euphorb. India 325. 2007.

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

*Distrib.* India: Evergreen forests at about 350 m altitude, rare. Kerala (Cultivated in Arya Vaidya Sala, Kottakkal in Malappuram Dist, Kerala).



**7.2. var. travancorensis**

*Fl. & Fr.* March - April.

*Distrib.* India: Evergreen forests, at 200 - 1000 m altitudes, rare. Kerala and Tamil Nadu.

Endemic.

## DOUBTFUL SPECIES

**Cleistanthus oblongifolius** (Roxb.) Müll.Arg. in DC., Prodr. 15(2): 506. 1866, p. p., quoad var. *genuina*, excl. var. *scaber*; Chakrab. et al. in J. Econ. Taxon. Bot. 26: 339. 2002, p. p., excl. syn. *Nanopetalum myrianthum* Hassk.; N.P.Balacr. & Chakrab., Fam. Euphorb. India 325. 2007, p. p., excl. syn. *Nanopetalum myrianthum* Hassk. *Clutia oblongifolia* Roxb., Fl. Ind., ed. Carey 3: 730. 1832 (as '*Chlytia*'); Wall., Cat. No. 7887. 1847. *Cleistanthus chartaceus* Müll.Arg. in DC., Prodr. 15(2): 507. 1866; Hook.f., Fl. Brit. India 5: 282. 1887; Kanjilal et al., Fl. Assam 4: 147. 1940. *C. myrianthus* (Hassk.) Kurz ssp. *attenuatus* Jabl., l. c. 39. 1915, p. p. tantum quoad specim. Sylhet.

Distinguishable from *C. myrianthus* in the leaves being decurrent to petioles at base, sparsely or scattered sericeous beneath and in the evanescently rufous-villous ovary.

*Fl. & Fr.* Feb. – July.

*Distrib.* India: Recorded for NE. India (Kanjilal et al. 1940) and cultivated in Indian Botanic Garden, Howrah. No specimen seen.

Bangladesh.

**Tribe 4. DRYPETEAE (Griseb.) Hurus.**  
**(T. Chakrabarty & N. P. Balakrishnan)**

Trees or shrubs, dioecious. Leaves alternate, entire or denticulate, stipulate. Inflorescences in axillary fascicles or cauliflorous. Male flowers: sepals mostly 4, sometimes 5, imbricate; petals absent; disc intrastaminal; stamens (2 -) 3 - 20 (- 50), free; anthers introrse or extrorse; pollen grains 3-colporate, reticulate; pistillode small or obsolete. Female flowers: sepals deciduous; disc annular or absent; ovary 1 or 2-locular; styles mostly entire and sometimes dilated; ovules anatropous, with massive obturator. Fruits capsular or drupaceous; seeds 1 per locule or per fruit; endosperm copious; cotyledons flat, broader and slightly larger than radicle.

Tropical regions, 4 genera; 2 in India.

## KEY TO THE GENERA

- 1 a. Male flowers large, not crowded; disc present; stamens mostly 3 - 50; styles stigmatiform, not dilated **58. Drypetes**
- b. Male flowers 2 - 3 mm in diam., crowded; disc absent; stamens mostly 2 - 3 (-4); styles petaloid, dilated **59. Putranjiva**

### 58. *Drypetes* Vahl

Tall evergreen trees or shrubs. Leaves alternate, simple, entire or denticulate along margins, mostly unequal-sided at base, glabrous or sometimes pubescent, penninerved with slender lateral nerves and usually with prominent, finely reticulate ultimate venation, short-petioled; stipules small, caducous. Inflorescences axillary or cauliflorous, fascicled, the flowers sometimes subsessile. Male flowers: sepals (2 or 3) 4 or 5, free, imbricate; petals absent; stamens 3 - 50, free; anthers 2-loculed, basifixed, extrorse or introrse; disc central, pubescent or glabrous, disciform, flat or with variously raised or crenate or lobulate margins, the lobes rarely produced outward embracing the bases of filaments. Female flowers: sepals 4 or 5 (- 6), same as in male but usually larger; petals absent; disc annular or occasionally shortly cupular; ovary 1 or 2 (- 3)-locular; ovules anatropous, 2 in each locule; styles obsolete or occasionally 1 - 3 mm long; stigmas mostly flabellate or sometimes circular or reniform. Fruits drupaceous, indehiscent, occasionally somewhat flattened; exocarp mostly fleshy and thick or sometimes thin; endocarp crustaceous or bony, sometimes sculptured; seeds solitary in each locule, ecarunculate; testa smooth; endosperm fleshy; embryo straight; cotyledons broad.

Mostly in Old World tropics, also in New World tropics, subtropical East Asia and South Africa, about 200 species; 20 species in India.

*Literature.* CHAKRABARTY, T., M. GANGOPADHYAY & N. P. BALAKRISHNAN (1997). The genus *Drypetes* (Euphorbiaceae) in the Indian subcontinent. *J. Econ. Taxon. Bot.* 21(2): 251 - 280, ff. 1 - 8.

*Notes.* The chromosome number reported so far is only in four African species, with the diploid number as  $2n = 40$  (Hans, *Taxon* 22: 591 - 636. 1973). Pollination is anemophilous or entomophilous. Pollen grains are prolate, tricolporate, tectate and with large endocolpus (Punt, *Wentia* 7: 1 - 116. 1962).

Almost all species yield timber of good quality and used for construction of houses or making furniture, agricultural implements or various other wooden materials.

#### KEY TO THE SPECIES

- |  |                                |
|--|--------------------------------|
| 1 a. Styles 2 - 3 mm long  | <b>8. <i>D. indica</i></b>     |
| b. Styles obsolete   | 2                              |
| 2 a. Ovary and fruits 1-locular (unknown in <i>D. porteri</i> ); leaves usually smaller (up to 16 cm long)   | 3                              |
| b. Ovary and fruits 2-locular; leaves various, often larger  | 10                             |
| 3 a. Leaves stiffly coriaceous, broadly rounded or obtuse or retuse at apex; minor nerves bullately impressed; fruits globose or fusiform, 6 - 8 mm in diam., fleshy | <b>16. <i>D. sepiaria</i></b>  |
| b. Leaves chartaceous to thinly coriaceous, acuminate or at least narrowing towards apex; minor nerves not bullately impressed; fruits not as above                  | 4                              |
| 4 a. Leaves crenulate-serrulate or denticulate along margins   | 5                              |
| b. Leaves entire along margins   | 7                              |
| 5 a. Endocarp of fruits sculptured with strong spiniform outgrowths  | <b>18. <i>D. sumatrana</i></b> |
| b. Endocarp of fruits not sculptured   | 6                              |
| 6 a. Fruits large, 16 - 18 x 10 - 13 mm, not flattened   | <b>1. <i>D. andamanica</i></b> |
| b. Fruits small, ca 10 x 7 - 8 mm, often somewhat flattened  | <b>7. <i>D. gardneri</i></b>   |

- 7 a. Minor nerves of leaves finely reticulate, forming polygonal areoles, never branching into veins of higher order 8  
 b. Minor nerves of leaves not so finely reticulate, forming more or less squarish or rectangular areoles, often branching into veins of higher order 9
- 8 a. Leaves 11 - 16.5 cm long, glossy; petioles 3 - 6 mm long, pulvinate at apex, mostly geniculate **6. D. ellisii**  
 b. Leaves 5 - 9 cm long, not glossy; petioles 9 - 11 mm long, pulvinate at apex, mostly geniculate **15. D. porteri**
- 9 a. Lateral nerves of leaves 6 - 9 pairs; male disc entire; female pedicels 4 - 5 mm long; fruiting pedicels 10 - 12 mm long; fruits mostly ovoid to ellipsoid, 1.7 - 2 cm long **20. D. wightii**  
 b. Lateral nerves of leaves 7 - 16 pairs; male disc lobulate; female pedicels 8 - 15 mm long; fruiting pedicels 20 - 26 mm long; fruits obovoid, 2 - 2.5 cm long **19. D. venusta**
- 10 a. Inflorescences (at least partly) cauliflorous, on old wood 11  
 b. Inflorescences strictly axillary, on main leafy shoots 14
- 11 a. Midrib on upper surface of leaves clearly channeled or impressed **11. D. longifolia**  
 b. Midrib on upper surface of leaves flat 12
- 12 a. Branchlets and leaves pubescent; leaves entire; fruits small (2 - 2.5 cm in diam.), on 10 - 12 mm long pedicels **12. D. malabarica**  
 b. Branchlets and leaves glabrous or glabrescent; leaves obscurely to prominently denticulate or serrulate along margins; fruits large (2.5 - 5 cm in diam.), sessile to subsessile 13
- 13 a. Glomerules of flowers coralliform; stamens 15 - 20; male disc shortly cupular and ribbed, with thin raised margins **4. D. confertiflora**  
 b. Glomerules of flowers not coralliform; stamens 30 - 40; male disc disciform, not ribbed **14. D. oblongifolia**
- 14 a. Leaves serrulate or denticulate along margins 15  
 b. Leaves entire along margins 16
- 15 a. Leaves 13 - 15 x 4 - 5 cm, chartaceous; midrib flat above; fruits ovoid-ellipsoid, thin-walled **9. D. jaintensis**  
 b. Leaves (10-) 15 - 35 x 4.5 - 8 cm, coriaceous; midrib often slightly incised above; fruits oblong-ellipsoid to globose or transverse, thick-walled **17. D. subsessilis** (p. p.)
- 16 a. Female and fruiting pedicels (fruits unknown in *D. eglandulosa*) longer, 5 - 15 mm long 17  
 b. Female (unknown in *D. leiocarpa*) and fruiting pedicels shorter, 0.5 - 5 mm long 19
- 17 a. Leaves larger, 7 - 28 cm long, glossy; female and fruiting pedicels 5 - 10 mm long; fruits sub-cubical **3. D. bhattacharyae**  
 b. Leaves smaller, 5 - 10 cm long, not glossy; female and fruiting pedicels 10 - 15 mm long; fruits not sub-cubical 18
- 18 a. Leaves brownish when dry; nerves and nervules prominent on the upper surface; fruits unknown (N E. India to Myanmar) **5. D. eglandulosa**  
 b. Leaves blackish when dry; nerves and nervules obscure or faint on the upper surface; fruits globose, 1.6 - 2 cm in diam., thick-walled (Nicobar Islands) **13. D. microphylla**
- 19 a. Fruits glabrous, globose **10. D. leiocarpa**  
 b. Fruits pubescent, of various shapes 20
- 20 a. Leaves often obscurely serrulate; midrib often slightly incised on the upper surface; male flowers 4 - 5 mm in diam.; stamens 3 - 4; female pedicels 0 - 2.5 (-5) mm long; fruits oblong-ellipsoid to globose or occasionally transverse **17. D. subsessilis** (p. p.)  
 b. Leaves always entire; midrib flat on the upper surface; male flowers ca 10 mm in diam.; stamens (6-) 8 - 15; female and fruiting pedicels 2 - 4 (-5) mm long; fruits subcubical or often transverse **2. D. assamica**

**1. *Drypetes andamanica*** (Kurz) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 261. 1922; M.P.Nayar in Red Data Book of Indian Pl. 3: 119. 1990. *Hemicyclia andamanica* Kurz [Rep. Veg. Andaman Isl. 47. 1870] in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 240. 1873 & Forest Fl. Burma 2: 365. 1877; Hook.f., Fl. Brit. India 5: 338. 1887.

Trees, 5 - 15 m tall, almost glabrous. Leaves oblong to elliptic or ovate-lanceolate, unequal-sided or occasionally rounded at base, shallowly sinuate-denticulate or repand-serrulate to entire along margins, caudate-acuminate or acute at apex, 6 - 15 x 2 - 5.5 cm, thinly coriaceous, glossy; lateral nerves 9 - 14 pairs, scarcely thicker than the tertiaries; petioles 3 - 10 mm long. Inflorescences axillary, the males fascicled, the females often solitary. Male flowers: 10 - 12 mm in diam.; pedicels 3 - 4 mm long; sepals 4 or 5, orbicular, 3 - 4 mm across, the outer coriaceous, the inner thinner; stamens 10 - 22, 5 - 6 mm long; anthers oblong to narrowly ovoid, ca 2 mm long; disc lobulate along margins, 1.5 - 2 mm in diam. Female flowers: pedicels 3 - 6 mm long; sepals 4, orbicular to obovate, 4 - 5 x 3 - 4.5 mm; disc annular; ovary ovoid, ca 2 x 1.6 mm, glabrous, 1-locular; stigma sessile, flabellate. Fruits obovoid, 1.6 - 1.8 x 1 - 1.3 cm, 1-locular, glabrous, smooth, thin-walled, yellow when dry; pedicels 4 - 10 mm long, yellowish pustulate.

*Fl. & Fr.* Jan. - June.

*Distrib.* India: Semievergreen or secondary forests, at low altitudes. Andaman Islands.

Myanmar.

*Uses.* The fruits are edible. Wood used for making charcoal.

**2. *Drypetes assamica*** (Hook.f) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 241. 1922; Kanjilal et al., Fl. Assam 4: 179. 1940; N.P.Balacr., Fl. Jowai 2: 423. 1983. *Cyclostemon assamicus* Hook.f., Fl. Brit. India 5: 342. 1887; Prain, Bengal Pl. 2: 937. 1903; Haines, Bot. Bihar Orissa 2: 136. 1921; Duthie, Fl. Gangetic Plain 3(1): 100. 1915; C.E.Parkinson, Forest Fl. Andaman Isl. 235. 1923; Gamble, Fl. Madras 2(7): 1301. 1925 (repr. ed. 2: 910. 1957).

*Asm.:* *Dukhoa*; *Beng.:* *Ban-bakul*; *Kh.:* *Dieng-pankhar*; *Mik.:* *Lali, Phang-gait-arong*.

Shrubs or trees, 2 - 15 m tall; branchlets puberulous when young, soon glabrous. Leaves elliptic to oblong-elliptic, unequal or often acute at base, entire, acuminate to acute or sometimes obtuse at apex, (5 -) 8 - 23 x (2-) 3.5 - 8.5 cm, coriaceous, glabrous, glossy; lateral nerves 6 - 15 pairs; petioles 3 - 12 mm long, glabrescent. Inflorescences axillary. Male flowers: ca 10 mm across; pedicels 3 - 5 mm long; sepals 4, suborbicular, 6 - 8 x 5 - 8 mm, sparsely puberulous or glabrous; stamens (6 -) 8 - 15, 4 - 5 mm long; anthers oblong, ca 1 mm long; disc plicate with the lobes mostly produced outwards embracing the bases of filaments, pubescent. Female flowers: pedicels 2 - 4 (- 5) mm long; sepals 4, suborbicular, 6 - 9 x 5 - 8 mm, puberulous; disc annular, pubescent; ovary globose or oblong-ellipsoid, 1.5 - 3 mm in diam., 2-locular, tomentellous; stigmas sessile, 2, flabellate, 1 - 2 mm broad. Fruits subcubical or often transverse, 13 - 20 x 12 - 20 mm, bilocular, thinly pubescent.

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

*Distrib.* India: Moist evergreen forests, primary forests, deciduous forests, subtropical forests, up to 1400 m altitude. Uttar Pradesh, West Bengal, Assam, Nagaland, Tripura, Mizoram, Orissa, Andhra Pradesh and Andaman Islands.

Bhutan, Bangladesh, Thailand and Indo-China.

*Uses.* The fruits are edible.

*Notes.* Closely related to *D. subsessilis*, into which it sometimes tends to merge and in such cases, the larger male flowers with greater number of stamens are the only reliable distinctions.

**3. *Drypetes bhattacharyae*** Chakrab. in J. Econ. Taxon. Bot. 7: 453. 1985 (1986), (sphalm. '*bhattacharyai*').

Shrubs or trees, 2 - 20 m tall; branchlets glabrous. Leaves narrowly elliptic to oblong-elliptic, unequal-sided or sometimes symmetric and acute at base, entire, acuminate or sometimes acute or mucronate at apex, 7 - 28 x 2 - 10 cm, coriaceous, glabrous, glossy; lateral nerves slender, 5 - 15 pairs; petioles 4 - 14 mm long. Inflorescences axillary, few-flowered. Male flowers: pedicels 5 - 10 mm long; sepals 4, orbicular, 5 - 8 x 5 - 7.5 mm; stamens 10 - 12, 4 - 5 mm long; anthers oblong, ca 2 mm long; disc lobulate with the lobes embracing the bases of the filaments. Female flowers: pedicels 5 - 10 mm long; sepals 4, suborbicular, 6 - 8 x 5 - 8 mm; disc annular; ovary globose, 2 - 3 mm in diam., glabrous, bilocular; style 0.2 - 0.4 mm long; stigmas 2, flabellate, 1 - 2 mm across. Fruits subcubically globose or oblong, truncate at apex, unlobed or faintly lobed, 12 - 18 x 10 - 15 mm, bilocular, glabrous.

*Fl. & Fr.* April - Oct.

*Distrib.* India: Littoral forests to inland forests along streamsides, on sandy or clayey soil; at low altitudes. Andaman & Nicobar Islands.

Endemic.

*Use.* The fruits are sweet and edible.

*Notes.* The species is very closely allied to *D. assamica* but distinct in the longer male and female pedicels, the glabrous ovary and fruits, and the presence of minute style subtending the stigmas.

**4. *Drypetes confertiflora*** (Hook.f.) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 246. 1922; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 259. 1997. *Cyclostemon confertiflorus* Hook.f., Fl. Brit. India 5: 341. 1887; T.Cooke, Fl. Bombay 2(3): 591. 1906; Gamble, Fl. Madras 2(7): 1302. 1925 (repr. ed. 2: 911. 1957).

Kan.: *Angai-mara* ; Mal.: *Kaduvapidukkan*.

Tall trees; branchlets glabrous. Leaves oblong to elliptic-oblong, unequal at base, denticulate to repand-serrulate along margins, acuminate or sometimes sub-acuminate at apex, 8 - 23 x 2.5 - 8 cm, stiffly coriaceous, glossy, glabrous; lateral nerves 5 - 9 pairs; petioles 4 - 9 mm long. Inflorescences cauliflorous. Male flowers: arising from coralliform glomerules, glabrous; pedicels 4 - 5 mm long; sepals 5 or 6, suborbicular, 4 - 6 x 3.5 - 5.5 mm; stamens 15 - 20, 2.5 - 4 mm long; anthers oblong, ca 1 mm long; disc impressed, shortly cupular, ribbed, with thin, raised margins. Female flowers: not seen (reported to be sessile, with shortly cupular disc, and brown-tomentose 2-locular ovary with 2 large semicircular stigmas). Fruits sessile to subsessile,

subglobose or cubical, 3.5 - 5 cm in diam., somewhat flattened, evanescently pubescent, 2-locular; endocarp fleshy.

*Fl. & Fr.* Nov. - April.

*Distrib.* India: Evergreen rain forests, at low altitudes, very rare. Maharashtra and Karnataka (Coorg and N. Kanara Districts).

Endemic.

*Uses.* Fruits used as fish-poison.

**5. *Drypetes eglandulosa*** (Roxb.) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 249. 1922; Kanjilal et al., Fl. Assam 4: 178. 1940; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 261. 1997. *Hopea eglandulosa* Roxb., Fl. Ind., ed. Carey 2: 611. 1832. *Cyclostemon eglandulosus* (Roxb.) Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 240. 1873 & Forest Fl. Burma 2: 364. 1877; Hook.f., Fl. Brit. India 5: 341. 1887.

Trees, 12 - 15 m tall; branchlets glabrous. Leaves elliptic to oblong-elliptic or ovate-oblong, unequal at base, entire, acuminate at apex, 5 - 8 x 2 - 3 cm, thinly coriaceous, glabrous; lateral nerves 5 - 8 pairs; petioles 3 - 8 mm long. Male flowers: not seen. Female flowers: axillary, solitary or in pairs; pedicels 10 - 15 mm long; sepals 4, obovate, 4 - 5 x 2 - 3 mm, puberulous outside; disc annular; ovary subglobose, ca 3 mm in diam., 2-locular, 2-lobed, densely pubescent; stigmas 2, sessile, flabellate, ca 1 mm across. Fruits unknown.

*Fl. & Fr.* Period unknown.

*Distrib.* India: Very rare. Assam and Tripura.

Bangladesh and Myanmar.

*Notes.* A very rare species never collected during the last more than 100 years. Except a few specimens prepared by Thomson, Griffith, Wight and Wallich from cultivated plants in Calcutta Botanic Garden, no collection from wild was seen. The live plant does not exist in the Garden now.

**6. *Drypetes ellisii*** S.P.Mathew & Chakrab. in J. Econ. Taxon. Bot. 14: 623, f. 1. 1990; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 261. 1997.

Trees, ca 10 m tall; branchlets glabrous. Leaves elliptic to oblong, subobtuse to subacute at base, entire along margins, acute to acuminate at apex, 11 - 16.5 x 4 - 5.5 cm, thinly coriaceous, glabrous, glossy; lateral nerves 8 - 9 pairs; petioles 9 - 11 mm long, pulvinate at apex, mostly geniculate. Flowers: not seen. Fruits axillary, solitary or in pairs, subglobose to obovoid, 12 - 13 mm in diam., glossy, smooth, glabrous, thin-walled, pale brown when dry, 1-locular, 1-seeded; disc annular; pedicels 5 - 7 mm long, glabrous.

*Fr.* April - June.

*Distrib.* India: Inland hill forests, at about 200 m altitude, rare. Andaman Islands.

Endemic.

**7. *Drypetes gardneri*** (Thwaites) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 270. 1922; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 264. 1997. *Hemicyclia gardneri* Thwaites in Hooker's J. Bot. Kew Gard. Misc. 7: 271. 1855 & Enum. Pl. Zeyl. 287. 1861; Hook.f., Fl. Brit. India 5: 338. 1887. *H. travancorica* Bourd., Forest Trees Travancore 329. 1908; Gamble, Fl. Madras 2(7): 1300. 1925 (repr. ed. 2: 910. 1957). *Drypetes travancorica* (Bourd.) S.K.Jain ex Santapau in Indian Forester 92: 643. 1966.

Mal.: *Vellei-pillai*.

Trees, up to 18 m tall; branchlets tomentellous to thinly puberulous, glabrous in age. Leaves elliptic to oblong-elliptic or ovate-lanceolate, unequal at base, crenulate-denticulate or serrulate or sometimes entire along margins, tapering and subacute or acuminate at apex, 2.5 - 9 x 1 - 3 cm, thinly coriaceous to chartaceous, glabrous above, puberulous on midrib or glabrous beneath; lateral nerves very slender, 6 - 12 pairs; petioles 2 - 6 mm long. Inflorescences axillary. Male flowers: pedicels 3 - 6 mm long; sepals 4 (or 5), obovate or triangular-oblong, 2.5 - 5 x 1.5 - 4 mm, tomentellous outside; stamens (8 -) 12 - 25, 2 - 4 mm long; anthers oblong, ca 1 mm long; disc curved along margins. Female flowers: pedicels 5 - 8 mm long; ovary obovoid, ca 2 x 1.5 mm, 1-locular, appendiculate, glabrous; style ca 0.5 mm long; stigma flabelliform or reniform, ca 0.5 mm across. Fruits obovoid (or ovoid, as recorded in literature), somewhat flattened, ca 10 x 7 mm (also reported to be ca 18 mm long), thin-walled, smooth, glabrous; pedicels ca 1 cm long.

*Fl. & Fr.* Sept. - June.

*Distrib.* India: Evergreen forests of southern parts of Western Ghats, at about 300 m altitude, rare. Tamil Nadu and Kerala.

Sri Lanka.

**8. *Drypetes indica*** (Müll.Arg.) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 278. 1922; Kanjilal et al., Fl. Assam 4: 177. 1940; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 265. 1997. *Cyclostemon indicus* Müll.Arg. in Linnaea 32: 81. 1863 & in DC., Prodr. 15(2): 481. 1866; Hook.f., Fl. Brit. India 5: 340. 1887. *C. lancifolius* Hook.f., l. c. 340. 1887. *C. griffithii* Hook.f., l. c. 340. 1887. *Drypetes lancifolia* (Hook.f.) Pax & K.Hoffm., l. c. 277. 1922; Kanjilal et al. l. c. 177. 1940. *D. griffithii* (Hook.f.) Pax & K.Hoffm., l. c. 277. 1922; Kanjilal et al. l. c. 177. 1940.

Kh.: *Dieng-kwai*.

Trees, up to 30 m tall; young shoots arising from prominent fusiform strobili of chaffy perulae; branchlets glabrous. Leaves narrowly oblong-elliptic or oblong-lanceolate to elliptic-lanceolate, unequal and acute to obtuse at base, entire, caudate or acuminate at apex, 7 - 15 x 2 - 4.5 cm, chartaceous to stiffly coriaceous, glabrous, often glossy; lateral nerves 5 - 12 pairs; petioles (1-) 3 - 5 (-10) mm long. Inflorescences axillary. Male flowers: pedicels 5 - 12 mm long; sepals 4, obovate to suborbicular or triangular, 2 - 3 x 2 - 2.5 mm; stamens 4 - 8, 2 - 2.5 mm long; anthers ellipsoid to suborbicular, 0.5 - 1 mm long; disc flat, entire or lobed. Female flowers: pedicels 5 - 25 mm long; sepals 4, elliptic to suborbicular, 3 - 4 x 2.5 - 3.5 mm; disc annular; ovary globose, ca 2 mm in diam., 2-locular, ochraceous tomentellous; styles 2, connate, 2 - 3 mm long; stigmas 2, flabellate or capitate, ca 0.5 mm across. Fruits subglobose or ellipsoid-oblong, 10 - 25 x 10 - 15 mm, sometimes bilobed, 2-locular, evanescently pubescent.

*Fl. & Fr.* April - Dec.

*Distrib.* India: Primary forests or tropical forests, up to 1650 m altitude; scarce. West Bengal, Sikkim, Arunachal Pradesh and Meghalaya.

Bhutan, Bangladesh, Myanmar, Thailand, China and Taiwan.

**9. *Drypetes jaintensis*** (C.B. Clarke ex Brandis) Pax & K. Hoffm. in Engl., Pflanz. IV.147.xv (heft 81): 251. 1922; Kanjilal et al., Fl. Assam 4: 179. 1940; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 266, f. 5. 1997. *Cyclostemon jaintensis* C.B. Clarke ex Brandis, Indian Trees 567. 1906.

Shrubs or small trees, ca 2 m high; branchlets glabrous. Leaves oblong to oblong-elliptic, unequal at base, repand-denticulate along margins, bluntly acuminate to subacute at apex, 13 - 15 x 4 - 5 cm, chartaceous, glabrous; lateral nerves 7 - 10 pairs; petioles 5 - 6 mm long, glabrous. Flowers: not seen. Inflorescences axillary. Fruits sessile, ovoid-ellipsoid, 15 - 18 x 13 - 15 mm, initially pubescent, finally glabrous, thin-walled, 2-locular, 1-seeded; persistent stigmas 2, suborbicular, ca 1 mm broad.

*Fr.* March.

*Distrib.* India: Primary forests, between 650 - 1100 m altitudes, very rare. Meghalaya.

Endemic.

**10. *Drypetes leiocarpa*** (Kurz) Pax & K. Hoffm. in Engl., Pflanz. IV.147.xv (heft 81): 251. 1922; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 266, f. 6. 1997. *Cyclostemon leiocarpus* Kurz in Trimen, J. Bot. 13: 330. 1875 & in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 45(3): 147. 1876; Hook.f., Fl. Brit. India 5: 343. 1887.

Trees, 10 - 30 m tall; branchlets glabrous. Leaves narrowly oblong to elliptic-oblong, unequal or symmetric and acute at base, entire, shortly acuminate to acute at apex, 8 - 15 x 2.5 - 4.5 cm, thinly coriaceous, glabrous; lateral nerves 8 - 12 pairs, scarcely thicker than the tertiaries; petioles 2.5 - 5 mm long. Flowers: not seen. Fruits axillary, globose, ca 2 cm in diam., 2-locular, faintly lobed, glabrous; stigmas 2, minute; pedicels ca 5 mm long.

*Fr.* Feb.

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

Endemic.

*Notes.* Distinguished from the closely related *D. assamica*, *D. bhattacharyae* and *D. subsessilis* in the somewhat larger globose fruits. The only specimen available is the type collection.

**11. *Drypetes longifolia*** (Blume) Pax & K. Hoffm. in Engl., Pflanz. IV.147.xv (heft 81): 245. 1922, pro majore parte; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 266. 1997. *Cyclostemon longifolius* Blume, Bijdr. Fl. Ned. Ind. 598. 1826; Hook.f., Fl. Brit. India 5: 341. 1887, p. p. *C. macrophyllus* Blume, l. c. 598. 1826; Hook.f., l. c. 340. 1887, p. p.; C.E. Parkinson, Forest Fl. Andaman Isl. 236. 1923. *C. calocarpus* Hook.f., l. c. 343. 1887. *Drypetes macrophylla* (Blume) Pax & K. Hoffm., l. c. 247. 1922. *D. calocarpa* (Hook.f.) Pax & K. Hoffm. l. c. 251. 1922. *Hydnocarpus castanea* sensu C.E. Parkinson, l. c. 84. 1923, non Hook.f. & Thomson 1872.



Trees, 4 - 15 (-18) m tall, with drooping branches; branchlets pubescent when young, glabrous when old. Leaves oblong to narrowly oblong-elliptic, oblique at base, entire, acute to obtuse or bluntly acuminate at apex, 10 - 35 x 3.5 - 12 cm, stiffly coriaceous, glabrous; midrib impressed above, raised beneath; lateral nerves 5 - 10 pairs; petioles 4 - 10 mm long. Inflorescences cauliflorous, axillary or infra-axillary. Male flowers: pedicels 5 - 20 mm long; sepals 4 or 5, suborbicular, 4 - 6 x 3.5 - 5 mm, tomentellous outside; stamens numerous, ca 50, 3 - 5 mm long; anthers ellipsoid to suborbicular, ca 1 mm long; disc flat. Female flowers: pedicels 10 - 15 mm long; sepals 4 or 5, suborbicular, 4 - 5 x 3.5 - 4.5 mm; disc annular; ovary globose, ca 2 mm in diam., 2-locular, tomentellous; stigmas 2, sessile, each bilobed, spreading, flabellate, ca 3 mm across. Fruits subglobose or ovoid, 2 - 2.5 cm in diam., evanescently tomentellous, 2-locular, unlobed, orange yellow when ripe, brown when dry; pedicels 15 - 20 mm long.

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

*Distrib.* India: Inland evergreen forests, sandy loam, up to 100 m altitude. Andaman & Nicobar Islands.

(?)Sri Lanka, Myanmar, Thailand and throughout Malesia.

*Notes.* Report by Ayyappan & Parthasarathy (in *Phytotaxonomy* 1: 133. 2001) from Anamalai hills of Tamil Nadu is based on wrong identification.

**12. *Drypetes malabarica*** (Bedd.) Airy Shaw in Kew Bull. 23: 56. 1969; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 269. 1997; R. Gopalan in J. Econ. Taxon. Bot. 23: 682, f. 1. 1999. *Cyclostemon malabaricus* Bedd., Forester's Man. 199. 1873 & Icon. Pl. Ind. Or. 41, t. 183. 1874; Hook.f., Fl. Brit. India 5: 341. 1887; Gamble, Fl. Madras 2(7): 1302. 1925 (repr. ed. 2: 911. 1957).

Mal.: *Kaduvapudukkan, Kalladamba*; Tam.: *Vella-elumbu*.

Trees, 10 - 15 m tall; branchlets densely pubescent. Leaves narrowly oblong, unequal at base, entire along margins, acuminate at apex, 10 - 25 x 6 - 8 cm, coriaceous, glabrous or pubescent on midrib above, pilose on nerves beneath; midrib flat above, raised beneath; lateral nerves 6 - 10 pairs; petioles 5 - 8 mm long, villous; stipules linear, ca 1 cm long. Inflorescences cauliflorous; flowers in clusters. Male flowers: pedicels ca 5 mm long; sepals 4, suborbicular, 4 - 5 x 3.5 - 4 mm, villous; stamens 30 - 40, 5 - 7 mm long; anthers oblong, ca 1.5 mm long; disc discoid. Female flowers: pedicels up to 2 cm long; sepals as in male flowers; ovary 2-loculed; styles 2, very short or absent; stigmas 2, dilated, reniform or ellipsoid. Fruits subglobose to oblong-ovoid, 2 - 2.5 cm in diam., 2-loculed, thick-walled, tomentellous; persistent stigmas 2, reniform; pedicels 10 - 12 mm long.

*Fl. & Fr.* Aug. - June.

*Distrib.* India: Evergreen forests of southern Western Ghats, at 900 - 1500 m altitude, very rare. Kerala and Tamil Nadu (Tirunelveli District).

Endemic.

*Note.* This species is very closely related to *D. longifolia* but distinct in the more persistent indumentum and midrib not impressed on the upper surface of the leaves. The type specimens collected by *Beddome* s. n. (CAL, K) do not have female flowers. Gopalan (l. c. 1999) collected

the species from Kannikatty (Tirunelveli Dist. of Tamil Nadu) in 1984 and provided the description of the female flowers.

Pollen 3-colporate, sexine micro-reticulate to reticulate. P = 35 µm (25 to 40), E = 35 µm (24 to 35). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery, Pondichery*).

**13. *Drypetes microphylla*** (Merr.) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 237. 1922; Chakrab. & Vasudeva Rao in J. Econ. Taxon. Bot. 6: 442. 1985. *Cyclostemon microphyllus* Merr. in Philipp. Lab. Publ. Bur. Bull. 17: 27. 1904 & in Philipp. J. Sci. I, Suppl. 76. 1906 & Enum. Philipp. Fl. Pl. 2: 407. 1923.

Trees, up to 18 m tall; branchlets glabrous. Leaves elliptic to oblong-elliptic, mostly unequal and acute at base, entire, caudate at apex, 7 - 10 x 2 - 3.5 cm, thinly coriaceous, glabrous; lateral nerves 5 - 8 pairs; petioles 5 - 10 mm long. Inflorescences axillary, also at the axils of fallen leaves. Male flowers: pedicels ca 5 mm long; sepals 4, orbicular-obovate, 3 - 3.5 x 1.5 - 2 mm, sparsely puberulous; stamens ca 8, ca 3 mm long; anthers oblong, ca 1.5 mm long; disc slightly lobulate, puberulous. Female flowers: pedicels 4 - 6 mm long; sepals 4, oblong-obovate, ca 4 x 3 mm; disc annular; ovary globose, ca 2.5 mm in diam., tomentellous, 2-locular; stigmas 2, sessile, flabellate, ca 2 mm broad. Fruits globose, 16 - 20 mm in diam., 2-locular, puberulous; pedicels 12 - 15 mm long.

*Fl. & Fr.* April - May.

*Distrib.* India: Inland forests, at sea level, common. Nicobar Islands.

Malay Peninsula, Sumatra, Borneo and Philippines.

**14. *Drypetes oblongifolia*** (Bedd.) Airy Shaw in Kew Bull. 23: 57. 1969; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 270. 1999. *Laneasagum oblongifolium* Bedd. in Madras J. Sci. Lit. II, 22: 71. 1861. *Cyclostemon macrophyllus* var. *sessiliflorus* Bedd., Fl. Sylv. S. India 2: 278. 1872. *C. macrophyllus* var. *peninsularis* Hook.f., Fl. Brit. India 5: 341. 1887. *C. macrophyllus* auct. non Blume, 1825; Brandis, Indian Trees 567. 1906, p. p.; Gamble, Fl. Madras 2(7): 1302. 1925 (repr. ed. 2: 911. 1957). *Drypetes longifolia* sensu Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 245 - 246. 1922, p. p. (non *Cyclostemon longifolius* Blume, 1825).

Mal.: *Mala-payin*.

Trees, 5 - 25 m tall; young parts (branchlets, petioles and leaves beneath) ochraceous pubescent, soon glabrous. Leaves oblong to oblong-elliptic or oblong-oblongeolate, oblique at base, obscurely to prominently denticulate or serrulate along margins, acuminate or often rounded at apex, 9 - 27 x 3 - 10 cm, stiffly coriaceous, glossy; midrib flat above; lateral nerves 5 - 10 pairs; petioles 3 - 10 mm long. Inflorescences mainly cauliflorous or sometimes axillary, sub-umbellate. Male flowers: 10 - 15 mm in diam., sessile; sepals 4 or 5, oblong to ovate, 8 - 10 x 4 - 5 mm, velutinous outside; stamens 30 - 40, 5 - 10 mm long; anthers oblong, 1 - 2 mm long; disc disciform, lobulate. Female flowers: 10 - 15 mm in diam., sessile; sepals 4 or 5, ovate to orbicular, 4 - 5 x 4 - 5 mm, villous; disc annular; ovary globose, ca 2 mm in diam., 2-locular, tomentose; stigmas 2, sessile, flabellate, 2 - 2.5 mm across. Fruits sessile, globose or sometimes ellipsoid-oblong, 3 - 3.5 cm in diam., often faintly lobed or flattened, 2-locular, densely yellow pubescent.

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

*Distrib.* India: Evergreen forests of Western Ghats, often along streams and riverbanks, at 200 - 1500 m altitudes, scarce. Karnataka (Coorg), Kerala and Tamil Nadu.

Borneo.

*Notes.* The disjunct distribution in Peninsular India and Borneo is perplexing. The species *D. longifolia* reported from Sri Lanka (Philcox in Dassan. & Clayton, Rev. Handb. Fl. Ceylon 11: 266. 1997) is most probably *D. oblongifolia* (Bedd.) Airy Shaw, an extension of South Indian distribution.

The flowers are foetid.

Pollen 3-colporate, sexine micro-reticulate to reticulate. P = 38 µm (36 to 42), E = 30 µm (26 to 34). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery*, Pondicherry).

**15. *Drypetes porteri*** (Gamble) Pax & K.Hoffm. in Engl., *Pflanzenr.* IV.147.xv (heft 81): 268. 1922; Chakrab. et al. in *J. Econ. Taxon. Bot.* 21(2): 271. 1922. *Hemicyclia porteri* Gamble in Hooker's, *Icon. Pl.* 8(1): t. 2701. 1901 & *Fl. Madras* 2(7): 1300. 1925 (repr. ed. 2: 910. 1957).

Eng.: Agilwood.

Shrubs or trees, 6 - 9 m tall; branchlets initially pubescent, soon glabrous. Leaves elliptic to obovate-oblong or obovate-elliptic, unequal at base, entire along margins, subacute or bluntly acuminate at apex, 5 - 9 x 2 - 4 cm, thinly coriaceous, glabrous; lateral nerves 5 - 7 pairs; petioles 3 - 8 mm long. Inflorescences axillary, also borne in the axils of fallen leaves. Male flowers: pedicels 5 - 10 mm long, puberulous; sepals 4, suborbicular, 4 - 5 x 4 - 5 mm; stamens ca 24, 2 - 2.5 mm long; anthers oblong, ca 1 mm long; disc disciform, crenate. Female flowers and fruits not seen.

*Fl.* March - May.

*Distrib.* India: Primary forests, at 600 - 1750 m altitudes, very rare. Tamil Nadu.

Endemic.

*Notes.* Closely akin to *D. wightii* but differing in the more finely reticulate minor nervules (rather than running parallel to each another and sometimes branching into veins of higher order) and stamens being more than double in number.

**16. *Drypetes sepiaria*** (Wight & Arn.) Pax & K.Hoffm. in Engl., *Pflanzenr.* IV.147.xv (heft 81): 271. 1922; Chakrab. et al. in *J. Econ. Taxon. Bot.* 21: 272. 1997. *Hemicyclia sepiaria* Wight & Arn. in *Edinburgh New Philos. J.* 14: 297. 1833; Hook.f., *Fl. Brit. India* 5: 337. 1887; Gamble, *Fl. Madras* 2(7): 1299. 1925 (repr. ed. 2: 909. 1957).

Kan.: *Hira*; Mal.: *Vella-kasavu*; Tam.: *Virai*, *Veeraimarom*; Tel.: *Bira*.

Shrubs or trees, 2 - 15 m tall; branchlets initially puberulous, soon glabrous. Leaves oblong-elliptic to ovate or sometimes orbicular or flabellate, broadly rounded, subtruncate or subcordate (often unequal) or occasionally acute to obtuse at base, entire to crenate-serrate or

denticulate along margins, broadly rounded to obtuse or retuse at apex, 2 - 9 x 1.5 - 4.5 cm, stiffly coriaceous, often glossy, glabrous or sometimes pubescent on midrib; lateral nerves 4 - 8 pairs; minor nerves bullately impressed; petioles 2 - 8 mm long. Inflorescences axillary, fasciculate. Male flowers: pedicels 5 - 7 mm long; sepals 4 (2 + 2), suborbicular, concave, 3 - 4 x 2.5 - 3.5 mm, unequal with the outer 2 smaller, puberulous to glabrous outside; stamens 4 - 8 (- 10), 1.5 - 3 mm long; filaments ca 2 mm long; anthers oblong, 0.5 - 1 mm long; disc flat or shortly cupular. Female flowers: pedicels 1 - 10 mm long; sepals 4, obovate to orbicular, 2 - 4 x 1.7 - 3.5 mm; disc annular, saucer-shaped, crenate; ovary globose to ovoid, 1 - 1.5 mm in diam., glabrous, 1 (or 2)-locular; stigma lying flat on apex of ovary or peltate on very minute style, orbicular or reniform, ca 2 mm across. Fruits globose or fusiform, 6 - 8 mm in diam., glabrous, 1-locular, 1-seeded; pedicels 4 - 10 mm long.

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

*Distrib.* India: Evergreen forests, up to 1000 m altitude, common. Maharashtra, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

*Uses.* Timber used as fuel.

**17. *Drypetes subsessilis*** (Kurz) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 248. 1922; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 273. 1997; Ayyappan & Parthasarathy in Phytotaxonomy 1: 132. 2001. *Cyclostemon subsessilis* Kurz in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 42(2): 240. 1873 & Forest Fl. Burma 2: 364. 1877; Hook.f., Fl. Brit. India 5: 342. 1887.

Trees, 4 - 10 (- 18) m tall; branchlets glabrous. Leaves oblong to oblong-elliptic, unequal at base, sharply serrate when young to obscurely serrate or entire along margins when mature, caudate-acuminate at apex, (10 -) 15 - 35 x (3 -) 4.5 - 8 cm, coriaceous to chartaceous, glabrous; midrib usually somewhat incised above; lateral nerves 7 - 17 pairs; petioles 5 - 15 mm long. Inflorescences axillary, fascicled at axils of fallen leaves. Male flowers: 4 - 5 mm across; pedicels 2 - 5 mm long; sepals 4, suborbicular, 2 - 3 x 1.5 - 2.8 mm; stamens 3 or 4, 4 - 5 mm long; disc plicate-dentate with short inner processes embracing the bases of filaments. Female flowers: pedicels up to 2.5 mm long; sepals 4, suborbicular, 4 - 5 x 3.5 - 4.5 mm; disc annular, puberulous; ovary globose, ca 2 mm in diam., 2-locular, tomentellous; stigmas 2, ca 1 mm across. Fruits oblong-ellipsoid to globose or occasionally transverse, 15 - 20 x 13 - 20 mm, bilobed, 2-locular, rusty puberulous; pedicels 0.5 - 2.5 (-5) mm long.

*Fl. & Fr.* Nov. - May.

*Distrib.* India: In moist tropical and subtropical forests, at 500 - 1200 m altitude. (?)Assam, West Bengal (*Gamble* 6644A in K), Orissa (*Gamble* 2422B in K), ?Tamil Nadu (Indira Gandhi Wild Life Sanctuary in Anamalai hills, Coimbatore Dist. - see Ayyappan & Parthasarathy, l. c.) and Andaman Islands (*Parkinson* 408 in K).

Bhutan, Myanmar and Thailand.

*Notes.* The disjunct distribution between NE. India, Bhutan, Myanmar and Thailand in the north and Anamalai hills in Tamil Nadu in south is perplexing.

**18. *Drypetes sumatrana*** (Miq.) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 270. 1922; Chakrab. & Vasudeva Rao in J. Econ. Taxon. Bot. 6: 475. 1985. *Anaua sumatrana* Miq., Fl. Ned. Ind., Eerste Bijv. 168, 410. 1860. *Hemicyclia lanceolata* Thwaites, Enum. Pl. Zeyl. 387. 1861; Hook.f., Fl. Brit. India 5: 338. 1887. *H. sumatrana* (Miq.) Müll.Arg. in DC., Prodr. 15(2): 487. 1866; Hook.f., l. c. 338. 1887, p. p. *Drypetes lanceolata* (Thwaites) Pax & K.Hoffm., l. c. 269. 1922.

Trees, 6 - 30 m tall; branchlets initially puberulous, soon glabrous. Leaves narrowly oblong-elliptic to lanceolate, unequal at base, crenate-serrate or shallowly sinuate-denticulate along margins, caudate or acuminate at apex, (2 -) 4 - 5 x 1 - 4 cm, thinly chartaceous to subcoriaceous, usually glossy, glabrous (except midrib) or sparsely appressed puberulous beneath; lateral nerves very slender, 5 - 17 pairs; petioles 2 - 7 (- 10) mm long. Inflorescences axillary. Male flowers: pedicels 2 - 4.5 mm long; sepals 4, orbicular or obovate, 3 - 3.5 x 2 - 3 mm, softly puberulous; stamens 10 - 21, 2 - 3 mm long; anthers oblong, 1 - 1.3 mm long; disc flat, often slightly crenate. Female flowers: pedicels 4 - 6 mm long; sepals 4, obovate, 3 - 4 x 2.5 - 3.5 mm; disc annular, fleshy; ovary oblong or ovoid, 2 - 2.5 x 1.5 - 2 mm, glabrous, 1-locular; style minute, often subterminal; stigma flabellate, ca 1 mm across. Fruits obovoid, oblong-ellipsoid to ovoid, flattened, (13 -) 15 - 17 x (8 -) 9 - 10 mm, usually longitudinally sulcate on ventral surface, glabrous, red when ripe, black-brown when dry, 1-locular; endocarp characteristically sculptured with strong spiniform outgrowths; pedicels 4 - 9 mm long.

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

*Distrib.* India: Inland forests, at sea level, common. Nicobar Islands.

Sri Lanka, Myanmar, Cambodia, Thailand and Sumatra.

*Use.* The tree yields timber of good quality.

**19. *Drypetes venusta*** (Wight) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 268. 1922; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 277. 1997. *Astylis venusta* Wight, Icon. Pl. Ind. Orient. 6: 13, t. 1992. 1853. *Hemicyclia venusta* (Wight) Thwaites in Hooker's J. Bot. Kew Gard. Misc. 7: 272. 1855; Hook.f., Fl. Brit. India 5: 339. 1887; T. Cooke, Fl. Bombay 2(3): 591. 1906; Gamble, Fl. Madras 2(7): 1300. 1925 (repr. ed. 2: 909. 1957). *H. elata* Bedd., Fl. Sylv. S. India 2: t. 279. 1872 & Forester's Man. 198. 1873; Hook.f., l. c. 339. 1887; Gamble, l. c. 1300. 1925. *Drypetes elata* (Bedd.) Pax & K.Hoffm., l. c. 268. 1922.

Mal.: *Konamaram, Palakani, Velleipuli*; Tam.: *Palla-kanni, Vellelambu*.

Trees, 10 - 30 m tall; branchlets drooping, glabrous. Leaves elliptic, oblong-elliptic to obovate, unequal or acute at base, entire along margins, acuminate or sometimes acute to subacute at apex, 4 - 15 x 1.5 - 5.5 cm, thinly coriaceous, glabrous; lateral nerves 7 - 16 pairs; areoles squarish or rectangular; petioles 3 - 10 mm long, glabrous. Inflorescences axillary. Male flowers: pedicels 3 - 20 mm long; sepals 4, elliptic-oblong, obovate to suborbicular, 2 - 4 x 1.5 - 3 mm; stamens (5 -) 6 - 10 (- 12), 1.5 - 2.5 mm long; anthers oblong, ca 1 mm long; disc lobulate, puberulous. Female flowers: pedicels 8 - 15 mm long; sepals 4, ovate or obovate, 3 - 4 x 1.8 - 3.5 mm; ovary oblong, ovoid or obovoid, 2 - 3 x ca 1.8 mm, glabrous, 1 (- 2)-locular; stigma 1, terminal, flabellate, orbicular or reniform, 1 - 1.5 mm across. Fruits drooping on 2 - 4 (- 6) cm long slender elongated pedicels, obovoid, 20 - 25 x 12 - 18 mm, smooth, 1-locular, glabrous, rarely appendiculate; seed solitary.

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

*Distrib.* India: Evergreen forests between 550 - 1500 m altitudes; common. Maharashtra, Karnataka, Kerala and Tamil Nadu.

Endemic.

*Notes.* Pollen 3-colporate, sexine reticulate. P = 40  $\mu$ m (35 to 45), E = 31  $\mu$ m (29 to 45). (*D. elata*, See Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. Publ. du depart. D'ecologie, Inst. Francias de Pondichery, Pondicherry).

**20. *Drypetes wightii*** (Hook.f.) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 273. 1922; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 277, f. 8. 1997. *Hemicyclia wightii* Hook.f., Fl. Brit. India 5: 339. 1887; Gamble, Fl. Madras 2(7): 1300. 1925 (repr. ed. 2: 909. 1957).

Mal.: *Vella-kasavu*; Tam.: *Vellelambu*.

Small trees; branchlets glabrous. Leaves elliptic to oblong-elliptic, oblique and acute at base, entire, acuminate at apex, 4 - 9 x 1.5 - 3.5 cm, thinly coriaceous, glabrous; lateral nerves 6 - 9 pairs; minor nerves running more or less parallel to each another and forming squarish or rectangular areoles, sometimes branching into veins of higher order; petioles 3 - 5 mm long. Inflorescences axillary, also in the axils of fallen leaves. Male flowers: pedicels 3 - 5 mm long; sepals 4 or 5, broadly elliptic to suborbicular, ca 3 x 2 - 2.5 mm, tomentellous outside; stamens 6 - 10, 1 - 1.5 mm long; anthers oblong, ca 0.5 mm long; disc entire. Female flowers: pedicels 4 - 5 mm long; sepals 4 or 5, suborbicular, 3 - 4 x 2.5 - 3.5 mm, tomentellous outside; disc annular; ovary ellipsoid, ca 2 x 1 mm, 1-locular, sparsely puberulous to glabrous; stigmas 2, reniform, ca 1 mm across. Fruits ovoid to ellipsoid, 17 - 20 x ca 15 mm, smooth, glabrous; pedicels 10 - 20 mm long.

*Fl. & Fr.* Dec. - April.

*Distrib.* India: Evergreen forests, between 900 - 1550 m altitudes, rare. Kerala and Tamil Nadu (noted to be very common at or near Kodaikanal).

Endemic.

#### CULTIVATED SPECIES

***Drypetes ugandensis*** (Rendle) Hutch. in D.Oliver, Fl. Trop. Africa 6(1): 687. 1047. 1912; Chakrab. et al. in J. Econ. Taxon. Bot. 21: 278. 1997. *Cyclostemon ugandensis* Rendle in J. Linn. Soc. Bot. 37: 211. 1905.

*Distrib.* India: Cultivated in the Indian Botanic Garden, Howrah.

Uganda.

#### 59. *Putranjiva* Wall.

Trees, monoecious or dioecious. Leaves alternate, simple, entire or serrulate, penninerved, short-petioled; nervules finely reticulate. Inflorescences axillary, fasciculate, the males dense-flowered. Male flowers: sepals 3 - 5, imbricate; petals absent; disc absent; stamens 2 - 4, filaments free or subconnate, anthers 2-loculed, thecae parallel; pistillode absent. Female flowers: subsolitary; sepals as in male; petals absent; disc absent; ovary 2 or 3-locular, locules biovulate;

ovules anatropous; styles 3 - 7 mm long or inconspicuous, dilated into broad fleshy stigmas. Fruits drupaceous, 1-locular, 1-seeded; seeds ovoid with crustaceous testa; endosperm fleshy; cotyledons broad, flat.

Indo-Malesia, ca 3 species; 1 species in India.

**Putranjiva roxburghii** Wall., Tent. Fl. Nepal. 61. 1826; Hook.f., Fl. Brit. India 5: 336. 1887; Prain, Bengal Pl. 2: 936. 1903; T.Cooke, Fl. Bombay 2(3): 590. 1906; Gamble, Fl. Madras 2(7): 1311. 1925 (repr. ed. 2: 917. 1957). *Nagea putranjiva* Roxb., Fl. Ind., ed. Carey 3: 766. 1832, nom. illeg. *Drypetes roxburghii* (Wall.) Hurus. in J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 6: 337. 1954.

Beng.: *Ghurnifal*, *Putranjiva*; Eng.: Wild olive; Hindi: *Putijia*, *Jiaputa*, *Juti*; Kan.: *Anani*; Mar.: *Pagvi*, *Kogri*, *Jewanputr*; Or.: *Poitundia*; Sans.: *Putranjiva*; Tam.: *Irukolli*, *Kampalai*, *Karippalai*, *Karupala*; Tel.: *Kadrajivi*, *Kuduru*, *Putrajivika*; Urdu: *Paishavdia*.

Trees, 4 - 20 m tall; branchlets puberulous, soon glabrous. Leaves oblong to oblong-elliptic or obliquely ovate, asymmetric, acute, obtuse to rounded at base, closely serrulate along margins, acute, obtuse to rounded at apex, 5 - 13 x 1.5 - 4.5 cm, chartaceous to thinly coriaceous, glabrous or thinly pubescent on midrib; lateral nerves very slender, 10 - 18 pairs; petioles 4 - 10 mm long. Inflorescences on main leafy branches and on special small-leaved lateral branches. Male flowers: 2 - 2.5 mm across; pedicels 1.5 - 2 mm long; sepals 3 - 5, suborbicular, ca 1 x 1 mm; stamens 2 - 4, 1.5 - 2 mm long; anthers orbicular, 0.5 - 1 mm long. Female flowers: pedicels 6 - 15 mm long; sepals 5 or 6, ovate to elliptic, 2 - 2.5 x 1.2 - 1.5 mm; ovary ovoid, ca 2 x 1.5 mm, yellow-felted, 2 or 3-locular; styles 2 or 3, 3 - 7 mm long, often connate below; stigmas flabellate. Fruits ovoid-ellipsoid or rhomboid-ellipsoid, 13 - 20 x 9 - 13 mm, acute to attenuate at base, brown-felted, 1-locular, 1-seeded; pedicels 6 - 25 mm long.

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

*Distrib.* India: Evergreen and deciduous forests, up to 1000 m altitude, common. Almost throughout India, excluding Andaman & Nicobar Islands.

Sri Lanka, Bangladesh, Myanmar, Thailand, Indo-China, Java, Moluccas, Lesser Sunda Is. and New Guinea.

*Uses.* Often cultivated. A decoction of the leaves and fruits given orally for cold, fever and rheumatism. Fruits made into necklaces and worn on children against all evils. For burning lamps, oil from seeds is used.

*Notes.* Several chromosome numbers have been reported for this species:  $n = 7$  (Sanjappa, Taxon 28: 274. 1979);  $2n = 38$  (Sharma & Jash, Proc. 45th Indian Sci. Congress. Part 3: 302 - 303. 1958);  $2n = 40$  (Raghavan, Proc. Indian Acad. Sci. Sect. B, 49: 239 - 244. 1959); and  $2n = 42$  (Gill, Chawla & Kanwal, Cytologia 38: 393 - 401. 1973).

### Tribe 5. HYMENOCARDIEAE (Müll.Arg.) Hutch. (N. P. Balakrishnan & T. Chakrabarty)

Old World tropics; Africa, India and SE. Asia, absent from Madagascar; monogeneric.

*Notes.* The monospecific South American genus *Didymocistus* Kuhlmann, included in this tribe by some authors, is not only morphologically distinct but also phytogeographically isolated from *Hymenocardia*, probably deserving a distinct tribe (Webster, Ann. Missouri Bot. Gard. 81: 33 - 144. 1994).

### 60. *Hymenocardia* Wall. ex Lindl.

Dioecious shrubs or trees with simple hairs and sessile glands. Leaves alternate, petiolate, stipulate, entire, penninerved or weakly trinerved at base. Male inflorescences axillary, catkin-like. Flowers: sessile; calyx cupular, irregularly 4 - 6-lobed or -partite; petals absent; disc absent; stamens 4 - 5; filaments included, free or shortly united below; anthers large, at first reflexed, later horizontal; thecae parallel, longitudinally dehiscent; connectives broad; pollen grains porate; pistillode columnar, often bifid at apex. Female inflorescences axillary, racemiform, 2 - 5-flowered; bracts persistent, becoming foliaceous in fruit. Flowers: shortly pedicellate; sepals 5, caducous; petals absent, disc absent; ovary 2-locular, flattened at right angles to the septum; locules biovulate; ovules anatropous; styles 2, elongated, subterete, free, entire or lacerate, papillose all over. Fruits capsular, flat, consisting of 2 compressed very broad wing-like cocci, separating from central axis; pericarp crustaceous; endocarp membranous; seeds usually solitary in each coccus, flat; testa thin; endosperm scanty; cotyledons very thin, broad and flat; rachis long.

Old World tropics, Africa, India to SE. Asia, particularly Malay Peninsula and Sumatra, ca 6 species; one in India.

***Hymenocardia punctata*** Wall. [Cat. No. 3549. 1831, nom. nud.] ex Lindl., *Intr. Nat. Syst. Bot.* ed. 2, 441. 1836; Hook.f., *Fl. Brit. India* 5: 377. 1887. *H. wallichii* Tul. in *Ann. Sci. Nat. Bot.*, Ser. 3, 15: 256. 1851; Pax & K. Hoffm. in *Engl., Pflanzenr.* IV.147.xv (heft 81): 78. 1922.

Shrubs or trees, up to 8 m high; branchlets ferruginous tomentellous. Leaves broadly oblong, oblong-elliptic, broadly elliptic to suborbicular, rounded, obtuse or acute at base, apiculate at apex, 3 - 10 x 1.5 - 5 cm, thinly coriaceous, glabrous above, densely punctate (all over) and sparsely hirtellous on major nerves beneath, often weakly trinerved at base; lateral nerves 4 - 7 pairs; nervules very prominent above. Male catkins up to 2.5 cm long; bracts broadly triangular, ca 0.5 mm long, shortly pedicellate. Flowers: ca 1.5 mm across; pedicels ca 0.3 mm long; calyx ca 1.5 mm long; lobes broadly triangular, ca 0.5 mm long; anthers ca 1 mm long. Female inflorescences up to 3 cm long, 2 - 5-flowered; rachis tomentellous. Flowers: pedicels ca 1 x 0.4 mm, puberulous; sepals ovate-lanceolate, ca 2 x 1 mm, pilose and punctate outside; ovary flattened at right angles to septum; styles ca 4 mm long. Fruits oblate or obcordate in outline, 7 - 10 x 15 - 20 mm, flat; wings reticulately veined; pedicels 2 - 2.5 mm long, densely hirtellous.

*Fl. & Fr.* Jan. - April.

*Distrib.* India: Arunachal Pradesh (Mishmi Hills).

Myanmar, Thailand, Laos, Cambodia, Malaysia and Indonesia (Sumatra).

*Note:* The present record is based on two herbarium sheets in CAL, bearing accession nos. 409859 and 409866, collected by Griffith from Mishmi hills in Arunachal Pradesh (annotated in pencil). However, according to J. D. Hooker (l. c.) the Mishmi ticket may be an error for Burma. A collection, *Gallatly* s. n. (CAL) from Tenasserim bears an annotation in pencil: "Common in Assam".



Tribe 6. **PHYLLANTHEAE** Dumort.

(T. Chakrabarty, M. Gangopadhyay &amp; N. P. Balakrishnan)

Trees, shrubs or herbs, monoecious or dioecious. Leaves alternate, entire, penninerved; stipules persistent or deciduous. Inflorescences axillary, racemes, fascicles or glomerules; bracts minute or indistinct. Male flowers: sepals 4 - 6, free or connate, imbricate; petals present or absent; disc extrastaminal, dissected or entire, rarely absent; stamens (2 -) 3 - 5 (- 10); filaments free or connate; anthers extrorse; pollen grains prolate to oblate, mostly 3-colporate, sometimes stephanocolporate or porate; pistillode present or absent. Female flowers: sepals mostly 5, imbricate, persistent or deciduous, often enlarged in fruit; disc cupular or lobed, sometimes dissected or absent; ovary mostly 3 - 5-locular; ovules anatropous or hemitropous; styles 3, free or variously connate, each entire, bifid or multifid. Fruits usually capsular, 3 - 5-locular, sometimes baccate or drupaceous; seeds 1 or 2 per locule; endosperm present; cotyledon broader than and at least equal in length with the radicle.

Tropical to warm temperate regions of America, Europe, Africa, Asia and Australia, 20 genera; 9 genera in India.

## KEY TO THE GENERA

- 1 a. Petals present in both male and female flowers 2
- b. Petals absent in both male and female flowers 3
- 2 a. Plants erect or at least ascending with few stems; ovules anatropous **65. Leptopus**
- b. Plants creeping with many stems; ovules hemitropous **61. Andrachne**
- 3 a. Disc in male flowers annular; ovules anatropous; pistillode absent **67. Meinekia**
- b. Disc in male flowers annular or dissected; ovules hemitropous; pistillode present or absent 4
- 4a. Pistillode present in male flowers (sometimes minute) **63. Flueggea**
- b. Pistillode absent in male flowers 5
- 5 a. Shrubs or trees, dioecious; disc annular in both male and female flowers; seed coat with bony endotesta and fleshy endotesta (not ventrally invaginated) and fleshy exotesta; fruits dry, irregularly dehiscent **66. Margaritaria**
- b. Herbs, shrubs or trees, monoecious or dioecious; disc usually dissected or absent in male flowers; seed coat lacking bony endotesta and fleshy exotesta (or else when capsular usually regularly septical) 6
- 6 a. Disc usually present in male and female flowers; seeds dry, not ventrally invaginated **68. Phyllanthus**
- b. Disc absent or, if present, then completely adnate to calyx in male and female flowers; seeds with thickened dry or fleshy exotesta, usually ventrally invaginated 7
- 7 a. Anthers apiculate; ovary 3 - 8-locular; styles usually entire; seed coat usually fleshy **64. Glochidion**
- b. Anthers not apiculate; ovary 3-locular; styles bifid or emarginate; seed coat dry or fleshy 8
- 8 a. Calyx in male flowers turbinate; seed coat fleshy **62. Breynia**
- b. Calyx in male flowers variable, not turbinate; seed coat dry **69. Sauropus**

**61. Andrachne L.**

Monoecious herbs or shrubs; indumentum of simple hairs or absent. Leaves alternate, small, petiolate, stipulate, entire, penninerved; lateral nerves arcuate, brochidromous. Inflorescences axillary, solitary or fasciculate. Male flowers: pedicellate; sepals 5, free or shortly connate at base; petals 5, shorter than sepals; disc glands 5, free, bilobed or dissected; stamens

5; filaments free or connate below into a column; anthers 4-locular, longitudinally dehiscent; thecae parallel; pollen grains 3-colporate; sexine reticulate or striate; pistillode trifid or obsolete. Female flowers: pedicellate; sepals 5, free or shortly connate at base, imbricate, sometimes accrescent in fruit; petals minute; disc glands free or connate; ovary 3-locular, glabrous or hispid; ovules 2 in each locule, hemitropous; styles 3, free, bifid. Fruits capsular, 3-lobed; seeds 2 per locule, triquetrous, smooth or striate, ecarunculate; endosperm fleshy; embryo curved; cotyledons flat, broad.

Africa, Southern Europe, through Asia Minor to Central Asia; ca 15 species; 1 species in India.

*Notes.* Webster (Taxon 24: 593 – 601. 1975) treated the genera *Andrachne* and *Leptopus* together but later changed his mind and separated them in 1994 (Ann. Missouri Bot. Gard. 81: 33 – 144). However, Govaerts et al. (World Checklist and Bibliography of Euphorbiaceae 1: 161. 2000 & 3: 1063. 2000) considered them to represent a single genus, *Andrachne*. Subsequently Radcliffe-Smith (Genera Euphorbiacearum, 2001) treated them as distinct genera.

Dr. Maria Vorontsova of Kew Gardens, who is at present carrying out the molecular phylogenetic work on the tribe Phyllanthae, clarified that although *Andrachne* and *Leptopus* have confusingly similar floral structure, they deserve distinct generic status. While *Andrachne* has markedly xerophytic niche with creeping habit and many stems and hemitropous ovules, *Leptopus* grows upright with fewer stems and anatropous ovules. Moreover, they exhibit no overlapping geographical distribution. *Andrachne* occurs in Africa, southern Europe and Asia Minor to Central Asia. *Leptopus* is native to Central Asia through India and China to the Philippines and Indonesia. India is on the boundary where these genera meet.

***Andrachne telephioides* L.**, Sp. Pl. 1014. 1753; Hook.f., Fl. Brit. India 5: 284. 1887; Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 174. 1922.

Much-branched procumbent to ascending herbs, up to 40 cm long, glaucous, entirely glabrous; branches densely arising from a woody rootstock, terete below, flattened above, up to 1.2 mm thick. Leaves cuneate-obovate, orbicular, spathulate-obovate, elliptic-ovate, orbicular-obovate or rhombate-obovate, cuneate or attenuate at base, entire along margins, rounded, obtuse, apiculate or mucronate at apex, 3 - 15 x 1 - 3 mm, firmly chartaceous; midrib faint, lateral nerves ca 3 pairs, inconspicuous; petioles 1 - 4 mm long; stipules suborbicular to triangular, subpeltate, fimbriate at base, ca 1 mm long, white to pinkish tinged. Inflorescences axillary, solitary or the males often 2 or 3 together; bracts linear-lanceolate, hyaline, up to 1 mm long. Male flowers: pedicels 0.5 - 1 mm long; sepals obovate or rhombate, ca 1.5 x 0.5 mm; petals spathulate-oblongate, ca 1 mm long; disc glands minute, hyaline, bilobed; stamens ca 1 mm long; filaments connate below into a column, free above; anthers orbicular, 4-lobed, ca 0.2 mm across; pistillode minute, trifid. Female flowers: pedicels ca 2 mm long; sepals obovate to suborbicular, ca 1.2 x 0.8 mm; petals obovate, ca 0.3 mm long; disc glands ca 0.2 mm across; ovary subglobose, ca 1 mm in diam., glabrous; styles up to 0.5 mm long, free, slender, bifid to base. Fruits slightly depressed globose, obtusely 3-lobed, 2 - 2.5 mm in diam., smooth, glabrous, finely reticulate-veined; pedicels 1.5 - 2 mm long; seeds 1.5 – 2 mm, smooth, dull yellowish brown.

*Fl. & Fr.* Dec. – March (-Sept.).

*Distrib.* India: Weed in cultivated lands, riverbanks, ditches, on rocks in river beds, road sides. Jammu & Kashmir, Punjab, Haryana, Uttar Pradesh, Uttarakhand, Rajasthan, Maharashtra and Madhya Pradesh.

Pakistan, Afghanistan and Westwards along Mediterranean areas to Spain.

*Note.* Chromosome number:  $2n = 24$  (Reese in Flora 144: 598 - 634. 1957).

## 62. *Breynia* J.R.Forst. & G.Forst., nom. cons.

Shrubs or trees, occasionally scandent or climbing, monoecious, evergreen, glabrous or rarely pubescent. Leaves alternate or distichous, entire and sometimes reflexed or revolute along margins, penninerved; petioles short; stipules short. Male inflorescences usually in the lower leaf-axils, fascicled, few-flowered. Flowers: pedicellate; calyx obconical, turbinate or sometimes cupular, 6-fid at apex with inflexed and imbricate lobes; petals and disc absent; stamens 3; filaments united in a column; anthers adnate to the column, linear, 2-loculed, longitudinally dehiscent. Female inflorescences usually in the upper leaf-axils, solitary or in pairs. Flowers: pedicellate, calyx obconical, cupular or patelliform, shallowly or deeply 6-lobed, often accrescent in fruit; petals and disc absent; ovary 3-locular; locules biovulate; styles 3, conspicuous and bifid or minute and simple. Fruits capsular, somewhat fleshy, 3-locular, unlobed, red when ripe, tardily dehiscent; seeds trigonous, with rounded backs; seed coat fleshy; endosperm copious; cotyledons broader than and 1 - 2 times larger than radicle.

Sri Lanka and India to China, SE. Asia, Malesia, Australia and New Caledonia, ca 25 species; 3 species in India.

*Literature.* CHAKRABARTY, T & M. GANGOPADHYAY (1996). The genus *Breynia* (Euphorbiaceae) in the Indian subcontinent. J. Econ. Taxon. Bot. 20: 501 - 512.

*Notes.* The haploid chromosome numbers in *B. retusa* and *B. vitis-idaea* are reported to be  $n = 26$  (Dutta, Taxon 16: 341 - 350. 1967; Mehra & Hans, Taxon. 18: 310 - 315. 1969 and Gill & Bedi, Taxon 28: 402. 1979).

The pollen grains are oblate spheroidal to oblate, intectate, reticulate; lumina 1 - 2  $\mu$ m. Aperture characterised by the large number of colpi and the double circular colpi transversalis (Punt, Wentia 7: 1 - 116. 1962).

### KEY TO THE SPECIES

- 1 a. Styles prominent, 1 - 2 mm long, bifid; fruiting calyx greatly enlarged, 6 - 12 mm in diam. **2. *B. retusa***
- b. Styles almost obsolete, up to 0.5 mm long, simple, subulate, triangular or deltoid; fruiting calyx not much enlarged, 2 - 5 mm in diam. 2
- 2 a. Plants usually scandent or climbing; leaves coriaceous, glaucous beneath, conspicuously reflexed or revolute along margins; fruits 6 - 10 mm in diam. **1. *B. racemosa***
- b. Plants arborescent; leaves membranous or often chartaceous, not or scarcely glaucous beneath, flat along margins; fruits 4 - 6 mm in diam. **3. *B. vitis-idaea***

**1. *Breynia racemosa*** (Blume) Müll.Arg. in DC., Prodr. 15(2): 441. 1866; Chakrab. & M. Gangop. in J. Econ. Taxon. Bot. 20: 505, f. 2. 1996. *Melanthesa racemosa* Blume, Bijdr. Fl. Ned. Ind. 592. 1826. *Phyllanthus reclinatus* Roxb. [Hort. Bengal. 69. 1814, nom. nud.] Fl. Ind., ed. Carey, 3: 669. 1832. *Breynia reclinata* (Roxb.) Hook.f., Fl. Brit. India 5: 331. 1887.

Shrubs, 1 - 6 m high, usually scandent, often climbing, entirely glabrous. Leaves ovate to elliptic, sometimes suborbicular or ovate-lanceolate, rounded, obtuse to acute at base, reflexed along margins, acute or sometimes obtuse and mucronate at apex, 2 - 7.5 x 1 - 4 cm, thinly to stiffly coriaceous, glaucous beneath; lateral nerves 3 - 6 pairs; petioles 2 - 5 mm long. Male flowers: pedicels (3 -) 6 - 10 mm long; calyx 2 - 3 x 2.5 - 3 mm; anthers 1.5 - 3 mm long. Female flowers: pedicels 1 - 4 mm long; calyx 2.5 - 5 mm in diam.; lobes suborbicular; ovary subglobose, 1 - 2 mm in diam.; styles almost obsolete, triangular or deltoid. Fruits globose, 6 - 10 mm in diam; pedicels 3 - 5 mm long; calyx up to 5 mm in diam.

*Fl. & Fr.* April - Dec.

*Distrib.* India: Edges of evergreen forests, mixed forests, open places in inland forests, rocky hill slopes, up to 175 m altitude. Nicobar Islands.

Myanmar, Thailand, Malaya, Sumatra, Java, Borneo and Celebes.

**2. *Breynia retusa*** (Dennst.) Alston in Ann. Roy. Bot. Gard. (Peradeniya) 11: 204. 1929 & in Trimen, Handb. Fl. Ceylon 6(Suppl.): 261. 1931. *Phyllanthus retusus* Dennst., Schluss. Hort. Malab. 1. Register: 15; 2. Register: 24; 3. Register: 31. 1818. *P. patens* Roxb., Fl. Ind., ed. Carey 3: 667. 1832. *P. turbinatus* K.D.König ex Roxb., l. c. 666. 1832 (non Sims., 1826). *Melanthesa obliqua* Wight, Icon. Pl. Ind. Orient. 5(2): 26, t. 1898. 1852. *M. turbinata* (K.D.König ex Roxb.) Wight, Icon. Pl. Ind. Orient. t. 1897. 1852 (as *truncata*). *Melanthesopsis patens* (Roxb.) Müll.Arg. in DC., Prodr. 15(1): 437. 1866. *Breynia patens* (Roxb.) Rolfe in J. Bot. 11: 359. 1882; Hook.f., Fl. Brit. India 5: 329. 1887. *B. angustifolia* Hook.f., l. c. 330. 1887.

Asm.: *Chitki*; Guj.: *Kamboi*; Hindi: *Kambhi, Kalamahomad*; Kan.: *Areinelli*; Kh.: *Sohmatiar-syurang*; Kon.: *Haddin*; Lep.: *Ikti*; Mal.: *Pavalapulah, Peruniruri*; Mar.: *Kagli, Dolfodi*; Or.: *Jajan*; Tam.: *Periseelai*; Tel.: *Devadai, Dawadaree*.

Shrubs (often bushy), 0.5 - 4 m high, entirely glabrous. Leaves ovate, oblong, elliptic to suborbicular, acute, obtuse to rounded at base, often slightly reflexed along margins, obtuse, rounded, emarginate or retuse at apex, 1 - 4 x 0.5 - 2.5 cm, membranous to chartaceous, often glaucescent beneath; lateral nerves 3 - 6 pairs; petioles 1 - 2 mm long; stipules triangular-acuminate, up to 2 mm long. Male flowers: pedicels 2 - 7 (- 11) mm long, calyx 1.5 - 5 x 1.5 - 3 mm; anthers 0.6 - 2 mm long. Female flowers: pedicels 1.5 - 5 mm long; calyx initially obconic, cupular or often campanulate, 1 - 4 x 3.5 - 6 mm, finally flattened and up to 8 mm in diam.; lobes flabellate, almost free, 1 - 3 x 1.5 - 4 mm, accrescent; ovary obconic, globose or turbinate, 1 - 2 mm in diam., excavate; styles 1 - 2 mm long, connate at base into a column (ca 1 mm long), bifid above. Fruits depressed, subglobose, often shallowly lobed, 4 - 5 x 8 - 10 mm; pedicels 4 - 6 (-15) mm long; persistent calyx patelliform, 9 - 12 mm across.

*Fl. & Fr.* April - Sept.

*Distrib.* India: Hill forests, sholas, subtropical forests, edges of primary forests, mixed deciduous forests, up to 1500 m altitude. Bihar, West Bengal, Sikkim, Assam, Meghalaya, Manipur, Mizoram, Orissa, Madhya Pradesh, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu.

Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, S.W. China, Indo-China, Thailand and Malaysia.

*Uses.* The sap has medicinal use in the treatment of eye diseases. The herbal drug, Leptuden, consisting of the extracts of *Leptadenia reticulata* Wight & Arn. and *B. retusa* is used as a galactagogue (Wealth of India 2: 294. 1988).

*Note.* Chromosome number:  $2n = 52$  (Mehra & Hans, Taxon 18: 310 - 315. 1969).

**3. *Breynia vitis-idaea*** (Burm.f.) C.E.C.Fisch. in Bull. Misc. Inform. Kew 1932: 65. 1932. *Rhamnus vitis-idaea* Burm.f., Fl. Indica 61. 1768, p. p., quoad lectotypus. *Phyllanthus rhamnoides* Retz., Observ. Bot. 5: 30. 1788, nom. illeg.; Willd., Sp. Pl., ed. 4, 4: 580. 1805. *P. vitis-idaea* (Burm.f.) K.D. Koenig ex Roxb., Fl. Ind., ed. Carey 3: 665. 1832. *Breynia rhamnoides* (Willd.) Müll.Arg. in DC., Prodr. 15(2): 440. 1866, nom. illeg.; Hook.f., Fl. Brit. India 5: 330. 1887; Prain, Bengal Pl. 2: 934. 1903; Haines, Bot. Bihar Orissa 2: 133. 1921; C.E.Parkinson, Forest Fl. Andaman Isl. 234. 1923; Gamble, Fl. Madras 2(7): 1304. 1925 (repr. ed. 2: 912. 1957); Kanjilal et al., Fl. Assam 4: 175. 1940. *Melanthesa rhamnoides* auct. non Blume, 1825; Miq., Fl. Ned. Ind. 1(2): 370. 1859; Wight, Icon. Pl. Ind. Orient. 5: 26, t. 1898 (1). 1852.

Beng.: *Kalisitki, Kamkatajuli, Silpati*; Hindi: *Tikhar*; Kan.: *Billisulli, Kaadu nugge*; Mal.: *Chuvanna-niruri, Kattu-niruri, Pavalapulah, Pavilapulu*; Or.: *Jajan*; Sant.: *Kadupala, Karki*; Tam.: *Kattuniruri, Manipullanti, Pomarai, Seppulaa, Sithuruvam*; Tel.: *Adavimunaga, Balli, Ettapurugudu, Yellari*.

Shrubs or trees, 2 - 8 m high; entirely glabrous. Leaves ovate, oblong, elliptic to orbicular or narrowly oblong to elliptic, acute, obtuse, rounded, cuneate or subtruncate at base, flat along margins, acute, obtuse to rounded at apex, 1 - 5 (- 7) x 0.8 - 3 (- 3.5) cm, membranous or often chartaceous; lateral nerves 4 - 7 pairs; petioles 2 - 5 mm long; stipules triangular to lanceolate, 1 - 2 mm long, stiff. Male flowers: pedicels 2 - 5 mm long; calyx cupular or obconic, 1.2 - 3 x 1.5 - 2 mm; anthers 1 - 2 mm long. Female flowers: pedicels 1 - 4 mm long; calyx cupular or obconic, patelliform in age, 1 - 1.5 x 1.2 - 2 mm, 6-fid at apex; teeth orbicular or deltoid, 0.5 - 0.8 mm; ovary depressed, sometimes raised and lobulate at the corners towards apex, 1 - 2 mm in diam.; styles subulate or triangular, ca 0.2 mm long. Fruits depressed to globose or ovoid, 2 - 6 x 4 - 6 mm, occasionally with a ring at the apex; pedicels 1.5 - 5 mm long; calyx 2 - 4 mm in diam.

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

*Distrib.* India: Deciduous forests, mixed forests, scrub forests, beach forests, sholas, up to 1500 m altitude. Uttar Pradesh, Bihar, West Bengal, Orissa, Andhra Pradesh, Goa, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka, Pakistan, Nepal, Bangladesh, Myanmar, China, Indo-China, Thailand, Malaysia, Ryu-Kyu Islands and Philippines.

*Uses.* The tribes of Sriharikota Island in Andhra Pradesh apply warmed leaves of this plant on rheumatic swellings.

*Note.* Chromosome numbers:  $2n = 52$  (Krishnappa & Reshme in Taxon 29: 533 - 547. 1980) and  $n = 26$  (Gill & Bedi, l. c. 1979).

### 63. *Flueggea* Willd.

Shrubs or trees, dioecious, rarely monoecious. Leaves mostly deciduous, alternate, short-petioled, stipulate, entire, penninerved. Inflorescences axillary, solitary or fasciculate-glomerulate; bracts minute. Male flowers: long pedicellate; sepals 4 - 7, imbricate; petals absent; disc glands 4 - 7, sometimes connate; stamens 4 - 7, free; anthers extrorse, longitudinally dehiscent; pollen grains subglobose, 3-colporate, semitectate; pistillode trifold at apex or rarely absent. Female flowers: pedicels terete or angled; sepals 4 - 7, imbricate; petals absent; disc annular, sometimes thickened, entire or variously lobed or angled; ovary (2 -) 3 (- 4)-locular; locules biovulate; ovules hemitropous; styles usually 3, free, bifid with dilated branches above. Fruits capsular and dehiscent into 3 cocci or baccate and indehiscent; columella persistent; seeds 2 per locule; testa thin, crustaceous, smooth to reticulate or verruculose, sometimes ventrally invaginated at hilum; endosperm copious; embryo straight or curved; cotyledons broader and longer than radicle.

Tropical and temperate Asia, ca 15 species; 2 species in India.

*Literature.* WEBSTER, G. L. (1984). A revision of *Flueggea* (Euphorbiaceae). *Allertonia* 3: 259 - 312.

#### KEY TO THE SPECIES

- 1 a. Branches terete or obtusely angled, tapering to spinose at tips; leaf-blade rounded or subcordate at apex; stipules 0.5 - 1 mm long; female flowers solitary or 2 or 3 per glomerule; carpels 2 or 3 **1. *F. leucopyrus***
- b. Branches especially young ones sharply angled, usually not spinose at tips; leafblade obtuse to acute at apex; stipules 1.5 - 3 mm long; female flowers 3 - 10 per glomerule; carpels always 3 **2. *F. virosa***

**1. *Flueggea leucopyrus*** Willd., *Sp. Pl.*, ed. 4, 4: 757. 1806; Hook.f., *Fl. Brit. India* 5: 328. 1887; Gamble, *Fl. Madras* 2(7): 1296. 1925 (repr. ed. 2: 907. 1957); Webster in *Allertonia* 3(4): 295. 1984. *Phyllanthus leucopyrus* K.D.Koenig ex Roxb., *Fl. Ind.*, ed. Carey 3: 658. 1832. *Securinega leucopyrus* (Willd.) Müll.Arg. in DC., *Prodr.* 15(2): 451. 1866.

Hindi: *Dalme, Harthe, Hartho*; Kan.: *Bili shooli gida*; Mal.: *Perinclavu*; Sans.: *Sweta-kambhoja*; Tam.: *Madpulantti, Pulanji*; Tel.: *Tella-pali, Tella-pulugudu, Tella-purugudu*.

Shrubs, 1.5 - 4 m high, entirely glabrous; lateral branchlets (bearing leaves) spinescent at tips. Leaves obovate (cuneate-obovate, obovate-elliptic, orbicular-obovate) to orbicular or obcordate, acute, obtuse, rounded or cuneate at base, entire, obtuse, rounded, truncate or emarginate at apex, 0.8 - 3 x 0.3 - 2 cm, chartaceous to coriaceous, glaucescent beneath; lateral nerves 4 - 5 (- 7) pairs; petioles 1 - 5 (- 8) mm long; stipules triangular, 0.5 - 1 mm long, persistent. Inflorescences arising precociously, axillary or at leafless nodes, male flowers many (20 - 40 per cymule) and glomerulate, the females 1 - 3 in fascicles at each node. Male flowers: pedicels 2 - 4 mm long; sepals 5, ovate, elliptic to suborbicular, 0.6 - 1 x 0.5 - 1 cm; disc glands 5, angular, ca 0.3 mm in diam.; stamens 5, 1 - 2 mm long; anthers suborbicular, ca 0.4 mm long; pistillode ca 1 mm long, trifold at apex. Female flowers: pedicels 1.5 - 2.5 x ca 0.4 mm; sepals 5, ovate-triangular or elliptic, 0.8 - 1.5 x 0.6 - 1 mm, persistent in fruit; disc flat, ca 0.8 mm in diam.; ovary ovoid, ca

1.2 x 0.8 mm, 3-locular; styles 3, ca 0.8 mm long. Fruits subglobose, capsular or baccate, 2 - 3 (-5) x 4 - 4.5 (-8) mm, white or brown when dry, unlobed, with prominent reticulate venation; seeds plano-convex, 2 - 2.5 mm across, smooth, brown.

*Fl. & Fr.* March - Dec.

*Distrib.* India: Thickets, scrub forests, edges of deciduous or semideciduous forests, up to 1000 m altitude. Rajasthan, Madhya Pradesh, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka, Pakistan, Myanmar and China.

*Uses.* Leaves made into a paste and applied over sores.

*Note.* Chromosome number:  $n = 28$  (Gill & Bedi, Taxon 28: 402. 1979).

**2. *Flueggea virosa*** (Roxb. ex Willd.) Voigt, Hort. Suburb. Calcutt. 152. 1845; Gamble, Fl. Madras 2(7): 1296. 1925 (repr. ed. 2: 907. 1957); G.L. Webster in Allertonia 3: 287. 1984. *Phyllanthus virosus* Roxb. ex Willd., Sp. Pl. ed. 4, 4: 578. 1805. *Flueggea microcarpa* Blume, Bijdr. Fl. Ned. Ind. 12: 580. 1826; Hook. f., Fl. Brit. India 5: 328. 1887. *Securinega virosa* (Roxb. ex Willd.) Baill. in Adansonia 6: 334. 1866. *S. microcarpa* (Blume) Pax & K.Hoffm. ex Aubrev., Fl. Forest. Sudano-Guin. 190. 1950.

Hindi: *Dalme, Patala*; Kan.: *Bili-horli, Gada hallae*; Mar.: *Pandhar-palli, Perinclavu*; Nep.: *Darim Pate, Phalame*; Tam.: *Irubulai, Karumpoola-chedi, Varadbula*.

Shrubs (often a straggler) or trees, 1 - 8 m tall, entirely glabrous. Leaves elliptic, oblong-elliptic to obovate or orbicular, acute, obtuse, rounded or cuneate at base, entire or occasionally undulate along margins, rounded, emarginate, obtuse to acute or apiculate at apex, 1.5 - 7 x 1 - 4 cm, chartaceous to membranous; lateral nerves 5 - 9 pairs; petioles 2 - 10 mm long. Inflorescences axillary, the male glomerules 20 - 40-flowered, the females up to 10-flowered. Male flowers: pedicels 1.5 - 5 mm long, filiform; sepals 5, ovate-elliptic, obovate or oblong, 0.8 - 1.5 x 0.5 - 1 mm; disc glands 5, ca 0.3 mm in diam.; stamens 5; filaments 1 - 2 mm long; anthers ellipsoid to suborbicular, 0.3 - 0.5 mm long; pistillode 1 - 1.5 mm long. Female flowers: pedicels 2 - 3 mm long; sepals 5, ovate-triangular or elliptic, 0.5 - 1 x 0.4 - 0.8 mm; disc annular, entire, ca 1 mm across; ovary subglobose or depressed, ca 0.5 mm in diam.; styles 0.7 - 1.5 mm long. Fruits subglobose, baccate or capsular, 2 - 2.5 x 3 - 6 mm, whitish, brown when dry, 3-locular, thin-walled; pedicels 3 - 5 mm long; seeds plano-convex, faintly reticulate, 2 - 2.5 mm across, brown.

*Fl. & Fr.* Feb. - Sept.

*Distrib.* India: Deciduous, semideciduous, evergreen or monsoon forests, scrubs, Khair-Sissoo forests, coastal forests, up to 2000 m altitude. Throughout India, including Andaman & Nicobar Islands.

Widespread in tropical Asia, Africa, Australia and Polynesia.

*Note.* Chromosome numbers:  $n = 8$  (Sanjappa & Sathyanaada, Taxon 28: 394. 1979),  $2n = 26$  (Gajapathy, Sci. & Cult. 28: 375 - 376. 1962) and  $2n = 48$  (Hsu, Taiwania 14: 11 -27. 1968).

### 64. *Glochidion* J.R.Forst. & G.Forst., nom. cons.

Shrubs or trees, monoecious, evergreen, glabrous or pubescent with simple, multicellular hairs; branchlets usually anfractuous when young. Leaves simple, alternate or distichous, symmetrical or asymmetrical, entire, penninerved, short petiolate; stipules subpersistent. Inflorescences axillary or occasionally slightly to markedly supra-axillary and/or pedunculate, fasciculate, unisexual or bisexual, few to many-flowered, often leafless when in fruiting simulating racemose inflorescences. Male flowers: pedicellate; sepals 3 + (2 -) 3, free, imbricate; petals and disc absent; stamens 3 - 8, usually sessile with filaments connate into an oblong mass; anther-thecae linear and longitudinally dehiscent; connectives produced into an erect appendage; pistillode absent. Female flowers: sessile or shortly pedicellate; calyx with 3 + (2 or) 3 free sepals or occasionally connate into a cupular, campanulate or obconic structure with 3 - 6 irregular lobes, imbricate; petals and disc absent; staminodes absent; ovary 3 - 15-locular, each locule biovulate; styles as many as the locules, usually connate into a columnar or clavate or sometimes conical, globose, turbinate or obconic structure, toothed or lobed at the apex or occasionally free and filiform, triangular, oblong, deltoid or globose and erect to connivent. Fruits capsular, seated on the non-acrescent calyx and crowned by the style column, usually depressed or sometimes subglobose, 3 - 15-locular, unlobed or shallowly to deeply lobed with the lobes rounded to bilobulate, crustaceous or coriaceous; seeds 3 - 15, usually triquetrous or hemispherical, laterally compressed, with a red arillate coat; albumen fleshy; cotyledons flat.

Tropical Asia to Northern Australia and Polynesia, a few species in Madagascar and tropical America, ca 320 species; 22 species in India.

*Literature.* CHAKRABARTY, T. & M. GANGOPADHYAY (1995). The genus *Glochidion* (Euphorbiaceae) in the Indian subcontinent. *J. Econ. Taxon. Bot.* 19(1): 173 - 234.

*Notes.* The chromosome numbers of the 6 species investigated so far have the haploid number of  $n = 26$ . The genus is thus based on  $x = 13$ .

The pollen grains are stephanocolporate with 4 apertures, spheroidal to prolate spheroidal in shape;  $P \times E = 25 \times 25 \mu\text{m}$ ;  $P/E = 1.06 \mu\text{m}$ ; colpus narrow, slit-like, endoaperture circular or llongate. Exine reticulate (Punt, Wentia 7: 1 - 116. 1962).

#### KEY TO THE SPECIES

- |   |   |                                   |
|---|---|-----------------------------------|
| 1 | a. Branchlets and/or under surface of leaves pubescent  | 2                                 |
|   | b. Branchlets and/or under surface of leaves glabrous   | 13                                |
| 2 | a. Inflorescences supra axillary and/or pedunculate   | <b>21. <i>G. zeylanicum</i></b>   |
|   | b. Inflorescences axillary and sessile  | 3                                 |
| 3 | a. Fruits unlobed or obscurely lobed  | 4                                 |
|   | b. Fruits shallowly to deeply lobed   | 5                                 |
| 4 | a. Male pedicels 10 - 20 mm long; fruits indehiscent, 10 - 18 mm in diam. with 8 - 10 longitudinal grooves                  | <b>17. <i>G. oblatum</i></b>      |
|   | b. Male pedicels up to 10 mm long; fruits dehiscent, mostly up to 10 mm in diam.  | <b>22. <i>G. zeylanicum</i></b>   |
| 5 | a. Female calyx cupular, campanulate or obconic, with 4 - 6 irregular lobes   | 6                                 |
|   | b. Female calyx not as above, comprising of (5 -) 6 more or less free sepals  | 7                                 |
| 6 | a. Leaves entirely glabrous; styles connate into a clavate, turbinate or obconic structure, usually with stout apical lobes | <b>5. <i>G. candolleianum</i></b> |



- b. Leaves sparsely pilose on major nerves beneath; styles connate into a subglobose mass or sometimes free and deltoid, triangular or globose **10. G. hohenackeri**
- 7 a. Ovary and fruits 8 - 12 (- 15)-locular 8  
b. Ovary and fruits 3 - 6-locular 9
- 8 a. Leaves often glaucescent beneath; tertiary nerves conspicuous on upper surface; style distinct, forming a ring, 0.2 – 0.5 mm long; fruits pedicellate **16. G. multiloculare**  
b. Leaves not glaucescent beneath; tertiary nerves inconspicuous on the upper surface; styles connate into a cone, ca 1 mm long; fruits sessile **6. G. coccineum**
- 9 a. Leaves beneath glabrous **12. G. khasicum**  
b. Leaves beneath puberulous at least on midrib 10
- 10 a. Leaves not glaucous; minor nervules conspicuously raised beneath **9. G. heyneanum**  
b. Leaves conspicuously glaucous at least on the under surface; minor nervules inconspicuous or faint but never raised beneath 11
- 11 a. Leaves rounded, obtuse, truncate or apiculate at apex; fruits 13 – 16 mm in diam.  
**2.2. G. andamanicum** var. **desmogyne**  
b. Leaves mostly caudate or acuminate or often apiculate at apex; fruits 5 – 12 mm in diam. 12
- 12 a. Leaves narrowly lanceolate, whitish beneath when dry; hairs on the lower surface appressed; male pedicels 5 - 8 mm long; fruits 6 – 8 mm in diam. **1. G. acuminatum**  
b. Leaves not narrow, ovate, obovate or broadly elliptic; hairs on the lower surface erect or ascending; male pedicels 8 - 12 mm long; fruits 8 -12 mm in diam. **18 G. nubigenum**
- 13 a. Inflorescence supra-axillary and/or pedunculate 14  
b. Inflorescences axillary and sessile 16
- 14 a. Fruits unlobed or obscurely lobed **21. G. zeylanicum**  
b. Fruits prominently lobed 15
- 15 a. Leaves glossy; styles columnar or conical, longer than broad; fruits 15 - 30 mm in diam. **14. G. lanceolarium**  
b. Leaves not glossy; styles turbinate, subglobose or cylindric, as long as broad; fruits up to 10 mm in diam. **3. G. bourdillonii**
- 16 a. Female calyx cupular, campanulate or obconic with 4 - 6 irregular lobes 17  
b. Female calyx not as above, comprising of (5 -) 6, more or less free sepals 18
- 17 a. Styles connate into clavate, turbinate or obconic structures, usually with stout apical lobes **5. G. candolleianum**  
b. Styles connate into a subglobose mass or sometimes free and deltoid, triangular or globose **17. G. hohenackeri**
- 18 a. Fruits unlobed **8. G. ellipticum**  
b. Fruits shallowly to deeply lobed 19
- 19 a. Ovary and fruits 8 - 15-locular 20  
b. Ovary and fruits 3 - 7-locular 22
- 20 a. Tertiary nerves of leaves predominantly perpendicular to the midrib; style free **16. G. multiloculare**  
b. Tertiary nerves of leaves not as above; styles connate 21
- 21 a. Plants of coastal habitats; leaves mostly obovate to orbicular, obtuse, rounded to emarginate at apex; ovary and fruits 10 – 14-locular **15. G. littorale**  
b. Plants not of coastal habitats; leaves mostly oblong, elliptic to lanceolate, apiculate to acuminate at apex; ovary and fruits 5 – 8-locular **14. G. lanceolarium**

- |   |  |
|---|--|
| 22 a. Fruits 15 - 30 mm in diam.  | <b>14. G. lanceolarium</b>                       |
| b. Fruits 4 - 18 mm in diam.  | 23   |
| 23 a. Styles free   | <b>21. G. thomsonii</b>                          |
| b. Styles connate   | 24   |
| 24 a. Styles subglobose, button-like or discoid   | <b>19. G. sphaerogynum</b>                       |
| b. Styles columnar, conical, clavate or obconic   | 25   |
| 25 a. Fruits shallowly lobed  | 26   |
| b. Fruits deeply lobed  | 27   |
| 26 a. Leaves glaucous beneath; fruits subglobose, 4 - 5 mm in diam.                         | <b>12. G. karnaticum</b>                         |
| b. Leaves not glaucous beneath; fruits depressed, 6 - 10 mm in diam.                        | <b>8. G. ellipticum</b>                          |
| 27 a. Fruiting pedicels 6 - 12 mm long  | <b>4. G. calocarpum</b>                          |
| b. Fruiting pedicels 1 - 6 mm long or fruits sessile  | 28   |
| 28 a. Fruits 14 - 18 mm in diam. (species of Andaman Islands)                               | 29   |
| b. Fruits 6 - 15 mm in diam. (species outside Andaman Islands)                              | 31   |
| 29 a. Styles clavate  | <b>11. G. jarawae</b>                            |
| b. Styles columnar to subconical  | 30   |
| 30 a. Anthers 3; sepals puberulous; styles 1 - 1.5 mm long; fruits sessile                  | <b>2. G. andamanicum</b> var. <b>andamanicum</b> |
| b. Anthers 5 or 6; sepals glabrous; styles 2 - 3 mm long; fruiting pedicels 0.5 - 3 mm long | <b>20. G. subsessile</b>                         |
| 31 a. Ovary and fruits glabrous   | <b>13. G. khasicum</b>                           |
| b. Ovary and fruits pubescent   | <b>7. G. daltonii</b>                            |

**1. Glochidion acuminatum** Müll.Arg. in *Linnaea* 32: 68. 1863; Hook.f., *Fl. Brit. India* 5: 323. 1887; Kanjilal et al., *Fl. Assam* 4: 186. 1940; Chakrab. & M.Gangop. in *J. Econ. Taxon. Bot.* 19: 181, f. 9. A - E. 1995.

Asm.: *Gorumora*; Kh.: *Dieng-jem, Dieng-jerti*; Lep.: *Kair-kung, Tetrikair*; Nep.: *Latikath*.

Trees, 5 - 12 m tall; branchlets appressed puberulous. Leaves narrowly elliptic to oblong or elliptic-lanceolate to oblong-lanceolate, often subfalcate, cuneate, acute or inequilateral at base and frequently decurrent into petioles at the extreme base, acuminate or caudate or sometimes apiculate at apex, 3 - 16 x 1 - 5 cm, chartaceous to thinly coriaceous, glabrous or sparsely puberulous on major nerves above, sparsely appressed puberulous on nerves beneath; lateral nerves 5 - 9 (- 12) pairs; petioles 2 - 5 mm long, puberulous. Inflorescences rarely slightly supra-axillary and shortly pedunculate, unisexual or mixed, many-flowered. Male flowers: pedicels 5 - 8 mm long; sepals oblong, elliptic or obovate, 1.5 - 3 x 1 - 2 mm; anthers 3, 1 - 1.5 mm long. Female flowers: pedicels 0.5 - 4 x ca 0.5 mm; sepals as in male, but 0.8 - 2 x 0.5 - 1.2 mm; ovary subglobose, ca 1 mm in diam., (3 -) 4 - 5 (-) 6-locular, tomentellous or sometimes glabrous; style columnar to clavate, 0.5 - 2 mm long; lobes 4 or 5, ovate, orbicular, oblong or linear, 0.3 - 1 mm long, erect or spreading. Fruits depressed-subglobose, deeply lobed with bilobulate lobes, 3 - 4 x 6 - 9 mm, (3 -) 4 - 5 (-) 6-locular, evanescently pubescent; pedicels 5 - 10 mm long, slender.

*Fl. & Fr.* April - Nov.

*Distrib.* India: Warm broad-leaved subtropical forests of the E. Himalayas, at 1000 - 2100 m altitudes, in primary forests in NE. India, up to 1800 m altitude. West Bengal, Sikkim, Assam, Arunachal Pradesh, Meghalaya, Nagaland and Mizoram.

Nepal, Bhutan, Bangladesh, China and Thailand (var. *siamense*).

*Note.* Chromosome number:  $2n = 52$  (Hans in Taxon 22: 591 - 636. 1973).

**2. *Glochidion andamanicum*** Kurz in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 42(2): 238. 1873 & Forest Fl. Burma 2: 346. 1877; Hook.f., Fl. Brit. India 5: 322. 1887. *Phyllanthus andamanicus* Kurz, Rep. Veg. Andaman Isl. ed. 1: 16. 1868, nom. illeg.

Trees, 4 - 7.5 m tall; branchlets glabrous. Leaves oblong, ovate-oblong to lanceolate or broadly elliptic or obovate-oblong, acute or unequal at base, usually decurrent into petioles at the extreme base, acute, apiculate to acuminate at apex, 4.5 - 15 x 2.5 - 7 cm (the lower ones smaller and often orbicular-elliptic), thinly coriaceous, glabrous, tomentellous to sparsely puberulous or often glaucescent beneath; lateral nerves 4 - 7 (- 10) pairs; petioles 2 - 5 (- 10) mm long, glabrous or sparsely puberulous. Inflorescences few-flowered or dense-flowered. Male flowers: pedicels slender, 3 (- 6) mm long; sepals oblong to elliptic, 1.2 - 3 x 0.5 - 1.5 mm; anthers 3 - 5, 0.8 - 1.5 mm long. Female flowers: sessile; sepals oblong to elliptic, triangular or linear, 1.3 - 3 x 0.2 - 1 mm; ovary depressed, 1 - 2 mm in diam., (4 -) 5 or 6-locular, densely puberulous; style columnar to subconical, 1 - 2 x 0.8 - 1.5 mm, puberulous; style-lobes 5 - 6, triangular, oblong, subulate or linear, 0.3 - 0.7 mm long, often bilobulate. Fruits sessile or on up to 2.5 mm long pedicels, depressed-subglobose, (4 -) 5 x 13 - 18 mm, (4 -) 5 or 6-locular, deeply lobed with the lobes bilobulate, puberulous, brown when dry.

#### KEY TO THE VARIETIES

- |  |                                     |
|--|-------------------------------------|
| 1a. Branchlets and leaves beneath glabrous; fruits sessile   | <b>2.1. var. <i>andamanicum</i></b> |
| b. Branchlets and leaves beneath (at least on midrib) puberulous; fruits with 2 - 5 mm long pedicels | <b>2.2. var. <i>desmogyne</i></b>   |

#### **2.1. var. *andamanicum***

*Fl. & Fr.* Jan. - May.

*Distrib.* India: Evergreen hill forests, at low altitudes, rare. Andaman Islands.

Endemic.

**2.2. var. *desmogyne*** (Hook.f.) Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19(1): 186, f. 4. D - H. 1995. *Glochidion desmogyne* Hook.f., Fl. Brit. India 5: 310. 1887, excl. *Gallatly* 359 (CAL). *G. airyshawii* N.P.Balacr. & Chakrab. in Bull. Bot. Surv. India 25: 220, f. 1. 1983 (1985).

*Fl. & Fr.* April - July.

*Distrib.* India: Inland evergreen forests on rocky loam, at low altitudes, scarce. Andaman Islands.

Myanmar.

**3. *Glochidion bourdillonii*** Gamble in Bull. Misc. Inform. Kew 1925: 330. 1925 & Fl. Madras 2(7): 1308. 1925 (repr. ed. 2: 915. 1957); Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 187, f. 1. A - E. 1995. *G. rigidum* sec. Bourd., Forest Trees Travancore 334, 1908, non Müll.Arg. 1863.

Trees, 4 - 10 m tall, entirely glabrous. Leaves narrowly oblong, elliptic-oblong to elliptic or ovate-lanceolate, unequal at base and decurrent into petioles at the extreme base, apiculate to acuminate at apex, 4 - 12 x 2 - 5.5 cm, thinly coriaceous to chartaceous; lateral nerves 4 - 8 pairs; petioles 3 - 6 mm long. Inflorescences axillary or slightly supra-axillary, up to 12-flowered, often shortly pedunculate. Male flowers: pedicels 6 - 10 mm long; sepals oblong-elliptic to subspathulate, 2 - 4 x 1 - 2 mm; anthers 3, ca 1 mm long. Female flowers: pedicels 1 - 5 mm long; sepals triangular, ovate to oblong, 0.7 - 1.5 x 0.3 - 1.2 mm; ovary depressed subglobose, 1 - 2 mm in diam., 4 or 5-locular; styles 4 or 5, initially free, deltoid, triangular or orbicular, 0.4 - 0.8 mm long, connivent or erect, finally connate and turbinate or subglobose or cylindric (with 0.5 - 1 mm long basal column), 1.2 - 2 x 1.2 - 3 mm; lobes looking like free styles. Fruits subglobose, somewhat depressed, 3 - 4 x (5 -) 7 - 10 mm, 4 or 5-locular, deeply lobed with the lobes mostly bilobulate; pedicels up to 5 mm long.

*Fl. & Fr.* March - Sept.

*Distrib.* India: Subtropical evergreen forests or sholas, often near streams, between 1000 - 2100 m altitudes, common. Karnataka, Kerala and Tamil Nadu.

Endemic.

**4. *Glochidion calocarpum*** Kurz in Trimen, J. Bot. 13: 330. 1875 & Forest Fl. Burma 2: 343. 1877; Hook.f., Fl. Brit. India 5: 309. 1887; Chakrab. & Vasudeva Rao in Econ. Bot. 44: 413. 1990.

Shrubs or trees, 2 - 12 m tall, entirely glabrous. Leaves asymmetric, oblong, elliptic to suborbicular or ovate to oblong-ovate or occasionally obovate, unequal at base, apiculate to acuminate or often obtuse to rounded at apex, (6.5 -) 10 - 25 x (3 -) 5 - 11.5 cm, thinly coriaceous to chartaceous, often glossy; lateral nerves 6 - 10 (- 12) pairs; petioles 3 - 8 mm long. Inflorescences many-flowered. Male flowers: pedicels 5 - 8 mm long; sepals oblong to ovate, 1.5 - 2 x 1 - 1.6 mm; anthers ca 8, 1 - 1.5 mm long. Female flowers: pedicels 3 - 5 x ca 0.6 mm; sepals ovate, triangular or oblong, 1.5 - 2.5 x 0.6 - 1.5 mm; ovary subglobose, 1 - 1.5 mm in diam., 5 or 6-locular; style conical, 1.7 - 4 mm long; lobes 5 or 6, triangular or orbicular, 0.2 - 0.5 mm long. Fruits depressed-subglobose, 5 - 7 x 13 - 16 mm, deeply 5 or 6-lobed with the lobes bilobulate or rounded; pedicels 6 - 12 mm long.

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

*Distrib.* India: From coastal forests to inland evergreen forests on rocky or clayey soil at low altitudes; very common in Nicobar Islands, but scarce in Andaman Islands. Andaman & Nicobar Islands.

Endemic.

*Uses.* The bark and seeds are anti-amoebic. For skin diseases, tribes on Nicobar Islands apply the bark and seeds after pounding into a paste.

**5. *Glochidion candolleianum*** (Wight & Arn.) Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 191, f. 10. E - I. 1995. *Lobocarpus candolleianus* Wight & Arn., Prodr. Fl. Ind. Orient. 1: 7. 1834. *Glochidion neilgherrense* Wight, Icon. Pl. Ind. Orient. 5(2): 29. 1852; Hook.f., Fl. Brit. India 5: 316. 1887; Gamble, Fl. Madras 2(7): 1307. 1925 (repr. ed. 2: 914. 1957). *G. arboreum* Wight, l. c. 29, t. 1907. 1852; Hook.f., l. c. 316. 1887; Gamble, l. c. 1307. 1925, p. p. *Phyllanthus neilgherrensis*

(Wight) Müll.Arg. in Flora 48: 385. 1865 & in DC., Prodr. 15(2): 303. 1866. *P. pycnocarpus* Müll.Arg., l. c. 386. 1865 & l. c. 304. 1866. *Glochidion pycnocarpum* (Müll.Arg.) Bedd., Forester's Man. 194. 1873; Hook.f., l. c. 315. 1887. *Phyllanthus arboreus* (Wight) Müll.Arg., l. c. 380. 1865 & 303. 1866. *P. perrottetianus* Müll.Arg. in Flora 48: 386. 1865 & in DC., Prodr. 15(2): 307. 1866. *Glochidion perrottetianum* (Müll.Arg.) Bedd., l. c., 194. 1873. *G. pauciflorum* Gamble, l. c. 1307. 1925. *G. sisparaense* Gamble, l. c. 1307. 1925.

Kan.: *Banavara*; Badaga of Nilgiris: *Hunikay*.

Trees, 3 - 12 m tall, often entirely glabrous; branchlets sometimes-scattered tawny puberulous. Leaves elliptic, oblong-elliptic, ovate-lanceolate to lanceolate or subfalcate, acute to rounded or often unequal at base, often curling upwards along margins on drying, acute, apiculate, attenuate to acuminate at apex, 5 - 14 x 2 - 6 cm, thinly or stiffly coriaceous, glabrous, sometimes glaucescent above; lateral nerves 4 - 9 pairs; petioles 2 - 7 mm long. Inflorescences few to many-flowered. Male flowers: pedicels 4 - 10 mm long; sepals oblong, elliptic to obovate, 2 - 4 x 1 - 2 mm; anthers 3, 1.5 - 2 mm long. Female flowers: sessile or pedicelled (pedicels up to 2 mm long); calyx usually campanulate, sometimes cupular, 1 - 4 x 1.5 - 4 mm, often sparsely appressed puberulous outside towards base, irregularly and shallowly to deeply 4 - 6-toothed; teeth of various shapes, 0.3 - 1.8 x 0.3 - 1.5 mm; ovary subglobose, 1 - 1.5 mm in diam., (3 -) 4 - 6-locular, tomentellous to glabrous; style clavate, turbinate or obconic, 1.5 - 3 x 1 - 3 mm; lobes (3 -) 4 - 6, ovate, oblong, triangular or suborbicular, 0.5 - 1.3 mm long, stout, connivent, erect or spreading. Fruits sessile or on up to 2 mm long pedicels, depressed-subglobose, 4.5 - 9 x 8 - 17 mm, (3 -) 4 - 6-locular, deeply lobed with the lobes rounded to bilobulate.

*Fl. & Fr.* Jan. - Oct.

*Distrib.* India: Mixed forests or sholas, at 600 - 2150 m altitudes, very common. Andhra Pradesh, Karnataka, Maharashtra, Kerala and Tamil Nadu.

Sri Lanka.

**6. *Glochidion coccineum*** (Buch.-Ham.) Müll.Arg. in Linnaea 32: 60. 1863; Hook.f., Fl. Brit. India 5: 308. 1887; Kanjilal et al., Fl. Assam 4: 182. 1940; Chakrab. & M. Gangop. in J. Econ. Taxon. Bot. 19: 192, f. 6 A - D. 1995. *Agyneia coccinea* Buch.-Ham in Symes, Embassy Ava 479. 1800 & ed. 2, 3: 317. 1809. *Phyllanthus coccineus* (Buch.-Ham.) Müll.Arg. in Flora 48: 370. 1865 & in DC., Prodr. 15(2): 280. 1866.

Burm.: *Ta-ma-sik*.

Shrubs or trees, up to 12 m tall; branchlets tomentose, glabrescent with age. Leaves oblong, elliptic-oblong to oblong-lanceolate, unequal-sided and acute to obtuse or rounded at base, rounded, subacute to acuminate at apex, 5 - 16 x 2 - 6.5 cm, coriaceous, sparsely pilose on midrib to glabrous; lateral nerves 5 - 11 pairs; petioles 2 - 5 mm long. Male flowers: pedicels 7 - 10 mm long, sparsely pilose; sepals oblong, obovate to oblanceolate, 1.5 - 4 x 1 - 2 mm; anthers 5 or 6, 1.5 - 2 mm long. Female flowers: sessile; sepals ovate to suborbicular, 1 - 1.5 mm across, tomentellous; ovary depressed, ca 1.5 mm in diam., 8 - 12-locular, villous; style conical, invaginated at apex, crenulate (the crenulations representing the apical lobes), ca 1 mm long. Fruits sessile, depressed, 8 - 12 x 16 - 25 mm, 8 - 12-locular, 16 - 24-lobed with shallow and narrow lobes, puberulous to glabrous, white when fresh, dark brown or coppery when dry.

*Fl. & Fr.* Nov. – May.

*Distr.* India: Mixed deciduous forests. Rare. ?West Bengal (J.D. Hooker s. n. in Müll.Arg., l. c. 1866) and Assam (Kanjilal et al. l. c. 1940). No specimen from India seen.

Myanmar, Thailand, China, Cambodia, Laos and Vietnam.

**7. *Glochidion daltonii*** (Müll.Arg.) Bedd., Forester's Man. 195. 1873; Kurz, Prelim. Rep. For. Veg. Pegu, App. A: p. cv, App. B: 77, in clavi. 1875 (as '*daltoni*') & Forest Fl. Burma 2: 344. 1877; Hook.f., Fl. Brit. India 5: 320. 1887; Kanjilal et al., Fl. Assam 4: 187. 1940; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 194, f. 3. A - E. 1995. *Phyllanthus daltonii* Müll.Arg. in Flora 48: 388. 1865 & in DC., Prodr. 15(2): 310. 1866 (excl. specimen of *Perrottet*). *Glochidion gamblei* Hook.f., l. c. 310. 1887; Kanjilal et al., l. c. 183. 1940.

Garó.: *Bolchiring*.

Shrubs or trees, 1 - 20 m tall, almost entirely glabrous; branchlets very occasionally pubescent. Leaves narrowly elliptic to oblong-lanceolate, sometimes subfalcate, unequal and acute at base, shortly decurrent into petioles at the extreme base, sometimes curling downwards along margins on drying, acuminate at apex, 4 - 14 x 1.5 - 4.5 cm, thinly to stiffly coriaceous, often glossy; lateral nerves slender, 5 - 9 pairs; petioles 2 - 4 mm long. Inflorescences many-flowered. Male flowers: pedicels 5 - 10 mm long; sepals oblong to oblanceolate, 2.5 - 3.5 x 1 - 2 mm; anthers 3 - 5, ca 1.5 mm long. Female flowers: sessile; sepals 3 + 2 (- 3), almost free, oblong, triangular or oblanceolate, 1 - 2.5 x 0.5 - 1.2 mm; ovary subglobose, ca 1 mm in diam., 4 - 6-locular, tomentose; style clavate or obconic, becoming more or less columnar later on, 2 - 5 x 1 - 2 mm; lobes 4 - 6, triangular or orbicular, 0.3 - 0.8 mm long, erect or spreading (thereby forming the clavae). Fruits depressed-subglobose, 4 - 6 x 10 - 15 mm, 4 - 6-locular, prominently lobed with bilobulate lobes, puberulous to glabrous.

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

*Distrib.* India: Subtropical forests, primary forests, up to 1200 m altitude. West Bengal, Sikkim, Meghalaya and Assam.

Bhutan, Myanmar, Thailand, China and Vietnam.

**8. *Glochidion ellipticum*** Wight, Icon. Pl. Ind. Orient. 5(2): t. 1906. 1852; Hook.f., Fl. Brit. India 5: 321. 1887; Gamble, Fl. Madras 2(7): 1308. 1925 (repr. ed. 2: 915. 1957), p. p., excl. syn.; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 199, f. 12 E - H. 1995. *Phyllanthus malabaricus* Müll.Arg. in Linnaea 34: 69. 1865 & in Flora 48: 386. 1865 & in DC., Prodr. 15(2): 305. 1866. *P. assamicum* Müll.Arg. in Flora 48: 378. 1865 & in DC., Prodr. 15(2): 297. 1866. *P. diversifolius* Miq. var. *wightianus* Müll.Arg. l. c. 378. 1865 & l. c. 298. 1866. *Glochidion malabaricum* (Müll.Arg.) Bedd., Forester's Man. 194. 1873; Hook.f., l. c. 319. 1887. *G. diversifolium* (Miq.) Bedd. var. *wightianum* (Müll.Arg.) Bedd., l. c. 193. 1873. *G. assamicum* (Müll.Arg.) Hook.f., l. c. 319. 1887; Prain, Bengal Pl. 2: 931. 1903; Haines, Bot. Bihar Orissa 2: 131. 1921; Kanjilal et al., Fl. Assam 4: 187. 1940. *G. ralphii* Hook.f., l. c. 314. 1887, p. p. *G. ellipticum* var. *wightianum* (Müll.Arg.) Hook.f., l. c. 321. 1887. *G. ellipticum* var. *ralphii* (Hook.f.) Gamble, l. c. 1308. 1925, p. p. *G. diversifolium* sensu Bedd., l. c. 193. 1873 (non *Phyllanthus diversifolius* Miq. 1860). *G. balakrishnani* G.J.Jothi et al. in J. Econ. Taxon. Bot. 26: 114, f. 1. 2002. *G. mandakamdevi* Borthakur & Kalita in J. Econ. Taxon. Bot. 30: 490, f. 2. 2006, syn. nov.

Asm.: *Panichhitiki*; Kh.: *Dieng-soh-kassiu*; Nep.: *Holdikath, Lati-mauwa*; Tam.: *Kokkamani-marum, Panippoduk-kaanai, Thirakkoli*.

Shrubs or trees, 2 - 15 m tall; almost entirely glabrous; branchlets sparsely puberulous when young, soon glabrous. Leaves oblong, elliptic to oblong-elliptic or lanceolate-elliptic to lanceolate-oblong or subfalcate or obovate, acute, attenuate or rounded or unequal at base, apiculate to acuminate or caudate or sometimes rounded or acute at apex, 4 - 17 x 1.5 - 9 cm, coriaceous or sometimes chartaceous, glossy; lateral nerves 5 - 10 pairs; petioles 2 - 6 mm long. Inflorescences often at the axils of fallen leaves, dense-flowered. Male flowers: pedicels filiform, 5 - 17 mm long; sepals ovate, elliptic or triangular, 1.5 - 5 x 0.3 - 2 mm; anthers 3 - 4 (- 5), 1 - 1.5 mm long. Female flowers: sessile to pedicellate (pedicels 1 - 5 mm long); sepals linear, oblong, elliptic or triangular, 1 - 3 x 0.5 - 1 mm; ovary subglobose, 0.5 - 1 mm in diam., (3 -) 4 (- 6)-locular, tomentellous to glabrous; style columnar to conical or sometimes obconic, 0.5 - 2 (- 3) x 0.3 - 2 mm; lobes (3 -) 4 (- 6), triangular, suborbicular, oblong to linear, 0.2 - 1 mm long, occasionally bilobulate, erect or spreading. Fruits depressed-subglobose, sometimes squarish, 2 - 4 x 6 - 8 (- 10) mm, (3 -) 4 (- 6)-locular, unlobed or shallowly lobed, crustaceous, puberulous to glabrous; pedicels 2 - 8 mm long.

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

*Distrib.* India: Evergreen, primary or deciduous forests, tropical forests, scrub, up to 1800 m altitude, common. Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Arunachal Pradesh, Meghalaya, Nagaland, Tripura, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala and Tamil Nadu.

Nepal, Bhutan, Bangladesh, Myanmar, Thailand, China, Taiwan and Vietnam.

*Note.* Chromosome number:  $2n = 52$  for *G. assamicum* (Mehra & Hans, Taxon 18: 310 - 315. 1969).

**9. *Glochidion heyneanum*** (Wight & Arn.) Wight [Icon. Pl. Ind. Orient. 5(2): 29, t. 1908 (lower right hand side figures). 1852, in obs.] ex Bedd., Forester's Man. 195. 1873; Hook.f., Fl. Brit. India 5: 323. 1887; Kanjilal et al., Fl. Assam 4: 186. 1940; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 205, f. 13. A - G. 1995. *Gynoon heyneanum* Wight & Arn. in Edinburgh New Philos. J. 14: 300. 1833 & in D.Dietr., Syn. Pl. 5: 388. 1852. *Glochidion velutinum* Wight, l. c. t. 1907, f. 2. 1852; Bedd., l. c. 195. 1873; Hook.f., l. c. 322. 1887. *Phyllanthus heyneanus* (Wight & Arn.) Müll.Arg. in Flora 48: 389. 1865 & in DC., Prodr. 15(2): 311. 1866, non Müll.Arg. 1863. *P. velutinus* (Wight) Müll.Arg., ll. c. c. 387. 1865 & 309. 1866. *P. asperus* Müll.Arg., ll. cc. 377. 1865 & 297. 1866; Hook.f., l. c. 327. 1887. *Glochidion asperum* (Müll.Arg.) Bedd., l. c. 193. 1873.

Asm.: *Dol-poduli*; Garo.: *Bolchiring*; Hindi: *Anwin, Chamoli, Katu-manwa, Korja*; Kan.: *Betta-hanche, Sottukoyina, Sullai-mara*; Kh.: *Dieng-jem, Uding-that, Wah-puriem*; Mal.: *Kayara*; Mar.: *Paritza, Shoura*; Punj.: *Gol-kamila, Pundna, Sama*; Tam.: *Paniccavu*.

Shrubs or trees, 2 - 12 m tall; all parts velutinous, tomentellous to sparsely pilose, hirsute or scabrid. Leaves elliptic, oblong-elliptic to lanceolate-elliptic or broadly elliptic to obovate or ovate, subequal or sometimes subcordate or cuneate-attenuate at base, often curling upwards along margins on drying, acute, obtuse to rounded or apiculate to acuminate at apex, 3 - 15 x 1.5 - 8 cm, thinly coriaceous to chartaceous; lateral nerves 4 - 8 (- 10) pairs; minor nervules mostly

conspicuous and strong beneath; petioles 1 - 6 mm long. Inflorescences 10 - 15-flowered. Male flowers: pedicels 5 - 14 mm long; sepals oblong, lanceolate or oblanceolate, 1.5 - 4 x 0.8 - 2 mm; anthers 3, 1 - 2 mm long. Female flowers: pedicels 1 - 5 (- 8) mm long; sepals ovate, triangular or oblong-lanceolate, 1 - 3 x 0.5 - 1.5 mm; ovary subglobose, 1 - 1.5 mm in diam., 3 - 6-locular; style columnar to clavate or occasionally obconic, 1 - 3 (- 4) x 0.5 - 1.8 mm (occasionally free and forming a globose mass of connivent lobes, 0.5 - 1 x 1 - 1.5 mm); apical lobes 3 - 6, orbicular, elliptic, oblong, deltoid or triangular, 0.3 - 1 mm long, often bilobulate. Fruits depressed-subglobose, 3 - 5 x 6 - 12 mm, 3 - 6-locular with bilobulate lobes; pedicels 5 - 10 mm long.

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

*Distrib.* India: Evergreen forests, grasslands, sholas, mixed or deciduous forests, scrub, tropical forests, up to 1900 m altitude, common. Almost throughout the country, except Andaman & Nicobar Islands.

Pakistan, Nepal, Bhutan, Bangladesh, Myanmar and China.

*Notes.* A variable species but easily recognizable and distinguishable from its immediate allies by the conspicuous minor venation on the under surface of leaves.

**10. *Glochidion hohenackeri*** (Müll.Arg.) Bedd., Forester's Man. 193. 1873; Hook.f., Fl. Brit. India 5: 314. 1887. *Phyllanthus hohenackeri* Müll.Arg. in Flora 48: 373. 1865 & in DC., Prodr. 15(2): 288. 1866. *Bradelia sinica* Gaertn., Fruct. Sem. Pl. 2: 127, t. 109, f. 1. 1790; Roxb., Fl. Ind., ed. Carey 3: 700. 1832 (non *Glochidion sinicum* Hook. & Arn. 1837). *Phyllanthus fagifolius* Müll.Arg., ll. cc. 373. 1865 & 288. 1866, p. p. tantum quoad Metz. (incl. var. *concolor*). *Glochidion fagifolium* (Müll.Arg.) Miq. ex Bedd., l. c. 193. 1873; Hook.f., l. c. 312. 1887, p. p.; Gamble, Fl. Madras 2(7): 1308. 1925 (repr. ed. 2: 915. 1957). *G. sinicum* sensu S.M.Almeida, Fl. Savantvadi 1: 387. 1990 (non *Bradleia sinica* Gaertn., 1790). *G. hohenackeri* (Müll.Arg.) Bedd. var. *kothayarensis* G.J.Jothi & V.S.Manickam in Indian J. Forest. 27(1): 41, f. 1. 2004, syn. nov.

Shrubs or trees, 1.5 - 12 m high; almost entirely glabrous or branchlets, leaves beneath, petioles and flowers puberulous. Leaves elliptic, ovate to elliptic-oblong or elliptic-lanceolate, sometimes oblique or subfalcate, acute, rounded or inequilateral at base, sometimes curling upwards along margins on drying, apiculate to acuminate or caudate at apex, 5 - 15 x 1.5 - 6.5 cm, thinly or occasionally stiffly coriaceous, often glaucous beneath; lateral nerves 3 - 10 pairs; petioles 2 - 6 mm long. Inflorescences few-flowered (females) or many-flowered (males), sometimes bisexual. Male flowers: pedicels capillary, 5 - 15 mm long; sepals narrowly oblong to spatulate, 2 - 5 x 1 - 2 mm; anthers 3 or 4, ca 2 mm long. Female flowers: few, sessile, in clusters; calyx cupular or sometimes obconic, 1.5 - 3.5 x 2 - 3 mm, irregularly 4 - 6-toothed; teeth triangular, deltoid or suborbicular, 0.4 - 1.2 mm long; ovary depressed, ca 0.5 x 1.5 - 2 mm, 3 - 5 (- 6)-locular, tomentellous to glabrous; styles 3 - 5 (- 6), usually connate into a subglobose or discoid mass, 0.8 - 2 x 1.5 - 3 mm, often with minute projections at the corners, sometimes free or connate only at base and then (each style) globose, deltoid or triangular, 0.6 - 1.2 x 0.8 - 1.2 mm. Fruits depressed-subglobose, 2 - 5 x 6 - 12 mm, 3 - 5 (- 6)-locular, deeply 6 - 8-lobed with bilobulate lobes, appressed puberulous to glabrous; pedicels absent or 0.5 - 4 x 0.5 - 1.2 mm.

#### KEY TO THE VARIETIES

- |  |                                      |
|--|--------------------------------------|
| 1 a. Branchlets, leaves beneath, petioles and flowers glabrous | <b>10.1. var. <i>hohenackeri</i></b> |
| b. Branchlets, leaves beneath, petioles and flowers puberulous | <b>10.2. var. <i>johnstonei</i></b>  |



**10.1. var. hohenackeri**

Kan.: *Bhanavara, Nirehelli, Nirjani, Sullal*; Mal.: *Kuluchand*; Kon.: *Bhoma*; Mar.: *Bhoma*; Tam.: *Thinakolli*.

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

*Distrib.* Evergreen forests and shola forests of Western Ghats, up to 2500 m altitude. Common. Goa, Maharashtra, Karnataka, Kerala, Tamil Nadu and Odisha.

Endemic.

**10.2. var. johnstonei** (Hook.f.) Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 210. 1995. *Glochidion johnstonei* Hook.f., Fl. Brit. India 5: 314. 1887; Gamble, Fl. Madras 2(7): 1307. 1925 (repr. ed. 2: 914. 1957).

*Fl. & Fr.* Nov. - April.

*Distrib.* Evergreen forests, up to 1500 m altitude. Rare. Karnataka and Kerala.

Endemic.

**11. *Glochidion jarawae*** Chakrab. & N.P.Balacr. in J. Econ. Taxon. Bot. 26: 527, t. 1. 2002.

Andaman (Jarawa name): *Tangapo*.

Trees, 8 – 10 m tall, almost entirely glabrous (except ovary). Leaves narrow, oblong to elliptic, acute, rounded or asymmetric at base, apiculate, mucronate or shortly and bluntly acuminate at apex, 7 – 14 x 3 – 5 cm, curling upwards along margin on drying, thinly coriaceous; lateral nerves 5 – 8 pairs; petioles 3 – 5 mm long. Inflorescences axillary, fasciculate, consisting of ca 20 male flowers and 3 – 5 female flowers seated on small pulvini. Male flowers: pedicels 6 – 7 mm long; sepals oblong, spathulate-oblongate to spathulate-orbicular, rounded at apex, 1.8 – 2.5 x 0.8 – 2 mm; anthers 5, ca 1 x 0.8 mm. Female flowers: pedicels ca 2 mm long, slightly tapering towards base; sepals ovate-triangular or triangular-lanceolate, 1.5 – 1.7 x 0.8 – 1.2 mm; ovary subglobose, 5-lobed, ca 1 mm in diam., tomentose; style clavate, 1.8 – 2 x ca 0.5 mm; apical lobes 5, subulate, narrowly triangular or ovate-triangular, 0.8 – 1 mm long, initially conniving, finally spreading. Fruits not seen.

*Fl. & Fr.* Aug. – Sept.

*Distrib.* India: Coastal forests on sandy loam; Andaman & Nicobar Islands (South Andaman Island, in Jarawa Reserve). Scarce.

Endemic.

**12. *Glochidion karnaticum*** Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 211, f. 7, G -K. 1995.

Stature unknown; branchlets glabrous. Leaves elliptic to oblong-elliptic, acute at base, caudate at apex, 6 - 11 x 2.5 - 4 cm, thinly coriaceous, glabrous; lateral nerves 5 - 7 pairs; petioles

2 - 3 mm long, glabrous. Inflorescences axillary, bisexual. Male flowers: pedicels filiform, 7 - 10 mm long; sepals narrowly oblong, elliptic to ovate, 1 - 2 x 0.5 - 1 mm, glabrous; anthers 3, ca 1 mm long. Female flowers: pedicels ca 2 mm long, puberulous; sepals oblong, 1 - 1.5 x ca 0.5 mm, puberulous outside; ovary subglobose, ca 1 mm in diam., 4-locular, glabrous; styles columnar, ca 1 x 0.4 mm; lobes 4, linear or triangular, ca 0.3 mm long, erect or spreading. Fruits subglobose, 2 - 3 x 4 - 5 mm, 4-locular, shallowly lobed with bilobulate lobes, crustaceous, glabrous.

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

*Distrib.* India: Karnataka (N. Kanara District).

Endemic.

**13. *Glochidion khasicum*** (Müll.Arg.) Hook.f., *Fl. Brit. India* 5: 324. 1887; Kanjilal et al., *Fl. Assam*. 4: 187. 1940. *Phyllanthus khasicus* Müll.Arg. in *Flora* 48: 389. 1865 & in DC., *Prodr.* 15(2): 311. 1866.

Kh.: *Dieng-jirti, Dieng-soh-romai*.

Shrubs or trees, 2 - 12 (- 16) m tall, almost entirely glabrous; branchlets often minutely white-pubescent. Leaves elliptic to oblong or ovate to ovate-lanceolate, inequilateral at base, caudate or acuminate at apex, 5 - 15 x 1.5 - 6 cm, thinly to stiffly coriaceous or sometimes chartaceous; lateral nerves 4 - 8 pairs; petioles 3 - 5 (- 7) mm long. Inflorescences few-flowered, occasionally very shortly pedunculate. Male flowers: pedicels (3 -) 5 - 9 mm long; sepals oblong-elliptic to lanceolate, 2 - 3 x 1 - 1.8 mm; anthers 3, ca 1 mm long. Female flowers: pedicels absent or up to 2 mm long; sepals ovate, triangular, oblong or lanceolate, (1.5 -) 2 - 3 x 0.6 - 1.5 mm, glabrous; ovary 3 (or 4)-locular, 1 - 1.5 mm in diam.; style columnar to subclavate, 3 - 4 x 0.6 - 1 mm; apical lobes 3, ovate or triangular, 0.5 - 1 mm long, undivided or each bilobulate. Fruits depressed subglobose, 3 - 5 x 7 - 10 mm, 3 (or 4)-locular, strongly lobed with bilobulate lobes; pedicels 1 - 5 mm long.

#### KEY TO THE VARIETIES

- 1 a. Branchlets and female sepals minutely white-pubescent; apical stylar lobes bilobulate **13.1. var. *bilobulatum***  
 b. Branchlets and female sepals glabrous; apical stylar lobes undivided **13.2. var. *khasicum***

**13.1. var. *bilobulatum*** (Vasudeva Rao & Chakrab.) Chakrab. & M.Gangop. in *J. Econ. Taxon. Bot.* 19: 213. 1995. *Glochidion bilobulatum* Vasudeva Rao & Chakrab. in *J. Econ. Taxon. Bot.* 5: 936. 1984.

*Fl.* March - April.

*Distrib.* India: Inland hill forests, rocky loam, at about 450 m altitude. Andaman Islands (North Andaman Island on Saddle Peak).

Endemic.

**13.2. var. *khasicum***

(see Chakrab. & M.Gangop. in *J. Econ. Taxon. Bot.* 19: 213, f. 14. A - E. 1995).

*Fl. & Fr.* April - Oct.

*Distrib.* India: Primary forests or tropical forests, up to 1800 m altitudes. West Bengal, Sikkim, Assam, Arunachal Pradesh and Meghalaya.

Bhutan and China.

*Use.* The fruits are edible and eaten by tribal people of Khasi hills in Meghalaya.

*Note.* Chromosome number:  $2n = 52$  (Mehra & Hans, Taxon 18: 310 - 315. 1969).

**14. *Glochidion lanceolarium* (Roxb.) Voigt, Hort. Suburb. Calcutt. 153. 1845; Müll.Arg. in Linnaea 32: 60. 1863; Hook.f., Fl. Brit. India 5: 308. 1887, p. p.; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 214, f. 11. A - D. 1995. *Bradleia lanceolaria* Roxb. [Hort. Bengal. 69. 1814, nom. nud.] Fl. Ind., ed. Carey 3: 697. 1832. *Glochisandra acuminata* Wight, Icon. Pl. Ind. Orient. 5(2): 28, t. 1905. 1852. *Phyllanthus lanceolarius* (Roxb.) Müll.Arg. in Flora 48: 371. 1865 & in DC., Prodr. 15(2): 282. 1866. *Glochidion subsessile* N.P.Balacr. & Chakrab. ssp. *birmanicum* Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 13: 716. 1989.**

*Asm.:* *Armlochan, Barapani-mudi*; *Beng.:* *Anguti, Bhauri, Panialla*; *Hindi:* *Lodam, Simbed-daru*; *Naga.:* *Armlochan*; *Nep.:* *Bangikath*; *Or.:* *Chikni, Kalchu*; *Sant.:* *Bania-kandhum*.

Bushy shrubs or trees, 1.5 - 2 m high, almost entirely glabrous. Leaves oblong to elliptic or lanceolate or elliptic-obovate to oblanceolate, unequal at base, subacute, apiculate to acuminate or caudate at apex, 5 - 15 (- 22) x 2.5 - 6 (- 8) cm, coriaceous, glossy, smooth; lateral nerves 4 - 10 pairs; petioles 2 - 10 mm long. Inflorescences sometimes slightly supra-axillary and pedunculate (peduncles up to 5 mm long), rarely narrowly thyriform and up to 4 cm long, the males 12 - 20-flowered, the females fewer-flowered. Male flowers: pedicels 7 - 20 mm long; sepals elliptic, oblong to lanceolate, 2.5 - 5 x 1 - 2.5 mm; anthers 3 - 4 (- 6), 1.5 - 2 mm long. Female flowers: sessile; sepals oblong, ovate, elliptic or triangular, 1.5 - 3 x 0.8 - 2 mm; ovary depressed or subglobose, 1 - 1.5 mm in diam., 5 - 8-locular, tomentellous; style columnar or conical, 1 - 1.8 x ca 1 mm; lobes 5 - 8, triangular or deltoid, 0.2 - 0.5 (- 1) mm long, often bilobulate at apex, connivent to straight. Fruits depressed-subglobose, 5 - 10 x 15 - 30 mm, 5 - 8-locular, shallowly to deeply lobed with the lobes often bilobulate, smooth, appressed puberulous towards apex; pedicels absent or 1 - 5 mm long.

*Fl. & Fr.* Sept. - June.

*Distrib.* India: Deciduous, secondary or moist broad-leaved forests, often in swampy places, up to 1800 m altitude. Uttarakhand, Jharkhand, West Bengal, Sikkim, Assam, Meghalaya, Orissa, Chhattisgarh and Karnataka.

Nepal, Bhutan, Bangladesh, Myanmar, Thailand, Cambodia, Laos, Vietnam and China.

*Uses.* Bark pounded and administered orally for indigestion and vomiting. Timber often used for construction of houses. The oil expressed from seeds used as illuminant.

**15. *Glochidion littorale*** Blume, Bijdr. Fl. Ned. Ind. 585. 1826; Bedd., Forester's Man. 191. 1873; Hook.f., Fl. Brit. India 5: 308. 1887; Gamble, Fl. Madras 2(7): 1306. 1925 (repr. ed. 2: 914. 1957); Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 215. 1995. *Phyllanthus littoralis* (Blume) Müll.Arg. in Flora 48: 370. 1865 & in DC., Prodr. 15(2): 280. 1866.

Shrubs or small trees, 1 - 6 m tall, entirely glabrous. Leaves broadly obovate to orbicular or sometimes broadly oblong to oblong-elliptic, cuneate or acute at base, rounded, obtuse or emarginate at apex, 3 - 11 x 2 - 6 cm, coriaceous, glossy; lateral nerves 4 - 8 pairs; petioles 3 - 5 mm long. Inflorescences few-flowered. Male flowers (immature ones seen): pedicels 4 - 7 mm long; sepals elliptic, ca 2 x 1 mm; anthers 4 - 6, ca 1 mm long. Female flowers: pedicels 1 - 2 mm long, ca 1 mm thick; sepals broadly ovate to suborbicular, 2 - 3 x 1 - 2 mm; ovary subglobose, ca 2 mm in diam., 10 - 14-locular, glabrous; style conical, ca 1 x 1 mm, multifid or crenulate at apex. Fruits subglobose, 9 - 12 x 12 - 17 mm, 10 - 14-locular, shallowly lobed; pedicels 3 - 5 mm long.

*Fl. & Fr.* Period unknown.

*Distrib.* India: Coastal areas, rare. Kerala and (?) Tamil Nadu.

Sri Lanka, Thailand, China and Indonesia (Java).

**16. *Glochidion multiloculare*** (Rottler ex Willd.) Voigt, Hort. Suburb. Calcutt. 152. 1845; Hook.f., Fl. Brit. India 5: 307. 1887; Prain, Bengal Pl. 2: 930. 1903; Duthie, Fl. Gangetic Plain 3(1): 89. 1915; Haines, Bot. Bihar Orissa 2: 130. 1921; Kanjilal et al., Fl. Assam 4: 181. 1940, p. p. *Agyneia multilocularis* Rottler ex Willd. in Ges. Naturf. Freunde Berlin Neue Schriften 4: 206. 1803 & Sp. Pl. ed. 4, 4: 569. 1805. *Bradleia multiloculare* (Rottler ex Willd.) Spreng., Syst. Veg. 3: 19. 1826; Roxb., Fl. Ind., ed. Carey 3: 696. 1832. *Phyllanthus multilocularis* (Rottler ex Willd.) Müll.Arg. in Flora 48: 370. 1865 & in DC., Prodr. 15(2): 279. 1866.

*Asm.:* *Garumora*, *Panimudi*; Beng. (Tripura): *Keonara*; Burm.: *Mama*; Sant.: *Nanha-baniakandhum*.

Bushy shrubs or trees, 1 - 8 m tall, almost entirely glabrous or entirely pubescent. Leaves oblong-lanceolate, elliptic-lanceolate to oblanceolate, acute or unequal at base, curling upwards along margins on drying, acute to apiculate or rounded at apex, 3 - 14 x 0.5 - 4 cm, chartaceous to coriaceous, often glaucous beneath; lateral nerves 5 - 8 pairs; petioles 1 - 4 x 1 - 2 mm. Inflorescences dense-flowered, sometimes borne in the axils of fallen leaves, occasionally pedunculate (peduncles up to 7 mm long). Male flowers: pedicels 5 - 8 mm long; sepals 3 + 2 (- 3), oblong, ovate to suborbicular, 1.5 - 2 x 0.7 - 1.5 mm; anthers ca 5 (reported to be 4 - 12), 1 - 1.5 mm long. Female flowers: pedicels 3 - 5 mm long; sepals 5 - 6 + 3 - 6, ovate, oblong, lanceolate or suborbicular, 1.5 - 2.5 x 0.5 - 2.5 mm; ovary depressed, 1.5 - 2.5 mm in diam., 8 - 12 (- 15)-locular, densely pubescent or glabrous; styles with stigma broader than high (hardly any stigmatic cone), 8 - 12 in a ring or connivent forming a conical or subglobose mass (1.5 - 2 mm long) or sometimes longer (0.5 - 1 mm long). Fruits depressed-subglobose, 6 - 9 x 12 - 25 mm, 8 - 12 (- 15)-locular, deeply lobed (lobes narrow), glabrous, dark brown to blackish when dry; pedicels 3 - 9 mm long.

#### KEY TO THE VARIETIES

- 1 a. All parts (often except ovary) glabrous
- b. All parts pubescent

- 16. 1. var. *multiloculare***
- 16. 2. var. *pubescens***

**16.1. var. multiloculare**

(Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19(1): 217, f. 7. A-F. 1995).

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

*Distrib.* India: Deciduous forests or grassland, tropical forests, sal forests, mixed forests, up to 550 m altitude. Uttar Pradesh, Bihar, Jharkhand, West Bengal, Sikkim, Assam, Arunachal Pradesh, Meghalaya, Nagaland, Manipur and Tripura.

Nepal, Bhutan, Bangladesh and Myanmar.

**16.2. var. pubescens** Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 14: 720. 1990.

*Fl. & Fr.* April - July.

*Distrib.* India: Tropical forests. Sikkim and Assam.

Endemic.

**17. *Glochidion nubigenum*** Hook.f., Fl. Brit. India 5: 315. 1887; Chakrab. & M. Gangop. in J. Econ. Taxon. Bot. 19: 219, f. 15 F - N. 1995. *G. velutinum* Wight var. *nubigenum* (Hook.f.) Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 14: 720. 1990.

Burm.: *Tameinzoke*.

Trees, 5 - 8 (-20) m tall; branchlets pubescent or tomentellous, glabrescent in age. Leaves elliptic to oblong-elliptic or ovate to ovate-lanceolate, equilateral (acute, rounded to truncate) or inequilateral at base, cuspidate, caudate or acuminate at apex, 6 - 15 x 2.5 - 6 cm, chartaceous to coriaceous, sparsely hirsute on major nerves to glabrous above, tomentellous to sparsely pilose (at least on nerves) and more or less glaucous beneath; lateral nerves 4 - 8 pairs; petioles 2 - 6 mm long. Inflorescences unisexual or mixed. Male flowers: pedicels 8 - 12 mm long, glabrous; sepals obovate, 2 - 2.5 x 1.5 - 2 mm; anthers 3, ca 1.5 mm long. Female flowers: pedicels 1 - 2 x 0.7 - 1.2 mm; sepals broadly elliptic, suborbicular or obovate, 1 - 2 x 0.5 - 1.5 mm; ovary depressed, 1 - 2 mm in diam., 3 - 5 (-6)-locular, tomentellous; styles 3 - 5 (-6), variable, free and triangular to orbicular (0.7 - 1.5 mm long), in a ring or forming a cupular structure or subglobose or obconic (ca 1.5 x 1.5 mm) or discoid mass (ca 1 x 2 -2.5 mm) or connate and forming a button-like structure (ca 1 x 2.5 mm), with or without a basal column (up to 1 mm long). Fruits depressed-subglobose, 3 - 4 x 8 - 10 mm, 3 - 6-locular, prominently lobed with the lobes more or less deeply bilobulate, glabrous; pedicels 3 - 10 mm long.

*Fl. & Fr.* April - Nov.

*Distrib.* India: In warm broad-leaved forests, between 1500 - 2400 m altitudes. West Bengal, Sikkim, Assam and (?) Arunachal Pradesh.

Nepal, Bhutan, Myanmar, China and Thailand.

**18. *Glochidion oblatum*** Hook.f., Fl. Brit. India 5: 312. 1887; Kanjilal et al., Fl. Assam 4: 184. 1940, p. p.; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 221, f. 14. F - I. 1995.

Asm.: *Gorumara*.

Shrubs or trees, 2 - 8 m tall; branchlets tomentellous or appressed pubescent. Leaves

oblong to elliptic or elliptic-lanceolate to oblong-lanceolate, acute to obtuse or unequal at base, often somewhat incurved along margins on drying, acute and mucronate or apiculate to acuminate at apex, 3 - 12 x 1.5 - 4.5 cm, chartaceous to thinly coriaceous, sparsely puberulous on midrib to glabrous and glaucous above, sparsely pilose on midrib and lateral nerves to glabrous beneath; lateral nerves 5 - 9 pairs; petioles 2 - 4 mm long. Inflorescences 10 - 15-flowered. Male flowers: pedicels 1 - 2 cm long; sepals oblong, elliptic, oblanceolate to spatulate, 2 - 3.5 x 0.8 - 2 mm; anthers 3 - 4 (- 6), ca 2 mm long. Female flowers: pedicels 1 - 2 mm long; sepals oblong to ovate or linear, 1.5 - 2 x 0.5 - 1 mm; ovary subglobose or depressed, 1 - 2 mm in diam., 4 - 5-locular, villous; style columnar or occasionally conical, 1.3 - 2 x 0.8 - 1 mm; lobes 4 or 5, orbicular, ca 0.3 mm long. Fruits depressed-subglobose, 4 - 7 x 10 - 18 mm, unlobed or obscurely lobed, 4 or 5-locular, smooth, thin-walled, with 8 - 10 longitudinal grooves, indehiscent; pedicels 3 - 7 mm long.

*Fl. & Fr.* April - June; Nov. - Dec.

*Distrib.* India: Tropical forests, up to 900 m altitude. Sikkim, West Bengal, Assam, Meghalaya, Nagaland and Mizoram.

Bhutan, ?Bangladesh, Myanmar, Thailand and China (Yunnan).

**19. *Glochidion sphaerogynum*** (Müll.Arg.) Kurz, Forest Fl. Burma 2: 346. 1877; Hook.f., Fl. Brit. India 5: 317. 1887; Prain, Bengal Pl. 2: 931. 1903; Kanjilal et al., Fl. Assam 4: 188. 1940; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 223, f. 3 F - I. 1995. *Phyllanthus sphaerogynus* Müll.Arg. in Flora 48: 375. 1865 & in DC., Prodr. 15(2): 293. 1866. *Glochidion mandakatense* Kalita & Borthakur in J. Econ. Taxon. Bot. 30: 488. 2006 (as '*mandakatensis*'), syn. nov.

Garó.: *Bol-jakru*; Kh.: *Dieng-soh-um*; Mik.: *Theng-kong-arong*; Naga.: *Chaiang*; Nep.: *Malchia*, *Rokte*.

Shrubs or trees, 1 - 20 m tall, entirely glabrous. Leaves oblong-elliptic, oblong-lanceolate, elliptic-lanceolate, ovate-lanceolate to lanceolate, unequal and cuneate-attenuate or acute at base, strongly curling upwards along margins on drying, acuminate at apex, 4.5 - 16 (- 35) x 1.5 - 5 (- 8) cm, coriaceous, glossy; lateral nerves 5 - 10 pairs; petioles 3 - 7 mm long. Inflorescences dense-flowered, occasionally pedunculate (peduncles up to 5 mm long). Male flowers: pedicels 5 - 15 mm long; sepals broadly elliptic or obovate-spathulate, 1.5 - 2.5 x 1 - 2.5 mm; anthers 3, ca 1.2 mm long. Female flowers: pedicels 1 - 6 mm long; sepals orbicular to broadly obovate, 1 - 2 x 1 - 2 mm, coriaceous; ovary depressed, 0.5 - 1.5 mm in diam., 4 - 5 (- 6)-locular; style subglobose or button-like or discoid, 1 - 1.5 x 2 - 3 mm. Fruits depressed-subglobose, 3 - 4 x 7 - 10 mm, 4 or 5 (or 6)-locular, prominently lobed with the lobes bilobulate.

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

*Distrib.* India: Tropical forests and primary forests, up to 950 m altitude. West Bengal, (?) Sikkim, Assam, Arunachal Pradesh, Meghalaya and Mizoram.

Bhutan, (?)Nepal, Bangladesh, Myanmar, China, Vietnam and Thailand.

*Note.* Chromosome number: 2n = 52 (Mehra & Hans, J. Indian Bot. Soc. 51: 379 - 325. 1971).

**20. *Glochidion subsessile*** N.P.Balacr. & Chakrab. in Proc. Indian Acad. Sci. (Pl. Sci.) 92: 359. 1983. *G. andamanicum* sensu C.E.Parkinson, Forest Fl. Andaman Isl. 235. 1923, non Kurz, 1873.

Trees, 5 - 7 m tall, entirely glabrous. Leaves oblong to elliptic-oblong or sometimes obovate to oblong-oblong, unequal at base, apiculate to acuminate at apex, 3.5 - 12 x 2 - 5.5 cm, thinly coriaceous or sometimes chartaceous, glossy; lateral nerves 5 - 8 pairs; petioles 2 - 5 mm long. Inflorescences mixed. Male flowers: pedicels 8 - 15 mm long; sepals oblong to obovate or triangular, 1.5 - 3 x 0.7 - 1.5 mm; anthers 5 or 6, ca 1 mm long. Female flowers: pedicels absent or up to 1.5 mm long; sepals oblong to ovate, 1 - 2.5 x 0.5 - 1.3 mm, ovary subglobose, 0.8 - 1 x 1 - 1.3 mm, 5 or 6-locular; style columnar, sometimes tapering towards base, 2 - 3.2 x 0.5 - 0.8 mm; lobes 5 or 6, bilobulate at apex. Fruits depressed-subglobose, 5 - 8 x 14 - 18 mm, 5 or 6-locular, lobed with the lobes rounded to bilobulate, smooth; pedicels 0.5 - 3 mm long.

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

*Distrib.* India: Evergreen hill forests, up to 300 m, common. Andaman Islands.

Endemic.

*Use.* An extract of the bark is reported to have antitumor properties.

**21. *Glochidion thomsonii*** (Müll.Arg.) Hook.f., Fl. Brit. India 5: 318. 1887; Kanjilal et al., Fl. Assam. 4: 185. 1940; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 225, f. 2 D - G. 1995. *Phyllanthus thomsonii* Müll.Arg. in Flora 48: 375. 1865 & in DC., Prodr. 15(2): 293. 1866.

Shrubs or trees, 2 - 10 m tall, entirely glabrous. Leaves elliptic, oblong-elliptic to ovate, equal and acute, obtuse to rounded or unequal at base, often strongly curling upwards along margins on drying, acute, subacute to apiculate and mucronate at apex, 4 - 11 x 2 - 4.5 cm, coriaceous or occasionally chartaceous, glaucous beneath; lateral nerves 5 - 8 pairs; petioles 2 - 4 mm long. Inflorescences unisexual, many-flowered. Male flowers: pedicels 5 - 8 mm long; sepals elliptic to oblong, 2 - 2.5 x ca 1 mm; anthers 3, ca 1.2 mm long. Female flowers: pedicels 5 - 10 mm long; sepals ovate, triangular to suborbicular, 1 - 2.5 x 0.6 - 2 mm; ovary subglobose, ca 1 mm in diam., 3 (or 4)-locular; styles 3, free, deltoid, 0.3 - 0.8 mm long, forming a ring or cone. Fruits depressed subglobose, 2.5 - 4 x 6 - 8 mm, 3 (or 4)-locular, prominently lobed with the lobes deeply to shallowly bilobulate, crustaceous, smooth; pedicels 1 - 1.5 cm long, wiry.

*Fl. & Fr.* June - Nov.

*Distrib.* India: In thickets, at 200 - 1500 m altitudes. Assam and Meghalaya.

?Bangladesh and China.

**22. *Glochidion zeylanicum*** (Gaertn.) A.Juss., Euphorb. Gen. 107, t. 3. 1824; Hook.f., Fl. Brit. India 5: 310. 1887; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 226. 1995. *Bradleya zeylanica* Gaertn., Fruct. Sem. Pl. 2: 128, t. 109. 1791. *B. nitida* Roxb. [Hort. Bengal. 69.1814, nom. nud.] Fl. Ind., ed. Carey 3: 699. 1832. *Glochidion nitidum* (Roxb.) Voigt, Hort. Suburb. Calcutt. 153. 1845. *Phyllanthus nitidus* (Roxb.) Müll.Arg. in Flora 48: 371. 1865 & in DC., Prodr. 15(2): 282. 1866. *P. canaranus* Müll.Arg., ll. cc. 371. 1865 & 284. 1886. *P. zeylanicus* (Gaertn.) Müll.Arg. in DC., Prodr. 15(2): 181. 1866. *Glochidion canaranum* (Müll.Arg.) Bedd., Forester's Man. 192. 1873.

Asm.: *Bam-pani-mudi*; Kan.: *Banda, Neeru kuku, Savrigidda*; Kon.: *Araki*; Mal.: *Nirvetti*; Tam.: *Kumbala, Kumbal-maram, Kokkamani-maram*; Tel.: *Itepulla*.

Shrubs or trees, 2 - 6 (-13) m tall, almost entirely glabrous or pubescent. Leaves oblong to elliptic or broadly so or oblong-lanceolate to elliptic-lanceolate or ovate, ovate-oblong, ovate-elliptic to suborbicular, symmetric to asymmetric, cordate, truncate, rounded, obtuse, acute or unequal at base, apiculate to acuminate or sometimes rounded, obtuse to acute at apex, 5.5 - 26 x 2.5 - 12 cm, pubescent to glabrous, chartaceous to stiffly coriaceous, often glossy; lateral nerves 4 - 12 pairs; petioles 2 - 8 mm long. Inflorescences mostly supra axillary and pedunculate. Male flowers: pedicels 5 - 10 mm long; sepals 3 + 2 - 3, oblong, ovate, suborbicular or obovate, 1 - 3 x 0.7 - 2 mm; anthers 3 - 8, 1.2 - 2 mm long. Female flowers: sessile to pedicellate; pedicels 1 - 8 mm long; sepals 3 + 2 - 3, triangular, deltoid, oblong, ovate or suborbicular, 1 - 3 x 0.6 - 2.5 mm; occasionally the calyx cupular and 1.5 - 4 x 2 - 3 mm with 0.3 - 1.5 mm long ovate or deltoid teeth; ovary subglobose, depressed, 1 - 2.5 mm in diam., 4 - 7-locular, tomentose or glabrous; styles free, triangular, oblong to linear, 0.3 - 1.2 mm long, connivent to erect or united and columnar, conical to clavate, 0.5 - 3.5 x 0.5 - 1.2 mm; apical lobes (in case of united styles) 4 - 7, triangular, linear, oblong or suborbicular, 0.2 - 1 mm long. Fruits sessile to pedicellate, depressed-subglobose, 3 - 8 x 4 - 12 mm, obscurely or shallowly lobed with bilobulate lobes, sometimes unlobed, 4 - 8-locular, puberulous to glabrous, sometimes with slender irregular ridges on the surface; pedicels 2 - 8 mm long.

India and Sri Lanka to Malesia, 5 varieties in India.

#### KEY TO THE VARIETIES

- |  |                                 |
|--|---------------------------------|
| 1 a. All parts (except ovary) glabrous   | <b>22.5. var. zeylanicum</b>    |
| b. All parts pubescent   | 2                               |
| 2 a. Female flowers sessile; fruits sessile to subsessile, shallowly lobed with the lobes bilobulate | <b>22.2. var. arunachalense</b> |
| b. Female flowers pedicellate; fruits pedicellate, unlobed   | 3                               |
| 3 a. Capsules 3 - 4 x 4 - 7 mm   | <b>22.1. var. arborescens</b>   |
| b. Capsules 2 - 6 x 7 - 12 mm  | 4                               |
| 4 a. Capsule solitary in each axil   | <b>22.3. var. paucicarpum</b>   |
| b. Capsules several in each axil   | <b>22.4. var. tomentosum</b>    |

**22.1. var. arborescens** (Blume) Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 19: 228. 1995. *Glochidion arborescens* Blume, Bijdr. Fl. Ned. Ind. 584. 1826; Kanjilal et al., Fl. Assam 4: 188. 1940. *Phyllanthus arborescens* (Blume) Müll. Arg. in Flora 48: 370. 1865 & in DC., Prodr. 15(2): 279. 1866. *Glochidion hirsutum* auct. non (Roxb.) Voigt, 1845: S.Panda & A.P.Das in J. Bombay Nat. Hist. Soc. 88: 469. 1992; Chakrab. & N.P.Balacr. in J. Econ. Taxon. Bot. Addit. Ser. 9: 71. 1992, pro min. parte.

Lush.: *Toitil*.

Trees, up to 16 m tall.

*Fl. & Fr.* April - Dec.

*Distrib.* India: Evergreen to deciduous thickly forested areas, at 450 - 900 m altitudes. Orissa, West Bengal, Arunachal Pradesh, Assam, Mizoram and Andaman & Nicobar Islands.



Bangladesh, Myanmar, Thailand, Malay Peninsula, Banka, Borneo and Java.

*Note.* Chromosome number:  $2n = 52$  (Hans, *Taxon* 22: 591 - 636. 1973).

**22.2. var. *arunachalense*** Chakrab. & M.Gangop. in *J. Econ. Taxon. Bot.* 19: 229. 1995.

Shrubs or trees, 2 - 3 m high; branchlets rufous villous; leaves, flowers and fruits pubescent; capsules lobed.

*Fr.* May.

*Distrib.* India: Dry hill slopes, at about 1600 m altitude. Arunachal Pradesh (Kameng Dist.).

Endemic.

**22.3. var. *paucicarpum*** Chakrab. & N.P.Balacr. in *J. Econ. Taxon. Bot.* 28: 123, t. 1. 2004.

*Fl. & Fr.* July - Aug.

*Distrib.* India: Inland forests on clayey loam, at ca 100 m altitude. Middle Andaman Island (Jarawa Reserve Area).

Endemic.

*Note.* This is the only variety seen to possess solitary axillary fruit.

**22.4. var. *tomentosum*** Trimen, *Handb. Fl. Ceylon* 4: 29. 1898; Chakrab. & M. Gangop. in *J. Econ. Taxon. Bot.* 19: 229. 1995. *Glochidion tomentosum* Dalzell in Hooker's *J. Bot. Kew Gard. Misc.* 2: 38. 1851; Hook.f., *Fl. Brit. India* 5: 309. 1887; Gamble, *Fl. Madras* 2(7): 1306. 1925 (repr. ed. 2: 2: 914. 1957), var. *tomentosum* only. *Bradleya hirsuta* Roxb., *Fl. Ind.*, ed. Carey 3: 699. 1832. *Glochidion hirsutum* (Roxb.) Voigt, *Hort. Suburb. Calcutt.* 153. 1845; Hook.f., l. c. 311. 1887; Prain, *Bengal Pl.* 2: 931. 1903; C.E.Parkinson, *Forest Fl. Andaman Isl.* 233. 1923; Kanjilal et al., *Fl. Assam* 4: 184. 1940. *Phyllanthus tomentosus* (Dalzell) Müll.Arg. in *Flora* 48: 371. 1865 & in DC., *Prodr.* 15(2): 283. 1866. *P. hirsutus* (Roxb.) Müll.Arg., ll. cc. 371. 1865 & 283. 1866. *Glochidion mishmiense* Hook.f., l. c. 327. 1887; Kanjilal et al., l. c. 189. 1940. *G. tomentosum* var. *talbotii* Hook.f., l. c. 311. 1887. *G. zeylanicum* var. *talbotii* (Hook.f.) Haines, *Bot. Bihar Orissa* 2: 132. 1921; Govaerts et al., *World Checkl. & Bibl. Euphorbiaceae* 3: 967. 2000. *G. montanum* sensu Bahadur et al. in *Indian Forester* 99: 624. 1973, non Thwaites, 1861.

Asm.: *Panimudi*; Tam.: *Vellai-candanum*.

Shrub or tree, 1 - 10 m high.

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

*Distrib.* India: Evergreen, subtropical or deciduous forests, marshy habitats, subtidal forests, up to 1050 m altitude. Almost throughout the country, including Andaman & Nicobar Islands.

Sri Lanka, Bhutan, Bangladesh, Myanmar, Thailand, China (Hainan & Yunnan), Hongkong and Taiwan.

*Uses.* A timber-yielding tree.

**22.5. var. zeylanicum**

(see Chakrab. & M. Gangop. in J. Econ. Taxon. Bot. 19: 227. 1995).

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

*Distrib.* India: Evergreen inland primary or deciduous forests, borders of forests, swampy areas or bay, up to 1500 m altitude. Assam, Tripura, Orissa, Chhattisgarh, Andhra Pradesh, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka, Bangladesh, Myanmar, Thailand and throughout Malesia to N. Australia.

*Uses.* Bark used as a stomachic. The fruits are cooling and restorative. The tender shoots helps to reduce itches.

**65. Leptopus Decne.**

Herbs, undershrubs or shrubs, monoecious or dioecious, erect or ascending or procumbent, sometimes scandent. Leaves alternate, simple, petiolate, entire, laxly hairy to glabrous beneath, penninerved; stipules inserted at lateral bases of petiole, caducous or rarely persistent. Inflorescences axillary, solitary or fasciculate, Male flowers: pedicels usually filiform, articulate above base; sepals 5 (-6), imbricate, distinct or shortly connate at base; petals as many as sepals, about half as long as sepals, sometimes keeled at back; disc glands scale-like, linear, entire or bifid at apex, as long as petals, opposite to sepals; stamens 5; filaments broad at base, narrowed upwards; anthers 4-locular, introrse, longitudinally dehiscent; pistillode trifid or obsolete. Female flowers: axillary or 2 – 4-together, long-pedicelled; sepals 5 or 6, 3-nerved, sometimes enlarged in fruit; petals 5 or 6, small, often hidden between the sepals and the disc lobes and apparently obsolete; disc scales as in male or annular and flattened; ovary glabrous, hispid or hirsute; ovules 2 in each locule, anatropous, styles 3, each deeply bifid; staminodes minute or obsolete. Fruits capsular, 3-lobed, with 3 bivalved cocci; seeds turgidly trigonous, with a broad convex back, smooth or transversely striate, without caruncle, glabrous, hispid or hirsute; embryo curved, cotyledons flattened and broad.

Native to Central Asia, extending to the Philippines and Indonesia; 10 species; 4 species in India.

KEY TO THE SPECIES

- 1 a. Plants up to 3 m high; leaves caudate at apex (cauda 5 – 25 mm long), glabrous beneath; female flowers 2 – 4 per axil **4. L. emicans**
- b. Plants up to 1.5 m high; leaves subacute, rounded, obtuse, mucronate or acuminate at apex (acumen up to 5 mm long, pubescent at least on midrib beneath; female flowers 1 or 2 per axil **2**
- 2 a. Ascending herbs; female and fruiting pedicels ca 1 mm long; ovary shortly hirsute; capsules evanescently pubescent **1. L. australis**
- b. Erect undershrubs or shrubs, sometimes scandent; female and fruiting pedicels 8 – 50 mm long; ovary and capsules glabrous **3**
- 3 a. Branchlets acutely angled; leaves shortly acuminate at apex; male pedicels 6 – 8 mm long; male disc segments bipartite, linear and with a gland in between **2. L. clarkei**

- b. Branchlets terete when mature; leaves subacute, rounded, obtuse or mucronate at apex; male pedicels 7 – 18 mm long; male disc segments bipartite, ovate and without a gland in between

### 3. *L. cordifolius*

**1. *Leptopus australis*** (Zoll. & Moritzi) Pojark., Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR 20: 270. 1960; Voronts. & Petra Hoffm. in Kew Bull. 64: 629, f. 1. 2009 (publ. 2010). *Andrachne australis* Zoll. & Moritzi in Zoll., Natuur-Genesesk. Arch. Ned. Indie 2: 17. 1845. *Leptopus sanjappae* Sumathi, Karthig., Jayanthi & Diwakar in Bull. Bot. Surv. India 47: 155, f. 1. 2005 (publ. 2006). *L. calcareus* (Ridl.) Pojark. var. *sanjappae* (Sumathi, Karthig., Jayanthi & Diwakar) Chakrab. & N.P.Balacr. in J. Econ. Taxon. Bot. 32: 603. 2008.

Monoecious ascending herbs, up to 30 cm high; branches weak, brittle, densely appressed hairy, glabrous in age. Leaves elliptic-lanceolate, oblong-elliptic to ovate, cuneate to obtuse or rounded at base, apiculate to mucronate at apex, 1 – 4.5 x 0.4 – 1.7 cm, chartaceous, ciliate hairy along margins, hairy on midrib and lateral nerves beneath; lateral nerves 6 – 8 pairs, prominent; petioles 0.4 – 1.7 cm long, hairy; stipules lanceolate, ca 1.5 x 1 mm, persistent. Inflorescences axillary, male in clusters, female solitary or in pairs; bracts minute, congested, ca 0.2 mm long, hairy. Male flowers: 3 – 4 mm across; pedicels 2 – 4 mm long, puberulous; sepals 5, narrowly obovate, 1.5 – 2 x 1 – 1.2 mm, pubescent outside; petals 5, narrowly obovate, 0.8 – 1 x ca 0.5 mm, glabrous; disc glands 5, ca 1 mm long, bilobed almost to base; stamens 5; filaments ca 1 mm long; anthers oblong, ca 0.2 mm long; pistillode minute. Female flowers: ca 5 mm across; pedicels ca 1 mm long; sepals 5, broadly elliptic, 2 - 2.5 x 1.7 - 2 mm, densely pubescent outside, sparsely puberulous inside, enlarging to ca 5 x 5 mm in fruit; petals hidden between the sepals and the disc lobes; disc glands broad, ca 1 mm across; ovary ca 1 mm long, shortly hirsute; styles 3, ca 1 mm long, bifid. Capsules subglobose, ca 6 x 6 mm, 3-lobed; fruiting pedicels ca 1 mm long; seeds 6, triquetrous, ca 2 x 2 mm, transversely striate, pale brown.

*Fl. & Fr.* Sept. – March.

*Distrib.* India. Stunted evergreen vegetation, near Bamboo brakes, at ca 600 m alt. Andaman & Nicobar Islands, North Andaman Isl. (Saddle Peak National Park).

Thailand, Hainan, Sumatra, Java, Timor and Philippines.

**2. *Leptopus clarkei*** (Hook.f.) Pojark., Bot. Mater. Gerb. Bot. Inst. Komarova Acad. Nauk SSSR 20: 272. 1960; Li in Notes Roy. Bot. Gard. Edinburgh 40: 469. 1983; Voronts. & Petra Hoffm. in Kew Bull. 64: 632, f. 3 A – G. 2009 (publ. 2010). *Andrachne clarkei* Hook.f., Fl. Brit. India 5: 285. 1887; Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 172. 1922. *Arachne clarkei* (Hook.f.) Pojark. in Bot. Zhurn. SSSR 25: 342. 1940, nom. invalid.

Erect herbs or shrubs, 30 – 150 cm high, monoecious; branches greyish green, acutely angled and striate, glabrous except young branchlets. Leaves ovate-lanceolate, rounded at base, acuminate at apex, 2 – 6.5 x 1 – 2 cm, membranous to chartaceous, sparsely pilose beneath; lateral nerves 3 – 6 pairs, slightly elevated beneath; petioles 1.5 - 10 mm long; stipules deltoid, up to 1.2 mm long. Inflorescences unisexual or bisexual. Male flowers: solitary or 2 – 3-together; pedicels 6 - 17 mm long, filiform; sepals obovate to oblong, 1.2 – 3 x 0.7 – 1.4 mm, pilose outside; petals obovate, 0.8 – 1.5 x 0.2 – 1 mm, membranous, glabrous; disc glands partially bilobed, linear; stamens erect; filaments 0.7 – 1.2 mm long; anthers broadly ovoid; pistillode small. Female flowers: solitary or in pairs; pedicels 10 - 20 mm long; sepals ovate to elliptic, 1.5 – 5 x 0.7

– 1.8 mm, 3-nerved, glabrous to hirsute outside; petals obovate, 0.2 – 0.5 x ca 0.3 mm; disc glands bifid to the middle, 0.5 – 1 mm long; ovary glabrous to sparsely hirsute; styles 3, up to 1 mm long, free; stigmas capitate. Fruits depressed-subglobose, 2 – 3.5 x 3.5 – 5.5 mm; sparsely hirsute to glabrous, brown when dry; pedicels 15 – 35 mm long; seeds triquetrous, 1.8 – 2.5 x 1.5 – 2 mm, smooth, glabrous.

*Fl. & Fr.* Apr. - Oct.

*Distrib.* India: At about 1600 m altitude. Nagaland and Manipur.

Myanmar, China and Vietnam.

**3. *Leptopus cordifolius*** Wall. ex Decne., *Voy. Inde* 4: 155. 1844; Voronts. & Petra Hoffm. in *Kew Bull.* 64: 633, f. 2 M. 2009 (publ. 2010). *Phyllanthus cordifolius* Wall. [Cat. No. 7913A. 1847, nom. nud.] ex Decne., l. c. 155. 1844, nom. invalid., pro syn. *Andrachne cordifolia* (Wall. ex Decne.) Müll.Arg. in DC., *Prodr.* 15(2): 234. 1866; Hook.f., *Fl. Brit. India* 5: 283. 1887. *Arachne cordifolia* (Wall. ex Decne.) Pojark. in *Bot. Zhurn. SSSR* 25: 342. 1940, nom. invalid. *A. cordifolia* (Wall. ex Decne.) Hurus. in *J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot.* 6: 339. 1954.

Erect or scandent shrubs, up to 3 m high; branchlets terete towards base, pilose or puberulous when young, soon glabrous. Leaves ovate, ovate-oblong, ovate-lanceolate to lanceolate or oblong-lanceolate, rounded, subtruncate, subcordate, obtuse or acute at base, entire along margins, subacute, mucronate, rounded or obtuse at apex, 2.5 - 11 x 0.8 - 4 cm, membranous to thinly chartaceous, glabrous above, thinly brown or white-tomentellous, sparsely pilose to puberulous only on midrib beneath; lateral nerves faint above, faint to prominent beneath; tertiary nerves obscure above, faint to prominent beneath, laxly reticulate; petioles (2-) 5 - 40 mm long, scattered pilose to glabrous; stipules triangular, 0.5 - 1 mm long, persistent. Male inflorescences axillary, 1 - 4-flowered. Flowers: pedicels 7 - 20 mm long, filiform; sepals obovate to orbicular-obovate or broadly oblong-elliptic, shortly connate at base, 1.5 - 3 x 1.2 - 2 mm, sparsely and coarsely pilose towards base outside; petals obovate to spatulate-obovate, 1.3 - 2 x 0.8 - 1.5 mm, hyaline, glabrous; disc glands 5, obcordate, bilobed, ca 1 x 1 mm, thin; stamens 5, free or very shortly connate at base into a column; filaments ca 1.5 mm long; anthers ovoid, ca 0.4 mm long; pistillode ca 1 mm long, trifid at apex. Female inflorescences axillary, solitary or flowers in pairs. Flowers: pedicels 1.5 - 5 cm long, filiform, sparsely pilose to glabrous; sepals orbicular or ovate-orbicular, 3 - 5 x 3 - 4 mm, apiculate, with prominent venation, pilose towards base outside; petals obovate, 0.2 – 0.5 x 0.2 – 0.4 mm; disc glands 5, suborbicular or obcordate, ca 0.5 x 1 mm, bilobed; ovary subglobose, ca 1 x 1.5 mm, glabrous; styles 3, 1 – 1.6 mm long, free, deeply bifid. Fruits subglobose, 3.5 - 4 x 5 - 7 mm, 3-lobed, glabrous, conspicuously veined, dark brown when dry; pedicels 1.5 - 5 cm long.

*Fl. & Fr.* May - Nov.

*Distrib.* India: Western Himalayas at 1700 - 2700 m altitudes and Eastern Himalayas, at 1200 - 1800 m. Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Arunachal Pradesh and Meghalaya.

Nepal and Pakistan.

*Note.* Chromosome numbers:  $2n = 22$  (Gill et al., *Cytologia* 38: 393 - 401. 1973) and  $2n = 24$  (Choda & Mehra, *Curr. Sci.* 41: 76. 1972).

**4. *Leptopus emicans*** (Dunn) Pojark. in Bot. Mater. Gerb. Bot. Inst. Komarova Acad. Nauk SSSR 20: 272. 1960; Voronts. & Petra Hoffm. in Kew Bull. 64: 636. 2009 (publ. 2010). *Andrachne emicans* Dunn in Bull. Misc. Inform. Kew 1920: 210. 1920. *Arachne emicans* (Dunn) Pojark. in Bot. Zhurn. SSSR 25: 342. 1940, nom. invalid.

Shrubs, up to 3 m high, entirely glabrous; young shoots erect, up to 2 m long; branchlets somewhat herbaceous, flattened and ribbed towards tips, semiterete towards base, up to 3 mm thick; lateral branchlets horizontal or arching upwards, ca 1.3 mm thick at base, bearing smaller leaves. Leaves lanceolate to elliptic-lanceolate, (3-) 4 - 11 x (0.6 -) 1 - 2.5 cm, cuneate or acute at base, caudate or acuminate (cauda or acumen 5 - 25 mm long) at apex, thinly membranous; lateral nerves 5 - 9 pairs, slender, faint above, prominent beneath; tertiary nerves obscure above, somewhat prominent beneath, scalariform, petioles 1 - 3 cm long, 0.8 - 1 mm thick; stipules deltoid, ca 1 mm long. Male flowers not seen. *Female flowers* in axillary, fasciculate, 2 - 4-flowered fascicles; pedicels 9 - 11 mm long, slender; sepals ovate, ca 2 x 1.2 mm, obtuse at apex, thin; petals spatulate, ca 0.4 x 0.2 mm; disc glands 5, alternating sepals, suborbicular to ovate, ca 0.8 mm in diam., bilobed, thin; ovary subglobose, ca 1 mm in diam., glabrous; styles 3, up to 1 mm long, free. Fruits subglobose to depressed-globose, 3 - 4 x 5 - 6 mm, 3-lobed, brown when dry, conspicuously reticulate-veined, glabrous; fruiting pedicels 10 - 12 mm long; seeds 6, angular, ca 1.5 mm long.

*Fl. & Fr.* Nov. - Dec.

*Distrib.* India: Tropical evergreen forests, along riverbanks, at 500 - 1200 m. Arunachal Pradesh (Lohit dist., Outer Abor hills).

Myanmar.

*Note.* According to the original author (S. T. Dunn), the young shoots springing up to a height of 3 m make this a notable plant in the jungles.

## 66. *Margaritaria* L.f.

Shrubs or trees, dioecious, deciduous, rarely evergreen; indumentum absent; flowers appearing with young flush of leaves. Leaves simple, distichous, symmetric, entire, penninerved; petioles short; stipules entire or denticulate. Inflorescences axillary, fasciculate or a few fascicles on up to 1 cm long lateral branches; flowers bracteate, pedicelled; female flowers occasionally solitary. Male flowers: on long capillary pedicels; sepals 4, biseriata, the outer 2 smaller, entire or denticulate; petals absent; disc annular, adnate to the base of calyx; stamens 4; filaments free; anthers extrorse in bud, muticous, longitudinally dehiscent; pollen grains subglobose, 3-colporate, semitectate; pistillode absent. Female flowers: long-pedicelled; calyx and disc as in male; ovary 2 - 6-locular; ovules 2 in each locule, hemitropous; styles 2 - 6, free or connate at base into a column, bifid above. Fruits capsular, globose, irregularly dehiscent, the green exocarp usually separating from the thin endocarp; seeds 2 in each locule; outer sarcotesta fleshy, metallic blue; inner sclerotesta thick, woody, smooth or rugose, invaginated at chalazal end; endosperm copious; embryo straight or slightly curved; cotyledons thin and flat, longer than the radicle.

Tropical America, Africa, Asia and Australia, ca 14 species; one in India.

*Literature.* WEBSTER, G. L. (1979). A revision of *Margaritaria* (Euphorbiaceae). J. Arnold Arbor. 60: 403 - 444.

**Margaritaria indica** (Dalzell) Airy Shaw in Kew Bull. 20: 387. 1966; Chakrab. in J. Econ. Taxon. Bot. 6: 262. 1985. *Prosorus indicus* Dalzell in Hooker's J. Bot. Kew Gard. Misc. 4: 346. 1852 (as '*indica*'); Haines, Bot. Bihar Orissa 2: 127. 1921; Gamble, Fl. Madras 2(7): 1294. 1925 (repr. ed. 2: 905. 1957). *Phyllanthus indicus* (Dalzell) Müll.Arg. in Linnaea 32: 52. 1863 & in DC., Prodr. 15(2): 417. 1886; Hook.f., Fl. Brit. India 5: 305. 1887.

Trees, 10 - 25 m tall. Leaves oblong, oblong-elliptic to oblong-lanceolate, cuneate-attenuate, acute to rounded at base, entire, mucronate or shortly acuminate at apex, 4 - 20 x 1 - 8 cm, membranous when young, finally chartaceous; lateral nerves 7 - 12 pairs; petioles 5 - 10 mm long. Inflorescences precocious, axillary, fasciculate, often pedunculate (peduncles up to 7 mm long, the fascicles often biseriate on peduncles. Male flowers: several in each fascicle, ca 1.5 mm across; pedicels 5 - 12 mm long; sepals broadly oblong, elliptic, suborbicular or obovate, 1 - 1.8 x 0.6 - 1.5 mm; disc flat, adnate, 0.8 - 1.3 mm in diam.; filaments ca 1 mm long; anthers ellipsoid to oblong, 0.7 - 1 mm long. Female flowers: solitary or in fascicles (up to 8-flowered), ca 2 mm across; pedicels 6 - 20 mm long; sepals ovate to oblong, 1.5 - 2 x 1 - 1.5 mm; disc entire, 2 - 2.5 mm in diam.; ovary globose, ca 1.5 mm in diam., 3-locular; styles 3, 1.5 - 2 mm long, almost free above; stigmas bifid. Fruits subglobose, 9 - 12 mm in diam., irregularly dehiscent.

*Fl. & Fr.* March - June.

*Distrib.* India: Semievergreen and moist deciduous forests, up to 700 m altitude. Orissa, Andhra Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu and Andaman Islands.

Sri Lanka and India to China, Taiwan, Vietnam, Thailand, Sumatra to Philippines and New Guinea (excl. Malay Peninsula).

## 67. *Meineckia* Bail.

Shrubs or undershrubs, sometimes nearly herbaceous, deciduous or evergreen, monoecious or dioecious. Leaves distichous, shortly petiolate, stipulate. Inflorescences axillary clusters representing reduced cymules, unisexual or bisexual, when bisexual the first or central flower being female and the others male. Male flowers: several in each cymule; pedicels slender; calyx-lobes 5 (or 6), with a single midvein; petals absent; disc annular or patelliform, partially adnate to the calyx; stamens 5, united at base into a column; anthers extrorse, laterally dehiscent; pollen grains tricolporate, finely reticulate, colpus transversalis elliptic and costate; pistillode projecting from the top of the staminal column. Female flowers: solitary or rarely 2-together; pedicels long; calyx-lobes 5; disc annular; ovary glabrous, 3-locular; ovules 2 in each locule, anatropous; styles 3, each bifid; stigma clavate. Fruits capsular, thin-walled, conspicuously reticulate-veined; seeds 1 (when one ovule in each locule get aborted) or 2 per locule, ecarunculate, strongly curved and reniform in outline, deeply or shallowly foveolate-pitted; embryo embedded in copious endosperm; cotyledons flat, thin, broader than radicle.

Disjunct in New World (Mexico to Columbia and Brazil) and Old World (South India, Sri Lanka and NE. India), ca 28 species; 4 species in India.

*Literature.* WEBSTER, G. L. (1965). A revision of the genus *Meineckia* (Euphorbiaceae). Acta Bot. Neerl. 14: 323 - 365.

## KEY TO THE SPECIES

- 1 a. Leaves acute, subacute, rounded or apiculate at apex at apex, 2 - 6 cm long; fruiting pedicels 1 - 2.5 cm long **4. M. parvifolia**
- b. Leaves acuminate at apex, mostly 5 - 10 cm long or more; fruiting pedicels 2 - 9 cm long **2**
- 2 a. Petioles 2.5 - 6.5 cm long; fruiting pedicels ca 2 cm long **3. M. macropus**
- b. Petioles up to 1.3 cm long; fruiting pedicels 5 cm or more long **3**
- 3 a. Leaves narrowed at base; veinlets prominent beneath; stipules 1.2 - 1.7 mm wide; female calyx lobes 2.5 mm or more long **1. M. calycina**
- b. Leaves mostly unequal at base; veinlets not prominent beneath; stipules 0.7 - 1 mm wide; female calyx lobes up to 2 mm long **2. M. longipes**

**1. *Meineckia calycina*** G.L. Webster in Acta Bot. Neerl. 14: 354, f. 7. 1965.

Shrubs (?), monoecious, glabrous with compressed or somewhat angled branches. Leaves elliptic-lanceolate, cuneate at base, acuminate at apex, somewhat revolute along margins, 5 - 14 x 2 - 5 cm, membranous; lateral nerves 7 - 10 pairs; petioles 4 - 13 mm long; stipules scarious. Inflorescences bisexual cymules with solitary female and several male flowers in a cluster. Male flowers: pedicels 3 - 3.5 mm long; calyx lobes broadly elliptic, ca 2.2 x 2 mm; disc ca 2.5 mm in diam. when spread out; filaments united almost up to the top, ca 0.9 mm long; anthers ca 0.4 mm broad; pistillode ca 0.2 mm high. Female flowers: pedicels 3.5 - 5 cm long, becoming 4.5 - 9 cm long in fruit; calyx lobes ovate or elliptic, 2.5 - 3 mm long, thick and foliaceous, becoming scarious in fruit; disc massive and fleshy; styles 0.5 - 0.7 mm long, slender, capitate. Fruits not seen.

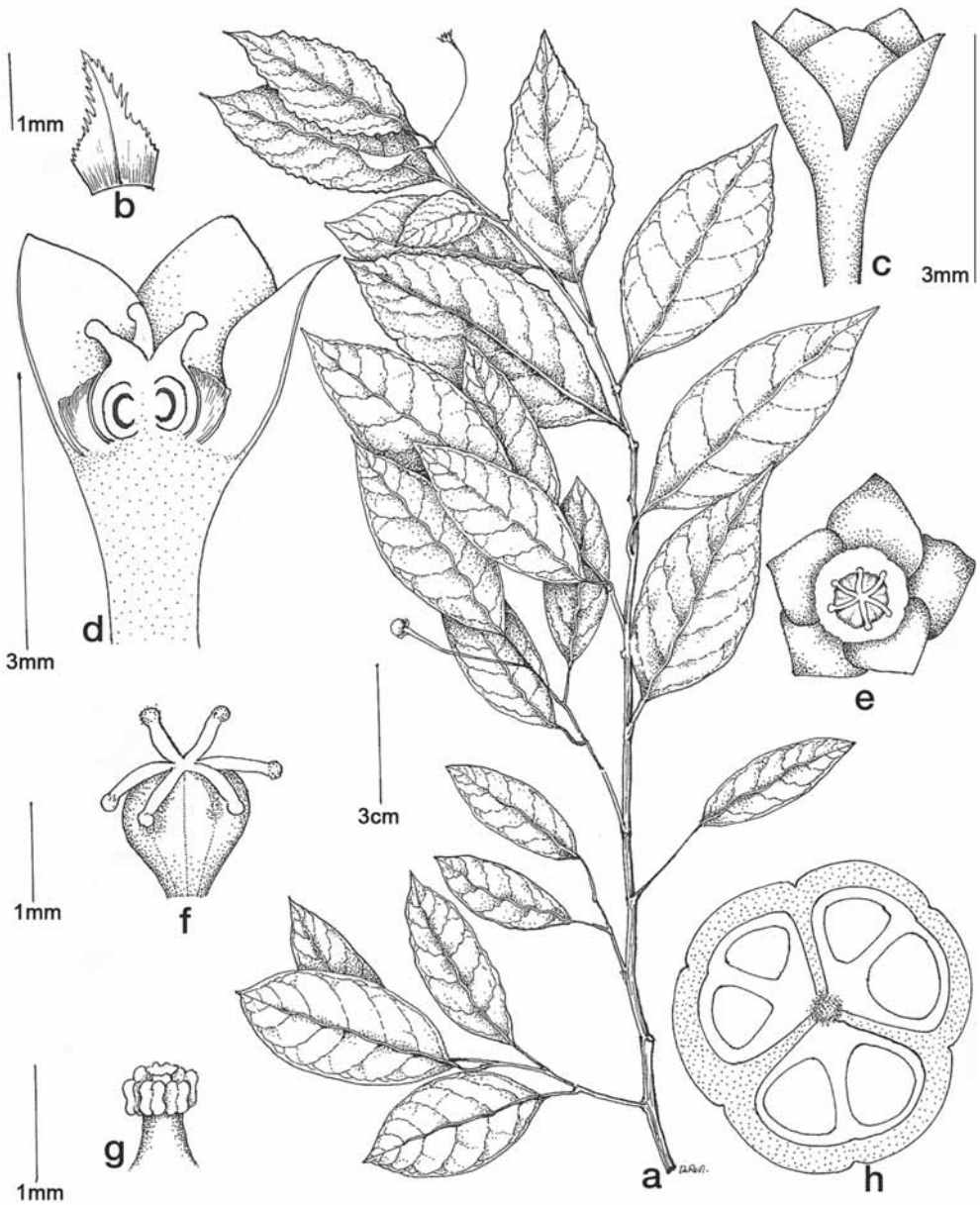
*Distrib.* India: Evergreen subtropical montane forests, between 1300 - 1800 m altitudes. Tamil Nadu (Anamalai hills). Rare and known only from the type collection (Anamalai hills, Fischer 3594 in K).

Endemic.

*Note.* The description given here is adopted from Webster (l. c.), as no herbarium material could be examined.

**2. *Meineckia longipes*** (Wight) G.L. Webster in Acta Bot. Neerl. 14: 352, ff. 6, 15, 23. 1965. *Peltandra longipes* Wight, Icon. Pl. Ind. Orient. 5(2): 25, t. 1891. 1852. *Phyllanthus longipes* (Wight) Müll. Arg. in Linnaea 32: 11. 1863; Hook.f., Fl. Brit. India 5: 287. 1887. *Neopeltandra longipes* (Wight) Gamble, Fl. Madras 2(7): 1286. 1925 (repr. ed. 2: 900. 1957). **Fig. 39**

Shrubs or undershrubs, ca 1 m high; entirely glabrous. Leaves narrowly ovate, ovate, oblong, narrowly oblong-elliptic, elliptic or oblong-lanceolate, unequal or sometimes equal and acute to subacute at base, entire to undulate along margins, caudate, acuminate or apiculate at apex, 3.5 - 12 x 1.3 - 4 cm, membranous to chartaceous; lateral nerves 5 - 10 pairs; petioles 7 - 20 mm long. Male flowers: not seen. Female flowers: solitary per axil or with 1 - 2 immature flowers; pedicels 3.5 - 7 cm long, filiform; sepals 5, broad, ovate to suborbicular, 1.5 - 2 mm long; disc annular, thick; ovary subglobose, ca 1.5 mm in diam.; styles 3, ca 0.5 mm long, free, bifid above. Fruits subglobose, ca 7 x 10 mm, 3-lobed, invaginated at apex, brown when dry.



**Fig. 39.** *Meineckia longipes* (Wight) G.L. Webster: a. habit; b. stipule; c. female flower; d. l. s. of female flower; e. female flower (top view); f. pistil; g. staminal column; h. t. s. of ovary.



*Fl. & Fr.* Sept. - Oct.

*Distrib.* India: Evergreen subtropical montane forests, at 1200 - 1800 m altitudes. Kerala and Tamil Nadu.

Endemic.

**3. *Meineckia macropus*** (Hook.f.) G.L. Webster in Acta Bot. Neerl. 14: 352. 1965. *Phyllanthus macropus* Hook.f., Fl. Brit. India 5: 287. 1887. *Neopeltandra macropus* (Hook.f.) Kanjilal et al., Fl. Assam 4: 150. 1940.

Shrubs, glabrous; branches proximally terete, distally angled; lenticels inconspicuous. Leaves ovate-elliptic to oblong-lanceolate, narrowed and obtuse at base, finely acuminate, crispate-undulate along margins when dry, 8 – 10 x 2 – 5 cm, membranous; midrib raised on both sides; lateral nerves 6 – 9 pairs; veinlets at right angles to the midrib or lateral veins, raised beneath; petioles 2.5 – 6.5 cm long. Male flowers: not seen. Female flowers: pedicels in fruit ca 2 cm long; podium indistinct; styles not seen. Fruits on long axillary pedicels; seeds ca 2.5 mm long, shallowly pitted.

*Distrib.* India: Arunachal Pradesh (Mishmi hills); rare, known only from type collection (Mishmi hills, Arunachal Pradesh, *Griffith* 4811 in K).

Endemic.

*Note.* Having seen no specimen, a fresh description was not possible. As per the original description, this species appears to be closely related to *M. longipes* but quite distinct in the much longer petioles.

**4. *Meineckia parvifolia*** (Wight) G.L. Webster in Acta Bot. Neerl. 14: 342., ff. 5, 11, 19. 1965; Sivar. & Manilal in J. Bombay Nat. Hist. Soc. 72: 237. 1975. *Peltandra parvifolia* Wight, Icon. Pl. Ind. Orient. 5: t. 1892. 1852. *Phyllanthus peltandrus* Müll.Arg. in Linnaea 32: 11. 1863. *Neopeltandra parvifolia* (Wight) Alston in Trimen Handb. Fl. Ceylon 6 (Suppl.): 256. 1931. *Phyllanthus thwaitesianus* Müll.Arg. l. c. 11. 1863; Hook.f., Fl. Brit. India 5: 287. 1887. *P. suberosus* Wight ex Müll.Arg. l. c. 11. 1863; Hook.f., l. c. 287. 1887. *Neopeltandra suberosa* (Wight ex Müll.Arg.) Gamble, Fl. Madras 2(7): 1286. 1925 (repr. ed. 2: 900. 1957).

Shrubs or perennial woody herbs up to 1 m high; branchlets minutely pubescent to glabrous. Leaves on stems up to twice larger than those on branches, narrowly ovate, ovate, ovate-elliptic, ovate-oblong, elliptic to suborbicular or oblong-elliptic, acute, obtuse, rounded or unequal at base, entire, acute, subacute, rounded or apiculate at apex, 1.6 - 8 x 1 - 4.5 cm, membranous, glabrous; lateral nerves 4 - 7 pairs; petioles slender, 2 – 5 (-25) mm long. Inflorescences axillary, very short racemes of both male and female flowers together. Male flowers: clustered on short peduncles or solitary at leaf-axils; pedicels filiform, 2 – 4 mm long; sepals 5, oblong-ovate, ca 1 x 0.8 mm; disc cupular or campanulate, 5-lobed; stamens 5, rarely 3, ca 9 mm long; filaments united below into ca 0.5 mm long column, trifid above; anthers up to 0.2 mm long. Female flowers: axillary, solitary; pedicels up to 2 cm long; sepals 5, ovate-orbicular, ca 1 x 1 mm; disc annular, ca 1 mm in diam.; ovary subglobose, ca 0.7 mm in diam., glabrous, 3-locular; styles 3, free, ca 0.6 mm long, bifid above. Fruits subglobose or depressed-globose, shallowly 3-lobed, ca 3 x 2 mm, glabrous.

*Fl. & Fr.* June - Jan.

*Distrib.* India: Subtropical evergreen forests at 1200 - 1800 m altitudes. Andhra Pradesh, Tamil Nadu and Kerala (Kozhikode Dist., Sivarajan & Manilal, l. c.).

Sri Lanka.

## 68. *Phyllanthus* L.

Trees, shrubs or herbs, monoecious, glabrous or with simple hairs; branching unspecialized with spiral or distichous phyllotaxy, or phyllanthoid with leaves on main axes reduced to cataphylls, subtending deciduous branchlets with distichous leaves. Leaves variable, simple, symmetric or sometimes asymmetric, entire, penninerved, short-petioled; stipules varied, entire to fimbriate, sometimes scarious along margins, often peltate, rarely hardening and becoming spinescent on older branches. Inflorescences usually axillary, fasciculate or solitary, unisexual or bisexual, sometimes flowers in racemes on panicles; bracteoles 2 per flower, entire to fimbriate and often scarious along margins, often peltate. Male flowers: sepals 3 + 2 or 3 or sometimes 2 + 2, free, imbricate, entire to fimbriate and often white on scarious along margins; petals absent; disc glands of various shapes and sizes; stamens 3 - 6; filaments free or connate; anthers 2-loculed, free or occasionally connate, vertically or transversely dehiscent; pistillode absent. Female flowers: pedicellate or occasionally subsessile; sepals 3 + 2 or 3, as in male, occasionally accrescent; petals absent; disc cupular-annular or flat, entire, crenate or lobed or divided into segments; ovary usually 3-locular, in a few species 4 - 12-locular; locules biovulate; ovules anatropous or amphitropous; styles 3, short, free or shortly connate, bifid. Fruits mostly dehiscent capsules, occasionally baccate or drupaceous; cocci crustaceous, mostly 3, bivalved, separating from a persistent columella; seeds 2 per locule, trigonous; testa smooth or sculptured, exarillate; endosperms cartilaginous; embryo straight or slightly curved; cotyledons usually broader than the radicle.

A large and very diverse genus of 750 - 850 species, widespread in tropical and subtropical regions around the world; 51 species in India.

*Literature:* CHAUDHARY, L. B. & R. R. RAO (2002). Taxonomic study of herbaceous species of *Phyllanthus* L. (Euphorbiaceae) in India. *Phytotaxonomy* 2: 143 - 162. GANGOPADHYAY, M., T. CHAKRABARTY & N. P. BALAKRISHNAN (2004). On the status of *Phyllanthus airyshawii* and *P. kozhikodensis* (Euphorbiaceae). *J. Econ. Taxon Bot.* 28: 585 - 590. 2004 (2005). MITRA, R. L. & M. SANJAPPA (2003). *Phyllanthus parvifolius*, *P. clarkei* (Euphorbiaceae) and related Indian taxa. *Bull. Bot. Surv. India* 45: 1 - 20, ff. 1 - 4. 2003 (2004). WEBSTER, G. L. (1956 - 1958). A monographic study of the West Indian species of *Phyllanthus*. *J. Arnold Arbor.* 37: 91 - 122, 217 - 268, 340 - 359; 38: 51 - 80, 170 - 198, 295 - 373; 39: 49 - 100, 111 - 212.

### KEY TO THE SPECIES

- |   |  |   |
|---|--|---|
| 1 | a. Fruits more or less fleshy, drupaceous or baccate   | 2 |
|   | b. Fruits dry dehiscent, capsular  | 6 |
| 2 | a. Fruit a berry, 3.5 - 10 mm in diam.   | 3 |
|   | b. Fruit a drupe, 1 - 3 cm in diam.  | 4 |
| 3 | a. Stamens of inner whorl connate at base; female pedicels filiform; styles 5 - 10 (-12), up to 0.5 mm long, triangular, free or very shortly connate at base; berries 5 - 10 (- 12)-locular |   |

**35. *P. reticulatus***

- b. Stamens all free; female pedicels thickened upwards; styles 3, 2 - 2.5 mm long, connate below into a column (0.5 - 1 mm long), bifid above; berries 3-locular **33. P. glaucus**
- 4 a. Leaves ovate, oblong to elliptic, 3 - 9 x 1.5 - 4 cm, distantly distichous; sepals 4; stamens 4; filaments free **1. P. acidus**
- b. Leaves linear-oblong to narrowly oblong-elliptic, 3 - 22 x 1 - 7.5 mm, closely distichous; sepals 6; stamens 3; filaments connate into a column 5
- 5 a. Leaves usually 100 or more pairs per branchlet, closely distichous and often overlapping, linear-oblong, 3 - 20 x 1 - 5 mm; petioles 0.4 - 1 mm long **2. P. emblica**
- b. Leaves up to 50 pairs per branchlet, not closely distichous, not overlapping, only touching each other, oblong, oblong-elliptic to linear-oblong, 10 - 25 x 2 - 10 mm; petioles 1 - 3 mm long **3. P. indofischeri**
- 6 a. Leaves arising singly and 2 - 3-together at the same axil **27. P. myrtifolius**
- b. Leaves always arising singly at leaf-axils 7
- 7 a. Annual herbs 8
- b. Perennial undershrubs, shrubs or trees 20
- 8 a. Leaves white hispidulous beneath along margins; female flowers subsessile; fruits tuberculate on up to 0.5 mm long pedicels **51. P. urinaria**
- b. Leaves beneath glabrous or at least not white hispidulous along margins; female flowers pedicellate; fruits smooth, on more than 1 mm long pedicels 9
- 9 a. Proximal leaves of leaf-bearing branchlets double the size of the distal leaves **37. P. airyshawii**
- b. All leaves of branchlets more or less of the same size
- 10 a. Venation of leaves immersed; plants occurring mostly on sandy beaches **49. P. rotundifolius**
- b. Venation of leaves (at least lateral nerves) visible at least on the under surface; plants not strandline 11
- 11 a. Cymules mostly (90%) consisting of one male and one female flowers **39. P. amarus**
- b. Cymules otherwise 12
- 12 a. Stipules peltate, cordate or sagittate at base 13
- b. Stipules neither peltate nor cordate or sagittate at base 15
- 13 a. Anthers connate into a subglobose mass, vertically dehiscent; ovary and fruits smooth **26. P. maderaspatensis**
- b. Anthers free, transversely dehiscent; ovary and fruits verrucose or muriculate 14
- 14 a. Leaves 5 - 10 mm long, thickened along margins; male flowers subsessile; female pedicels 1.5 - 3 mm long; fruiting pedicels 3 - 4 mm long **28. P. narayanswamii**
- b. Leaves 6 - 25 mm long, flat along margins; male pedicels 1.5 - 3 mm long; female pedicels (2.5 -) 4 - 10 mm long; fruiting pedicels 5 - 15 mm long **32. P. simplex**
- 15 a. Sepals 5; stamens 5 16
- b. Sepals 6; stamens 3 17
- 16 a. Herbs, becoming shrubby, up to 45 cm high; cataphylls present; stipules linear to triangular lanceolate, entire, unlobed; leaves elliptic to oblong-elliptic, lateral veins distinct and raised on both surfaces; female disc annular, entire, fleshy **36. P. tenellus**
- b. Herbs, up to 10 cm high; cataphylls absent; stipules linear-lanceolate, often lobed or lacinate at basal portion; leaves spatulate or obovate, lateral veins not visible; female disc of 5 distinct rectangular or tongue-shaped glands **38. P. ajmerianus**

- 17 a. Leaves scabridulous with white hairs on lower surface; venation distinct on the upper surface; stipules serrate **31. P. scabrifolius**  
 b. Leaves not scabridulous nor white hairy beneath; venation inconspicuous on the upper surface; stipules entire 18
- 18 a. Female disc crenate or shallowly lobed; leaves usually narrowed at apex to a point; antherthecae dehiscing horizontally or obliquely **42. P. debilis**  
 b. Female disc deeply dissected; leaves rounded, obtuse, apiculate or subacute at apex; antherthecae dehiscing vertically 19
- 19 a. Branchlets usually scabrid-hispidulous at the angles; petioles 0.4 - 1 mm long; stipules 0.4 - 1 mm long; bracts up to 1 mm long; filaments united into a column **43. P. fraternus**  
 b. Branchlets glabrous; petioles 1 - 1.5 mm long; stipules 1 - 2 mm long; bracts 1 - 2 mm long; filaments free at least halfway above **30. P. rheedei**
- 20 a. Sepals in male flowers 4 (*Eriococcus*) 21  
 b. Sepals in male flowers 5 - 6 37
- 21 a. Fruits enclosed by the enlarged calyx **12. P. macrocalyx**  
 b. Fruits not enclosed by the enlarged calyx 22
- 22 a. Branchlets leafless or with suppressed leaves along the upper portion 23  
 b. Branchlets with normal leaves at upper portion 26
- 23 a. Branchlets and often nerves on leaves beneath pubescent 24  
 b. Plants entirely glabrous 25
- 24 a. Leaves 1 - 3 x 0.5 - 1.3 cm, chartaceous to thinly coriaceous, glabrous; lateral nerves 5 or 6 pairs; petioles ca 1 mm long; male cymules 1-flowered; filaments almost free; fruits glabrous **14. P. pulcher** (p. p.)  
 b. Leaves 2 - 5 x 1 - 3 cm, membranous to thinly chartaceous, mostly pilose beneath on nerves; lateral nerves 6 - 11 pairs; petioles 1.5 - 3 mm long; male cymules 3 - 5-flowered; filaments united into a column; fruits evanescently papillose-puberulous **17. P. sikkimensis**
- 25 a. Apices of branchlets leafless; leaves acute to attenuate-mucronate at apex, often marbled with white, purple or brown along veins; stipules epeltate; male sepals entire; disc 2-lobed, fleshy; fruits 6 - 8 mm in diam. **4. P. bailloneanus**  
 b. Apices of branchlets with suppressed leaves; leaves apiculate at apex, not marbled; stipules peltate; male sepals lanceolate; disc of 4 distinct glands; fruits ca 10 mm in diam. **9. P. gageanus**
- 26 a. Leaves 3 - 12 cm long 27  
 b. Leaves 0.5 - 3 cm long 31
- 27 a. Branchlets tomentellous 28  
 b. Plants entirely glabrous 29
- 28 a. Leaves acute, subacute or shortly acuminate (acumen up to 5 mm long) at apex; female cymules pedunculate, fasciculate; female and fruiting pedicels 10 - 15 mm long; fruits 4 - 6 mm in diam. **19. P. tetrandrus**  
 b. Leaves usually acuminate or caudate (acumen on cauda 10 - 20 mm long) at apex; female cymules epedunculate, 1-flowered; female and fruiting pedicels 2 - 7 mm long; fruits 8 - 20 mm in diam. **10. P. gomphocarpus**
- 29 a. Sepals all entire; male pedicels 10 - 12 mm long **5. P. beddomei**  
 b. Sepals (at least in male flowers) fimbriate or denticulate; male pedicels up to 5 mm long 30
- 30 a. Leaves chartaceous to thinly coriaceous; fruits ca 0.6 cm in diam. **8. P. fimbriatus**  
 b. Leaves membranous; fruits 2 - 3 cm in diam. **13. P. megacarpus**
- 31 a. Leaf bearing branchlets arising in fascicles of 3 - 5; leaves linear-oblong to narrowly oblong **18. P. talbotii**

- b. Leaf bearing branchlets arising singly; leaves otherwise 32
- 32 a. Fruits villous 33
- b. Fruits glabrous 34
- 33 a. Leaves 0.5 - 1 cm long; male cymules 1-flowered; anthers sessile; female and fruiting pedicels up to 10 mm long **6. P. chandrasekari**
- b. Leaves 1 - 2.7 cm long; male cymules 2 or 3-flowered; anthers on ca 1 mm long column; female and fruiting pedicels 10 - 20 mm long **7. P. cinereus**
- 34 a. Lateral nerves of leaves immersed or faint; nervules hidden; stipules peltate, hastate at base 35
- b. Lateral nerves and nervules of leaves visible at least on the under surface; stipules epeltate, not hastate at base 36
- 35 a. Phyllanthoid branches crowded towards tip of stem; lateral nerves of leaves hidden; sepals lacerate; bracts lacerate to denticulate **17. P. singampattianus**
- b. Phyllanthoid branches scattered along the stem; lateral nerves of leaves faint; sepals entire to undulate; bracts entire **15. P. rangachariarii**
- 36 a. Branchlets rufous tomentellous to scattered whitish puberulous or pilose; lateral nerves of leaves 5 or 6 pairs, arising at 35° to 45° angles with the midrib; filaments ca 0.3 mm long, almost free; fruits without a stipe **14. P. pulcher** (p. p.)
- b. Branchlets glabrous; lateral nerves of leaves 6 - 11 pairs, arising at 45° to 70° angles with the midrib; filaments ca 1 mm long, connate into a column; fruits shortly stipitate **11. P. heyneanus**
- 37 a. Branchlets leafless and bearing dense-flowered fascicles at apical portion; staminal column long, slender, exerted; stylar column stout, exerted 38
- b. Branchlets with normal leaves at apical portion 39
- 38 a. Shrubs or small trees, 2 - 3 m tall; leaf-bearing branchlets 5 - 17 cm long, glabrous; petioles glabrous; pseudoracemes 1 - 5 cm long; fruiting pedicels 3 - 4 mm long **21. P. andamanicus**
- b. Trees 3 - 12 m tall; leaf-bearing branchlets 15 - 60 cm long, rufous tomentellous; petioles rusty tomentellous; pseudoracemes 10 - 20 cm long; fruiting pedicels 5 - 10 mm long **23. P. columnaris**
- 39 a. Inflorescences ramiflorous, glomerulate; seeds hollow at the hilum **34. P. pinnatus**
- b. Inflorescences axillary, fasciculate or solitary or flowers in axillary or supra-axillary racemes or spikes 40
- 40 a. Flowers in axillary or supra-axillary racemes and spikes **22. P. baecobotryoides**
- b. Flowers in axillary fascicles or solitary 41
- 41 a. Stipules peltate 42
- b. Stipules epeltate 46
- 42 a. Leaves scattered reddish brown hirsute on the lower surface **25.1. P. macraei** var. **hispidus**
- b. Leaves glabrous on the lower surface 43
- 43 a. Male pedicels ca 15 mm long; sepals recurved; filaments 2 - 3.5 mm long, united below (for 3/4th length) into a slender column **44. P. griffithii**
- b. Male pedicels 1.5 - 3 mm long; sepals erect or spreading; filaments up to 0.8 mm long, free or shortly connate below into a column 44
- 44 a. Female and fruiting pedicels 15 - 30 mm long, filiform **25.2. P. macraei** var. **macraei**
- b. Female and fruiting pedicels 5 - 12 mm long 45
- 45 a. Leaves usually obovate, rounded or subobtusate at apex, membranous to chartaceous; flowers arising on short pulvini; fruits 3 - 3.5 mm in diam. **46. P. praetervisus**

- b. Leaves narrowly oblong, elliptic to ovate-elliptic, apiculate or acute-mucronate at apex, coriaceous to chartaceous; flowers arising amidst tufts of bracts, often forming short brachyblasts; fruits 2 - 2.5 mm in diam. **48. P. roeperianus**
- 46 a. Leaves 3.5 - 9 cm long **20. P. anamalayanus**  
 b. Leaves 0.2 - 3.5 cm long 47
- 47 a. Stipules on main branches hardening and becoming spiniform 48  
 b. Stipules on main branches not modified into spines, or if spiniform then deciduous 49
- 48 a. Stipular spines persistent; leaves oblong, elliptic-oblong to linear-oblong, 2 - 8 x 1 - 3 mm, stiff chartaceous; filaments connate into a column to about the middle; styles ca 1.5 mm long, united below into a column; fruiting pedicels up to 1.5 mm long **24. P. lawii**  
 b. Stipular spines deciduous; leaves obovate (or narrowly so) obovate-elliptic to obovate-oblong 4 - 15 x 2 - 7 mm, membranous; filaments free; styles 0.5 - 1 mm long, free; fruiting pedicels 2 - 6 mm long **47. P. pseudoparvifolius**
- 49 a. Leaves linear-oblong to narrowly oblong, usually slightly constricted at the middle; nervules very prominent on the under surface **29. P. polyphyllus**  
 b. Leaves obovate, elliptic to oblong, not constricted at the middle; nervules obscure or less conspicuous on the under surface 50
- 50 a. Petioles 0.2 - 1 mm long 51  
 b. Petioles 1 - 2.5 mm long 52
- 51 a. Branchlets scaberulous at angles; leaves membranous to firmly chartaceous, rounded, truncate, retuse or apiculate at apex; lateral nerves prominent to very prominent on the under surface; petioles 0.5 - 1 mm long; styles free **41. P. clarkei**  
 b. Branchlets glabrous; leaves coriaceous, obtuse-mucronate at apex; lateral nerves faint on the under surface; petioles 0.2 - 0.4 mm long; styles connate below into a column **50. P. sanjappae**
- 52 a. Plants densely hairy; leaf-bearing branches solitary at each node; leaves firmly chartaceous, curling down along margins; flowers subtended by tufts of subflabellate fimbriate bracts; male flowers solitary or accompanied by a female flower in cymules **40. P. brevipes**  
 b. Plants entirely glabrous; leaf-bearing branches often 2 or 3 at each node; leaves membranous, flat along margins; flowers subtended by entire bracts; male flowers paired or up to 10-flowered in each cymule **45. P. leschenaultii**

## KEY TO THE SUBGENERA

- 1 a. Herbs, shrubs or trees; branching not phyllanthoid; leaves on main stems spiral or distichous, not reduced to scales; stamens 3; filaments shortly connate for short length or free; anthers dehiscent horizontally; styles bifid **Subg. 3. Isocladus**  
 b. Shrubs, herbs or trees; branching phyllanthoid, if not then plants shrubby; leaves on main stems spirally arranged, leaves on deciduous branchlets distichous; stamens 2 - 15; filaments connate for greater part; anthers dehiscent longitudinally or horizontally; styles entire or bifid 2
- 2 a. Woody shrubs; sepals 4 in male, 6 in female, toothed, lacerate or fimbriate, rarely subentire; stamens 2 or 3; filaments usually connate; pollen grains globose, porate; fruits capsular, dry or somewhat fleshy **Subg. 2. Eriococcus**  
 b. Herbs, woody herbs or trees; sepals 5 or 6 in both male and female, entire, not lacerate nor fimbriate; male sepals 5 or 6; stamens 2 - 15; filaments free or connate; pollen grains not porate, areolate, colporate, striate or foveolate; fruits various 3
- 3 a. Stamens 2 - 15, free or more commonly united; pollen grains globose, areolate; carpels 3; fruits 6-seeded **Subg. 6. Xylophylla**

- b. Stamens 2 - 6; pollen grains colporate, striate or foveolate; carpels 3 or 4; fruits 6 or 8-seeded  
4
- 4 a. Stamens 5 or 6; anthers elongate; pollen grains tricolporate; carpels 3 - 10; fruits baccate, 3-  
or 8 - 16-seeded Subg. **4. Kirganelia**
- b. Stamens 2 - 4; anthers short; pollen grains colporate, striate or foveolate; carpels 3 or 4; fruits  
6-seeded 5
- 5 a. Trees with drupaceous or pithy fruits; pollen grains colporate; carpels 3 or 4  
Subg. **1. Cicca**
- b. Herbs or low woody shrubs with capsular fruits; pollen grains colporate, striate or  
foveolate; carpels 3 Subg. **5. Phyllanthus**

### Subgenus **1. Cicca** (L.) G.L.Webster

Trees or shrubs, monoecious or dioecious; branching phyllanthoid. Inflorescences fascicled, cauliflorous. Male flowers: calyx-lobes 4 or 6; disc 4 or 6 lobes or absent; stamens 3 or 4; filaments free; anthers dehiscent vertically; pollen grains 3-colporate. Female flowers: calyx-lobes 4 or 6; disc urceolate or absent; ovary of 2 - 4 carpels; styles bifid, free or shortly connate at base. Fruits drupaceous or woody, indehiscent, sometimes dehiscent ultimately; seeds 1 or 2 in each fertile locule.

Asia and New World, ca 6 species; 3 species in India.

**1. Phyllanthus acidus** (L.) Skeels in U.S.D.A. Bur. Pl. Industr. Bull. 148: 17. 1909; G.L. Webster in J. Arnold Arbor. 38: 66. 1957. *Averrhoa acida* L., Sp. Pl. 428. 1753. *Cicca disticha* L., Mant. Pl. 1: 124. 1767; Gamble, Fl. Madras 2(7): 1346. 1925 (repr. ed. 2: 942. 1957). *Phyllanthus distichus* (L.) Müll.Arg. in DC., Prodr. 15(2): 413. 1866; Hook.f., Fl. Brit. India 5: 304. 1887.

Beng.: *Hariphal, Loda, Noari*; Eng.: Country Gooseberry, Star Gooseberry, Malay Gooseberry; Hindi: *Chalmeri, Harparauri*; Kan.: *Ananelli, Karinelli, Rayaranelli*; Kon.: *Rajamvali*; Mal.: *Arinelli, Nellippuli*; Mar.: *Harparawri, Rainvala*; Or.: *Naarkuli*; Sans.: *Ghana, Kamala-valkala, Lavani*; Tam.: *Arinelli, Arunelli, Sadadaaram, Sadagam*; Tel.: *Rachayusirika, Ratsamsirika*; Urdu: *Harpharuri*.

Trees, 5 - 20 m tall, deciduous, entirely glabrous; leaf-bearing branchlets crowded towards tips of branches, arising from old scars, 20 - 50 cm long. Leaves ovate to ovate-lanceolate or ovate-oblong to oblong-elliptic, slightly oblique and acute, obtuse to rounded at base, acute, subacute, apiculate to acuminate at apex, 3 - 9 x 1.5 - 4 cm, chartaceous or sometimes membranous, often glaucous beneath; lateral nerves 5 - 8 pairs; petioles 1.5 - 4 mm long; stipules lanceolate, ca 1 x 0.4 mm, thin, entire to fimbriate. Inflorescences cauli- or ramiflorous, racemiform, 2 - 5-together above the leaf scars, 4 - 10 cm long; male cymules many-flowered, female cymules 1-flowered, 1 or 2 per raceme; bracts lanceolate, 0.5 - 0.8 mm long, scarious and fimbriate along margins. Male flowers: pedicels 1 - 2 mm long; sepals 2 + 2, ovate to suborbicular, 1 - 2 x 1 - 1.8 mm; disc glands 4, suborbicular; stamens 4, free, 2 - 3 mm long; anthers ellipsoid-oblong, ca 0.4 mm long, longitudinally dehiscent. Female flowers: pedicels 2 - 4 mm long; sepals 2 + 2, ovate to suborbicular, 1.5 - 2 x 1 - 1.5 mm; disc lobulate, ca 1 mm across; ovary subglobose, ca 1 mm in diam., 3 or 4-locular; styles free, 1.5 - 2 mm long, deeply bifid, reflexed. Fruits drupaceous, in dangling clusters on branches, globose or depressed-globose, 1.2 - 1.5 x 1.7 - 2.2 cm, shallowly 6 - 8-lobed, yellowish when ripe, pulpy, acidic, indehiscent; fruiting pedicels 3 - 5 mm long.

*Fl. & Fr.* March - Sept.

*Distrib.* India: Widely cultivated in West Bengal and all southern States.

Probably native of the coastal region of NE. Brazil. Some suggest that this species is native of Madagascar and/or India.

Widely grown in Bangladesh, Myanmar, Vietnam, Cambodia, Laos, Thailand, Malaysia, Indonesia and Philippines.

*Uses.* The fruits are sour and eaten raw, cooked or pickled. The fruits find use to make soft drinks, jelly, vinegar, syrup, etc. They are astringent, hepatotonic and reported to purify and enrich the blood. It is also useful in biliousness, vomiting, constipation, piles, bronchitis, improving appetite, etc. The root and seeds are cathartic (Kirtikar & Basu, Indian Med. Pl. ed. 2, 3: 2227, t. 862A. 1935). The leaves also possess medicinal properties. In Kerala, the fresh leaves are made into a paste, mixed with pepper, and used externally for rheumatic complaints. The fruits are rich in Vitamins C and B group, iron, calcium and phosphorous.

**2. *Phyllanthus emblica* L.**, Sp. Pl. 982. 1753; Roxb., Fl. Ind., ed. Carey 3: 671. 1832; Hook.f., Fl. Brit. India 5: 289. 1887. *Emblica officinalis* Gaertn., Fruct. Sem. Pl. 2: 122, t. 108, f. 2. 1791; Wight, Icon. Pl. Ind. Orient. 5: 26, t. 1896. 1852; Haines, Bot. Bihar Orissa 2: 128. 1921; Gamble, Fl. Madras 2(7): 1295. 1925 (repr. ed. 2: 906. 1957); Kanjilal et al., Fl. Assam 4: 159. 1940.

Asm.: *Amalaki, Anola, Eola*; Beng.: *Amlaki*; Burm.: *Zibyu, Ta-ma-pen*; Eng.: *Emblic myrobalan tree*; Garo.: *Ambari*; Guj.: *Amalan, Amali, Ambala, Ambri*; Hindi: *Amla, Amalaka, Aonla*; Kan.: *Nelli, Nellika, Nelli-mara*; Kh. *Soh-myr-lain*; Kon.: *Amrali, Auna*; Lep.: *Amlokung, Suom*; Mal.: *Amlakam, Nelli, Nellikka, Nellikka-maram*; Mar.: *Amla, Anvala, Anoli, Avla*; Nep.: *Amala*; Or.: *Alathanda, Amalaki, Aonla*; Sans.: *Amraphala, Amlaki, Adiphala, Dhatri, Jatiphala, Karshaphala, Pancharrsha* etc.; Sant.: *Meral*; Tam.: *Amalagam, Kattunelli, Indul-nelli, Nelli, Nellikkai, Perunelli, Toppi-nelli*; Tel.: *Amlakamu, Nelli, Pullayasinika, Udirika, Usiriki*; Urdu: *Anwala, Ounla, Oura*.

Trees, 3 - 15 m high; young parts puberulous; leaf-bearing branchlets arising singly or in pairs from scars of previous year, 3 - 30 cm long, tomentellous to glabrous. Leaves closely distichous, symmetric or sometimes oblique, linear-oblong, rounded, subcordate or truncate at base, slightly inflexed, thickened or scarious along margins, rounded, obtuse, apiculate or mucronate at apex, 3 - 20 x 1 - 5 mm, chartaceous to thinly coriaceous, glabrous above, glabrous or occasionally sparsely puberulous beneath; lateral nerves 5 - 12 (- 15) pairs; petioles 0.4 - 1 mm long, puberulous to glabrous; stipules triangular, 1 - 1.5 x 0.3 - 0.6 mm, ciliate, denticulate along margins. Inflorescences arising with young flush of leaves; cymules fascicled, usually crowded towards the proximal portions of the branchlets, also on leafless racemes, 1.5 - 3 cm long, usually consisting of solely male flowers or one central female and the remainder male flowers; bracts triangular-acuminate, 0.8 - 1.5 x 0.2 - 0.5 mm, entire. Male flowers: pedicels 1 - 4.5 mm long, glabrous; sepals 3 + 3, oblong-obovate, flabellate-obovate to spatulate-ob lanceolate, subequal, 1 - 2.5 x 0.5 - 2 mm, thin and entire to slightly wavy along margins, glabrous; disc glands 6, clavate or sub-triangular, ca 0.2 mm across; stamens 3; filaments connate into a column (0.5 - 1 mm long); anthers oblong, 0.5 - 1 mm long, connate into a squarish or globose mass. Female flowers: subsessile or pedicels up to 0.5 mm long; sepals 3 + 3, oblong-obovate to oblanceolate, 1.5 - 3 x 0.5 - 2 mm, entire to minutely denticulate; disc shortly cupular-annular, deeply 6-lobed,



0.5 - 1 mm across; ovary ovoid, 3-locular, ca 0.8 mm in diam., glabrous; styles 3, 2 - 3 mm long, shortly connate below into a column, bifid to quadrifid above, recurved. Fruits drupaceous, globose, 1.5 - 3 cm in diam., indehiscent, pale green or yellowish green; epicarp fleshy, smooth, obscurely 6-lobed; endocarp hard, crustaceous.

*Fl. & Fr.:* Aug. – June.

*Distrib.* India: Common in deciduous forests, scrub, riverbanks etc., up to 1200 (- 1800) m altitude; frequently cultivated; almost throughout the country including Andaman Islands.

Sri Lanka, Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, Thailand, China, W. Malesia and Lesser Sunda Islands.

*Uses.* The mature fruits are very sour, eaten raw or preserved as pickles. Available literature (Kirtikar & Basu, Indian Med. Pl. ed. 2, 3: 2220, t. 858. 1935; Wealth of India 3: 168 - 170. 1952) emphasize that *Phyllanthus emblica* is an important traditional plant of medicine and often considered as a sacred tree. The fruit is an essential article in Hindu Materia Medica and has been held in high esteem in indigenous medicine. The most popular use of the fruits is in 'Chyawanaprash' a general tonic for young and old for health, vitality and for retarding the aging process in elderly people. It is a component in the medicinal preparation called 'Trifala', useful to provide resistance to common cold and viral infections. The fruit contains about 2 per cent Vitamin C and is the richest known natural source of this vitamin. Fermented liquor prepared from the fruits is used in jaundice, dyspepsia and cough and along with limejuice for arresting acute dysentery.

Leaf juice is used for eye infection, fruit paste against diarrhoea and fruits used as cooling agent and as laxative by tribes of Virudunagar in Tamil Nadu (Rajendran et al., Indian J. Trad. Med. 1: 67. 2002). Root and bark are astringent. Fruits also used as shampoo. Coconut oil boiled with the fruit, if used regularly, promotes hair growth, ensures black hair and produces sound sleep at night.

**3. *Phyllanthus indofischeri*** Bennet in Indian Forester 109: 221. 1983; C.J. Saldanha, Fl. Karnataka 2: 157. 1996. *Emblica fischeri* Gamble in Bull. Misc. Inform. Kew 1925: 330. 1925 & Fl. Madras 2(7): 1295. 1925 (repr. ed. 2: 906. 1957). *Phyllanthus fischeri* (Gamble) J.L.Ellis in Bull. Bot. Surv. India 22: 193. 1980 (1982) (non Pax, 1895). *P. cecilfischeri* J.L.Ellis in Bull. Bot. Surv. India 24: 209. 1982 (1983).

Trees, up to 7 m tall; branches finely pubescent. Leaves subsessile, distichous, up to 50 on each leaf-bearing branchlets, narrowly elliptic-oblong, truncate or rounded at base, rounded-apiculate or retuse at apex, 15 – 25 x 5 – 10 mm; petioles 1 – 3 mm long; stipules linear, acute. Flowers: in axillary fascicles. Male flowers: many in upper axils of branchlets; filaments connate; disc glands large. Female flowers: few in lower axils of branchlets; disc urceolate; styles thin, twice bifid, recurved. Fruits globose, deeply trilobed with 3 pyrenes, fleshy, drupaceous, ultimately dehiscent.

*Fl.* Dec. - July.

*Distrib.* India: Tropical and subtropical deciduous or semideciduous forests, up to 1200 m altitude. Tamil Nadu, Karnataka and Andhra Pradesh.

Endemic.

### Subgenus 2. **Eriococcus** (Hassk.) Croizat & Metc.

Shrubs or small trees, monoecious; branching phyllanthoid. Male flowers: calyx-lobes 4 – 6, entire to conspicuously lacerate; disc cupular or with distinct lobes; stamens 2 or 3; filaments connate; anthers dehiscing vertically to horizontally; pollen grains globose, porate. Female flowers: calyx-lobes 4 – 6; disc pateliform or urceolate; ovary of 3 – 8 carpels, smooth or hirsute; styles bifid, entire or connate. Fruits capsular.

S. India, NE. India, Andaman & Nicobar Islands and Sri Lanka to Malaysia and Philippines, 25 species; 14 species indigenous and one (*P. pulcher*) under cultivation in India.

**4. *Phyllanthus baillonianus*** Müll.Arg. in *Linnaea* 32: 47. 1863 & in DC., *Prodr.* 15(2): 422. 1866; Hook.f., *Fl. Brit. India* 5: 300. 1887. *Reidia latifolia* Wight, *Icon. Pl. Ind. Orient.* 5(2): 28, t. 1904, f. 2 (in icon f. 3). 1852, non *Phyllanthus latifolius* (L.) Sw., 1800. *Epistylum cordifolium* Baill. [*Etude Euporb.* 648. 1858, nom. nud.]. *E. latifolium* (Wight) Thwaites, *Enum. Pl. Zeyl.* 283. 1861. *Reidia bailloniana* (Müll.Arg.) Gamble, *Fl. Madras* 2(7): 1293. 1925 (repr. ed. 2: 904. 1957).

Undershrubs or subshrubs, 0.6 - 1.5 m high, entirely glabrous; main stems bearing reduced scaly leaves; leaf-bearing branchlets 15 - 50 cm long, leafless at tips. Leaves obliquely ovate, ovate-triangular to lanceolate or sometimes rhombate-ovate, acute, obtuse to rounded at base, acute, acute-mucronate or attenuate-mucronate at apex, 2.5 - 7.5 x 1.5 - 3 (- 3.5) cm, thinly coriaceous, chartaceous to membranous, often glaucous beneath, sometimes marbled with white, purple or brown along venation; lateral nerves 6 - 12 pairs; petioles 1.5 - 3 mm long; stipules lanceolate-filiform, linear or triangular-acuminate, 1.5 - 3.5 x 0.8 - 1.5 mm, entire. Inflorescences at the upper leaf axils and bracteate nodes of terminal leafless racemes; male cymules 1 - 3-flowered, in the latter case one flower maturing at a time; female cymules towards the tips, 1 or 2 flowered; bracts linear-lanceolate or subulate, (0.5 -) 3 - 5 mm long, entire; flowers red. Male flowers: pedicels 5 - 12 mm long, filiform; sepals 2 + 2, orbicular to orbicular-flabellate, 1.8 - 2 x 2 - 2.5 mm, entire; disc 4, paired into 2 lobes, fleshy, mucronate; stamens 2, ca 1 mm long; filaments very stout, connate into a small mass; anther cells broadly oblong-ellipsoid, ca 0.4 mm long, widely separated, horizontal. Female flowers: pedicels 8 - 15 x 0.3 (at base) - 1.2 (at apex) mm; sepals 3 + 3, broadly ovate to orbicular-obovate, 1.8 - 3.5 x 1.8 - 3 mm, entire; disc concave-cupuliform or annular and flat, 6-segmented or wavy, 1.5 - 3 mm across, with minute white tubercles; ovary subglobose, 1 - 2 mm in diam., smooth; styles 3, free, 1 - 1.3 mm long, each bipartite halfway. Fruits subglobose, 5 - 6 x 6 - 8 mm, tricocous, smooth; fruiting pedicels 15 - 30 x 0.5 (at base) - 2 (at apex) mm.

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

*Distrib.* India: Common in mixed forests between (200-) 950 - 1500 m altitudes in Tirunelveli district, rare elsewhere. Tamil Nadu.

Sri Lanka.

**5. *Phyllanthus beddomei*** (Gamble) M.Mohanani in J. Econ. Taxon. Bot. 6: 480. 1985. *Reidia beddomei* Gamble in Bull. Misc. Inform. Kew 1925: 331. 1925 & Fl. Madras 2(7): 1293. 1925 (repr. ed. 2: 904. 1957).

Undershrubs, erect, entirely glabrous; leaf-bearing branchlets reddish brown. Leaves ovate, widely ovate to suborbicular or ovate-oblong, rounded, obtuse or unequal at base, acute or apiculate at apex, 3 - 5 x 2 - 3 cm, membranous, glaucous beneath; lateral nerves 6 - 8 pairs; petioles 2 - 3 mm long; stipules minute. Inflorescences axillary; male cymules at the proximal axils, 1 or 2-flowered; female cymules at the tips, 1 or 2-flowered; bracts lanceolate, ca 2 mm long, entire. Male flowers: pedicels 10 - 12 mm long; sepals 2 + 2, ovate to oblong, up to 5 x 3 mm, entire; disc 4-lobed, punctate; stamens 2; filaments connate into a stout column; anthers horizontal. Female flowers: pedicels up to 2 cm long; sepals 3 + 3, ovate, elliptic to oblong, 6 - 10 x 3 - 6 mm, entire; disc patelliform, crenate, punctate; ovary 3-locular; styles bifid, spreading. Fruits not seen.

*Fl.* July.

*Distrib.* India: Rare at 1500 - 1600 m altitude. Tamil Nadu and Kerala.

Endemic.

**6. *Phyllanthus chandrasei*** Govaerts & Radcl.-Sm. in Kew Bull. 51: 176. 1996. *Reidia stipulacea* Gamble in Bull. Misc. Inform. Kew 1925: 332. 1925 & Fl. Madras 2(7): 1293. 1925 (repr. ed. 2: 905. 1957). *Phyllanthus stipulaceus* (Gamble) Kumari & Chandrab. in A.N.Henry et al., Fl. Tamil Nadu, India, Ser. I. Analysis 2: 239. 1987 (non Bojer, 1837).

Straggling shrubs or undershrubs; branches terete, with persistent stipules; leaf-bearing branchlets arising singly, up to 15 cm long, spreading. Leaves obliquely ovate or falcate-ovate, 5 - 10 x 2.5 - 5 mm, unequal at base, apiculate or shortly acuminate at apex, membranous, hispid beneath; lateral nerves 5 or 6 pairs, faint; petioles ca 0.5 mm long; stipules lanceolate, stiff, persistent. Inflorescences axillary; male cymules 1-flowered at the proximal axils; bisexual cymules with female flowers towards the tips; bracts linear-lanceolate, up to 2 mm long, entire. Male flowers: pedicels ca 5 mm long, filiform, glabrous; sepals 2 + 2, broadly ovate to deltoid-suborbicular, ca 2 x 2 mm, entire, pellucid-punctate; disc glands 4, obcordate to squarish, entire, truncate; stamens 2, subsessile, horizontal. Female flowers: pedicels ca 10 mm long; sepals 3 + 3, broadly ovate to deltoid-ovate, ca 2 x 1.8 - 2 mm, entire, pellucid-punctate, glabrous; disc glands 6, suborbicular, entire; ovary depressed-globose, ca 0.8 mm in diam., villous; styles 3, ca 1 mm long, free, bifid to midway. Fruits subglobose, depressed, ca 4 x 6 mm, densely soft hairy, with branched hairs.

*Fl. & Fr.* June - July.

*Distrib.* India: Shola forests of Nilgiri hills, along edges of streams in thick undergrowth, at 1000 - 1500 m altitudes; rare (Gamble, 1925). Tamil Nadu.

Endemic.

**7. *Phyllanthus cinereus*** Müll.Arg. in Linnaea 32: 48. 1863 & in DC., Prodr. 15(2): 425. 1866; Hook.f., Fl. Brit. India 5: 303. 1887; Trimen, Handb. Fl. Ceylon. 4: 26. 1898; G.L.Webster in



**Fig. 40. a – f. *Phyllanthus leschenaultii* Müll.Arg.:** a. habit; b. male flower; c. stamens with disc; d. female flower; e. pistil with disc; f. fruit. **g – l. *Phyllanthus cinereus* Müll.Arg.:** g. habit; h. male flower; i. stamens with disc; j. female flower; k. pistil with disc; l. pistil; m. fruit.

Dassan. & Clayton, Rev. Handb. Fl. Ceylon 11: 233. 1997. *Reidia floribunda* Wight, Icon. Pl. Ind. Orient. 5(2): 28, t. 1903. 1852 (non *Phyllanthus floribundus* HBK 1817, nec Müll.Arg. 1863); Gamble, Fl. Madras 2(7): 1293. 1925; Rani in K.M. Matthew, Fl. Tamil Nadu Carnatic 3(2): 1470. 1983. *Epistylum floribundum* (Wight) Thwaites, Enum. Pl. Zeyl. 283. 1861. *Phyllanthus affinis* Müll.Arg. in Linnaea 32: 48. 1863 & in DC., Prodr. 15(2): 425. 1866; Hook.f., Fl. Brit. India 5: 304. 1887; Trimen, Handb. Fl. Ceylon 4: 26. 1898. *P. wightianus* Müll.Arg. in Linnaea 32: 47. 1863 & in DC., Prodr. 15(2): 425. 1866, pro nom. nov. [(non *P. wightianus* Müll.Arg. in l. c c. 6. 1863 & 334. 1866 = *P. pinnatus* (Wight) G.L. Webster)]; Hook. f., Fl. Brit. India 5: 303. 1887. *Epistylum phyllanthoides* Baill. [Etude Euphorb. 648. 1858, nom. nud.], p. p., tantum quoad *Thwaites* CP 71, excl. *Heyne* in *Wallich* 7905.

**Fig. 40 g - l**

Shrubs, up to 2 m high; branches villous or tomentose; leaf-bearing branchlets 7 - 25 cm long, tomentellous to scattered pilose. Leaves more or less oblique, ovate to ovate-oblong or oblong to oblong-elliptic, 1 - 2.7 x 0.5 - 1.6 cm, unequal and acute, obtuse or rounded at base, apiculate or cuspidate at apex, membranous, scattered pilose to puberulous above and beneath; lateral nerves 5 - 10 pairs; petioles 1 - 1.3 mm long, tomentose to puberulous; stipules triangular or deltoid, 1.5 - 3 x 0.3 - 1 mm, entire. Inflorescences axillary; male cymules 2 or 3-flowered, at the proximal axils; female cymules 1-flowered, at the tips; bracts triangular-acuminate to linear-filiform, 1 - 3 x 0.4 - 0.5 mm, entire to irregularly denticulate. Male flowers: pedicels 5 - 10 mm long, pilose to villous; sepals 2 + 2, ovate-lanceolate, 2 - 2.5 x 0.8 - 1.2 mm, entire and ciliate, thin, villous to sparsely pilose outside; disc glands 4, flabellate, ca 1 x 1 mm, thin, muriculate; stamens 2; filaments united into a column (ca 0.1 mm long), slender, trifid at apex; anther cells 0.5 - 1 mm long, horizontal. Female flowers: pedicels 10 - 15 mm long, puberulous; sepals 6, oblong-elliptic to ovate, 2.5 - 3 x 1.2 - 2 mm, entire to undulate-crenulate and ciliolate along margins, evanescently puberulous; disc glands 6, obovate, ca 1 x 1 mm; ovary subglobose, ca 1.5 mm in diam., papillose-puberulous; styles 3, free, 0.5 - 0.8 mm long, deeply bifid. Fruits globose to subglobose, 4 - 5 x 5 - 7 mm, coarsely brown-pilose or pubescent; fruiting pedicels 10 - 20 mm long.

*Fl. & Fr.* April - Dec.

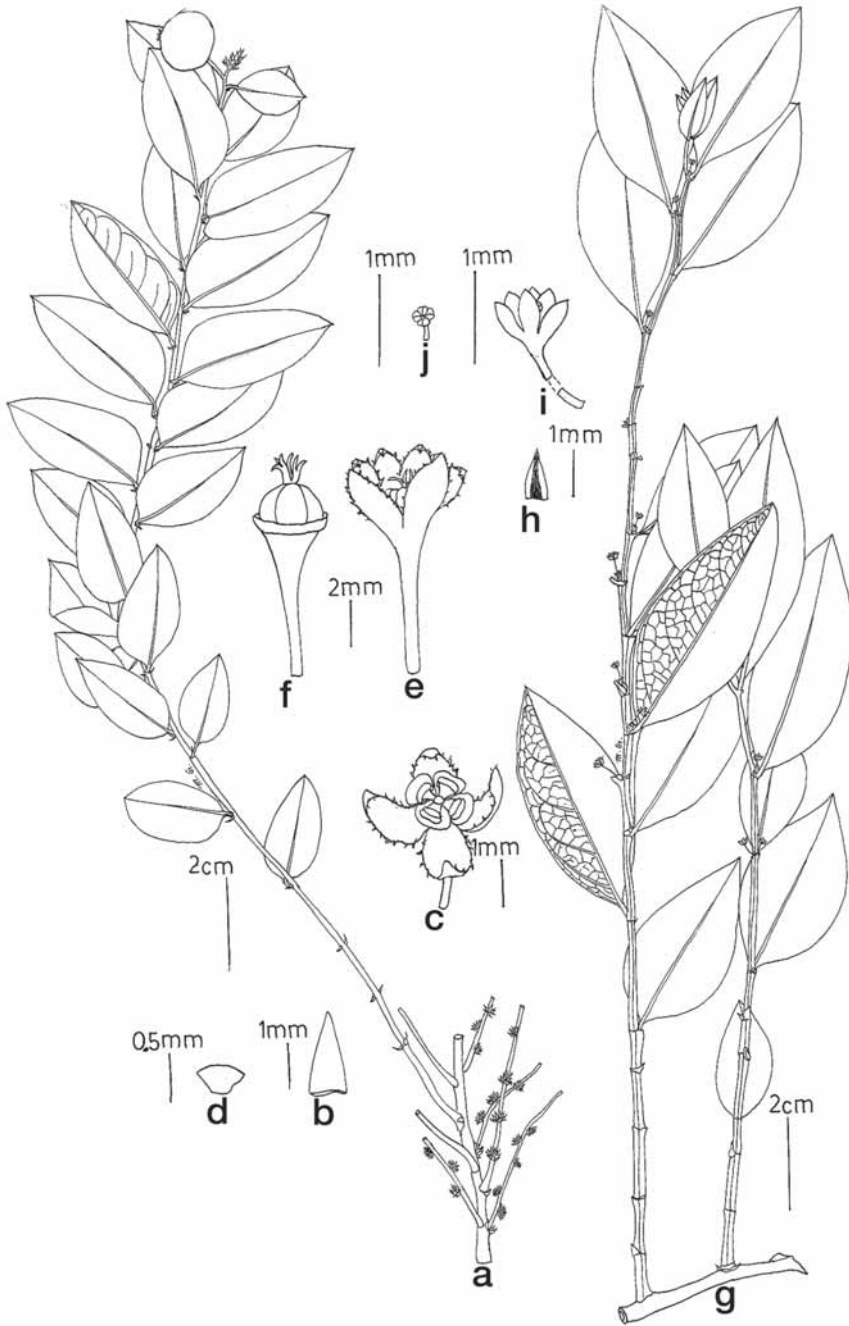
*Distrib.* India: Common at 600 - 1800 m altitudes. Tamil Nadu and Karnataka.

Sri Lanka.

**8. *Phyllanthus fimbriatus*** (Wight) Müll.Arg. in Linnaea 32: 47. 1863 & in DC., Prodr. 15(2): 422. 1866; Hook.f., Fl. Brit. India 5: 302. 1887. *Reidia fimbriata* Wight, Icon. Pl. Ind. Orient. 5(2): 28, t. 1904, f. 1. 1852; Gamble, Fl. Madras 2(7): 1292. 1925 (repr. ed. 2: 904. 1957).

**Fig. 41 g - i**

Shrubs, entirely glabrous; leaf-bearing branchlets 15 - 30 cm long. Leaves slightly oblique, ovate or elliptic to oblong-elliptic, unequal at base, acute-mucronate to shortly acuminate at apex, 3.5 - 7.5 x 1.5 - 3 cm, chartaceous to thinly coriaceous; lateral nerves 6 - 8 pairs, prominent; petioles ca 2 mm long; stipules ovate-triangular or triangular-acuminate, 1.5 - 4 x 1 - 3 mm, entire. Inflorescences axillary, few-flowered; male cymules usually at the proximal axils; females towards the tips; bracts forming short brachyblasts, deltoid, ca 1 x 1 mm, entire. Male flowers (slightly immature ones seen): pedicels ca 5 mm long; sepals 2 + 2, orbicular-ovate, ca 2 x 2 mm, thin and crenulate or fimbriate along margins; disc glands 4, flabelliform, ca 1 mm across; stamens 2; filaments short, united below into a minute stout column; anther cells oblong-ellipsoid, ca 0.5 mm long, horizontal, embedded at the corners of a thick connective. Female flowers: pedicels ca



**Fig. 41. a – f. *Phyllanthus gageanus* (Gamble) M.Mohanani:** a. habit; c. stipule; c. male flower; d. disc gland; e. female flower; f. pistil with disc. **g – i. *Phyllanthus fimbriatus* (Wight) Müll.Arg.:** g. habit; h. stipule; i. male flower; j. stamens.

7 x 0.5 (at base) – 2 (at apex) mm; sepals 3 + 3, ovate-triangular, ca 3.5 x 1.5 mm, all or the outer or the inner undulate; disc shortly cupular, ca 1.5 mm across, entire; ovary subglobose, 1 - 1.5 mm in diam., glabrous, smooth; styles 3, 1 - 1.5 mm long, free, slender, deeply bifid, recurved. Fruits subglobose, 6 – 8 mm in diam., 3-lobed.

*Fl. & Fr.* May – June.

*Distrib.* India: Rare on the Western Ghats at about 1200 m altitude. Tamil Nadu.

Endemic.

**9. *Phyllanthus gageanus*** (Gamble) M.Mohanani in J. Econ. Taxon. Bot. 6: 480. 1985. *Reidia gageana* Gamble in Bull. Misc. Inform. Kew 1925: 331. 1925 & Fl. Madras 2(7): 1292. 1925 (repr. ed. 2: 904. 1957); A.N.Henry & Vivek. in J. Bombay Nat. Hist. Soc. 75: 694. 1970.

**Fig. 41 a - f**

Shrubs, erect, ca 50 cm high, glabrous; branches spirally arranged, terete; leaf-bearing branchlets 7 - 30 cm long, leafless for 2 – 4 cm along upper portion, with reduced stipuliform leaves. Leaves obliquely oblong, falcate-oblong, narrowly ovate-oblong to ovate-lanceolate, unequal, cuneate or acute at base, acute and mucronate or apiculate at apex, 2 – 5 x 1 – 2 cm, membranous, shiny, glaucous beneath; lateral nerves 6 - 10 pairs; petioles 1.5 - 3 mm long; stipules linear-subulate or lanceolate, ca 2 x 0.5 mm, entire, peltate. Inflorescences axillary; male cymules fascicled, at the proximal leaf axils, multi-bracteate with imbricating clusters of bracts; female cymules 1-flowered at the distal leafless portion; bracts ovate, 1 - 2 x 0.5 - 0.7 mm, peltate, thin. Male flowers: pedicels 5 - 10 mm long, filiform; sepals 2 + 2, narrowly ovate to deltoid-lanceolate, lacerate along margins, 1.5 - 2.5 x 0.8 - 1.6 mm, minutely pellucid-punctate; disc glands 4, orbicular, broadly truncate, ca 1.2 x 1.5 mm; stamens 2; filaments connate into a short and stout column (ca 0.5 mm long); anther cells ca 1.2 mm long, horizontal, forming a subglobose mass (slightly immature) on a thick connective. Female flowers: pedicels 12 - 15 mm long; sepals 3 + 3, lanceolate, cucullate, lacinate along margins, 2 - 4 x 1 - 2 mm; disc annular, saucer-shaped, flattened and wavy along margins, ca 0.8 mm in diam., tuberculate on surface; ovary globose, ca 1.2 mm across; styles 3, free below, bifid above, ca 1.5 mm long, the arms reflexed. Fruits globose, ca 10 mm in diam., tricocous, smooth; seeds trigonous, ca 1 mm long, appressed hairy.

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

*Distrib.* India: Rare on the Western Ghats in evergreen forests at about 600 m altitude. Kerala and Tamil Nadu.

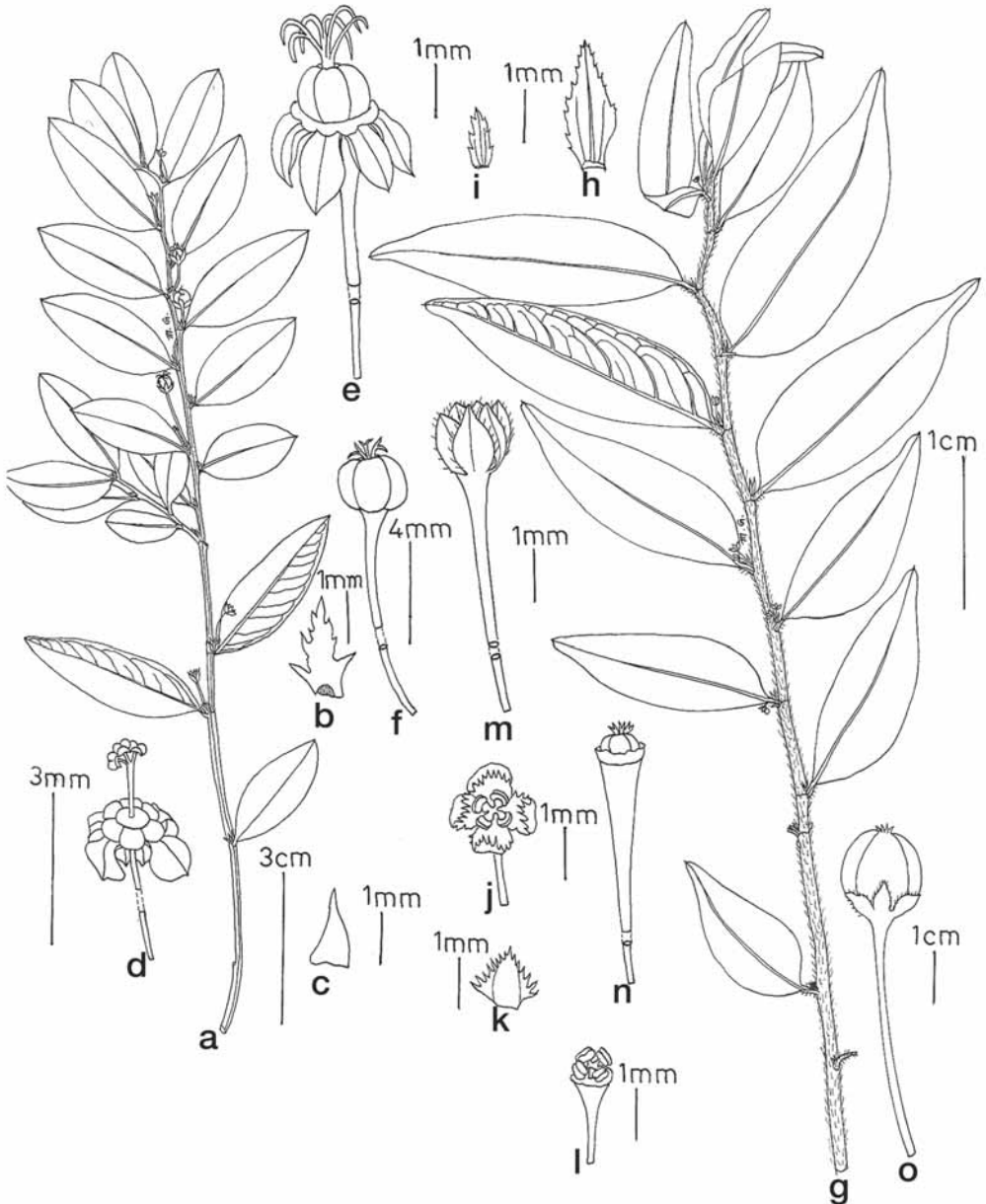
Endemic and rare.

*Note.* Narrow habitat, climatic preferences and the few female flowers are causes for the rarity of this species. It is under the endangered category.

**10. *Phyllanthus gomphocarpus*** Hook.f., Fl. Brit. India 5: 301. 1887; N.P.Balacr. & N.G.Nair in Indian Forester 103(9): 639. 1977.

**Fig. 42 g - o**

Shrubs, 0.5 - 2 m high; stem simple; leaf-bearing branchlets 30 - 60 cm long, rufous tomentose when young, sparsely puberulous in age. Leaves falcate to obliquely ovate-oblong to lanceolate, unequal at base, acuminate or caudate at apex, 3 - 10 x 1.5 - 3 cm, membranous,



**Fig. 42. a – f. *Phyllanthus griffithii* Müll.Arg.:** a. habit; b. stipule; c. bract; d. male flower; e. female flower; f. fruit. **g – o. *Phyllanthus gomphocarpus* Hook.f.:** g. habit; h. stipule; i. bract; j. male flower; k. male sepal; l. stamens; m. female flower; n. carpel with disc; o. fruit.



sparsely rufous puberulous on midrib above and beneath, reddish when young, green when mature; lateral nerves 4 - 8 pairs; petioles 2 - 3 mm long, tomentellous; stipules triangular-acuminate, 2 - 3 mm long, glandular-fimbriate. Inflorescences axillary; male cymules fasciculate, at the proximal axils; female cymules 1-flowered, at the tips; bracts ovate to linear-lanceolate, 1.2 - 3 x 0.3 - 1.2 mm, glandular-fimbriate. Male flowers: pedicels (1.5 -) 4 - 6 mm long; sepals 2 + 2, ovate-orbicular to ovate-lanceolate, glandular-lacerate along margins, 1 - 1.5 x 1 - 1.2 mm, glabrous; disc cup-shaped with 4 reniform yellow glands; stamens 2; filaments connate below into a minute column, free above; anther cells orbicular-ellipsoid, ca 0.3 mm long, horizontal. Female flowers: pedicels 2 - 6 mm long, rigid at base, filiform above, glabrous; sepals 3 + 3, ovate-triangular to ovate-lanceolate, fringed with capitate glands along margins, (1 -) 4 - 5 x (0.8 -) 2 - 2.5 mm, glabrous; disc cupular-annular, ca 1 mm across; ovary subglobose, 1 - 2 mm in diam., glabrous; styles 3, 0.3 - 2 mm long, free, each bifid. Fruits depressed-subglobose, 5 - 18 x 8 - 20 mm, 3-lobed, smooth, glabrous, brown when dry; seeds reniform, ca 4 x 3 mm.

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

*Distrib.* India: In mixed or primary forests, on clayey loam at low altitudes. Nicobar Islands.

Myanmar, Malaysia, Java and Sumatra.

**11. *Phyllanthus heyneanus*** Müll.Arg. in *Linnaea* 32: 49. 1863 [non (Wight & Arn.) Müll.Arg., 1865]. *Reidia ovalifolia* Wight, *Icon. Pl. Ind. Orient.* 5: 28, t. 1904(3). 1852 (non *P. ovalifolius* Forssk., 1775). *Phyllanthus longiflorus* B. Heyne in Wall. [Cat. No. 7905. 1847, nom. nud.] ex Hook.f., *Fl. Brit. India* 5: 302. 1887. *Reidia longiflora* (B. Heyne ex Hook.f.) Gamble, *Fl. Madras* 2(7): 1293. 1925 (repr. ed. 2: 905. 1957). *Eriococcus ovalifolius* (Wight) K.K.N. Nair in *J. Bombay Nat. Hist. Soc.* 79: 454. 1982 (publ. 1983).

Mal.: *Malenkizhanelli*; Tam.: *Nallapulatti*.

Shrubs, bushy, up to 2 m high, entirely glabrous; leaves on main stems entirely reduced to scales; leaf-bearing branchlets crowded at summit of stems, 5 - 25 cm long, with 30 - 45 leaves. Leaves oblique, obovate, oblong-obovate to spatulate or broadly elliptic to oblong, unequal at base, subacute or apiculate at apex, 10 - 25 x 3 - 10 mm, membranous to thinly chartaceous, glaucous beneath; lateral nerves 6 - 11 pairs; petioles 1 - 1.5 mm long; stipules linear-subulate to lanceolate, 1 - 3 x 0.2 - 0.6 mm, entire. Inflorescences axillary; male cymules 2 - 3-flowered, at the proximal axils; female cymules 1-flowered, at the distal axils; bracts linear to filiform, 1 - 1.5 mm long, entire. Male flowers: pedicels 3 - 5 mm long; sepals 2 + 2, ovate to ovate-oblong, 2 - 3 x 1 - 1.8 mm, entire, thin; disc glands 4, rectangular or reniform, thin, ca 0.5 mm across; stamens 2; filaments connate into a slender column (ca 1 mm long); anther cells in a ring at the tip of broad and flat connective, suborbicular, 0.2 - 0.4 mm across, horizontal. Female flowers: pedicels 12 - 15 mm long; sepals 3 + 3, narrow, ovate-oblong to lanceolate or oblanceolate, 3 - 5 x 0.8 - 1.4 mm, often undulate towards apex; disc annular, ca 0.5 - 1 mm, wavy or shallowly lobed; ovary subglobose, ca 1.2 mm in diam.; styles 3, ca 1 mm long, slender, almost free, deeply bifid. Fruits subglobose, 2.5 - 4 x 3 - 4 mm, 3-lobed, black when dry, ca 0.5 mm long stipitate; fruiting pedicels 1.5 - 2 cm long.

*Fl. & Fr.* March - Sept.

*Distrib.* India: Rare on the Western Ghats, up to 700 m altitude. Tamil Nadu and Kerala. Sri Lanka.

**12. *Phyllanthus macrocalyx*** Müll.Arg. in *Linnaea* 32: 48. 1863 & in DC., *Prodr.* 15(2): 423. 1866; Hook.f., *Fl. Brit. India* 5: 301. 1887. *Reidia macrocalyx* (Müll.Arg.) Gamble, *Fl. Madras* 2(7): 1292. 1925 (repr. ed. 2: 904. 1957).

Shrubs, entirely glabrous; leaf-bearing branchlets 15 - 30 cm long. Leaves oblong to elliptic or often ovate, acute, obtuse to rounded at base, apiculate or sometimes acute to obtuse at apex, 3 - 7.5 x 1.8 - 3.5 cm, membranous to chartaceous, glaucescent beneath; lateral nerves 6 - 8 pairs; petioles 1.5 - 2.5 mm long; stipules linear, 4 - 6 x ca 1 mm, entire, broad at base. Inflorescences axillary, solitary; male cymules at the proximal axils, female cymules towards the tips; bracts ovate-lanceolate, up to 4 mm long, entire. Male flowers: pedicels 5 - 10 mm long, slender; sepals 2 + 2, broadly ovate to oblong, ca 3 x 2 mm, entire; disc 4-lobed, fleshy, verruculose; stamens 2, ca 1 mm long; filaments short and stout, connate; anthers cells ca 0.4 mm long, horizontal. Female flowers: pedicels initially 5 - 7 mm long, finally 15 - 20 mm in fruiting; sepals 3 + 3, orbicular-obovate, 10 - 25 x 7 - 20 mm (in fruiting), entire; disc broadly saucer-shaped, fleshy, granular; ovary glabrous; styles reflexed, bifid to midway. Fruits not seen.

*Fl. & Fr.* Aug.

*Distrib.* India: Tamil Nadu and Kerala.

Endemic.

**13. *Phyllanthus megacarpus*** (Gamble) Kumari & Chandrab. in A.N.Henry et al., *Fl. Tamil Nadu, India, Ser. I. Analysis* 2: 238. 1987. *Reidia megacarpa* Gamble in *Bull. Misc. Inform. Kew* 1925: 332. 1925 & *Fl. Madras* 2(7): 1292. 1925 (repr. ed. 2: 904. 1957).

Undershrubs, erect, entirely glabrous; leaf-bearing branchlets 30 - 35 cm long. Leaves ovate-lanceolate, unequal at base, shortly acuminate or apiculate at apex, 3 - 7 x 1.5 - 3.5 mm, membranous, glaucous beneath; lateral nerves 6 - 10 pairs; petioles 2 - 3 mm long; stipules lanceolate, 3 - 5 mm long. Inflorescences axillary; male cymules few-flowered, at the proximal axils; female cymules 1-flowered, at the distal axils; bracts minute. Male flowers: pedicels ca 5 mm long, filiform; sepals 2 + 2, orbicular-ovate, ca 2 x 2 mm, denticulate; disc glands 4, suborbicular or reniform, large, thick; stamens 2; filaments connate into a short column (ca 0.5 mm long); anther cells oblong, horizontal. Female flowers: pedicels 13 - 15 mm long, slender; sepals 3 + 3, orbicular-ovate or suborbicular, 2 - 3 x 2 - 2.5 mm, denticulate; disc shortly cupular, covering half of ovary, entire; ovary subglobose; styles 3, free, short, bifid halfway. Fruits obovoid or subglobose, ca 2.5 x 2 - 3 cm, crustaceous; seeds ca 5 mm long, sparsely pilose.

*Fl. & Fr.* Nov.

*Distrib.* India: Along the Western Ghats of Peninsular India, at about 1000 m altitude, rare. Tamil Nadu and Kerala.

Endemic.

**14. *Phyllanthus pulcher*** Wall. [Cat. No. 7908. 1847, nom. nud.] ex Müll.Arg. in *Linnaea* 32: 49. 1863 & in DC., *Prodr.* 15(2): 421. 1866; Hook.f., *Fl. Brit. India* 5: 301. 1887.

Shrubs, 0.6 - 2 m high; leaf-bearing branchlets 6 - 16 cm long, tomentellous to puberulous or pilose, bearing ca 15 - 25 leaves, often leafless towards tips. Leaves obliquely oblong, oblong-elliptic to ovate-oblong, unequal and acute to subacute at base, apiculate, acute or shortly acuminate at apex, 1 - 3 x 0.5 - 1.5 cm, chartaceous to thinly coriaceous, glabrous, glaucescent beneath; lateral nerves 4 - 6 pairs; petioles 1 - 1.5 mm long; stipules triangular-lanceolate to linear-filiform, 2 - 5 mm long, serrulate or entire. Inflorescences axillary; male cymules 1-several-flowered, at the proximal axils; female cymules 1-flowered, towards the tips; bracts in tufts, linear or ovate-lanceolate, 1.2 - 4.5 x 0.1 - 1.5 mm, entire, ciliolate. Male flowers: pedicels 4 - 8 mm long, filiform; sepals 2 + 2, broadly ovate-triangular to ovate-lanceolate, 1.2 - 1.5 x 1 - 1.2 mm, thin, fimbriate, often minutely pubescent outside; disc glands 4, flabellate or subquadrate, ca 0.5 mm across; stamens 2; filaments ca 0.3 mm long, almost free, horizontal; anther thecae oblong, ca 0.3 mm long, almost free, horizontal. Female flowers: pedicels 5 - 20 mm long, slender, glabrous; sepals 3 + 3, rhombate-ovate, 3 - 3.5 x 1 - 1.5 mm, thin and irregularly lacerate or fimbriate along margins, glabrous, purplish red at base, whitish towards apical part; disc annular-cupular, 6-lobed, ca 0.5 x 1.5 mm; ovary subglobose, ca 1 x 1.2 mm, smooth, glabrous; styles 3, free, ca 0.4 mm long, deeply bifid. Fruits subglobose, ca 3 mm in diam., smooth, glabrous; fruiting pedicels up to 25 mm long, with persistent sepals.

*Fl. & Fr.* July - Nov.

*Distrib.* India: Cultivated in Gardens, often as escape, 700 - 1700 m. West Bengal and Sikkim.

Sri Lanka, Bhutan, Myanmar, Cambodia, Laos, Vietnam, China, Thailand, Malaysia and Indonesia; West Indies.

**15. *Phyllanthus rangachariarii*** C.Murugan, K.A.A.Kabeer & G.V.S.Murthy in Bull. Bot. Surv. India 50: 201, f. 1. 2008 (publ. 2009).

Shrubs, up to 2 m high, entirely glabrous; branches terete, smooth; leaf-bearing branchlets 8 - 15 cm long, scattered along stem. Leaves oblong, oblique, unequal and acute at base, margins entire and recurved, acute at apex, 5 - 10 x 2 - 5 mm, coriaceous; lateral nerves 4 or 5 per side, faint; nervules immersed; petioles 1 - 2 mm long; stipules lanceolate, 2 - 3 mm long, hastate at base. Inflorescences axillary; male cymules at proximal axils, 2 or 3-flowered; female cymules at distal axils, solitary; bracts linear to filiform, ca 1 mm long, entire. Male flowers: pedicels 3 - 4 mm long, thickened towards apex; sepals 2 + 2, orbicular, ca 2 x 2 mm, entire to undulate; disc glands 4, reniform; stamens 2; filaments connate below into a slender ca 0.5 mm long column; anther cells minute, horizontal. Female flowers: pedicels ca 10 mm long, thickened towards apex; sepals 3 + 3, oblong, 3 - 4 x 1.5 - 2 mm, entire; disc annular, thin, undulate; ovary globose, ca 2 mm in diam.; styles up to 0.4 mm long, deeply bifid, reflexed. Capsules depressed-globose, ca 4 mm in diam.; fruiting pedicels up to 12 mm long.

*Fl. & Fr.* Sept. - Oct.

*Distrib.* India: Rare in evergreen forests at about 900 m altitude. Tamil Nadu (Agasthiyamalai).

Endemic.

**16. *Phyllanthus sikkimensis*** Müll.Arg. in *Linnaea* 32: 48. 1863 & in DC., *Prodr.* 15(2): 425. 1866. *Agyneia tetrandra* Buch.-Ham. in *Trans. Linn. Soc. London* 15: 125. 1826 (non *P. tetrandrus* Roxb., 1832). *Phyllanthus hamiltonianus* Müll.Arg. in *Linnaea* 34: 75. 1865 & in DC., *Prodr.* 15(2): 424. 1866; Hook.f., *Fl. Brit. India* 5: 304. 1887. *Reidia hamiltoniana* (Müll.Arg.) A.M.Cowan & Cowan, *Trees N. Bengal* 117. 1929. *Eriococcus hamiltonianus* (Müll.Arg.) Hurus. & Yas. Tanaka in H. Hara, *Fl. E. Himal.* 117. 1966. **Fig. 43 j - p**

Asm.: *Moyra-tikoni*.

Shrubs or trees, 1 - 5 m high; leaf-bearing branchlets 13 - 40 cm long, pilose or puberulous to subglabrous, usually leafless at tips (for 10 - 15 cm length) bearing flowers. Leaves symmetric to asymmetric, ovate, ovate-elliptic to oblong-elliptic, unequal at base, acute-mucronate, apiculate or apiculate-mucronate at apex, 2 - 5 x 1 - 3 cm, membranous to thinly chartaceous, sparsely whitish pilose to glabrous above, whitish pilose (at least on nerves) to glabrous beneath; lateral nerves 6 - 11 pairs; petioles 1.5 - 3 mm long, puberulous to glabrous; stipules triangular-acuminate to subulate, 1 - 3 mm long, entire. Inflorescences axillary and terminal racemes; male cymules 3 - 5-flowered at the proximal axils; female cymules 1-flowered at the distal axils and leafless ends; bracts ovate-acuminate to lanceolate, 1 - 2 mm long, entire. Male flowers: pedicels 5 - 15 mm long; sepals 2 + 2, ovate, ca 1 x 0.5 mm, fimbriate, sparsely puberulous outside; disc glands 4, distinct or occasionally connate and deeply lobed; stamens 2; filaments connate into a stout column (ca 0.3 mm long); anther cells subglobose, ca 0.3 mm across, horizontal. Female flowers: pedicels 10 - 25 mm long; sepals 3 + 3, ovate or triangular-acuminate, 2 - 2.5 x 0.8 - 1.2 mm, denticulate to fimbriate or undulate, puberulous outside; disc cupular-annular, ca 0.3 x 1.5 mm; ovary subglobose, 0.8 - 2 mm in diam., hirtellous; styles 3, free, up to 1 mm long, bifid halfway. Fruits subglobose, 2.5 - 3 x 3 - 4.5 mm, shallowly to deeply 3-lobed, crustaceous, muriculate, rufous scabrid or papillose-puberulous to glabrous.

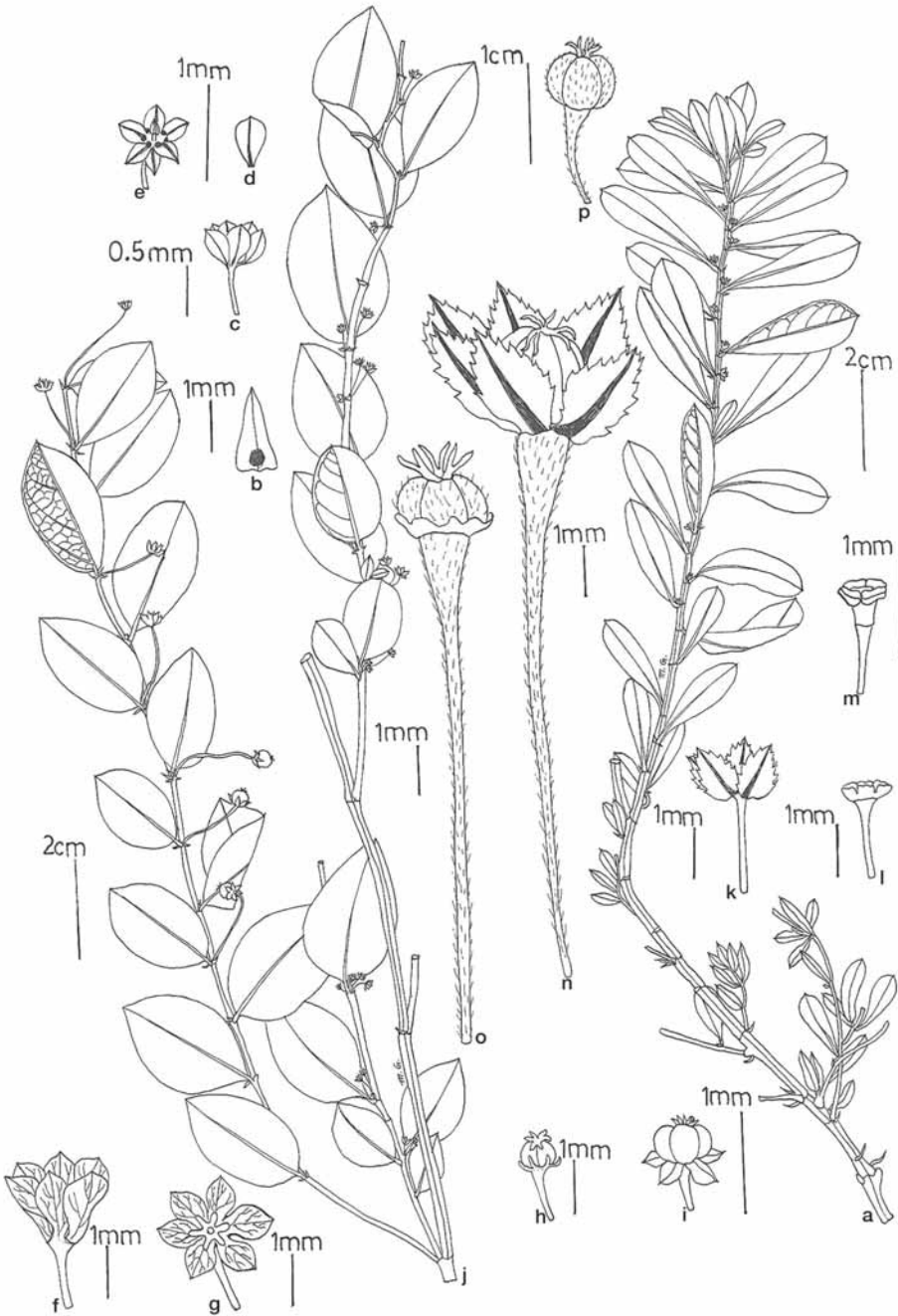
*Fl. & Fr.* April - Nov.

*Distrib.* India: Common in tropical forests of Duars and foothills of Himalayas at 150 - 1300 m altitudes; in open places or sandy areas on clay humus soil or rocky loam up to 300 m in NE. India. Sikkim, West Bengal, Assam and Tripura.

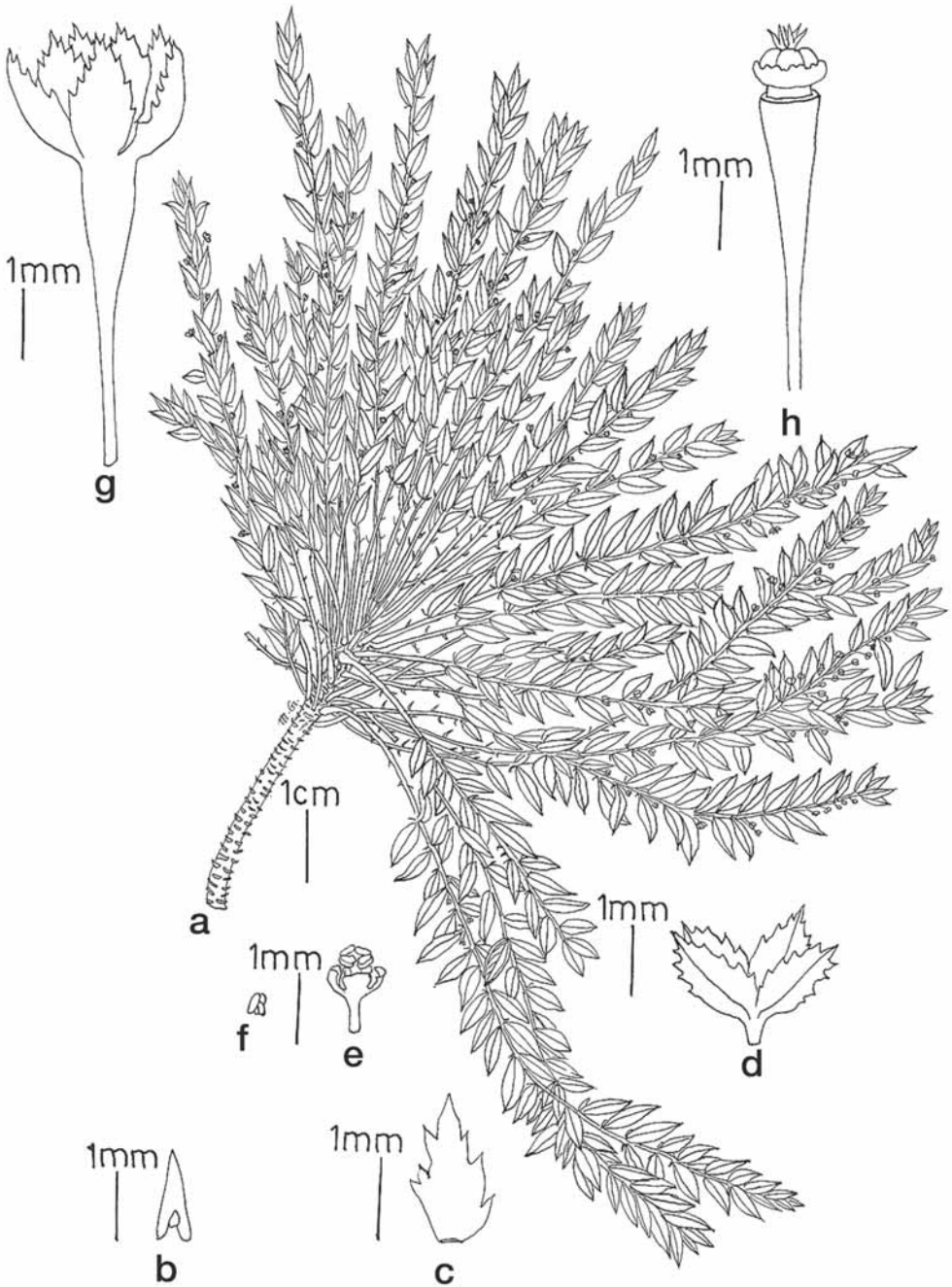
Nepal, Bhutan, Bangladesh, Myanmar and Thailand to N. Malaysia.

**17. *Phyllanthus singampattianus*** (Sebastine & A.N.Henry) Kumari & Chandrab. in A.N.Henry et al., *Fl. Tamil Nadu, India, Ser. I. Analysis* 2: 238. 1987. *Reidia singampattiana* Sebastine & A.N.Henry in *Bull. Bot. Surv. India* 2: 437, t. 1. 1960; Parthasarathy & Mahadevan in *Bull. Bot. Surv. India* 27: 259. 1985 (publ. 1987). **Fig. 44**

Woody herbs, undershrubs to trees, 0.4 - 4.5 m high, almost entirely glabrous; stem woody, terete, rough; leaf-bearing branchlets crowded at summit of stems, 5.5 - 12 cm long, spreading, obscurely puberulous at tips. Leaves falcate-lanceolate or sometimes obliquely elliptic-lanceolate, unequal and acute at base, acute at apex, 3.5 - 7 x 1.2 - 3 mm, coriaceous, glaucous green or brownish and minutely papillose beneath; lateral nerves and nervules obscure; petioles ca 1 mm long; stipules ovate-lanceolate to narrowly subulate or lanceolate, hastate at base, entire to irregularly undulate along margins, 1 - 2 x 0.5 - 1 mm. Inflorescences axillary; male cymules 1 - 4-flowered, at the proximal axils of branchlets; female cymules 1-flowered, at the tips of branchlets; bracts many, clustered, imbricate, ovate to suborbicular, lacerate-denticulate



**Fig. 43. a – i. *Phyllanthus maderaspatensis* L.:** a. habit; b. stipule; c. male flower; d. male sepal; e. male flower (top view); f. female flower; g. female sepals with disc; h. pistil; i. fruit. **j – p. *Phyllanthus sikkimensis* Muell.Arg.:** j. habit; k. male flower; l. disc; m. stamens; n. female flower; o. pistil with disc; p. fruit.



**Fig. 44. *Phyllanthus singampattianus*** (Sebast. & A.N.Henry) Kumari & Chandrab.: a. habit; b. stipule; c. bract; d. male flower; e. stamens with disc; f. anther; g. female flower; h. pistil with disc.

along margins, 1 - 2.5 x 0.6 - 1 mm, hyaline. Male flowers: pedicels pulvinate at apex, 1 - 4 mm long; sepals 2 + 2, ovate to orbicular-ovate, deeply lacerate along margins, 1.2 - 1.5 x 0.8 - 1.2 mm, thin, brick red; disc glands 4, flabellate, ca 0.3 mm across, minutely tuberculate; stamens 2; filaments connate into 0.2 - 0.3 mm long column; anther thecae minute, horizontal. Female flowers: pedicels pulvinate at apex, 4.5 - 5 mm long; sepals 3 + 3, broadly ovate, ovate-oblong to lanceolate, irregularly lacerate, 1.5 - 2.2 x 0.7 - 1.2 mm; disc ring-like, ca 0.3 x 0.8 mm, thin, undulate or lobed; ovary subglobose, 0.5 - 1 mm in diam., 3-lobed; styles 3, free, 0.3 - 0.5 mm long, bilobed up to base. Fruits subglobose, ca 2 x 3 - 4 mm, crustaceous.

*Fl. & Fr.* July - Oct.

*Distrib.* India: Common in the type locality in dense humid evergreen forests of southern Western Ghats, along riverbanks along rocky places, at (800-) 1100 - 1700 m altitudes. Tamil Nadu (Tirunelveli District) and Kerala.

Endemic.

**18. *Phyllanthus talbotii*** Sedgw. in J. Indian Bot. Soc. 2: 124, f. 2. 1921; N.P.Singh & B.G.Kulkarni in Red Data Book of Indian Pl. 3: 124, illus. 1990.

Shrubs, 1 - 1.5 m high (once noted to be a herb, 30 cm); leaf-bearing branchlets 3 - 5 together, 3 - 18 cm long, pilose or puberulous to glabrescent. Leaves closely distichous (overlapping), oblong to linear-oblong, rounded to subcordate at base, apiculate to shortly acuminate at apex, 3 - 9 x 1 - 3.5 mm, coriaceous, finely puberulous or papillose to glabrous on both surfaces; lateral nerves and nervules obscure; petioles 0.5 - 1 mm long; stipules linear-lanceolate, 2 - 2.5 mm long, entire. Inflorescences axillary; male cymules 1- few-flowered at the proximal axils; female cymules 1-flowered at the tips; bracts linear-lanceolate, 1 - 2.5 mm long, entire. Male flowers: pedicels 1 - 3 mm long; sepals 2 + 2, orbicular-ovate, 1.8 - 2 x 0.8 - 1.2 mm, slightly undulate and scarious along margins, puberulous to glabrous outside; disc glands 4, capitate, ca 0.2 mm long; stamens 2; filaments connate into a column (ca 0.5 mm long); anther cells suborbicular, ca 0.1 mm across, horizontal at the tip of the column. Female flowers: pedicels 4 - 5 mm long, slender; sepals 3 + 3, ovate, ovate-oblong or obovate, 1 - 1.5 x 0.8 - 1.1 mm, entire to wavy towards apex, thin, glabrous; disc annular, 0.5 - 1 mm across, crenate or shallowly lobed; ovary subglobose, ca 0.5 mm in diam., scattered papillose, shortly stipitate; styles 3, free, ca 0.5 mm long, slender, deeply bifid above. Fruits subglobose, 2.5 - 3 x ca 3 mm, deeply 3-lobed, brown, invaginated at apex, stipitate (stipe ca 0.5 mm long), sparsely papillose.

*Fl. & Fr.:* May - Dec.

*Distrib.:* India: On rocky river beds or in wet places near water course, at about 600 m altitude, rare. Maharashtra and Karnataka.

Endemic.

**19. *Phyllanthus tetrandrus*** Roxb., Fl. Ind., ed. Carey 3: 674. 1832. *Epistylum roxburghii* Baill., Etude Euphorb. 648. 1858, pro nom. nov. *Phyllanthus roxburghii* (Baill.) Müll.Arg. in Linnaea 32: 47. 1863 & in DC., Prodr. 15(2): 420. 1866; Hook.f., Fl. Brit. India 5: 300. 1887.

Shrubs; young shoots pubescent; leaf-bearing branchlets 15 - 60 cm long, tomentellous to scattered puberulous. Leaves obliquely ovate-lanceolate or sometimes oblong-elliptic, acute,

rounded or unequal at base, acute to subacute or shortly acuminate at apex, 4 - 10 x 1.5 - 3.5 cm, membranous to chartaceous, glabrous above, glabrous or sparsely puberulous on midrib beneath; lateral nerves 6 - 10 pairs; petioles 2 - 3 mm long, tomentellous to puberulous; stipules triangular-acuminate to subulate, 2 - 4 x 1 - 2 mm, entire, denticulate to lacerate. Inflorescences axillary, 8 - 15-flowered, pedunculate; male cymules at the proximal axils; female cymules at the tips (often vice-versa or mixed); bracts clustered, forming short brachyblasts, subulate, lanceolate or triangular-acuminate, up to 1 mm long, subentire. Male flowers: pedicels 4 - 6 mm long, puberulous to glabrous; sepals 2 + 2, ovate to ovate-lanceolate, 1.2 - 1.5 x 0.5 - 1 mm, fimbriate, puberulous outside; disc glands 4, obovate, sub-flabellate or suborbicular, ca 0.2 mm across; stamens 2; filaments ca 0.2 mm long, free or connate at base; anther thecae oblong, 0.2 - 0.4 mm long, horizontal. Female flowers: pedicels 10 - 15 mm long, sparsely puberulous to glabrous; sepals (5 or) 6, obovate, broadly elliptic or ovate-elliptic, 1.2 - 1.5 x 0.8 - 2 mm, denticulate or lacerate (towards tips); disc annular, lobed; ovary depressed, ca 0.5 mm in diam., glabrous; styles 3, free, ca 0.5 mm long, bifid. Fruits depressed-globose, 3 - 3.5 x 4 - 6 mm, crustaceous, invaginated at apex, glabrous.

*Fl. & Fr.* Sept. - Oct.

*Distrib.* India: Assam, Manipur and Mizoram.

Bangladesh.

### Subgenus 3. **Isocladus** G.L.Webster

Herbs or shrubs, monoecious or dioecious; branching not phyllanthoid. Leaves spirally or distichously arranged. Male flowers: calyx-lobes 5; disc lobes 5; stamens 3; filaments free or united; anthers dehiscing vertically or horizontally; pollen grains colpate or areolate with ora at midway between the angles. Female flowers: calyx-lobes 5; disc cupuliform or 5-lobed, often each lobe bifid; ovary 3-loculed; styles free or united. Fruits capsular, dehiscent.

Circumtropical, ca 60 species; 13 species in India.

**20. *Phyllanthus anamalayanus*** (Gamble) G.L.Webster in Ann. Missouri Bot. Gard. 81: 45. 1994. *Pseudoglochidion anamalayanum* Gamble in Bull. Misc. Inform. Kew 1925: 330. 1925 & Fl. Madras 2(7): 1285. 1925 (repr. ed. 2: 899. 1957); Ahmedullah & M.P.Nayar in Red Data Book of Indian Pl. 3: 126. 1990.

Shrubs or small trees, almost entirely glabrous; branches glabrous; branchlets 15 - 25 cm long, sparsely puberulous towards apices, soon glabrous. Leaves symmetric to slightly asymmetric, narrow, elliptic, oblong-elliptic to ovate-oblong or lanceolate, acute (also attenuate according to Gamble, l. c.) at base, apiculate or acute at apex, 3.5 - 9 x 1.5 - 3 cm, chartaceous to thinly coriaceous, often glaucous beneath; lateral nerves 6 or 7 (8 or 9, Gamble, l. c.) pairs, prominent; petioles 1.5 - 3 mm long, puberulous; stipules linear-subulate to linear-lanceolate, 2 - 2.5 x ca 0.8 mm, entire, caducous. Inflorescences axillary, towards tips of branchlets; cymules unisexual, solitary or few-flowered (Gamble, l. c.). Male flowers (only immature ones seen): pedicels ca 5 mm long, filiform; sepals 3 + 3, ovate-lanceolate, 2 - 3 x 1 - 1.3 mm, entire; disc glands 6, conspicuous, fimbriate at apex; stamens 3; filaments united into a column; anthers vertically dehiscent; connective produced. Female flowers (only immature ones seen): pedicels short; sepals 3 + 3, glabrous, entire; disc annular, crenate; ovary ovoid, 3-locular; styles 3,



connate into a column, minutely 6-toothed at apex. Fruits not seen (reported to be depressed, 7 - 8 mm in diam., 3 or 4-lobed; seeds 3 or 4 mm long, dorsally villous).

*Fl.* March - April.

*Distrib.* India: Occurring at 1200 - 1300 m altitudes. Tamil Nadu (Anamalai hills of Coimbatore Dist.).

Endemic and rare.

**21. *Phyllanthus andamanicus*** N.P.Balakr. & N.G.Nair in Bull. Bot. Surv. India 24: 35, f. 5. 1982 (publ. 1983). *P. balakrishnairii* Govaerts & Radcl.-Sm. in Kew Bull. 51: 176. 1996, nom. superfl.

Shrubs or small shrubby trees, 2 - 3 m tall, entirely glabrous; branchlets 5 - 17 cm long, leafless towards tips, glabrous. Leaves oblong to broadly oblong-elliptic or ovate to ovate-oblong, acute or rounded at base, obtuse, rounded to emarginate at apex, 1 - 3.5 x 0.5 - 2.5 cm, thinly coriaceous; lateral nerves 7 - 9 pairs; petioles 1 - 2 mm long; stipules triangular-acuminate, 2 - 2.5 x 1 - 1.2 mm. Inflorescences unisexual, fasciculate on terminal leafless axes forming 1 - 5 cm long pseudoracemes, the males arranged towards apices, the females towards proximal ends as well as in the upper leaf axils; bracts subulate, ca 1 mm long, subentire. Male flowers: pedicels ca 2 mm long; sepals 3 + 3, ovate, ca 2 x 1 mm, entire; disc glands 5 or 6, distinct; stamens 3; filaments united into a slender 1 - 2 mm long column; anthers connate, ca 1 mm long, vertically dehiscent. Female flowers: pedicels 3 - 4 mm long; sepals 3 + 3, ovate, entire, 2 - 2.5 x 1.5 - 2 mm; disc annular, crenate; ovary subglobose, 2 - 2.5 mm in diam.; styles 3, 1.5 - 3 mm long, connate into a stout column. Fruits depressed-globose, 4 - 5 x 7 - 9 mm, shallowly 3-lobed, smooth.

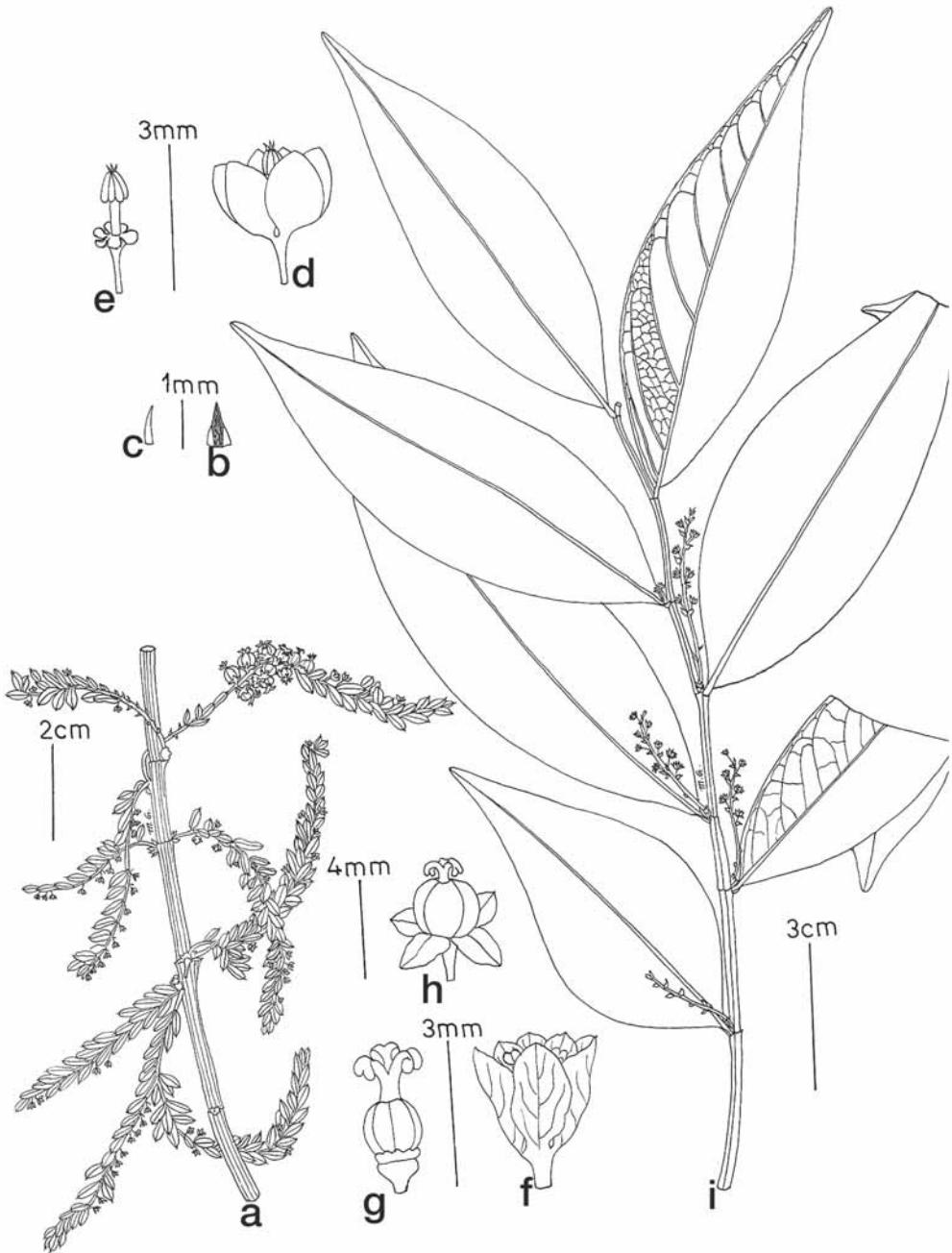
*Fl. & Fr.* Nov. - April.

*Distrib.* India: Restricted to subtropical hill forests on rocky lateritic soil at 550 - 650 m altitudes. N. Andaman Islands.

Endemic.

**22. *Phyllanthus baecobotryoides*** Wall. [Cat. No. 7942. 1847, nom. nud.] ex Müll.Arg. in Linnaea 32: 15. 1863 & in DC., Prodr. 15(2): 354. 1866; Hook.f., Fl. Brit. India 5: 291. 1887; Kanjilal et al., Fl. Assam 4: 151. 1940. **Fig. 45 i**

Shrubs or small trees, entirely glabrous; branchlets 15 - 30 cm long, quadrangular and striate. Leaves ovate, narrowly ovate-elliptic to ovate-lanceolate acute, obtuse to rounded at base, acuminate at apex, 4.5 - 15.5 x 2 - 5 cm, thinly coriaceous to chartaceous, glossy; lateral nerves 5 - 8 pairs; petioles 1.5 - 3 mm long; stipules triangular-acuminate or lanceolate, up to 2 mm long. Inflorescences racemiform or spicate, axillary or slightly supra-axillary, 3 - 6 (- 100) cm long; cymules unisexual, bracts deltoid or linear, 0.5 - 1 x 0.2 - 0.4 mm, entire. Male flowers: pedicels ca 1 mm long, slender; sepals (5 or) 6, ovate, 1.5 - 2 x 1 - 1.3 mm, entire; disc annular, crenate, shallowly lobed or consisting of 5 or 6 distinct glands (vide Hook.f., l.c.); stamens 3; filaments united into ca 1 mm long column; anthers connate into an ovoid mass, 0.5 - 0.8 mm long, vertically dehiscing. Female flowers: not seen (reported to be subsessile); sepals 5 - 6, oblong-lanceolate, disc of almost free glands or united and urceolate; ovary 3-locular; styles



**Fig. 45. a – h. *Phyllanthus lawii* J.Graham:** a. habit; b. stipule; c. bract; d. male flower; e. stamens with disc; f. female flower; g. pistil with disc; h. fruit. **i. *Phyllanthus baeobotryoides* Wall. ex Müll.Arg.:** habit.

united into a column as long as ovary, free part bipartite and recurved). Fruits not seen.

*Fl. & Fr.* Feb. - June.

*Distrib.* India: Meghalaya.

Bangladesh and Myanmar.

**23. *Phyllanthus columnaris*** Müll.Arg. in *Linnaea* 32: 15. 1863 & in DC., *Prodr.* 15(2): 354. 1866; Hook.f., *Fl. Brit. India* 5: 291. 1887; C.E.Parkinson, *Forest Fl. Andaman Isl.* 233. 1923.

**Fig. 46 j - p**

Burm. (Andamans): *Thilpagan, Kalmeg-lek-thai.*

Trees, deciduous, 3 - 12 m tall; branchlets 15 - 60 cm long, leafless towards tips, tomentellous, sparsely puberulous in age. Leaves broadly oblong to oblong-lanceolate or oblong-elliptic to elliptic-lanceolate, cuneate, obtuse to rounded or unequal at base, acute, apiculate or acute-mucronate or sometimes rounded to obtuse at apex, 1 - 6 x 0.5 - 2.5 cm, membranous to thinly coriaceous, sparsely puberulous on midrib above, tomentellous to pilose on midrib and lateral nerves beneath, glaucous beneath; lateral nerves 5 - 12 pairs; petioles 2 - 3 mm long; stipules linear-subulate, 2 - 2.5 x 0.3 - 1.5 mm, entire. Inflorescences axillary at the upper axils and on terminal leafless tomentellous pseudoracemes (10 - 20 cm long); cymules 15 - 50-flowered with usually one female and the remainder male flowers; female flowers also solitary at the upper leaf axils; bracts triangular, ca 2 x 1.2 mm, entire. Male flowers: pedicels 1 - 2.5 mm long, filiform; sepals 3 + 3, obovate to spatulate-flabellate or oblong-elliptic or ovate to ovate-oblong, 0.5 - 2.5 x 0.3 - 2 mm; disc-glands 6, obovate, minute; stamens 3; filaments connate into a slender column (1 - 4 mm long); anthers ellipsoid-oblong, ca 0.3 mm long, vertically dehiscent. Female flowers: pedicels 2 - 7 mm long; sepals 3 + 3, ovate, ovate-elliptic to orbicular, 0.8 - 3 x 0.7 - 2 mm; disc annular, ca 1 mm across, shallowly lobed or crenate; ovary subglobose, ca 1 x 1.3 mm, glabrous; styles 3, connate into a stout column (3 - 5 mm long); apical lobes 3, 1 - 1.5 mm long. Fruits depressed-globose, 4 - 5 x 8 - 10 mm, deeply 3-lobed, glabrous, smooth; fruiting pedicels 5 - 10 mm long.

*Fl. & Fr.* April - Dec.

*Distrib.* India: Common in inland forests on edges of forests, often on loamy soil, at low altitudes. Andaman Islands.

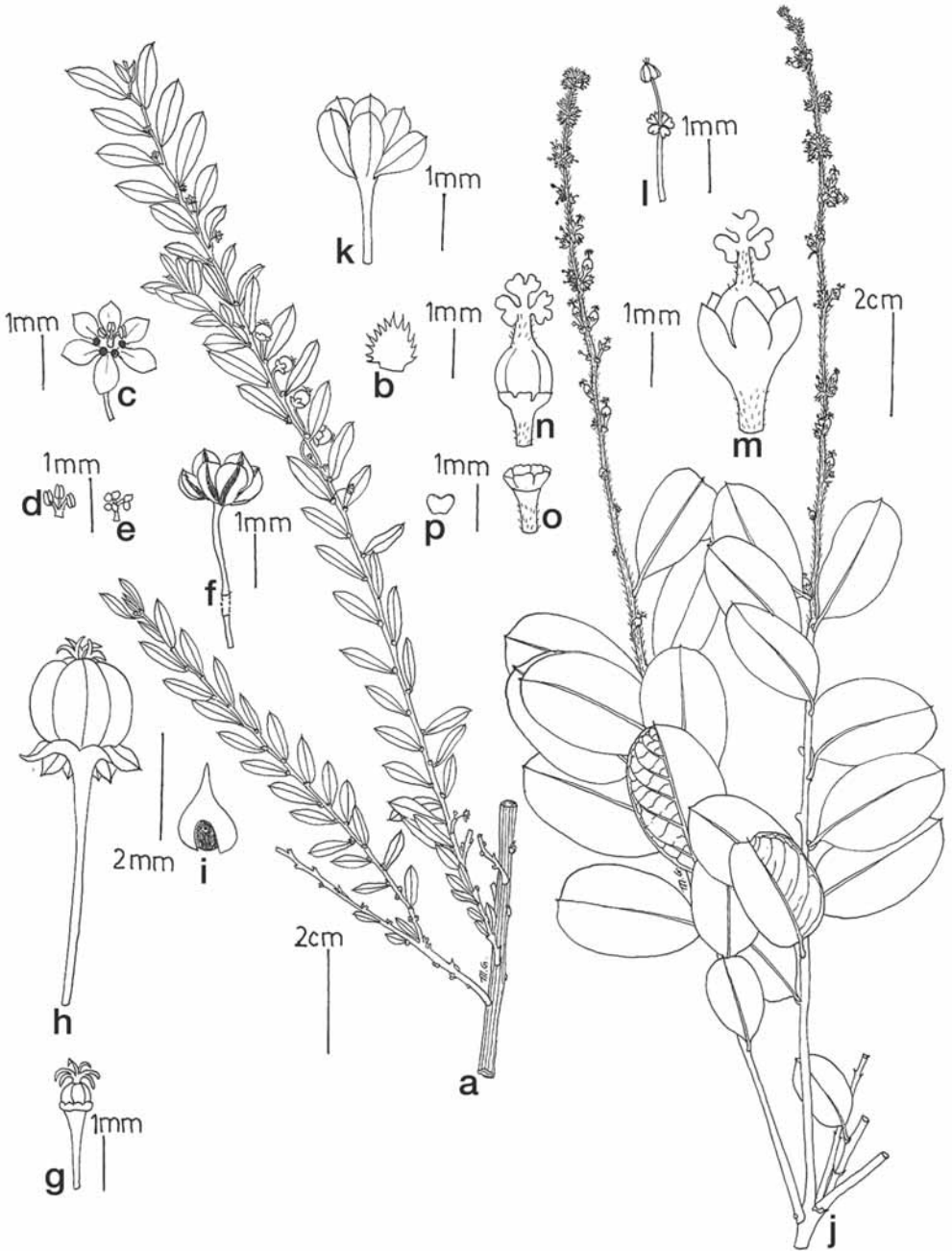
Myanmar, Thailand and Malaysia.

**24. *Phyllanthus lawii*** J.Graham, *Cat. Pl. Bombay* 181. 1839; Müll.Arg. in DC., *Prodr.* 15(2): 353. 1866; Hook.f., *Fl. Brit. India* 5: 290. 1887; Haines, *Bot. Bihar Orissa* 2: 124. 1921; Gamble, *Fl. Madras* 2 (7): 1288. 1925 (repr. ed. 2: 901. 1957); Govearts et al., *World Checkl. & Bibl. Euphorbiaceae* 4: 1293. 2000. *P. juniperinoides* Müll.Arg. in *Linnaea* 32: 18. 1863 & in DC., *Prodr.* 15(2): 358. 1866.

**Fig. 45 a - h**

Hindi.: *Tirsibiris*; Mal.: *Kuruthu-nelli, Uri*; Mar.: *Kati, Khad-sherni*; Tam.: *Vattu-nelli.*

Shrubs, 0.7 - 1.5 m high, sometimes straggling, entirely glabrous or occasionally branchlets sparsely yellowish puberulous when young; stems rigid, rough with stipular scars or spinescent tubercles when old; branchlets fascicled or often solitary, 2 - 10 cm long, slender, striate. Leaves



**Fig. 46. a – i. *Phyllanthus roeperianus* Wall. ex Müll.Arg.:** a. habit; b. bract; c. male flower; d & e. stamens; f. female flower; g. pistil with disc; h. fruit; i. stipule. **j – p. *Phyllanthus columnaris* Müll.Arg.:** j. habit; k. male flower; l. stamens with disc; m. female flower; n. pistil; o. entire disc; p. disc gland.

closely distichous, oblong, elliptic-oblong to linear-oblong, subcordate, obtuse to rounded at base, obtuse to apiculate at apex, entire, 2 - 8 x 1 - 3 mm, stiffly chartaceous, glaucous beneath; lateral nerves 4 - 6 pairs; petioles 0.2 - 0.4 mm long; stipules semisagittate on branches, 1 - 1.5 mm long, persistent, modified into spines on main branches. Inflorescences axillary; cymules unisexual or bisexual, the males at the proximal axils, 2 or 3-flowered, often with 1 female flower; female cymules 1-flowered at the distal axils; bracts triangular-acuminate to linear-filiform, 1 - 2 x 0.1 - 0.5 mm, entire, irregularly dentate at apex. Male flowers: pedicels filiform, ca 5 mm long; sepals 3 + 3, ovate to elliptic-lanceolate, 0.8 - 1.5 x 0.5 - 0.8 mm, entire; disc glands 6, suborbicular, peltate, ca 0.3 mm across; stamens 3; filaments connate into a column (ca 0.5 mm long); anthers oblong, ca 0.5 mm long, connate into an ellipsoid mass. Female flowers: pedicels 0.5 - 1 mm long; sepals 3 + 3, obovate to oblong, 2 - 3 x 1.2 - 1.5 mm, entire; disc annular, ca 1 mm across; styles 3, ca 1.5 mm long, connate below into a column, bifid above. Fruits subglobose, slightly depressed at top, 2.5 - 3.5 x 3 - 4 mm, 3-angled or 3-lobed, smooth; fruiting pedicels ca 1.5 mm long.

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

*Distrib.* India: Reported to be gregarious along the riverbanks and on rocky river beds, sometimes forming dense thickets, at low altitudes. West Bengal, Orissa, Jharkhand, Madhya Pradesh, Andhra Pradesh, Maharashtra, Karnataka and Tamil Nadu (Manchola in Tirunelveli Dist.).

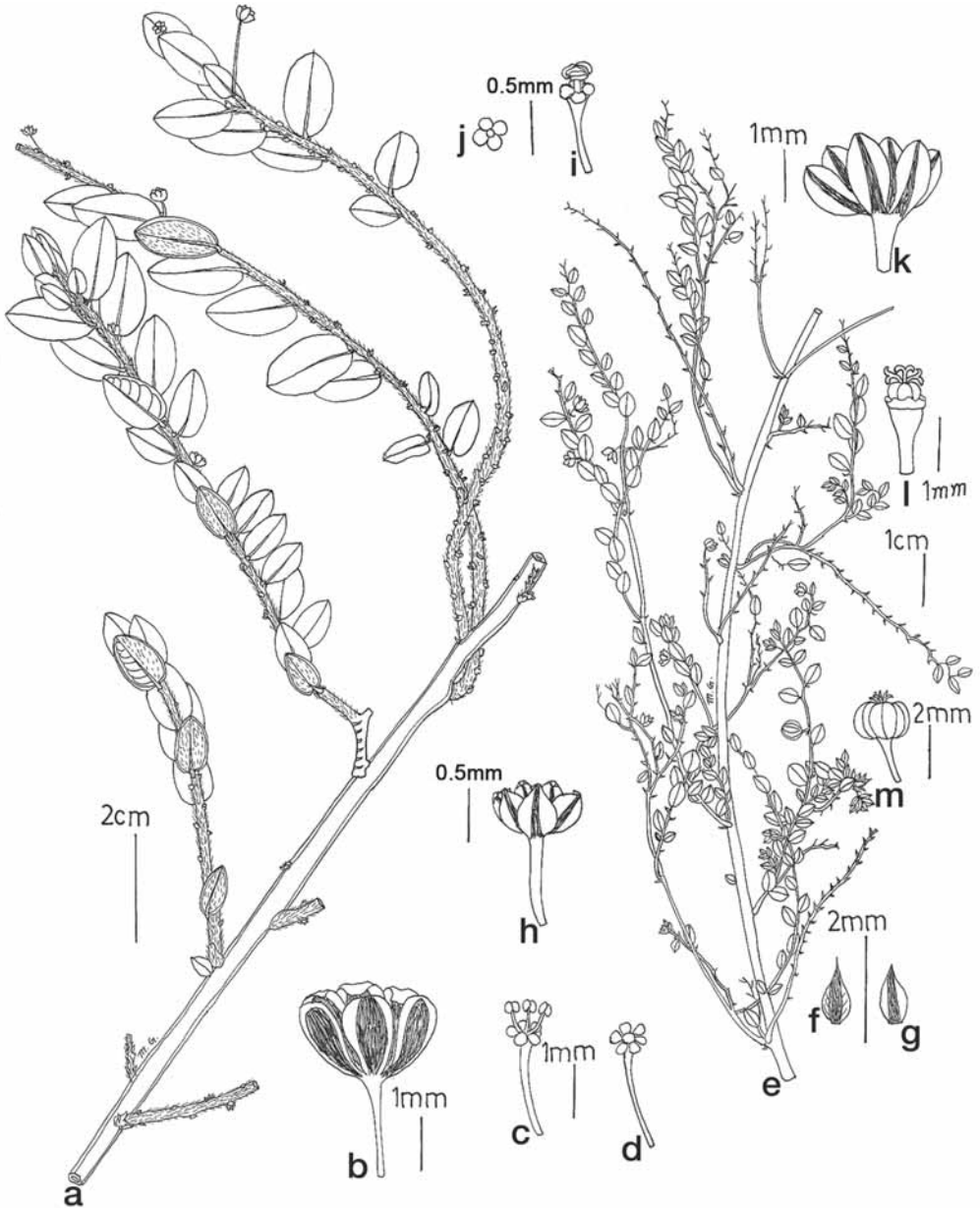
Endemic.

**25. *Phyllanthus macraei*** Müll.Arg. in *Linnaea* 32: 29. 1863 & in DC., *Prodr.* 15(2): 393. 1866; Hook.f., *Fl. Brit. India* 5: 296. 1887; Gamble, *Fl. Madras* 1290. 1925 (repr. ed. 2: 902. 1957). *Macraea rheedei* Wight, *Icon. Pl. Ind. Orient.* 5(2): 27, t. 1901. 1852 (as '*rheedii*'), non *P. rheedei* Wight, 1852.

Undershrubs or shrubs, up to 1 m high, entirely glabrous (except ovary) or branchlets and leaves beneath scattered hirsute (var. *hispidus*); branchlets compressed, winged, weak. Leaves broadly elliptic to oblong or ovate-elliptic or sometimes lanceolate-oblong, obtuse to rounded or subcordate at base, obtuse, subacute or apiculate at apex, ciliate-hairy along margins, 2 - 5 x 1 - 2.5 cm, coriaceous to chartaceous, glaucous beneath; lateral nerves 5 or 7 pairs; petioles 1 - 3 mm long; stipules broadly triangular-ovate or orbicular, peltate and subsagittate at base, denticulate-lacerate and scarious along margins. Inflorescences axillary; male cymules fascicled (according to Wight's drawing, cymules with 2 male + 1 female flowers or only of 2 male and 1 female flowers); bracts peltate. Male flowers: pedicels 2 - 3 mm long; sepals 3 + 3, obovate, ca 1.5 - 1 mm, hook-like and incurved at apex, entire and white-margined; disc glands 6, flat; stamens 3, free; filaments free, ca 0.7 mm long; anthers minute, transversely dehiscent. Female flowers: pedicels 2.5 - 5 mm long; sepals 3 + 3; disc 6-lobulate, cushion-shaped; ovary hirtellous; styles short, free, deeply bifid. Fruits subglobose or depressed, 3-lobed, ca 2.5 x 5 mm, prominently warted when wet; seeds minutely verruculose on back.

#### KEY TO THE VARIETIES

- 1 a. Branchlets and leaves beneath softly scattered hispid; leaves subcordate at base **25.1. var. *hispidus***
- b. Plants entirely glabrous (except ovary); leaves obtuse to rounded at base **25.2. var. *macraei***



**Fig. 47. a–d. *Phyllanthus macraei* Müll.Arg. var. *hispidus* Gamble:** A. habit; B. male flower; c. stamens; d. disc. **e–m. *Phyllanthus rotundifolius* Klein ex Willd.:** e. habit; f & g. bracts; h. male flower; i. stamens with disc; j. disc glands; k. female flower; l. pistil with disc; m. fruit.

**25.1. var. hispidus** Gamble, Fl. Madras 2(7): 1290. 1925 (repr. ed. 2: 902. 1957).

**Fig. 47 a - d**

Stature unknown. Leaves oblong or broadly so or sometimes ovate, subcordate at base, rounded to apiculate at apex, 1 – 2 x 0.5 – 1 cm, coriaceous, scattered reddish brown hirsute beneath; lateral nerves 5 or 6 pairs; petioles ca 1 mm long; stipules peltate, entire to subentire, dorsally gibbous. Cymules unisexual, solitary, males at the proximal axils, females at the tip. Fruits subglobose, ca 2 x 3 mm; fruiting pedicels ca 15 mm long.

*Fl. & Fr.* June – Oct.

*Distrib.* India: Along edges of forests on the Western Ghats, at about 2100 m altitude, rare. Tamil Nadu (Pulney hills).

Endemic.

**25.2. var. macraei**

*Fl. & Fr.* July - Dec.

*Distrib.* India: In shola forests on the Western Ghats, at 1500 - 2500 m altitudes; rare. Tamil Nadu and Kerala.

Endemic.

**26. Phyllanthus maderaspatensis** L., Sp. Pl. 2: 982. 1753; Roxb., Fl. Ind., ed. Carey 3: 654. 1832; Hook.f., Fl. Brit. India 5: 292. 1887.

**Fig. 43 a - i**

Guj.: *Bakrado, Kamorcha, Kandochha, Ranavali*; Hindi: *Hazarmani, Kanocha, Monyosha*; Mar.: *Kachora*; Tam.: *Melanelli*; Tel.: *Nala-userekee*; Urdu: *Kanodcha*.

Herbs or undershrubs, with woody base, 15 - 50 (- 90) cm high, erect or ascending, glabrous; branches flattened to terete or often 4-angled. Leaves arising on all branches including young stem, cuneate-obovate to oblanceolate or spatulate, sometimes linear-oblong, cuneate, acute or rounded at base, rounded, truncate, apiculate or emarginate at apex, 5 – 30 (- 45) x 3 – 7 (- 10) mm, chartaceous to thinly coriaceous, often glaucous beneath; lateral nerves 4 - 8 pairs; petioles ca 1 mm long; stipules triangular-lanceolate, to subulate, subpeltate at base, entire, 1 - 2.5 x 0.5 - 0.8 mm, scarious and white along margins. Inflorescences axillary; cymules bisexual, consisting of 3 or 4 males + 1 female or 2 or 3 males + 1 female flowers, sometimes with a solitary female flower in lower axils; bracts ovate-lanceolate to lanceolate, 1 - 1.5 x 0.3 - 1 mm, peltate, entire. Male flowers: pedicels 0.5 - 1 mm long, filiform; sepals 3 + 3, obovate to obovate-elliptic, 0.7 - 1 x 0.3 - 0.6 mm, entire and white-margined; disc glands 6, up to 0.2 mm across; stamens 3; column minutely trifid at apex; anthers oblong, 0.1 - 0.3 mm long, connate into a subglobose mass, vertically dehiscent. Female flowers: pedicels 1 - 1.5 mm long; sepals 3 + 3, orbicular to obovate, 1 - 1.2 x 0.8 - 1 mm, entire and scarious at margins; disc star-shaped with 6 linear-oblong lobes or annular and lobulate; ovary subglobose, ca 0.5 mm in diam.; styles 3, free, 0.3 - 0.5 mm long, shortly bifid at apex. Fruits subglobose, slightly depressed, 1.5 - 2.5 x 3 - 3.5 mm, shallowly to deeply 3 - 6-lobed, smooth, brown or black when dry; fruiting pedicels 1.5 - 3 x 0.3 - 1 mm; seeds trigonous, verruculose with concentric lines of minute tubercles.

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

*Distrib.* India: Common weed in dry regions, gardens, cultivated fields, waste places, roadsides, riverbanks, hill slopes, seacoasts, etc. on shady, clayey, or black soil, up to 1000 m altitude. Bihar, Jharkhand, Orissa, Madhya Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Kerala, Lakshadweep Islands, Tamil Nadu and Andaman & Nicobar Islands (North Andamans, reported by Reddy & Dutt, J. Bombay Nat. Hist. Soc. 102: 134. 2005).

Sri Lanka and Pakistan; tropical Africa to Arabia and eastwards to Bangladesh, Myanmar, S. China, Java and Australia.

*Uses.* According to Kirtikar & Basu (Ind. Med. Pl. ed. 2, 3: 2222, t. 859A. 1935), the leaves are expectorant and diaphoretic. The seeds are carminative, laxative, astringent, liver-tonic, diaphoretic and useful in bronchitis, earache and ascites. In South India, infusion of leaves is taken for headache. For the chemical characters, see Wealth of India, Raw Materials 8: 35. 1969.

**27. *Phyllanthus myrtifolius*** (Wight) Müll.Arg. in Linnaea 32: 35. 1863 & in DC., Prodr. 15(2): 396. 1866; Hook.f., Fl. Brit. India 5: 296. 1887; R. Ansari & Jeeja in J. Econ. Taxon. Bot. 17: 141, f. 1. 1993. *Macraea myrtifolia* Wight, Icon. Pl. Ind. Orient. 5(2): 27, t. 1902, f. 2. 1852.

Shrubs or undershrubs, 0.7 - 2.5 m high, often forming a bush, almost entirely glabrous; branchlets winged or angled, up to 20 cm long, dense-leaved, minutely greyish-pubescent when young, soon glabrous, persistent. Leaves distichous, arising singly or often 2 or 3 together on all branches, spatulate-oblongate or linear-oblong, cuneate at base, shallowly cordate at the extreme base, rounded, obtuse to acute-mucronate at apex, 8 - 20 x 2 - 4.5 mm, coriaceous; lateral nerves 5 - 8 pairs; petioles ca 1 mm long, hispidulous; stipules subulate or ovate-acuminate, truncate at base, ca 1 mm long, entire. Inflorescences axillary, glomerulate; cymules on short bracteate brachyblasts, 2 - 10-flowered; female flowers usually 1 per cymule and the rest males; bracts wide triangular, entire, concave. Male flowers: pedicels 5 - 10 mm long, slender; sepals 3 + 2 - 3, oblong, entire, ca 0.4 x 0.2 mm, hyaline; disc subglobose, ca 0.2 mm across, 6-lobed; stamens 3; filaments ca 0.2 mm long, free or connate at basal halfway; anthers suborbicular, minute, erect. Female flowers: pedicels 9 - 15 mm long, slender; sepals 3 + 3, ovate-lanceolate or oblong-lanceolate, 1.2 - 1.5 x ca 0.5 mm, entire, thick; disc shallowly cupular-annular, ca 0.2 - 0.8 mm, corrugated, angled; ovary subglobose, ca 0.4 x 0.5 mm, smooth; styles 3, free, ca 0.5 mm long, shortly bifid at apex. Fruits oblate or subglobose, often slightly depressed, 2 - 2.5 x ca 3 mm, 3-lobed, smooth, excavate at apex.

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

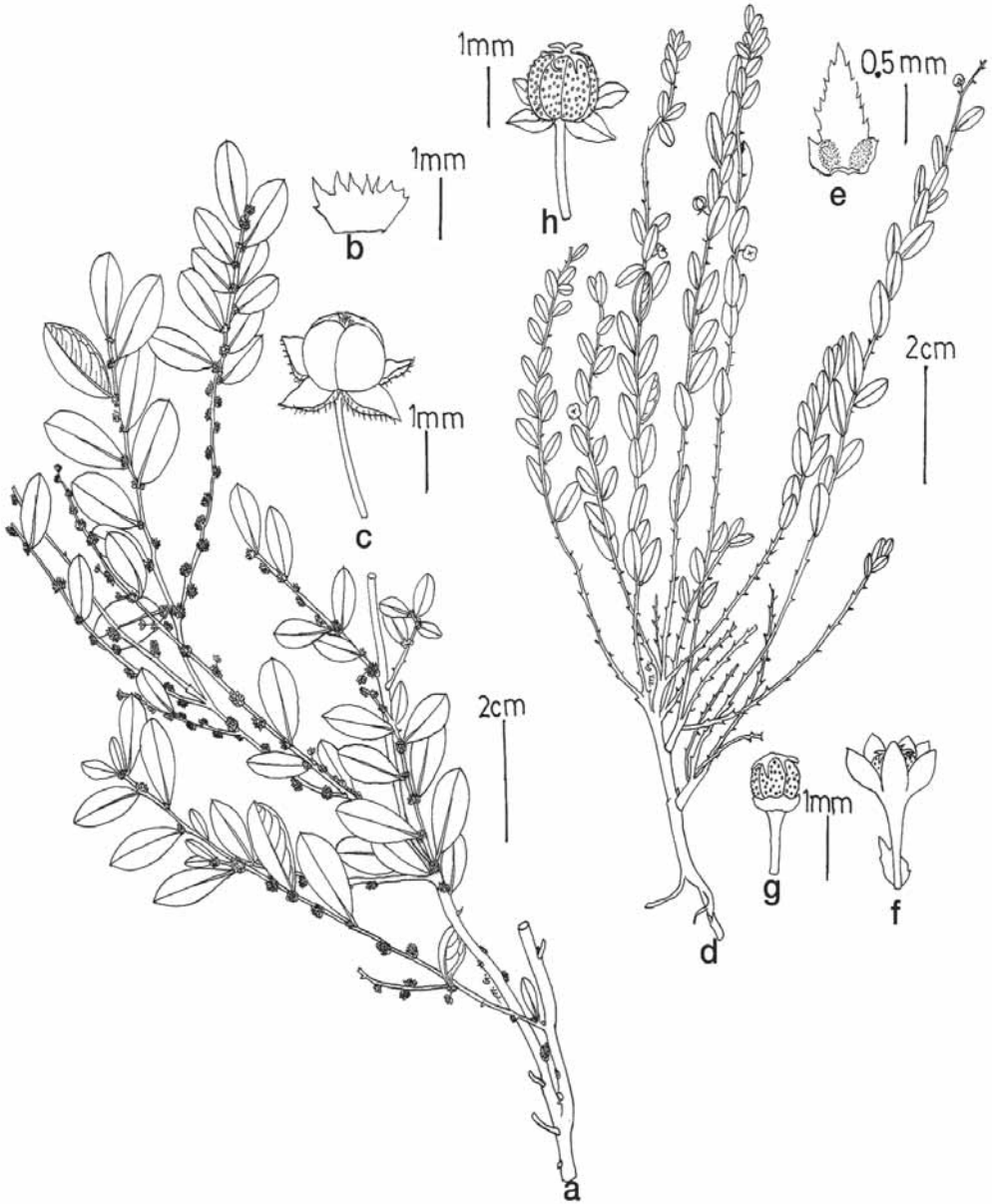
*Distrib.* India: Cultivated for hedges, occasionally found as an escape. Tamil Nadu (only one collection by Beddome from Nilgiri hills), Kerala (reported by Ansari & Jeeja, l. c. 1993) and Goa.

Native of Sri Lanka; also reported from Thailand, Hainan (China) and Taiwan.

**28. *Phyllanthus narayanswamii*** Gamble in Bull. Misc. Inform. Kew 1925: 329. 1925 & Fl. Madras 2(7): 1289. 1925 (repr. ed. 2: 902. 1957); Subba Rao & Kumari in Red Data Book of Indian Plants 1: 145. 1987. **Fig. 48 d - h**

Herbs or undershrubs, wiry, profusely branched from a woody rootstock, 15 - 45 cm high, entirely glabrous; branchlets wiry, 9 - 30 cm long, winged; main branches scabrous with stipular scars. Leaves elliptic-oblong or obovate-elliptic to obovate to oblanceolate, narrowly rounded,





**Fig. 48. a – c. *Phyllanthus brevipes* Hook.f.:** a. habit; b. bract; c. fruit. **d – h. *Phyllanthus narayanswamii* Gamble:** d. habit; e. stipule; f. female flower; g. pistil with disc; h. fruit.

subtruncate or cordate at base, thickened along margins, rounded, obtuse and often mucronulate at apex, 5 - 15 x 2 - 7 mm, coriaceous; lateral nerves 4 - 6 pairs; petioles 0.5 - 1 mm long; stipules triangular to deltoid, peltate and sagittate at base, irregularly denticulate along margins, 1 - 1.3 x 0.8 - 1.2 mm. Inflorescences axillary; male cymules fascicled at the proximal axils; female cymules 1-flowered towards tips; bracts deltoid-acuminate, lacerate along margins, 0.3 - 1 mm long. Male flowers: pedicels ca 3 mm long; sepals 3 + 3, oblong or ovate, sinuate along margins, 1.5 - 2 x 1 - 1.2 mm, subhyaline; disc glands 6, rounded, ca 0.5 mm across; stamens 3, free, erect, exserted; filaments ca 0.8 mm long; anthers subglobose, transversely dehiscent. Female flowers: pedicels 2.5 - 5 mm long, pulvinate at apex; sepals 3 + 3, ovate-elliptic, ovate-lanceolate or oblong, 0.8 - 1 x ca 0.5 mm, scarious and red along margins; disc annular, ca 0.8 mm across, entire to slightly wavy; ovary subglobose, ca 1.8 mm in diam., glandular-verrucose; styles 3, free, ca 0.5 mm long, bifid to halfway, with recurved or spreading arms. Fruits subglobose, ca 2 x 3 mm, shallowly 3 - 6-lobed, verrucose; fruiting pedicels 3 - 4 mm long.

*Fl. & Fr.* April - Oct.

*Distrib.* India: Deciduous and scrub forests in shaded places, or evergreen forests, often in rocky places. Andhra Pradesh and Tamil Nadu (Agastyamalai hills in Tirunelveli Dist.).

Endemic.

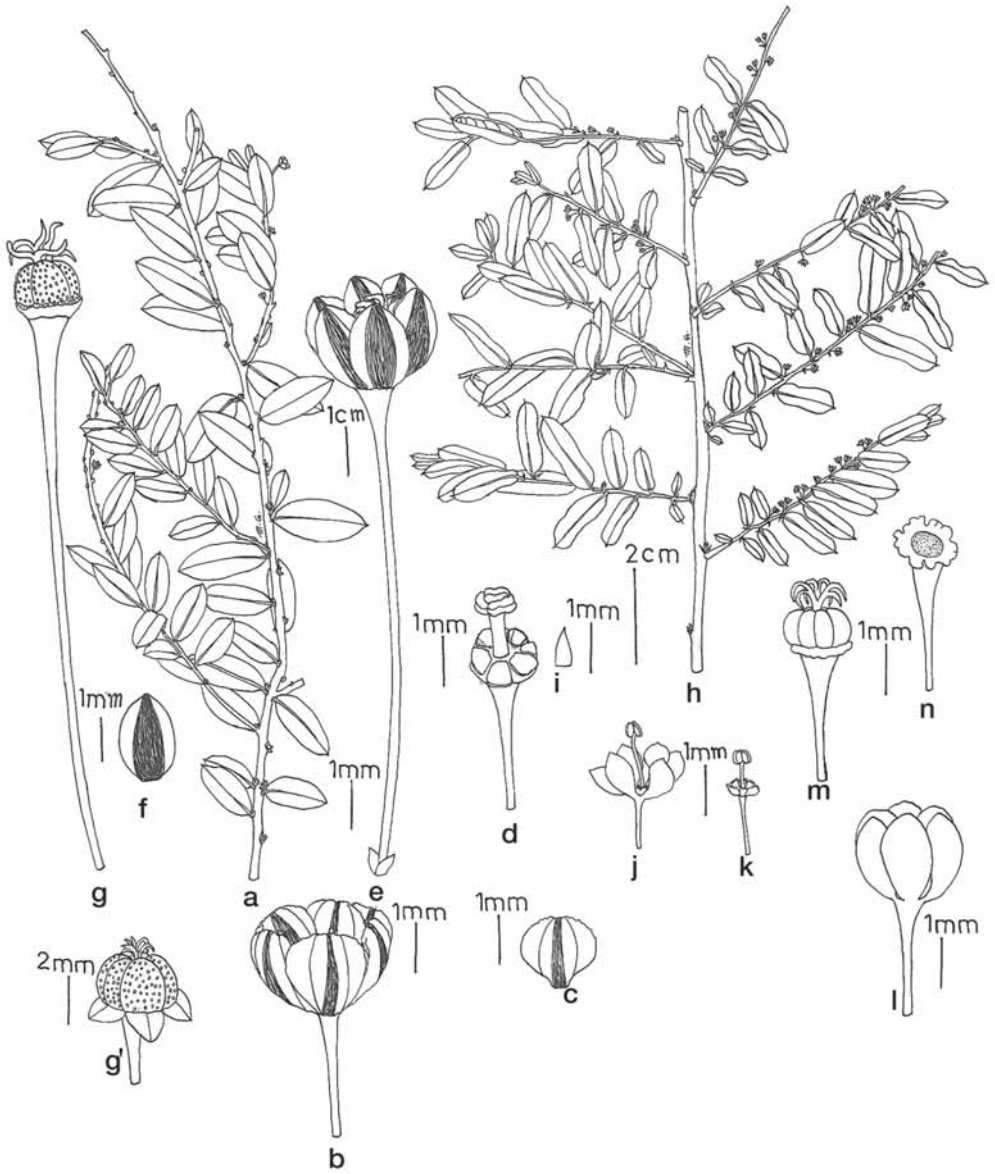
**29. *Phyllanthus polyphyllus*** Willd., Sp. Pl. ed. 4, 4: 586. 1805; Hook.f., Fl. Brit. India 54: 290. 1887; Gamble, Fl. Madras 2(7): 1288. 1925 (repr. ed. 2: 901. 1957). **Fig. 49 - h - n**

Kan.: *Krishna nelli*; Mal.: *Kattunelli*, *Kilarnelli*; Tam.: *Kilanelli*, *Sirunelli*.

Shrubs or trees, 2 - 6 m tall, glabrous; main stems with reduced scale leaves; branchlets arising singly, 2 or 3 together, 2 - 15 cm long, bearing 20 - 40, often slightly overlapping leaves. Leaves narrowly oblong to linear-oblong, usually slightly constricted at the middle, rounded or subcordate at base, rounded, obtuse, subacute, apiculate or mucronate at apex, 4 - 18 x 1 - 5 mm, thinly coriaceous; lateral nerves 5 - 9 pairs; petioles ca 0.5 mm long; stipules linear, triangular or deltoid, 1 - 2 x 0.3 - 1 mm, entire or slightly denticulate. Inflorescences axillary, glomerulate, with clusters of bracts or brachyblasts on a short peduncle; male cymules 1 - 3-flowered, at the proximal axils, female cymules 1 or 2-flowered at the tips; cymules often bisexual. Male flowers: pedicels 1.5 - 5 mm long; sepals 3 + (-2) 3, ovate, orbicular-obovate to oblanceolate, 1 - 1.5 x 0.6 - 1.1 mm, entire to subentire, thin; disc glands (5 -) 6, ca 0.5 mm across; stamens 3; filaments connate into a column (1 - 1.2 mm long); anthers connate into an ellipsoid mass, ca 0.5 mm long, vertically dehiscent. Female flowers: pedicels 1 - 3 mm long; sepals 3 + (2 -) 3, ovate-oblong, obovate or oblanceolate, 2 - 3 x 0.8 - 1.5 mm, entire to shallowly dentate and scarious along margins; disc annular, ca 1 mm across, shallowly 6-lobed with the lobes often undulate; ovary subglobose, ca 0.8 mm in diam., white pustulate; styles 3, 1 - 1.5 mm long, connate below into a column, deeply bifid above. Fruits subglobose, depressed, 2.5 - 3 x 5 - 6 mm, deeply 3-lobed, smooth, black when dry.

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

*Distrib.* India: Semideciduous forests and scrub jungles along eastern slopes of Western and both slopes of Eastern Ghats of Peninsular India, common at 300 - 1200 m altitudes. Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.



**Fig. 49. a – g’.** *Phyllanthus simplex* Retz. var. *gardnerianus* (Wight) Müll.Arg.: a. habit; b. male flower; c. male sepal; d. stamens with disc; e. female flower; f. female sepal; g. carpel with disc; g’. fruit. **h – n.** *Phyllanthus polyphyllus* Willd.: h. habit; i. bract; j. male flower; k. stamens with glandular disc; l. female flower; m. pistil; n. annular disc.

Sri Lanka.

**30. *Phyllanthus rheedei*** Wight, Icon. Pl. Ind. Orient. 5: 25, t. 1895, f. 1. 1852 (as *rheedii*), p. p., excl. syn. *Niruri* Rheede; Hook.f., Fl. Brit. India 5: 293. 1887; Gamble, Fl. Madras 2(7): 1298. 1925 (repr. ed. 2: 902. 1957); L.B.Chaudhary & R.R.Rao in Phytotaxonomy 2: 153. 2002, p. p.; M.Gangop. et al. in J. Econ. Taxon. Bot. 28: 588. 2004. *P. kozhikodianus* Sivar. & Manilal in J. Indian Bot. Soc. 56: 165, ff. 1 - 6. 1977; Sivar. & Joseph in J. Bombay Nat. Hist. Soc. 77: 369. 1980 (publ. 1981). **Fig. 50 f - 1**

Tel.: *Nalaballi*.

Herbs, sometimes becoming undershrubs, annual, erect, 15 - 60 (- 100) cm high, entirely glabrous; branchlets arising singly or in pairs, 10 - 25 cm long, bearing ca 10 - 15 leaves, simple to profusely branched, deciduous. Leaves symmetric, obovate, obovate-oblong, obovate-elliptic to orbicular-obovate or oblong-elliptic, cuneate, acute, obtuse to rounded at base, obtuse, subacute or apiculate at apex, 7 - 30 x 4 - 15 mm membranous, mostly glaucous beneath; lateral nerves 5 - 7 pairs; petioles 1 - 1.5 mm long; stipules lanceolate or subulate, entire, 1 - 2 mm long, white except for a green patch along midvein. Inflorescences axillary; cymes consisting of 1 - 3 males, 1 or 2 males + 1 female (proximal axils) or 1 female (at tips) flowers; bracts lanceolate, linear to filiform, 1 - 3 x 0.3 - 0.6 mm, thin, entire. Male flowers: pedicels 0.5 - 3.5 mm long, filiform; sepals 3 + 3, ovate-oblong, oblong or obovate, 0.2 - 0.8 x 0.15 - 0.2 mm, white-margined; disc glands 6, minute; stamens 3; filaments ca 0.2 mm long, free or connate below for about halfway; anthers orbicular, ca 0.2 mm across, vertically or obliquely dehiscent. Female flowers: pedicels 2.5 - 4 mm long, winged; sepals 3 + 3, ovate, ovate-oblong or obovate, 1 - 1.5 x 0.3 - 0.5 mm, thin, entire, white-margined; disc annular, ca 0.3 mm across, lobed; ovary subglobose, ca 0.5 mm in diam., smooth; styles 3, free, 0.3 - 0.6 mm long, bifid, spreading. Fruits subglobose or depressed, 1 - 1.2 x 1.8 - 2.5 mm, unlobed or shallowly lobed, smooth; fruiting calyx 3 - 4 mm across; fruiting pedicels 6 - 9 mm long; seeds trigonous, with 5 - 7 longitudinal ribs on back.

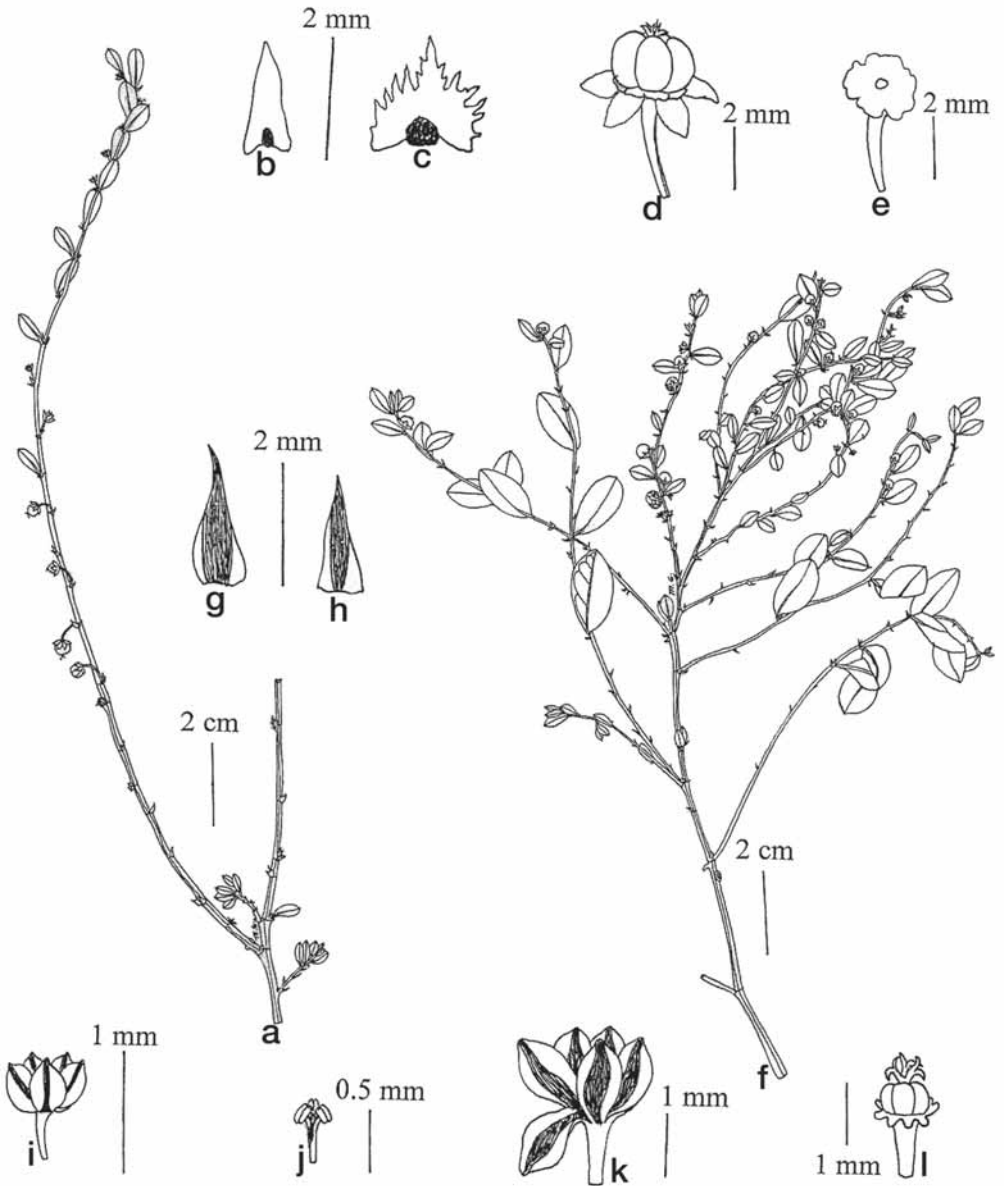
*Fl. & Fr.* March - Dec.

*Distrib.* India: Evergreen forests as undergrowth, moist shaded places, below rocky boulders, a weed in cultivated fields, open places, roadsides, up to 1700 m altitude, common. Arunachal Pradesh, Meghalaya, Assam, West Bengal (north), Sikkim, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Native of India and Sri Lanka. Introduced into Myanmar, Indonesia, Pacific Islands and West Indies.

**31. *Phyllanthus scabrifolius*** Hook.f., Fl. Brit. India 5: 299. 1887; Woodrow in J. Bombay Nat. Hist. Soc. 5: 370. 1899; T. Cooke, Fl. Bombay 2(3): 588. 1906; L.B.Chaudhary & R.R.Rao in Phytotaxonomy 2: 155. 2002; K.K.Sampath Kumar et al. in J. Econ. Taxon. Bot. 34: 389. 2010.

Herbs, annual, erect, up to 75 cm high; branched from base; main stem and lateral branches winged, hispidulous, particularly on angles; cataphylls triangular-lanceolate, ca 2 mm long. Leaves sessile, elliptic, oblong-elliptic or obovate to oblanceolate, cuneate or rounded at base, entire to denticulate along margins, apiculate to acuminate at apex, 4 - 20 x 2 - 10 mm, chartaceous, densely scabridulous with white hairs on lower surface, sparsely so above; lateral nerves 4 - 6 pairs, scaberrulous; tertiary nerves and nervules inconspicuous; petioles 1 - 2 mm long; stipules linear-lanceolate or triangular-lanceolate, ca 2 mm long, aristate at apex, thickened



**Fig. 50. a – e. *Phyllanthus clarkei* Hook.f.:** a. habit; b. stipule; c. bract; d. fruit; e. disc.  
**f – l. *Phyllanthus rheedei* Wight:** f. habit; g & h. bracts; i. male flower; j. stamens  
 (abnormal ?); k. female flower; l. pistil with disc.

and dark at midrib region, irregularly serrate along margins. Inflorescences unisexual, female flowers solitary in upper axils, male flowers in 1 - 3-flowered cymules at lower axils. Male flowers: pedicels ca 1 mm long; sepals 3 + 3, lanceolate, thickened along midrib region and broadly membranous along margins, glabrous; disc saucer-shaped, 6-lobed, tuberculate on upper surface; stamens 3; filaments connate below, free and spreading above. Female flowers: pedicels ca 2 mm long; sepals 3 + 3, lanceolate, oblanceolate or oblong, entire to dentate along margins, ca 2 x 1 mm, broadly thickened at midrib region, narrowly membranous along margins, glabrous to hispidulous outside, particularly on the thickened region; disc cup-shaped when young, becoming saucer-shaped later, irregularly lobed along margins; styles 3, free, erect when young, spreading later, each distinctly bilobed up to the middle. Fruits depressed-globose, 2 - 3 mm across; seeds trigonous, ca 2 mm long, with 8 - 10 concentric ribs and transverse striations.

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

*Distrib.* India: Evergreen forest floors, up to 1100 m altitude. Bhopal in Madhya Pradesh, Concan in Maharashtra, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Endemic and rare.

*Notes.* Recently Chaudhary & Rao (l. c.) reported it from Madhya Pradesh based on a specimen in LWG (Bhopal, Budni, Midghat forest, 17.9.1956, *Hiralal & Party* 32527).

**32. *Phyllanthus simplex*** Retz., *Observ. Bot.* 5: 29. 1789; Müll.Arg. in DC. *Prodr.* 15(2): 391. 1866; Hook.f., *Fl. Brit. India* 5: 295. 1887; Gamble, *Fl. Madras* 2(7): 1289. 1925 (repr. ed. 2: 902. 1957). *Macraea oblongifolia* Wight, *Icon. Pl. Ind. Orient.* 5(2): 27, t. 1902, f. 1. 1852. *Phyllanthus simplex* var. *oblongifolius* (Wight) Müll.Arg. in *Linnaea* 32: 32. 1863 & in DC., *Prodr.* 15 (2): 391. 1866; Hook.f., l. c. 295. 1887. *P. virgatus* auct. non G.Forst., 1786: Chakrab. & N.P. Balakr. in *J. Econ. Taxon. Bot. Addit. Ser.* 9: 98. 1992.

Herbs or undershrubs, 15 - 60 cm high, erect to decumbent, entirely glabrous; stem with normal distichous leaves, sparsely branching; branchlets ascending, compressed, narrowly angled, usually smooth. Leaves linear-oblong to oblong-lanceolate or sometimes narrowly elliptic to oblong-elliptic, rounded, truncate, cordate at base, rounded to acute, apiculate, mucronate or emarginate at apex, 5 - 25 (- 40) x 1.5 - 10 (- 13) mm, glabrous, chartaceous; lateral nerves 4 - 12 pairs; petioles 0.4 - 1 (- 2) mm long; stipules ovate, linear-lanceolate, triangular-acuminate or deltoid-acuminate, 1 - 2 (- 4) x 0.5 - 1 mm, scarios, entire or often denticulate along margins, cordate or sagittate at base. Inflorescences axillary; male cymules 2 - 4-flowered; female cymules 1-flowered; occasionally the cymules bisexual with 1 female and the rest male flowers; bracts 0.5 - 1 mm long, cordate at base. Male flowers: pedicels (0.5 -) 1.5 - 5 mm long; sepals 3 + 2 - 3, elliptic-obovate to oblong or orbicular, (0.7 -) 1 - 1.5 x 0.5 - 1.2 mm, scarios and entire to denticulate along margins; disc glands 6, obovate-oblong or flabellate, 0.1 - 0.3 mm across; stamens 3; filaments free, 0.3 - 0.5 mm long; anthers subglobose, ca 0.2 mm across, dehiscing horizontally. Female flowers: pedicels (2.5 -) 5 - 12 mm long; sepals 3 + 2 - 3, oblong-elliptic to ovate or obovate, 0.6 - 2.5 x 0.3 - 1.5 mm, white-margined, scarios, entire to denticulate; disc annular, slightly cupular, 0.8 - 1 mm across, entire or undulate; ovary subglobose, 0.6 - 1.5 mm across, 3-lobed, strongly papillate; styles 3, free, 0.5 - 1 mm long, deeply bifid. Fruits subglobose, slightly depressed, 1.8 - 2.5 x 2.5 - 5 mm, 3-lobed, papillate-verruculose; fruiting

pedicels up to 12 mm long, often reflexed; seeds trigonous, 1.2 – 2 mm long, verruculose with concentric lines of tubercles, brownish black.

*Notes.* Mueller (1866) merged *P. virgatus* Forst. f. (1786) with *P. simplex* Retz. (1789), but incorrectly used the later name for the species and reduced *P. virgatus* as variety *virgatus*. Webster (in Pacific Science 40: 94. 1986) indicates that the populations in Asian regions including India and Sri Lanka are *P. simplex* Retz. and separable form *P. virgatus* which appear to be restricted to Pacific Islands. *P. simplex* has strongly papillate ovaries and entire female disc, whereas *P. virgatus* has smooth ovaries and irregularly dissected female disc.

#### KEY TO THE VARIETIES

- 1 a. Leaves mostly thinly coriaceous; male pedicels 2 – 5 mm long; male sepals 1.2 – 1.5 mm long; fruiting pedicels 7 – 12 mm long; seeds ca 2 mm long **32.1. var. gardnerianus**  
 b. Leaves mostly chartaceous; male pedicels and sepals ca 0.5 mm long; fruiting pedicels 2 – 6 mm long; seeds ca 1.5 mm long **32.2. var. simplex**

**32.1. var. gardnerianus** (Wight) Müll.Arg. in Linnaea 32: 33. 1863 & in DC., Prodr. 15(2): 392. 1866; Hook.f., Fl. Brit. India 5: 295. 1887. *Macraea gardneriana* Wight, Icon. Pl. Ind. Orient. 5(2): 27, t. 1902, f. 3. 1852. *Phyllanthus gardnerianus* (Wight) Baill., Etude Euphorb. 628. 1858. *P. virgatus* var. *gardnerianus* (Wight) Govaerts & Radcl.-Sm. in Kew Bull. 51: 177. 1996.

**Fig. 49 a - g'**

Herbs or undershrubs, perennial, 30 - 60 cm high.

*Fl. & Fr.* Jan. - April and Aug.

*Distrib.* India: Subtropical evergreen forests or along dry hill slopes on the Western Ghats, at 900 - 1500 m altitudes, rare. Karnataka, Kerala, Tamil Nadu (Nilgiri and Pulney hills), Maharashtra and Odisha.

Sri Lanka.

#### **32.2. var. simplex**

*Asm.:* *Bon-babri*; *Guj.:* *Motibhonyaanmali*; *Mar.:* *Bhuiavali*; *Sans.:* *Tandameral*; *Tel.:* *Uchchiyusirika*.

Herbs, annual or perennial, up to 20 cm high.

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

*Distrib.* India: Common weed in waste places, cultivated fields, roadsides, riverbanks, grasslands, forest undergrowth, up to 1500 m altitude; almost throughout the country including Andaman & Nicobar Islands.

Sri Lanka (and India) to SE. Asia, S. China, Indo-China and Malesia.

#### Subgenus **4. Kirganelia** (A.Juss.) G.L.Webster

Trees, shrubs or herbs, monoecious or dioecious; branching phyllanthoid. Male flowers:

calyx-lobes 5 or 6; disc of 5 or 6 lobes; stamens 5 or 6; filaments free or rarely united; anthers dehiscent vertically or horizontally; pollen grains more or less globose, colpate. Female flowers: calyx-lobes 5 or 6; disc usually as in male; ovary of 3 – 12 carpels; styles bifid or sometimes entire, often thickened and fleshy. Fruits capsular or baccate; seeds trigonous.

Africa, Asia and Australia, two species introduced to W. Indies, ca 35 species; 4 species in India.

**33. *Phyllanthus glaucus*** Wall. [Cat. No. 7927 A. 1847, nom. nud.] ex Müll.Arg. in Linnaea 32: 14. 1863; Hook.f., Fl. Brit. India 5: 288. 1887. *P. flueggeiformis* Müll.Arg. in DC., Prodr. 15(2): 349. 1866. *Flueggeopsis glauca* (Wall. ex Müll.Arg.) A.Das in Kanjilal et al., Fl. Assam 4: 158. 1940; V.Naray. in Kanjilal et al., Fl. Assam 4: erratum. 1940.

Kh.: *Dieng-soh-matan, U-soh-matiar*.

Shrubs or trees, 2 - 6 m high, entirely glabrous; branches terete; leaf-bearing branchlets 2 – few together, 5 - 15 cm long, delicate. Leaves elliptic or broadly so, oblong-elliptic to suborbicular or obovate-oblong, acute, obtuse to rounded at base, apiculate, subacute, rounded or retuse at apex, 1.5 - 4 x 0.8 - 2 cm, membranous to chartaceous, sometimes glaucous beneath; lateral nerves 5 - 10 pairs; petioles 2 - 3 mm long; stipules ovate-lanceolate, linear or broadly triangular, 2 - 5 x 0.5 - 2 mm, entire, thin. Inflorescences often precocious, axillary fascicles of 4 - 12 flowers; cymules with 1 - 3 female and the remainder male flowers; also ramiflorous and racemiform; bracts triangular, 1 - 2.5 x 0.8 - 1.2 mm, entire. Male flowers: pedicels 2 - 5 mm long; sepals 4, ovate, oblong, elliptic or obovate, 1 - 1.2 x 0.6 - 1 mm, entire, thin; disc glands 3 or 5, ca 0.3 mm across; stamens 3 or 5, 1 - 1.2 mm long; filaments free; anthers broadly ovate, ca 0.5 mm long. Female flowers: pedicels 3 - 5 mm long, thickened above; sepals 3 + 3, ovate, elliptic to obovate, 1.2 - 1.5 x ca 1 mm; disc annular or cupular, ca 0.6 mm across, crenate; ovary subglobose, ca 1 mm in diam., glabrous; styles 3, 2 - 2.5 mm long, connate below into a column, bifid above. Fruits baccate, subglobose, 4 - 7 x 5 - 10 mm, 3-locular; fruiting pedicels 5 - 8 mm long; seeds tawny.

*Fl. & Fr.* April - July.

*Distrib.* India: Evergreen and subtropical forests, hedges, roadsides, on moist soil at 150 - 1800 m (up to 2700 m on the Himalayas); Sikkim, Arunachal Pradesh, Meghalaya, Nagaland and Manipur.

Nepal, Bhutan, Myanmar and China.

*Uses.* The roots used medicinally to treat intestinal parasites in infants.

**34. *Phyllanthus pinnatus*** (Wight) G.L.Webster in J. Arnold Arbor. 38: 52. 1957, in adnot. *Chorisandra pinnata* Wight, Icon. Pl. Ind. Orient. 6: 13, t. 1944. 1853; Gamble, Fl. Madras 2(7): 1285. 1925 (repr. ed. 2: 899. 1957).

Shrubs, bushy, 1 - 1.5 m high, or trees up to 4 m tall, entirely glabrous; main branches rough with stipule-scars and reduced scaly leaves; leaf-bearing branchlets fascicled, 4 - 7 mm long, few-leaved, often deciduous. Leaves elliptic, ovate-elliptic, falcately oblong-elliptic to orbicular or obovate, obliquely cuneate, acute, obtuse to rounded at base, acute, rounded or obtuse and apiculate at apex, 5 - 23 x 4 - 17 mm, membranous, glabrous, pale glaucous beneath;



lateral nerves 5 or 6 pairs, forked near margins; petioles 1 - 3 mm long, hirsute; stipules linear, subulate, ca 2 mm long, scarious, deciduous. Inflorescences ramiflorous, unisexual; glomerules many-flowered, often pedunculate; bracts tufted, oblong, obovate-oblong, flabellate or orbicular, 1 - 2 x 1 - 1.3 mm. Male flowers: at proximal axils; pedicels 3 - 9 mm long, filiform; sepals 3 + 3, obovate, ovate or orbicular, 0.6 - 1.2 x 0.4 - 1 mm, fimbriate-dentate at apex, thin; disc annular, ca 0.5 mm across, 6-lobed; stamens 6, exserted; filaments 1.5 - 2.8 mm long, free, filiform; anthers oblong, 0.5 - 0.8 mm long, longitudinally dehiscent. Female flowers: at distal axils; pedicels 8 - 37 mm long, filiform; sepals 6, broadly ovate to elliptic, 2 - 2.2 x 1.6 - 1.8 mm, scarious along margins; disc subtire to 6-lobed, ca 2 mm across, flat; ovary globose, ca 1.8 mm in diam., shortly stipitate; styles 3, very shortly connate at base, almost free and bifid to base, 1.8 - 2.2 mm long. Fruits subglobose to globose, 6 - 8 x 10 - 11 mm, 3-lobed, crustaceous, wrinkled, with longitudinal nervation; seeds globose, plano-convex, ca 3 x 2.5 mm, orange borwn.

*Fl. & Fr.* Feb. – Oct..

*Distrib.* India: Semideciduous and scrub forests, up to 1000 m, common. Andhra Pradesh and Tamil Nadu.

Sri Lanka and East Africa.

**35. *Phyllanthus reticulatus*** Poir. in Lam., *Encycl.* 5: 298. 1804; Hook.f., *Fl. Brit. India* 5: 288. 1887, *sensu lato*. *Kirganelia reticulata* (Poir.) Baill., *Etude Euphorb.* 613. 1858; Gamble, *Fl. Madras* 2(7): 1294. 1925 (repr. ed. 2: 905. 1957).

*Asm.*: *Amluki*; *Beng.*: *Panjuli*; *Guj.*: *Daluwan, Datwan, Puvan, Shinavi*; *Hindi*: *Buinowla, Kalemadhkaper, Makhi, Panjali, Panjuli*; *Kan.*: *Anamsuli, Chippulinellu, Holiballi, Sanna kagesoppu*; *Konk.*: *Panpoi*; *Mal.*: *Kattuniruri, Kilanelli, Nirnelli*; *Mar.*: *Pavan, Pavana*; *Or.*: *Bonotihudi, Jojangi, Phajoli*; *Raj.*: *Kabonan, Nedbadi*; *Sans.*: *Bahuppaja, Bahupushpa, Kambhoji, Krishna-Kaambhoji*; *Tam.*: *Abirajni, Karunelli, Karuppupplanji, Melanelli, Poola, Pula, Pullanti*; *Tel.*: *Nallapuli, Nalla-purugudu, Phulisaar, Purugudu*.

Shrubs, bushy, often straggling, scandent, or a tree, 1 - 4 m high, glabrous or pubescent; leaf-bearing branchlets 3 - 20 cm long. Leaves narrowly to broadly oblong-elliptic, elliptic to suborbicular or obovate to obovate-oblong or ovate-oblong, rounded, obtuse, acute or sometimes truncate or subcordate at base, rounded, obtuse, acute or apiculate at apex, 1 - 7 x 0.4 - 3 cm, thinly coriaceous, chartaceous or sometimes membranous, sparsely pilose on major nerves to glabrous above, glabrous beneath, often glaucous on the under surface; lateral nerves 4 - 7 (- 13) pairs; petioles 1 - 3 (- 5) mm long, tomentellous to glabrous; stipules linear, subulate to lanceolate, truncate at base, 0.8 - 1.5 x 0.3 - 1 mm, entire, often hardened, spiniform and recurved on older branches. Inflorescences axillary or sometimes on leafless racemes up to 6 cm long; male cymules 2 - 6-flowered; female cymules 1 - 6-flowered; proximal cymules often bisexual; bracts triangular or linear-lanceolate, 1 - 1.5 mm long. Male flowers: pedicels 4 - 10 mm long, glabrous; sepals 5 or 6, entire, 1 - 2.5 x 0.8 - 1.5 mm, thin, the outer broadly elliptic or oblong to obovate, ca 1 mm broad, the inner suborbicular, ca 1.5 mm broad; disc glands 5 or 6, pitted, ca 0.2 mm across; stamens 5 or 6 (3 + 2 or 2 + 3), unequal; outer filaments ca 1 mm long, free; inner filaments ca 1.2 mm long, connate below into a column, free above; anthers oblong-ellipsoid, 0.3 - 0.5 mm long, erect, vertically dehiscent. Female flowers: pedicels 3 - 8 mm long; sepals 5 or 6, in 2 or 3 series, 1.2 - 2.5 x 0.7 - 1.5 mm, entire to wavy and often white along margins; outer

oblong-elliptic or obovate, ca 1 mm across; inner suborbicular, ca 1.5 mm across; disc annular, crenate or consisting of 5 or 6 distinct glands, obscurely pitted; ovary subglobose, 1 - 1.5 mm in diam., 5 - 10 (- 12)-locular, smooth; styles 5 - 10 (- 12), up to 0.5 mm long, triangular, free or very shortly connate at base, shortly bifid at apex. Fruits baccate, subglobose to globose, 2 - 5 (- 6) x 3.5 - 5.5 (- 7) mm, often slightly depressed, unlobed, fleshy, smooth, glabrous; seeds trigonous, smooth.

*Fl. & Fr.* Aug. - April.

*Distrib.* India: Common in deciduous forests, scrub, subtropical forests or in secondary vegetation, often along stream sides, up to 800 (- 1800) m altitude; almost throughout the country including Andaman & Nicobar Islands.

Sri Lanka, Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, Thailand, China, Vietnam, Laos, Cambodia and throughout Malesia up to NE. Australia; Tropical W. Africa.

*Uses.* According to Kirtikar & Basu (Indian Med. Pl. ed. 2, 3: 2219, t. 857. 1935) and Wealth of India, Raw Materials (5: 320 - 321. 1959), the fruits are astringent and useful in rheumatic inflammations (*Vata*) and diseases of blood. The leaf juice made into a pill with camphor and cloves is a remedy of bleeding gums in Konkan region of Karnataka State. The leaf juice used for diarrhoea afflicting infants in NE. India. Roots used as a red dye in Tamil Nadu. Stems used for making baskets in Nicobar Islands. Roots and leaves used in bleeding gums and as diuretic in Andhra Pradesh. The berries are sweet in taste.

**36. *Phyllanthus tenellus* Roxb.** [Hort. Bengal. 69. 1814, nom. nud.] Fl. Ind., ed. Carey 3: 668. 1832; Hook.f. in Hooker's Icon. Pl. t. 1569. 1887; R.L. Mitra in Bull. Bot. Surv. India 27: 154, f. 1. 1985 (publ. 1987); Tandyekkal & Ramla in J. Econ. Taxon. Bot. 21: 731 - 733. 1997; Reddy & Raju in J. Econ. Taxon. Bot. 26: 197. 2002; E.S.Kumar et al. in J. Econ. Taxon. Bot. 28: 756. 2004.

Mal.: *Melarnelli*.

Herbs, annual, erect, 20 - 60 cm high, entirely glabrous; main stems bearing spirally arranged reduced cataphylls; leaf-bearing branchlets 3 - 15 cm long, deciduous, each with 10 - 25 leaves. Leaves obovate-oblong to obovate-elliptic or lanceolate, acute, obtuse to rounded at base, acute, obtuse, rounded to apiculate at apex, 4 - 25 x 2 - 10 mm, membranous; lateral nerves 5 - 8 pairs; petioles 0.8 - 1 mm long; stipules lanceolate or subulate-filiform, 1 - 1.5 mm long, entire and scarious along margins. Inflorescences axillary, on deciduous branchlets; proximal cymules with 2 or 3 male flowers and 1 or 2 female flowers; distal cymules with 1 (- 2) female flowers; bracts lanceolate, up to 1 mm long. Male flowers: pedicels 0.5 - 1.5 mm long; sepals 5, elliptic-obovate, obtuse, cucullate at apex, 0.3 - 0.7 x 0.3 - 0.4 mm, thin, entire and scarious along margins; disc glands 5, obcordate, cuneate at base, ca 0.2 mm across; stamens 5, free; filaments free, distally bent, ca 0.3 mm long; anthers squarish, ca 0.2 mm across; thecae divergent and horizontally oriented, with the vertical dehiscent slits appearing horizontal and joining at the apex of the anther. Female flowers: pedicels flexuous, 2.5 - 7.5 mm long; sepals 5, triangular, oblong to ovate, 0.6 - 1 x 0.3 - 0.5 mm, thin, entire, whitish except the midrib, scarious-margined, reflexed in fruit; disc patelliform, crenate; ovary depressed, ca 0.8 mm across, smooth or minutely granular; styles 3, free, ca 0.4 mm long, deeply bifid. Fruits depressed, somewhat oblate, 1.2 - 1.5 x 2 - 3 mm; testa granular or smooth; fruiting pedicels 4 - 8 mm long; seeds trigonous, densely papillose with concentric lines of tubercles on back.

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

*Distrib.* India: Introduced into Calcutta Botanic Garden in 1802 by Capt. Tennet, but never spread in West Bengal. Now seen in Maharashtra, Andhra Pradesh, Tamil Nadu and Kerala only. Reddy & Raju (l. c. 2002) report it from Tirupati Hills (Chittoor District) and Warangal District of Andhra Pradesh. Tandyekkal & Ramla (l. c. 1997) report it from Vallikunnu (Malappuram District) and E.S. Kumar et al. (l. c. 2004) from Thiruvananthapuram District of Kerala.

Sri Lanka; native of Mascarene Islands; introduced into Japan (Kurosawa in J. Jap. Bot. 76: 51 – 52. 2001) and New World.

### Subgenus 5. *Phyllanthus*

Herbs or undershrubs, monoecious or dioecious; branching phyllanthoid. Leaves alternate, distichous, and relatively small. Inflorescences in axillary clusters with solitary female flower with solitary or cymes of many male flowers. Male flowers: calyx-lobes 5 or 6; disc of 5 or 6 lobes; stamens 2 or 3; filaments free or united; anthers dehiscent vertically or horizontally. Female flowers: calyx-lobes 5 or 6; disc cupuliform or divided into 5 or more lobes; ovary of 3 carpels, smooth or roughened; styles bifid, mostly free. Fruits capsular, often explosively dehiscent; seeds trigonous, 2 in each locule, mostly ribbed or verruculose.

Pantropical, ca 25 species; 16 species in India.

**37. *Phyllanthus airy-shawii*** Brunel & J.P.Roux in Nord. J. Bot. 4: 470, f. 3. 1984; R.L.Mitra & M.P.Nayar in Taxon 37: 470. 1988. *P. debilis* Wall. [‘Herb. Buch.-Ham.’ Cat. No. 7892 A, p. p.] ex Hook.f., Fl. Brit. India 5: 299. 1887, p. p. maj., non Klein ex Willd., 1805.

Herbs, annual, usually up to 60 cm high, entirely glabrous; leaf-bearing branchlets 2 - 7 cm long. Leaves distichous, proximal ones of branchlets double the size of distal ones, elliptic to obovate or suborbicular, acute or rounded at base, rounded, obtuse, apiculate, acute, mucronate or rarely truncate at apex, 4 – 20 x 2 – 10 mm, membranous or often chartaceous, glaucescent beneath; lateral nerves 4 - 6 pairs; petioles ca 1mm long; stipules linear-lanceolate to linear-filiform, 1.5 - 3 x 0.3 - 0.6 mm, entire. Inflorescences axillary, solitary, the males at the proximal axils, the females towards the tips; bracts ovate-lanceolate to linear-filiform, 1 - 2 x 0.2 - 0.5 mm, entire. Male flowers: pedicels 1 - 1.2 mm long; sepals 3 + 3, ovate-elliptic or obovate, 1 - 1.2 x 0.4 - 0.8 mm, entire and scarious along margins; disc glands 6, 4-lobed, stipitate; stamens 3, united below into 0.3 mm long column, trifid at apex; anthers oblong, ca 0.1 mm long, vertically dehiscent. Female flowers: pedicels 1.2 - 2 x 0.1 (at base) - 0.4 (at apex) mm; sepals 3 + 3, obovate-oblong to spatulate, 1.2 - 2.5 x 0.4 - 1.5 mm, entire, scarious and white along margins; disc glands 6, obovate, minute; ovary globose, 0.5 - 0.9 mm in diam., 3-lobed; styles 3, free, 0.3 - 0.5 mm long, bifid. Fruits subglobose, 1.5 - 2 x 1.8 - 2.5 mm, scarcely or prominently 3-lobed, smooth; fruiting pedicels 2 - 3 x 0.2 (at base) - 0.5 (at apex) mm; calyx ca 5 mm across; seeds trigonous, 1 - 1.5 x 0.5 - 0.8 mm, irregularly 6 or 7 ribbed on back.

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

*Distrib.* India: In cultivated fields, waste places, roadsides, hill slopes etc., up to 1500 m altitude. Uttar Pradesh, Bihar, Jharkhand, West Bengal, Sikkim, Assam, Meghalaya, Orissa, Madhya Pradesh and Andhra Pradesh.

Bangladesh, Myanmar and Thailand.

**38. *Phyllanthus ajmerianus*** L.B.Chaudhary & R.R.Rao in *Phytotaxonomy* 2: 147, f. 3. 2002.

Herbs, annual, prostrate, 2.5 – 10 cm long, dull green; stems many, arising from the base, slender, thread-like, striate, glabrous or scaberulous; cataphylls absent. Leaves spatulate to obovate or ovate-elliptic (particularly in upper part of the stem) cuneate at base, entire along margins, subobtusate to obtuse at apex, 4–7 x 1.5–2 mm, glabrous, coriaceous; lateral nerves not visible; stipules linear-lanceolate, acuminate at apex, ca 1 mm long. Inflorescences unisexual cymules, with solitary female flower in lower axils and male flowers in 1 (- 3) flowered cymules. Male flowers: minute; sepals 5, elliptic-obovate; stamens 5, filaments connate for one-third at basal portion, free above; disc segments 5, saucer-shaped. Female flowers: pedicels 1.5–1.8 mm long; sepals oblanceolate or obovate, ca 1 mm long, thickened and dark at midrib region, thin and membranous along margins; disc segments 5, rectangular or tongue-shaped; styles 3, free, recurved, deeply bilobed almost to the base. Fruits obovate, obtusely trilobed, ca 1.5 mm in diam.; seeds trigonous, ca 0.8 mm long, light brown, faintly tuberculate.

*Fl. & Fr.* Aug. – Dec.

*Distrib.* India: Dried ditches around ponds, tanks and other water bodies in clay soil. Rajasthan [Type: Rajasthan, Ajmer village, Kekri Tank, 350 m, 31.12.1959, *V. S. Sharma* 1385 (Holotype in LWG)].

Endemic.

**39. *Phyllanthus amarus*** Schumach. & Thonn., *Beskr. Guin. Pl.* 421. 1827 & *Kongl. Danske Vidensk. Selsk. Skr.* 4: 195 - 196. 1829; R.L. Mitra & S.K. Jain in *Bull. Bot. Surv. India* 27: 164. 1985 (publ. 1987). *P. nanus* Hook.f., *Fl. Brit. India* 5: 298. 1887; Kanjilal et al., *Fl. Assam* 4: 155. 1940; Haines, *Bot. Bihar Orissa* 2: 127. 1921. *P. niruri* auct. non L. 1753: Müll.Arg. in DC., *Prodr.* 15(2): 406. 1866 (var. *genuinus*); Hook.f., l. c. 298. 1887, p. p.

Beng.: *Bhuiamla*, *Sadahajaroni*; Guj.: *Bhoryaanmali*; Hindi: *Bhonyaabali*, *Jar-amlā*, *Safed hajarmari*; Kan.: *Kiranelligida*; Mal.: *Kirganelli*, *Kizharnelli*; Mar.: *Bhuiavala*; Or.: *Bhuiavala*; Raj.: *Gugario*; Sans.: *Adhyanda*, *Ajata*, *Amlika*, *Bahupatri*, etc.; Sind.: *Niruri*; Tam.: *Kilanelli*, *Kilkaynell*, *Kizharnellii*; Tel.: *Nelausirika*, *Nelausiri*, *Nelavusari*; Urdu: *Bhuiamla*.

Herbs, annual, erect, occasionally ascending or diffuse, 15 - 75 cm high, entirely glabrous; stems herbaceous or woody, simple or branched; leaf-bearing branchlets 2 - 15 cm long, often scabridulous. Leaves oblong to oblong-elliptic or broadly so or oblong-obovate to oblong-ob lanceolate, rounded to obtuse, often subtruncate or acute at base, rounded to obtuse and often apiculate at apex, 2 – 12 x 1.2 – 6 mm, membranous or thinly chartaceous; lateral nerves 4 - 6 pairs; petioles 0.3 - 1 mm long; stipules triangular-lanceolate or linear or linear-lanceolate, 0.8 - 1.2 x 0.2 - 0.4 mm, entire. Inflorescences axillary; cymules usually bisexual, each consisting of one male and one female flowers (see Mitra & Jain, l. c. for variation); bracteoles linear-lanceolate, 0.5 - 1 x 0.2 - 0.4 mm, entire, scarious. Male flowers: pedicels 0.3 - 1 mm long, slender; sepals 5 (or 6), ovate-oblong, oblong or oblong-elliptic, 0.2 - 0.6 x 0.1 - 0.3 mm, entire, scarious; disc glands 5, minute, stipitate; stamens 3; filaments united into a slender column (0.1 - 0.3 mm long); anthers connate in a mass (ca 0.15 mm across), vertically dehiscent. Female flowers: pedicels 0.5

- 1 mm long, slender; sepals 5, oblong to ovate-oblong, 0.5 - 1 x 0.3 - 0.5 mm, entire and scarious along margins; disc annular, flat, ca 0.4 mm across, deeply lobed; ovary subglobose, 0.4 - 0.6 mm, smooth; styles 3, free, ca 0.3 mm long, bifid, spreading. Fruits smooth, ca 2 mm in diam.; fruiting pedicels 1 - 2 mm long; seeds trigonous, with 5 or 6 longitudinal ribs on the back, ca 1 x 0.8 mm, brown.

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

*Distrib.* India: Common weed in waste places, gardens, riverbanks, coastal forests, forest clearings etc., up to 1500 m altitude. Throughout the country.

Native of tropical America, now a pantropical weed.

*Uses.* The fresh whole plant with roots is excellent remedy for jaundice and also in stomach and urino-genital disorders.

**40. *Phyllanthus brevipes*** Hook.f., Fl. Brit. India 5: 297. 1887; Kanjilal et al., Fl. Assam 4: 154. 1940. **Fig. 48 a - c**

Undershrubs, ca 45 cm high, entirely glabrous; branches terete, up to 20 cm long, densely leafy. Leaves arising on all branches, obovate-oblong to obovate-elliptic or elliptic, acute, subacute or rounded at base, obtuse to rounded or subacute at apex, 8 - 25 x 5 - 12 mm, firmly chartaceous, pale greyish and glaucescent beneath; lateral nerves 5 - 8 pairs, raised on both surfaces; petioles 1 - 2 mm long; stipules broadly ovate, ca 0.8 mm long, fimbriate, membranous. Inflorescences arising in all leaf axils; cymules unisexual or bisexual with 1 male and 1 female flower, subtended by tufts of bracts; bracts sub-flabellate, ca 0.5 x 1 mm, fimbriate, scarious. Male flowers: pedicels ca 1.5 mm long; sepals 3 + 3, flabellate-obovate, ca 1 x 0.8 mm, entire; disc glands distinct, orbicular; stamens 3, ca 1.2 mm long; filaments united below into a column (about half way), free above; anthers orbicular, vertically dehiscent. Female flowers: pedicels 3 - 4 mm long; sepals 3 + 3, obovate or ovate, ca 1 x 0.5 mm, entire; disc deeply 6-lobed; ovary subglobose, ca 0.6 x 1 mm; styles 3, ca 0.5 mm long, free, bifid, recurved. Fruits subglobose, often depressed or ovoid, ca 2 x 3 mm, 3-lobed, smooth.

*Fl.* Dec.

*Distrib.* India: Arunachal Pradesh.

Endemic

**41. *Phyllanthus clarkei*** Hook.f., Fl. Brit. India 5: 297. 1887, p. p.; Kanjilal et al., Fl. Assam 4: 154. 1940, p. p.; R.L.Mitra & Sanjappa in Bull. Bot. Surv. India 45: 13, f. 3. 2003. **Fig. 50 a - e**

Kh.: *Soh-sa-kuriau*.

Undershrubs or shrubs, 45 - 120 cm high, glabrous; stems terete; branches brown; leaf-bearing branchlets 0.5 - 30 cm long, somewhat angled, scaberulous along the corners. Leaves cuneate-obovate, sometimes elliptic to oblanceolate, cuneate or acute at base, rounded, truncate, retuse or apiculate at apex, 5 - 20 x 2 - 10 mm, membranous to firmly chartaceous, glabrous, often

glaucous beneath; lateral nerves 3 - 5 pairs, very prominent beneath; petioles 0.5 - 1 mm long; stipules triangular, lanceolate, or subulate-filiform, 1 - 3.5 mm long, denticulate (towards base), slightly undulate or fimbriate, hyaline. Inflorescences axillary; male cymules 1 - 3-flowered; females solitary or paired; bracts in a tuft forming short brachyblasts, triangular-acuminate or flabellate-orbicular, 2 - 3 x 1 - 1.5 mm, fimbriate to subentire, hyaline. Male flowers: pedicels 2 - 5 mm long, filiform, glabrous; sepals 3 + 3, wide oblong to obovate, 1 - 1.5 x 0.5 - 1 mm, white, thin, minutely pubescent to glabrous outside; disc glands 3, deeply bilobed; stamens 3; filaments ca 0.6 mm long, free; anthers vertically dehiscent. Female flowers: pedicels 2.5 - 8 mm long, glabrous; sepals 3 + 3, obovate to elliptic-oblong, 1 - 1.5 x 0.7 - 1.1 mm, glabrous, slightly wavy and scarious along margins; disc cupular-annular, ca 1 mm across, crenate; ovary subglobose, ca 0.6 mm in diam., glabrous; styles 3, spreading, ca 1 mm long, free, deeply bifid. Fruits subglobose, slightly depressed, 2 - 3 x 3.5 - 5 mm, unlobed, slightly lobed or 3-angled, smooth; fruiting pedicels up to 1 cm long.

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

Distrib. India: Common on the Himalayas, montane forests, between 1500 - 2500 m altitudes; up to 1800 m in NE. India. Jammu & Kashmir, Himachal Pradesh, Uttarkhand, West Bengal, Sikkim, Arunachal Pradesh, Nagaland and Manipur.

Nepal, Bhutan, Bangladesh, Myanmar, China, Vietnam and Thailand.

**42. *Phyllanthus debilis*** Klein ex Willd., Sp. Pl., ed. 4, 4: 582. 1805; G.L. Webster in J. Arnold Arbor. 38: 307. 1957, non Buch.-Ham. ex Hook.f. 1887; R.L. Mitra & S.K. Jain in Bull. Bot. Surv. India 27: 169, f. 2. 1985 (publ. 1987). *P. niruri* var. *debilis* (Klein ex Willd.) Müll.Arg. in Linnaea 32: 43. 1863 & in DC., Prodr. 15(2): 407. 1866. *P. mukerjeeanus* D.Mitra & Bennet in Bull. Bot. Soc. Bengal 19: 145. 1967. *P. niruri* auct. non L. 1753; Hook.f., Fl. Brit. India 5: 298. 1887, p. p. tantum quo ad syn. *P. polyphyllus* [Herb. Wight in Wall. Cat. No. 7895 D. 1847, nom. nud.].

Herbs, annual, erect, 15 - 40 (- 70) cm high, entirely glabrous; stems with normal leaves when young, when old bearing reduced scaly leaves; leaf-bearing branchlets 2 - 8 cm long, further branched, deciduous. Leaves narrowly oblong-elliptic to oblong-lanceolate or linear-oblong, or narrowly obovate to oblanceolate, acute, obtuse, rounded or cuneate at base, usually tapering to an acute apex, 4 - 20 x 0.8 - 7 mm, membranous to chartaceous, glaucous beneath; lateral nerves 4 - 6 pairs; petioles 0.5 - 1 mm long; stipules subulate to linear, truncate at base, acuminate at apex, 0.5 - 3 x 0.2 - 1.2 mm. Inflorescences axillary cymules on deciduous branchlets, unisexual; male cymules 2 - 5-flowered, at proximal axils, female cymules 1-flowered, at tips; bracts linear-lanceolate or ovate-lanceolate, 0.5 - 1.2 x 0.1 - 0.5 mm, entire, thin. Male flowers: pedicels 0.5 - 0.8 mm long, filiform; sepals 3 + 3, obtuse, obovate or oblong-elliptic, 0.5 - 0.8 x 0.2 - 0.6 mm, entire, thin; disc glands 6, obovate to suborbicular; stamens 3; filaments connate into a column, trifid at apex; anthers globose or deltoid, ca 0.1 mm across, horizontally dehiscent. Female flowers: pedicels 1 - 2 x 0.3 - 0.5 mm; sepals 3 + 3, ovate, obovate, oblong or oblong-elliptic, 1 - 1.5 x 0.4 - 1 mm, with white and scarious margins; disc cupular-annular, finally flattened, ca 0.5 mm across, entire, undulate or shallowly 6-lobed; ovary subglobose, 0.6 - 1.2 mm in diam., smooth; styles 3, free, 0.2 - 0.5 mm long, bifid to midway, spreading. Fruits subglobose, 1.1 - 2 x 1.8 - 2.5 mm, unlobed or scarcely lobed, smooth; fruiting calyx 3 - 4 mm across; seeds trigonous, ca 1 mm long, with 6 or 7 longitudinal ribs on the back, yellowish to pale brown.

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

*Distrib.* India: A weed of waste places and cultivated fields, mainly in coastal regions up to 1200 m altitude. Rajasthan, West Bengal, Orissa, Madhya Pradesh, Andhra Pradesh, Goa, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Islands.

Native of South India and Sri Lanka; introduced into Myanmar, Thailand, Malaysia (Penang), Indonesia, Pacific, West Indies and probably other tropical localities (Webster in Pacific Sci. 40: 104. 1986).

**43. *Phyllanthus fraternus*** G.L. Webster in Contr. Gray Herb. 176: 53. 1955 & in J. Arnold Arbor. 38: 309, f. 19 G & H. 1957; R.L. Mitra & S.K. Jain in Bull. Bot. Surv. India 27: 172, f. 3. 1985 (publ. 1987). *P. niruri* auct. non L. 1753: sensu Hook.f., Fl. Brit. India 5: 298. 1887, p. p.

Guj.: *Bhonya-anmali*; Kan.: *Kiranelligida*; Mar.: *Bhuivali*; Tam.: Keela-nelli.

Herbs, annual, erect or ascending, 10 - 50 cm high; stem without leaves; deciduous branchlets 4 - 8 cm long, subterete with a narrow sharp wing on either side, scabridulous, especially along ridges of wings, 10-30-leaved; internodes 2 - 4 mm long; leaf-bearing branchlets 2 - 15 cm long, flat, striate and winged or angled, usually scabridulous. Leaves narrowly to broadly oblong, elliptic-oblong, orbicular, obovate-oblong to oblanceolate, rounded, obtuse, acute or cuneate at base, rounded, obtuse, apiculate or mucronulate at apex, 2 - 20 x 1 - 12 mm, membranous to thinly coriaceous, glabrous or sometimes scabrid on midrib above, glabrous to scabrid on major nerves beneath; lateral nerves 4 - 7 pairs; petioles 0.4 - 1 mm long; stipules linear-lanceolate or subulate, truncate at base, entire, 0.4 - 2 x 0.3 - 0.5 mm, thin, scarious. Inflorescences proximal cymules consisting of 1 - 3 male flowers or together with 1 female flower, distal cymules usually bearing solitary female or sometimes with a male flower also; bracts ovate-lanceolate or linear-lanceolate, 0.5 - 1.5 x 0.2 - 0.6 mm, scarious, white-margined. Male flowers: pedicels 0.5 - 1 mm long, slender, scabrid to glabrous; sepals 3 + 3, subequal, broadly elliptic, obovate-elliptic, obovate-oblong to suborbicular, 0.3 - 1 x 0.2 - 0.5 mm, hyaline and white-margined, glabrous; disc glands 6, suborbicular, obovate or flabellate, ca 0.1 mm across; stamens 3; filaments connate into ca 0.2 mm long column; anthers sessile at column apex, suborbicular or squarish, ca 0.1 mm across, horizontally or obliquely dehiscent; anther-thecae divergent. Female flowers: pedicels 0.5 - 3 mm long, glabrous; sepals 3 + 3, unequal, obovate, oblanceolate, linear-spathulate, obtuse to subacute at apex, 1 - 2 x 0.3 - 1 mm, entire, scarious and white-margined, sometimes scabrid outside; disc in a ring, irregularly cup-shaped, deeply dissected with linear or subulate segments; ovary subglobose, 0.5 - 0.8 mm in diam., glabrous; styles 3, free, erect or ascending, slender, bifid at apex. Fruits subglobose or depressed, 1 - 2 x 2 - 3 mm, shallowly 3-lobed or 3-angled, smooth; fruiting pedicels 1.2 - 3.5 mm long; seeds trigonous, 1 - 1.5 x 0.7 - 1 mm, with 6 or 7 longitudinal ribs on the back.

*Fl. & Fr.* July - Jan.

*Distrib.* India: Weed in waste places and cultivated fields at low altitudes. Haryana, Delhi, Uttar Pradesh, Bihar, West Bengal, Tripura, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Karnataka, Lakshadweep Islands and Tamil Nadu.

Probably native to Pakistan and western India; introduced into West Indies and Africa.

**44. *Phyllanthus griffithii*** Müll. Arg. in Linnaea 32: 27. 1863 & in DC., Prodr. 15(2): 384. 1866; Hook.f., Fl. Brit. India 5: 294. 1887; Kanjilal et al., Fl. Assam 4: 152. 1940, p. p. **Fig. 42 a - f**

Shrubs, entirely glabrous; leaf-bearing branchlets 5 - 16 cm long, white-scabrous. Leaves narrowly oblong-elliptic, elliptic to lanceolate-elliptic or ovate-lanceolate to lanceolate, acute or rounded at base, acute to subacute or sometimes rounded at apex, 1.2 - 4 x 0.8 - 1.5 cm, chartaceous, sometimes glaucous beneath; lateral nerves 8 - 12 pairs; petioles 1.2 - 1.5 mm long; stipules triangular-acuminate to linear-subulate, 1 - 3 x 0.5 - 1.3 mm, lanceolate, peltate-auricled. Inflorescences axillary; cymules 1 - 3-flowered, unisexual when solitary or mixed; bracts forming short brachyblasts, triangular-ovate or deltoid-acuminate, ca 1 x 0.5 mm, subentire to irregularly lacinate-denticulate, scarios. Male flowers: pedicels 10 - 15 mm long; sepals 3 + 3, elliptic to orbicular-obovate, 1.2 - 2 x 0.8 - 1 mm, thin, recurved; disc glands 6, in a ring, orbicular, ca 0.5 mm across; stamens 3; filaments connate below into a slender column (1.5 - 3 mm long), free above (ca 0.5 mm long); anthers ovoid or suborbicular, ca 0.3 mm long, horizontal. Female flowers: pedicels 6 - 10 mm long, slender; sepals 5 or 6, oblong to ovate-oblong, 1.5 - 2.5 x 0.7 - 1.3 mm, entire, recurved; disc annular, subentire or crenate, thick; ovary subglobose, 1 - 1.5 mm in diam.; styles 3, ca 2 mm long, stout, connate below up to middle into a column, recurved, deeply bifid above. Fruits subglobose, 2 - 2.5 x 3 - 3.5 mm, shallowly lobed, black when dry; fruiting pedicels 1 - 2 cm long.

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

*Distrib.* India: Primary forests, at 500 - 1200 m altitudes. Meghalaya and Manipur.

Bhutan.

**45. *Phyllanthus leschenaultii*** Müll.Arg. in *Linnaea* 32: 37. 1863 (excl. var. *tenellus*) & in DC., *Prodr.* 15(2): 398. 1866; Hook.f., *Fl. Brit. India* 5: 296. 1887. *P. missionis* Hook.f., l. c. 297. 1887; Gamble, *Fl. Madras* 2(7): 1290. 1925 (repr. ed. 2: 903. 1957). **Fig. 40 a - f**

Undershrubs or shrubs, 0.6 - 2.5 m high, entirely glabrous; branches arising from short brachyblasts, often surrounded by stipules; leaf-bearing branchlets 3 - 15 cm long, arising singly, 2 or 3 together. Leaves narrowly to broadly oblong, elliptic, obovate to oblanceolate, cuneate, acute, obtuse or rounded at base, acute, obtuse to acute at apex, (6 -) 10 - 35 x (2 -) 4 - 15 mm, membranous, glaucous beneath; lateral nerves 5 - 11 pairs; petioles 1 - 2.5 mm long; stipules broadly triangular-lanceolate to subulate, 1 - 3 x 0.5 - 1.5 mm, entire to undulate. Inflorescences axillary; cymules 1 - 3-flowered, unisexual or bisexual; proximal cymules usually of 1 - 2 male flowers or mixed with 1 female flower; distal cymules usually of 1 female flower; bracts subulate-lanceolate, up to 1 mm long. Male flowers: pedicels 2 - 3 mm long; sepals 3 + 3, ovate-oblong to oblong, ca 1 x 0.3 - 0.6 mm, white-margined; disc glands 6, suborbicular, ca 0.3 mm; stamens 3; filaments connate below into ca 0.3 mm long column, trifid above; anthers orbicular, ca 0.3 mm across, longitudinally dehiscent. Female flowers: pedicels 4 - 7 mm long, slender; sepals 3 + 3, suborbicular, obovate to oblong-elliptic, 0.8 - 1.8 x 0.5 - 1.3 mm, entire and white-scarious margined; disc cupular-annular, ca 0.5 x 1.5 mm, crenate or 6-lobulate; ovary subglobose, ca 0.7 mm in diam.; styles 3, ca 0.5 mm long, almost free, bifid to halfway. Fruits subglobose or often slightly depressed, 1.5 - 3 x 2 - 3 mm, shallowly to deeply 3 - 6-angled or 3-lobed, smooth; fruiting pedicels 5 - 10 mm long.

*Fl. & Fr.* March - Sept.

*Distrib.* India: Common on the subtropical tracts of E. Himalayas, up to 1250 m altitude; also common in NE. India in open places between 200 - 1500 m altitudes. Western Ghats of



Kerala and Tamil Nadu and NE. India from Sikkim, West Bengal, Assam, Arunachal Pradesh, Meghalaya and Mizoram.

Bhutan.

**46. *Phyllanthus praetervisus*** Müll.Arg. in *Linnaea* 34: 73. 1865 & in DC., *Prodr.* 15(2): 385. 1866, p. maj. p. *P. juniperinus* var. *obovatus* Muell.Arg. in *Linnaea* 32: 28. 1863 (non *Phyllanthus obovatus* Muhl. ex Willd., 1805). *P. parvifolius* sensu Hook.f., *Fl. Brit. India* 5: 294. 1887, p. p., tantum quoad syn. *P. praetervisus* (non Buch.-Ham. ex D.Don, 1825).

Shrubs or undershrubs, 30 - 90 cm high, entirely glabrous; leaf-bearing branchlets arising singly or sometimes in fascicles from pulvini, up to 16 cm long. Leaves elliptic, obovate-elliptic to obovate-oblong, acute, obtuse to rounded at base, rounded to subobtuse at apex, 7 - 20 x 4 - 10 mm, membranous or sometimes chartaceous, mostly glaucous beneath; lateral nerves 4 - 9 pairs; petioles 0.5 - 1 mm long; stipules triangular-acuminate to deltoid-acuminate, 0.5 - 1.5 x 0.3 - 1 mm, peltate, sagittate at base, subentire, denticulate to fimbriate along margins. Inflorescences axillary; flowers arising on short pulvini; cymules composed of solitary male or female flowers, or 1 male + 1 female flower; bracts suborbicular, up to 1 mm long, peltate, fimbriate. Male flowers: pedicels 1.5 - 3 mm long, filiform; sepals 3 + 3, orbicular-obovate, ovate or oblong, 1 - 1.5 x 0.5 - 1 mm, thin, entire to slightly undulate; disc glands 6, ca 0.2 mm across; stamens 3; filaments almost free (basal column ca 0.1 mm long), 0.6 - 0.8 mm long; anthers suborbicular, ca 0.2 mm across, horizontal. Female flowers: pedicels 5 - 10 x 0.5 - 1 mm; sepals 3 + 3, oblong, ovate or orbicular-obovate, 0.8 - 1 x 0.5 - 0.8 mm, entire; disc annular, 0.5 - 0.8 mm across, crenate; ovary subglobose, 0.5 - 1 mm in diam.; styles 3, free, 0.5 - 0.8 mm long, deeply bifid. Fruits subglobose or depressed, 0.5 - 1.3 x 1.5 - 2 mm, 3-angled or 3-lobed, smooth, brown when dry; seeds 1 - 2 x 0.5 - 1.3 mm, minutely fibrillate in concentric rows.

*Fl. & Fr.* May - Feb.

*Distrib.* India: Tropical to subtropical forests, at 200 - 1500 m altitudes. West Bengal, Sikkim, Arunachal Pradesh, Nagaland, Manipur and Meghalaya.

Bhutan, Myanmar and SW. China.

**47. *Phyllanthus pseudoparvifolius*** R.L.Mitra & Sanjappa in *Bull. Bot. Surv. India* 45: 10, f. 2. 2003. *P. parvifolius* auct non Buch.-Ham. ex D.Don, 1825: *Kurz, Forest Fl. Burma* 2: 347. 1877, in clavi; Hook.f., *Fl. Brit. India* 5: 294. 1887, pro parte quoad descr. et spec. *Wall. Cat.* 7910 A, excl. syn. *P. praetervisus* et distrib. 'Jamu (Jammu) and Kashmir'; Kanjilal et al., *Fl. Assam* 4: 152. 1940; D.G.Long in *Grierson & D.G.Long, Fl. Bhutan* 1(3): 775. 1987, pro parte maxima.

Kh.: *Ja-la-mat-kha, Tew-khap-nip.*

Undershrubs or shrubs, 1 - 3 m high, almost entirely glabrous; leaf bearing branchlets arising singly or 2 - 6-together, simple or occasionally branched, 2 - 15 cm long, more or less flattened, white-scaberulous. Leaves obovate or narrowly so, obovate-elliptic, obovate-oblong to oblong-elliptic, 4 - 15 x 2 - 7 mm, rounded at base, often slightly curling downwards along margins (on drying), rounded, obtuse or apiculate at apex, chartaceous to membranous, often glaucescent beneath; lateral nerves 4 - 6 pairs; petioles 0.5 - 1 mm long, scaberulous; stipules subulate-acuminate or deltoid-acuminate, 1 - 2 x 0.4 - 1 mm, sagittate at base, entire to undulate and scarious along margins; stipules on main branches hardening and become spinuliform.

Inflorescences axillary; male cymules 2 or 3-flowered; female cymules 1 (or 2)-flowered, often with one male flower; bracts deltoid-filiform, subulate or linear-filiform, 0.5–1.5 mm long, entire, thin. Male flowers: pedicels 2–3 mm long, slender; sepals 3 + 3, ovate to orbicular or obovate, ca 1 x 0.8 mm, thin, entire, with prominent midvein; disc consisting of 6 distinct minute glands; stamens 3; filaments ca 0.5 mm long, free; anthers erect, laterally dehiscent. Female flowers: pedicels 1–2 mm long, slender; fruiting pedicels 2–6 mm long; sepals 3 + 3, wide ovate, ovate-oblong, elliptic or oblong, 1–1.5 x 0.7–1.2 mm, rounded to acute at apex, entire to slightly wavy, white and scarious along margins; disc annular, ca 1 mm across, undulate; ovary subglobose, ca 1 mm across, 3-lobed; styles 3, free, 0.5–1 mm long, deeply bifid. Fruits subglobose, slightly depressed, 1–2 x 2–3 mm, 3-lobed, intruded at apex, smooth or with irregular longitudinal striations; seeds trigonous, ca 2 x ca 1.5 mm, striate in concentric rows.

*Fl. & Fr.*: April – Jan.

*Distrib.*: India: Common in borders of forests and deciduous forests in northeast India, often on granite-rock, between 900–1650 m altitudes; in tropical and subtropical forests of the Himalayas at 200–2500 m altitudes. West Bengal, Sikkim and Meghalaya.

Nepal, Bhutan and Myanmar.

**48. *Phyllanthus roeperianus*** Wall. ex Müll.Arg. in *Linnaea* 32: 28. 1863 & in DC., *Prodr.* 15(2): 385. 1866; Hook.f., *Fl. Brit. India* 5: 294. 1887. **Fig. 46 a - i**

Shrubs, 1–3 m high, entirely glabrous; leaf-bearing branchlets 3–15 cm long, branched, striate and angled towards tips, rarely scaberulous along the corners, dense-leaved. Leaves narrowly oblong to linear-oblong or sometimes oblong-elliptic or narrowly ovate-elliptic, cordate, rounded, acute or cuneate at base, apiculate, acute-mucronate or subacute at apex, (5–) 10–30 x (1.5–) 2.5–8 mm, coriaceous or sometimes chartaceous, often glaucous beneath; lateral nerves 4–10 pairs; petioles 0.5–1.5 mm long; stipules subulate, triangular-acuminate or deltoid-acuminate, 1–1.5 x 0.8–1 mm, peltate, thin, sagittate at base, subentire. Inflorescences axillary; cymules bisexual, few-flowered, beset with tufts of bracts, often forming short brachyblasts; bracts broadly ovate, orbicular or flabellate, 0.5–1 x 0.3–0.8 mm, membranous, orange brown, fimbriate. Male flowers: pedicels 2–2.5 mm long; sepals 3 + 2–3, obovate, spatulate or ovate-elliptic, 0.7–1 x 0.4–0.6 mm, obtuse; disc glands 6, suborbicular, minute; stamens 3; filaments ca 0.5 mm long, connate below into a column (ca 0.2 mm long), free above; anthers orbicular, minute. Female flowers: pedicels 5–12 mm long; sepals 3 + 2–3, obovate-oblong to suborbicular, 1–1.5 x 0.5–1.2 mm, undulate; disc annular, ca 0.5 mm across, undulate; ovary globose, ca 0.5 mm in diam., 3-lobed; styles 3, ca 0.5 mm long, connate below into a column, deeply bifid above. Fruits subglobose, ca 2 x 2–2.5 mm, often slightly depressed, shallowly to prominently 3-lobed, smooth.

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

*Distrib.* India: Along the edges of forests, wastelands, rocky crevices or near streams, between 1000–1800 m altitudes. Meghalaya and Manipur.

Bangladesh and Myanmar.

*Uses.* Often cultivated and cuttings used as decorating pieces in flower arrangements.

*Note.* Govaerts et al. (World Checkl. and Bibl. of Euphorbiaceae 4: 1280. 2000) treats this as synonym of *Phyllanthus cochinchinensis* (Lour.) Spreng., Syst. Veg. 3: 21. 1826, based on *Cathetus cochinchinensis* Lour., which is distributed in Indo-china and China. It needs detailed study.

**49. *Phyllanthus rotundifolius*** Klein ex Willd., Sp. Pl. ed. 4, 4: 584. 1805; Müll.Arg. in DC., Prodr. 15(2): 405. 1866, p. p.; Hook.f., Fl. Brit. India 5: 299. 1887; Gamble, Fl. Madras 1290. 1925 (repr. ed. 2: 903. 1957); E.S.Kumar et al. in J. Econ. Taxon. Bot. 26: 486, ff. A–H. 2002.

**Fig. 47 e - m**

Herbs, annual or perennial by a slender rootstock, diffusely branched, prostrate or ascending, 16 - 35 cm long, almost entirely glabrous; main stems with reduced scaly leaves; main branches diffuse, prostrate or ascending, up to 8 cm long, angled to terete, sometimes minutely scabrous on the angles; leaf-bearing branchlets arising singly or in pairs, simple or branched, up to 10 cm long. Leaves orbicular-obovate, obcordate, broadly obovate to cuneate-obovate, rounded, broadly acute or subcordate at base, truncate to rounded or apiculate or mucronate at apex, 2 - 14 x 2 - 10 mm, coriaceous or chartaceous, often glaucous beneath; venation immersed; petioles 0.5 - 1.5 mm long; stipules subulate-filiform, deltoid or ovate-triangular, entire, 1 - 2 x 0.4 - 0.6 mm, white-margined. Inflorescences axillary; male cymules 1 - 3-flowered at the proximal axils; female cymules 1 (- 3)-flowered at distal axils; bracts ovate to ovate-lanceolate, ca 1 x 0.4 mm, slightly undulate to entire along margins. Male flowers: pedicels 0.5 - 1 mm long; sepals 3 + 3, oblong-ovate or orbicular-ovate, entire, 0.5 - 0.8 x 0.4 - 0.6 mm; disc glands 6, subglobose, ca 0.2 mm across, slightly pitted, wrinkled or warted; stamens 3; filaments united into a column (ca 0.2 mm long), trifid at apex; anthers subglobose, ca 0.2 mm across, dehiscing horizontally. Female flowers: pedicels 1 - 1.5 mm long; sepals 3 + 3, ovate-oblong to oblong-elliptic or obovate, entire, 1.5 - 2 x 1 - 1.2 mm, white and scarious along margins; disc cupular-annular, ca 0.5 mm across, slightly lobed; ovary subglobose, ca 0.5 mm in diam., smooth; styles 3, free, ca 0.2 mm long, shortly bilobed at apex. Fruits subglobose, slightly depressed, 1 - 2 x 1.5 - 2.5 mm, shallowly to deeply 3-lobed, smooth; fruiting pedicels ca 3 mm long; seeds trigonous, ca 1 mm long, with 5 - 7 longitudinal ribs on back, brown.

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

*Distrib.* India: Mostly on the sandy beaches or wastelands near coastal areas. Orissa, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

Sri Lanka, Pakistan to Arabia and tropical Africa.

**50. *Phyllanthus sanjappae*** Chakrab. & M.Gangop. in J. Bombay Nat. Hist. Soc. 90: 69, f. 1. 1993; Chakrab. & G.S.Lakra in J. Econ. Taxon. Bot. 26: 546. 2002.

Shrubs, densely branched, 1 - 2 m high, entirely glabrous; leaf-bearing branchlets 5 - 13 cm long. Leaves slightly asymmetric, cuneate-obovate to rhombate-obovate, cuneate at base, obtuse-mucronate at apex, 8 - 20 x 4 - 11 mm, coriaceous; lateral nerves 3 - 5 pairs; petioles 0.2 - 0.4 mm long; stipules not seen. Inflorescences axillary; female cymules 1-flowered, at the distal axils. Male flowers: not seen. Female flowers: pedicels 2 - 3 mm long; sepals 3 + 3, oblong, oblong-elliptic to broadly ovate-elliptic, 1.5 - 2 x 0.8 - 1.2 mm, entire and scarious along margins; disc cupular-annular, 1.2 - 1.5 mm across, crenate; ovary subglobose, ca 1 m in diam.; styles 3, 1 - 1.2 mm long, connate below into a column (ca 0.5 mm long), bifid to quadrifid above. Fruits

axillary, solitary, subglobose, 3-lobed, ca 3.5 x 4.5 mm, glabrous; the persistent central column ca 2.5 mm long; fruiting pedicels 5 - 6 mm long, ca 0.3 mm thick at base, ca 0.8 mm thick at apex.

*Fl. & Fr.* March – Sept.

*Distrib.* India: Scarce on dry hill slopes or on rocks near streams, from sea level to about 700 m altitude. North Andaman Islands.

Endemic.

**51. *Phyllanthus urinaria* L.**, Sp. Pl. 982. 1753; Roxb., Fl. Ind., ed. Carey 3: 660. 1832; Hook.f., Fl. Brit. India 5: 293. 1887; Gamble, Fl. Madras 2(7): 1289. 1925 (repr. ed. 2: 902. 1957). *P. leprocarpus* Wight, Icon. Pl. Ind. Orient. 5: t. 1895. 1852.

Beng.: *Hazarmani*; Guj.: *Karosada-bonyamali*; *Lalbhuinamula*; Kan.: *Kempu-kiranelli*; *Kempu-nelanelli*; Mar.: *Lalmundajanvali*; Or.: *Bhuinanla*; Sans.: *Adhyanda*, *Ajanta*, *Aphala*, *Arupa*, *Bahupata*, *Charati*, *Tamalika*; Sant.: *Badarzhapnil*; Tam.: *Shivappunelli*; Tel.: *Ettausipika*.

Herbs, annual or sometimes perennial, 20–50 (- 80) cm high, erect or decumbent, glabrous; main stems with reduced scaly leaves; branches prostrate to ascending, longitudinally angular or compressed-winged, white hispidulous along the corners; leaf-bearing branchlets diffuse, flattened or winged, 3 - 10 cm long, usually deciduous, with ca 20–35 leaves. Leaves oblong or narrowly so, oblong-elliptic or narrowly obovate-oblong to linear, sometimes faintly falcate, unequal at base, rounded, obtuse, mucronulate or apiculate at apex, 4 - 25 x 1.5 - 10 mm, usually white hispidulous along margins beneath, membranous to chartaceous, glabrous (except margin); lateral nerves 5 - 9 pairs; petioles 0.8 - 1 mm long; stipules linear, ovate-lanceolate to linear-filiform, often deltoid-acuminate, unequal and auriculate at base, 1 - 4 mm long, entire. Inflorescences axillary on deciduous branchlets; female cymules 1-flowered, at the proximal axils; male cymules 5–7-flowered, at the distal axils or vice versa; bracts lanceolate-acuminate, up to 0.7 mm long, entire. Male flowers: pedicels ca 0.5 mm long; sepals 3 + 3, spatulate, obovate to orbicular-obovate, 0.4 - 0.6 x 0.3 - 0.5 mm, entire, glabrous; disc glands 6; stamens 3; filaments connate into a column (ca 0.15 mm long), shortly trifid at apex; anthers oblong or suborbicular, ca 0.15 mm long, vertically dehiscent. Female flowers: subsessile; pedicels up to 0.5 mm long, thickened in fruit; sepals 3 + 3, oblong or ovate-lanceolate, obtuse at apex, entire, 0.6 - 0.8 x 0.2 - 0.4 mm, glabrous, reflexed in fruit; disc patelliform, ca 0.8 mm across, with 6 radiating rays; ovary subglobose, 0.8 - 1 mm in diam., densely papillate-muricate; styles 3, represented by three bilobed horizontally divaricate flat segments, ca 0.1 mm long. Fruits depressed-subglobose, 1.2 - 2 x 2 - 3 mm, 3-angled or slightly lobed, brown to dark brown, tuberculate or nearly smooth; seeds trigonous, ca 1 mm long, with 12 - 15 sharp transverse ridges on back and 1 - 3 circular pits on sides, brown.

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

*Distrib.* India: A common weed in moist waste places, cultivated fields, gardens, roadsides, forest borders, grasslands, etc. up to 1400 m altitude; almost throughout the country including Andaman & Nicobar Islands.

Native of southern Asia but now widespread in tropical and subtropical regions (Webster in Pacific Sci. 40: 104. 1986).

*Uses.* According to Kirtikar & Basu (Indian Med. Pl. ed. 2, 3: 2223, t. 859 B. 1935) the plant and its fruits are acrid, sour, cooling, bitter, alexipharmic and useful in thirst, biliousness, asthma and hiccoughs. It is much used as diuretic in dropsical affections and in gonorrhoea and other genito-urinal troubles.

### Subgenus 6. *Xylophylla* (L.) Baill.

Shrubs or small trees, monoecious; branching phyllanthoid; branchlets bipinnatifid with ultimate axes transformed into usually leafless phylloclades. Inflorescences cymules, produced at notches of phylloclades. Male flowers: calyx-lobes 6; disc lobes usually 6; stamens 5 or rarely 4; filaments united at base; anthers dehiscing horizontally; pollen grains globose, areolate. Female flowers: calyx-lobes 6 or rarely 5; disc lobed or cupuliform or urceolate; styles connate or free; style branched, often repeatedly. Fruits capsular, obovate, smooth or tuberculate; seeds trigonous, ovate and flattened, verruculose.

West Indies, about 10 species, one cultivated in India.

***Phyllanthus arbuscula*** (Sw.) J.F.Gmel., Syst. Nat. 2: 204. 1791; G.L. Webster in J. Arnold Arb. 39: 188, ff. 31 Q-S. 1958. *P. speciosus* Jacq., Collectanea Bot. 2: 360. 1789; Gamble, Fl. Madras 2(7): 1290. 1925, in obs. (repr. ed. 2: 903. 1957); Chandrab. in A.N.Henry et al., Fl. Tamil Nadu, India, Ser. I. Analysis 2: 238. 1987.

Ornamental shrubs or small trees, up to 5 m tall; branchlets bipinnatifid, flattened, the ultimate branchlets transformed into leafless phylloclades, laterally compressed greyish green-coloured, with all leaves reduced to scales; flowers in cymules at the notches of phylloclades, scarlet, greenish or cream-coloured; fruits trigonous, 4 - 5 mm in diam., dark reddish brown, rugulose.

Often cultivated in plains of Tamil Nadu.

### DOUBTFUL / IMPERFECTLY KNOWN TAXA

1. ***Phyllanthus pendulus*** Roxb., Fl. Ind., ed. Carey 3: 662. 1832; Müll.Arg. in DC., Prodr. 15(2): 359. 1866; Hook.f., Fl. Brit. India 5: 298. 1887; Prain, Bengal Pl. 2: 939. 1903. Reported from W. Bengal, but no collection seen so far.
2. ***Phyllanthus petiolaris*** Roxb., Fl. Ind., ed. Carey 3: 664. 1832.
3. ***Phyllanthus rotundatus*** Poir. in Lam., Encycl. 5: 297. 1804; Willd., Sp. Pl. ed. 4, 4: 579. 1805.
4. ***Phyllanthus urinaria*** L. var. ***laevis*** Haines, Bot. Bihar Orissa 2: 125. 1921.

### 69. *Sauropus* Blume (T. Chakrabarty & M. Gangopadhyay)

Shrubs, undershrubs or herbs, very occasionally scandent or climbing, monoecious, glabrous or rarely pubescent. Leaves usually arising on lateral branchlets, alternate, entire and often reflexed along margins, penninerved or occasionally strongly 3-nerved at base; petioles short; stipules subsistent. Inflorescences axillary, fasciculate or sometimes borne on densely bracteate brachyblasts, often bisexual, few-flowered, the females usually on the upper axils and solitary or in pairs, the males mostly maturing singly per axil. Male flowers: pedicellate; calyx unlobed and almost entire or variously lobed (lobes 3 + 3, imbricating), cupular or obconic, concave-cupular or globose in outline or flattened and discoid or star-shaped or very rarely

reflexed forming an inverted urceolate-campanulate tube, the tips of the lobes inflexed; petals absent; disc absent; stamens 3, opposite the outer perianth segments; filaments connate into a minute or short column; anthers borne either horizontally at the corners of the common triangular connective and facing downwards, or vertically at the free apices of the filaments or sometimes connate into a mass. Female flowers: pedicellate; calyx segments 3 + 3, shortly connate, the outer usually larger than the inner, often accrescent in fruit; petals and disc absent; ovary 3-locular; locules biovulate; styles short, broad, mostly bifid and horizontal, rarely erect. Fruits capsular, occasionally somewhat fleshy, thin-walled, rarely shortly stipitate; seeds triquetrous, without arils.

Africa (Mauritius), India, Sri Lanka, Nepal, Bhutan, Bangladesh, Myanmar, China, Vietnam, Thailand to Malesia, extending to Australia, about 80 species; 12 species in India.

*Literature.* CHAKRABARTY, T. & M. GANGOPADHYAY (1996). The genus *Sauropus* Blume (Euphorbiaceae) in the Indian subcontinent. J. Econ. Taxon. Bot. 20(3): 513 - 545, ff. 1- 13.

*Notes.* The chromosome number reports so far are only for two species, *S. bacciformis* having  $n = 24$  (Miller & Webster, Brittonia 14: 174 - 180. 1962; Datta, Taxon 16: 341 - 350. 1967) and *S. androgynus* with  $2n = 50$  (Sampath Kumar & Navaneetham, Proc. 68<sup>th</sup> Indian Sci. Congress, Part 3, p. 78. 1981) as well as  $2n = 52$  (Kothari et al., Taxon 29: 703 - 730. 1980).

Pollen grains of 3 species were studied by Punt (Wentia 7: 1 - 116. 1962). The grains are stephanocolporate, oblate, oblate-spheroidal or subprolate, intectate or tectate, reticulate or not.

#### KEY TO THE SPECIES

- |   |   |
|---|---|
| 1 a. Leaves strongly trinerved at base  | 2   |
| b. Leaves penninerved   | 3   |
| 2 a. Male perianth 2.5 - 5 mm in diam., discoid, unlobed, repand along margins  | <b>8. S. repandus</b>                         |
| b. Male perianth 4 - 10 mm in diam., star-shaped, deeply 6-lobed  | <b>12. S. trinervis</b>                       |
| 3 a. Male flowers flattened   | 4   |
| b. Male flowers not flattened   | 11  |
| 4 a. Male calyx discoid, entire or almost so  | 5   |
| b. Male calyx star-shaped, lobed  | 6   |
| 5 a. Fruiting calyx up to 8 mm in diam.   | <b>1. S. androgynus</b>                       |
| b. Fruiting calyx 20 - 30 mm in diam.   | <b>9. S. rhamnoides</b>                       |
| 6 a. Branchlets, petioles and leaves beneath puberulous   | 7   |
| b. Branchlets, petioles and leaves beneath glabrous   | 8   |
| 7 a. Lateral nerves of leaves 7 - 8 pairs; male pedicels 8 - 10 mm long; calyx segments unlobed   | <b>3. S. bishnupadae</b>                      |
| b. Lateral nerves of leaves 3 - 6 pairs; male pedicels 2 - 6 mm long; calyx segments emarginate to deeply bilobulate                                    | <b>4. S. compressus</b> var. <b>puberulus</b> |
| 8 a. Leaves 9 - 22 x 3 - 7.5 cm; petioles 4 - 6 mm long; female pedicels 5 - 20 mm long; fruits 10 - 12 x 18 - 20 mm; fruiting pedicels 15 - 60 mm long | <b>6. S. macranthus</b>                       |
| b. Leaves 0.5 - 5 x 0.1 - 3 cm; petioles 0.2 - 3 mm long; female pedicels 0.5 - 3 mm long; fruits 3 - 6 x 3.5 - 8 mm; fruiting pedicels up to 5 mm long | 9   |

- 9 a. Segments of male calyx unlobed, entire **7. S. quadrangularis**  
 b. Segments of male calyx emarginate to deeply bilobulate 10
- 10 a. Petioles up to 0.6 mm long; male calyx 1 - 1.5 mm in diam. **2. S. bacciformis**  
 b. Petioles 1- 1.5 (- 2.5) mm long; male calyx 2 - 3.5 mm in diam. **4. S. compressus** var. **compressus**
- 11 a. Male calyx unlobed or almost so, subglobose; fruits splitting into 6 segments forming a star-shaped structure **11. S. stipitatus**  
 b. Male calyx deeply lobed; fruits not splitting as above 12
- 12 a. Branchlets terete; leaves membranous; lateral nerves 7 - 8 pairs; male pedicels 1.5 - 4 mm long; male calyx concave-cupular (bowl-shaped) with oblong-lanceolate acute segments, ca 1 x 1.5 mm; female pedicels 4 - 5 mm long; female calyx segments ovate, acute; fruits somewhat depressed, 8 - 10 x 13 - 15 mm **5. S. gour-maitii**  
 b. Branchlets winged; leaves thinly chartaceous to thinly coriaceous; lateral nerves 4 - 7 pairs; male pedicels 4 - 8 mm long; male calyx cupular to more or less obconic, 2 - 3.5 x 2 - 4 mm; male calyx segments oblanceolate or wedge-shaped, emarginate-sinuate at apex; female pedicels 5 - 13 mm long; female calyx segments orbicular to flabellate; fruits globose to pyriform, 15 - 20 x 18 - 25 mm **10. S. saksenanus**

**1. Sauropus androgynus** (L.) Merr. in Forest. Bur. Philipp. Bull. 1: 30. 1903; Kanjilal et al., Fl. Assam 4: 172. 1940; Chakrab. & M. Gangop. in J. Econ. Taxon. Bot. 20: 519, f. 1 G - J. 1996. *Clutia androgyna* L., Mant. Pl. 1: 128. 1767. *Sauropus albicans* Blume, Bijdr. Fl. Ned. Ind. 596. 1826; Hook.f., Fl. Brit. India 5: 332. 1887. *S. lanceolatus* Hook.f., l. c. 333. 1887; Kanjilal et al., l. c. 173. 1940. *S. oblongifolius* Hook.f., l. c. 333. 1887; Kanjilal et al., l. c. 172. 1940.

Kan.: *Chekor-manis*; Kh.: *Dieng-soh-pit*; Lep.: *Sentungrung*.

Shrubs, up to 3 m high, entirely glabrous. Leaves ovate, ovate-oblong to ovate-lanceolate or triangular-ovate to triangular-lanceolate, acute, obtuse to rounded at base, caudate-acuminate, acute, obtuse, rounded or apiculate at apex, 3 - 12 x 0.5 - 3.5 cm, membranous, penninerved or occasionally weakly trinerved at base; lateral nerves 4 - 8 pairs; petioles 1 - 3.5 mm long; stipules linear-lanceolate, 1.5 - 4 mm long. Male flowers: pedicels 7 - 18 mm long; calyx flat, discoid, 3 - 13 mm in diam., almost unlobed, usually entire or repand or sometimes irregularly and shallowly 4 - 6-fid, stiff; anthers ca 0.5 mm long, horizontal. Female flowers: pedicels 5 - 8 mm long; calyx 5 - 8 mm in diam.; segments obovate, orbicular to flabellate, 1.5 - 4 x 1.2 - 3 mm, rounded or occasionally slightly undulate at apex; ovary turbinate, 1.5 - 2 mm in diam.; styles ca 1.2 mm long, bifid, recurved. Fruits depressed to subglobose, rarely sub-pyriform, unlobed, 5 - 10 (- 15) x 10 - 15 (- 20) mm, inflated, thin; pedicels 7 - 20 mm long.

*Fl. & Fr.* July - Jan.

*Distrib.* India: Tropical and subtropical primary evergreen forests, up to 1500 m altitude. West Bengal, Assam, Arunachal Pradesh, Meghalaya, Nagaland, Mizoram, Tripura, Karnataka, Tamil Nadu and Kerala.

Sri Lanka, Bhutan, Bangladesh, Myanmar, Thailand, China, Laos, Cambodia, Vietnam, Malay Peninsula, Java, Sumatra, Borneo, Celebes, Moluccas and New Guinea.

*Uses.* The leaves are rich in Vitamins A, B and C, almost 3 - 4 times more than in mangoes and papayas. Protein content in the leaves are 6 - 8 per cent. They are also rich in phosphorous

and iron. The leaves and tender leaves taste like fresh garden peas, and can be consumed raw in salads or cooked in *dal*, *curries*, rice, *chapattis*, *dosas*, *idlis* and *uttappams*. The flowers and fruits are also edible.

Pounded leaves and roots form a poultice used in ulcers of nose. A decoction of the roots is supposed to be very good in fever and stricture of bladder.

*Notes.* Pollen periporate, sexine reticulate.  $D = 31 \mu\text{m}$  (28 to 33). (Tissot, Chikki & Nayar, Pollen of Wet Evergreen Forests of Western Ghats, India. *Publ. du depart. D'ecologie, Inst. Francias de Pondichery*, Pondichery).

**2. *Sauropus bacciformis* (L.)** Airy Shaw in Kew Bull. 35: 685. 1980 & 36: 343. 1981; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 20: 523, f. 1 A - F. 1996. *Phyllanthus bacciformis* L., Mant. Pl. 2: 294. 1771. *Agyneia bacciformis* (L.) A.Juss., Euphorb. Gen. 24, t. 6. 1824; Müll.Arg. in DC., Prodr. 15(2): 238. 1866; Hook.f., Fl. Brit. India 5: 285. 1887. *Synostemon bacciformis* (L.) G.L.Webster in Taxon 9: 26. 1960, in adnot.

Prostrate or ascending herbs, up to 50 cm long, entirely glabrous; branchlets quadrangular to semiterete. Leaves variable, broadly to narrowly oblong to elliptic or lanceolate-oblong to linear or obovate to oblanceolate, rounded, obtuse or acute at base, acute, obtuse to rounded and mucronulate at apex, 5 - 26 x 1 - 10 mm, chartaceous; lateral nerves 3 - 6 pairs; petioles 0.2 - 0.6 mm long; stipules linear to triangular, 1 - 2 mm long. Male flowers: pedicels 2.5 - 6 mm long; calyx flat, star-shaped, 1 - 1.5 mm in diam.; segments 6, shortly connate, subflabellate, emarginate to bilobulate; anthers minute, horizontal. Female flowers: pedicels 0.5 - 1 mm long; calyx 3 - 3.5 mm in diam.; segments elliptic, ovate, spatulate or obovate, acute or acuminate, apiculate, 1 - 2.5 x 0.7 - 1.3 mm; ovary ovoid, ca 1 mm in diam.; styles broad, erect, minute, bifid. Fruits ovoid, ellipsoid or subglobose, 4.5 - 6 x 3.5 - 7 mm, unlobed, thin-walled; pedicels 0.5 - 1 mm long.

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

*Distrib.* India: Mainly coastal, on sandy soil. Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, ?Orissa and West Bengal.

Mauritius, Sri Lanka, Myanmar, Thailand, S. China, Malay Peninsula, Borneo, Java, Philippines and Lesser Sunda Islands.

**3. *Sauropus bishnupadae*** M.Gangop. & Chakrab. apud Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 20: 524, 544, f. 2 A - D. 1996.

Shrubs, up to 1.5 m high; branchlets appressed pilose. Leaves ovate to elliptic or ovate-oblong, unequal at base, acute and mucronate at apex, 2.5 - 5 x 1.5 - 2.5 cm, thinly chartaceous, sparsely appressed pilose above, scattered pilose (particularly on nerves) beneath, penninerved; lateral nerves 7 - 8 pairs; petioles 1.5 - 2 mm long, appressed pilose. Male flowers: pedicels 8 - 10 mm long; calyx flat, star-shaped, 2 - 3 mm in diam., sparsely puberulous outside; segments 6, suborbicular to squarish, 0.6 - 1 x 0.6 - 1 mm, truncate to rounded at apex, membranous; anthers ca 0.3 mm long. Female flowers: pedicels 2.5 - 3 mm long; calyx cupular, ca 3 mm in diam.; segments 6, free, ovate, acute, 1.5 - 2 x 0.8 - 1.2 mm, appressed puberulous to glabrescent outside; ovary depressed, ca 1 mm in diam.; styles ca 1 mm long, bifid, horizontal. Fruits not seen.

*Fl.* April - May.



*Distrib.* India: Tropical forests, at low altitudes. West Bengal and Sikkim.

Bangladesh.

**4. *Sauropus compressus*** Müll.Arg. in DC., Prodr. 15(2): 243. 1866; Hook.f., Fl. Brit. India 5: 336. 1887; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 20: 526, f. 4. 1996. *S. quadrangularis* (Willd.) Müll.Arg. var. *compressus* (Müll.Arg.) Airy Shaw in Kew Bull. 26: 337. 1972. *S. varieri* Sivar. & Indu Balach. in J. Econ. Taxon. Bot. 5: 918. 1984 (as '*varierii*'). *S. quadrangularis* auct. non (Willd.) Müll.Arg. 1866: Kurz, Forest Fl. Burma 2: 350. 1877.

Herbs or shrubs, 0.2 - 3 m high, entirely glabrous or puberulous to pubescent; branchlets compressed, 4-angled, or rarely semiterete; leaf-bearing branchlets 3 - 10 cm long. Leaves narrowly to broadly elliptic, oblong to suborbicular or ovate, obovate to obovate-elliptic or orbicular-obovate, acute, obtuse, rounded, subtruncate or often cuneate at base, acute, obtuse rounded or emarginate and sometimes mucronate at apex, 8 - 30 (- 40) x 3 - 20 (- 30) mm, usually membranous, often chartaceous, sometimes glaucous beneath, entirely glabrous or sparsely appressed greyish puberulous to pilose; lateral nerves 3 - 6 pairs; petioles 1 - 1.5 (- 2.5) mm long, glabrous or puberulous; stipules triangular to linear-lanceolate, up to 2 mm long. Male flowers: pedicels 2 - 6 mm long; calyx flat, star-shaped, 2 - 3.5 mm in diam.; segments 6, flabellate, suborbicular or squarish, emarginate-truncate to deeply bilobulate (lobules rounded to subacute), in the latter case the calyx appearing more or less equally 12-lobed; anthers ca 0.4 mm long, horizontal. Female flowers: pedicels 1 - 3 mm long; calyx cupular or flat, 4 - 5 mm in diam.; segments free, the outer obovate, flabellate to suborbicular, 1.5 - 2 x 1 - 3 mm, rounded, emarginate or truncate at apex, the inner deltoid, orbicular or reniform, 1 - 1.5 x 0.5 - 2 mm; ovary turbinate, ca 0.5 x 1 mm; styles up to 1.5 mm long, bifid, horizontal. Fruits somewhat depressed or subglobose, 4 - 5 x 6 - 8 mm, thin-walled; pedicels 2 - 3 x ca 0.5 mm; calyx up to 8 mm in diam.; segments up to 4 x 4.5 mm.

*Distrib.* Western and Eastern Himalayas to Myanmar, S. China, Indo-china and Thailand.

#### KEY TO THE VARIETIES

1 a. Plants glabrous

**4.1. var. *compressus***

b. Plants pubescent or puberulous

**4.2. var. *puberulus***

#### **4.1. var. *compressus***

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

*Distrib.* India: Between 150 and 900 m altitudes. Uttar Pradesh, West Bengal, Sikkim, Meghalaya, Mizoram, Orissa, Kerala (cult.) and Tamil Nadu.

Nepal, Bhutan, Myanmar, S. China, Indo-China and Thailand.

**4.2. var. *puberulus*** (Kurz) Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 20: 528. 1996. *Sauropus quadrangularis* (Willd.) Müll.Arg. var. *puberulus* Kurz, Forest Fl. Burma 2: 350. 1877; Hook.f., Fl. Brit. India 5: 335. 1887, in obs. *S. pubescens* Hook.f., l. c. 335. 1887; Haines, Bot. Bihar Orissa 2: 135. 1921; Gamble, Fl. Madras 2(7): 1303. 1925 (repr. ed. 2: 912. 1957).

*Fl. & Fr.* April - Jan.

*Distrib.* India: At about 600 m altitude. Sikkim, West Bengal, Bihar, Orissa and Andhra Pradesh.

Myanmar, Indo-china and Thailand.

**5. *Sauropus gour-maitii*** Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 20: 529, f. 5 A - E. 1996. *S. androgynus* sensu Gamble, Fl. Madras 2(7): 1303. 1925 (repr. ed. 2: 911. 1957), p. p.

Shrubs, 2 - 4 m tall, almost entirely glabrous; leaf-bearing branchlets 15 - 30 cm long, initially sparsely papillose puberulous, soon glabrous. Leaves ovate-lanceolate, triangular-lanceolate to lanceolate, obtuse, subtruncate or acute to subacute at bases, acute to acuminate at apex, 6 - 13 x 1.5 - 5 cm, membranous; lateral nerves 7 or 8 pairs; petioles 1.5 - 2 mm long. Male flowers: pedicels 1.5 - 4 mm long; calyx concave-cupular, ca 1 x 1.5 mm, deeply 6-lobed; segments oblong-obovate, ca 1.2 x 0.5 mm, shortly bifid at apex; staminal column ca 0.5 mm long; anthers narrowly ovoid, ca 0.8 mm long, erect when young, finally horizontal. Female flowers: pedicels 4 - 5 mm long; calyx cupular, ca 3 x 3.5 mm; segments ovate, 2 - 2.5 x 1 - 1.5 mm, acute to subacute; ovary trigonous, ca 1 x 0.8 mm; styles ca 0.5 mm long, erect, shortly bifid at apex. Fruits subglobose, somewhat depressed (similar to *S. androgynus*), unlobed, 8 - 10 x 13 - 15 mm, thin-walled, brown when dry; pedicels 10 - 12 mm long, slender.

*Fl. & Fr.* May - Dec.

*Distrib.* India: Primary evergreen or semideciduous forests, between 500 - 1300 m altitudes. Kerala and Tamil Nadu.

Endemic.

**6. *Sauropus macranthus*** Hassk., Retzia 1: 166. 1855 & Hort. Bogor. Descr. 52. 1858; Sikdar & Maiti in J. Econ. Taxon. Bot. 3: 228. 1982; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 20: 529, f. 6. 1996. *S. macrophyllus* Hook.f., Fl. Brit. India 5: 333. 1887, p. p.; Kanjilal et al., Fl. Assam 4: 173. 1940.

Shrubs, often bushy, 1 - 3 m high, entirely glabrous. Leaves ovate-oblong, ovate-elliptic, oblong-elliptic, oblong, oblong-lanceolate or ovate-lanceolate, rounded, obtuse to acute at base, acuminate at apex, 9 - 22 x 3 - 7.5 cm, chartaceous, often glossy; lateral nerves 6 - 10 (- 12) pairs; petioles 4 - 6 mm long; stipules subulate or linear, 3 - 7 mm long, white along margins. Male flowers: pedicels 3 - 10 mm long; calyx flat, star-shaped, 3 - 4.5 mm in diam.; segments narrowly triangular to oblong, 0.5 - 2 x 0.2 - 1 mm; anthers ca 0.2 mm long, horizontal. Female flowers: pedicels 5 - 20 mm long; calyx segments almost free, broadly oblong, spatulate, obovate to suborbicular, rounded at apex, 1.5 - 4 x 1 - 3 mm; ovary subglobose, 1 - 2 mm in diam.; styles ca 1.5 mm long, bifid. Fruits depressed-globose, 10 - 12 x 18 - 20 mm, shallowly 3-lobed, thin-walled; pedicels 1.5 - 6 cm long; seeds triquetrous, ca 10 x 7 mm.

*Fl. & Fr.* Dec. - April.

*Distrib.* India: Tropical or subtropical evergreen forests or semideciduous forests, up to 300 m altitude. West Bengal, Assam, Arunachal Pradesh, Nagaland and Mizoram.

Bhutan, S. China, SE. Asia, scattered through Malesia to N. Australia.

**7. *Sauropus quadrangularis*** (Willd.) Müll.Arg. in *Linnaea* 32: 73. 1863 & in DC., *Prodr.* 15(2): 242. 1866; Hook.f., *Fl. Brit. India* 5: 335. 1887; Haines, *Bot. Bihar Orissa* 2: 135. 1921; Gamble, *Fl. Madras* 2(7): 1303. 1925 (repr. ed. 2: 911. 1957); Chakrab. & M.Gangop. in *J. Econ. Taxon. Bot.* 20: 534, f. 9 A-D. 1996; Philcox in Dassan. & Clayton, *Rev. Handb. Fl. Ceylon* 13: 107. 1999. *Phyllanthus quadrangularis* Willd., *Sp. Pl.* ed. 4, 4: 585. 1805. *Ceratogynum rhamnoides* Wight, *Icon. Pl. Ind. Orient.* 5: 26, t. 1900. 1852. *Sauropus ceratogynum* Baill. [Etude Euphorb. 635. 1858, nom. subnud.] ex Müll.Arg., l. c. 243. 1866, p. p. *Phyllanthus rhamnoides* sensu Roxb., *Fl. Ind.*, ed. Carey 3: 663. 1832 (non Willd., 1805; nec *Sauropus rhamnoides* Blume, 1825).

Tel.: *Tellavusirika*.

Woody herbs or shrubs, 0.2 - 2 m high, entirely glabrous; branches angled or sometimes semiterete; leaf-bearing branchlets 5 - 16 cm long, often puberulous when young. Leaves ovate, elliptic, oblong to suborbicular or orbicular-obovate, acute, obtuse or rounded at base, acute, obtuse to rounded and usually mucronulate at apex, 7 - 40 x 4 - 27 mm, membranous to thinly chartaceous; lateral nerves 3 - 5 pairs; petioles 1 - 2 mm long; stipules linear-lanceolate, 1 - 2 mm long. Male flowers: pedicels 2 - 10 mm long; calyx flat, star-shaped, 1.5 - 4 mm in diam., thin; segments linear, linear-oblong or narrowly triangular, acute, attenuate or often narrowed and rounded at apex, 0.5 - 1.5 x ca 0.4 mm; anthers orbicular, ca 0.3 mm in diam., horizontal or sometimes ascending. Female flowers: pedicels 1 - 3 mm long; calyx initially cupular, finally flattened, 2.5 - 5 mm in diam.; segments free, narrowly oblong-obovate or orbicular to flabellate, rounded-emarginate or acute at apex, 1 - 2 x 0.4 - 2 mm; ovary turbinate, ca 0.6 x 1 mm; styles 1 - 1.5 mm long, bifid up to base, erect or horizontal. Fruits somewhat depressed or subglobose, 4 - 5 x 6 - 8 mm, thin-walled; pedicels up to 5 mm long; calyx up to 7 (- 12) mm in diam.; segments up to 3 (- 5) x 3.5 (- 7) mm.

*Fl. & Fr.* May - Sept.

*Distrib.* India: Edges of evergreen, semideciduous or deciduous forests, often on rocky lateritic slopes, up to 600 m altitude, common. Uttar Pradesh, Jharkhand, Madhya Pradesh, Andhra Pradesh, Maharashtra, Goa, Karnataka and Kerala.

Sri Lanka.

*Use.* Dried leaves when smoked reduce tonsillitis.

**8. *Sauropus repandus*** Müll.Arg. in *Flora* 55: 2. 1872; Hook.f., *Fl. Brit. India* 5: 334. 1887; Chakrab. & M.Gangop. in *J. Taxon. Bot.* 20: 537, f. 10. A - E. 1996. *S. trinervis* sensu Hook.f., l. c. 334. 1887, p. p. (Sikkim specimens only), non Müll.Arg., 1863.

Shrubs, 1 - 2 m high; almost glabrous; branches terete; leaf-bearing branchlets often papillose-puberulous. Leaves ovate-lanceolate, cuneate, acute, obtuse or truncate at base and sometimes decurrent into petioles; caudate-acuminate at apex, 5.5 - 13 x 2 - 3.5 cm, membranous to thinly chartaceous; strongly trinerved at base; upper lateral nerves 3 - 6 pairs; petioles 2 - 3 mm long; stipules linear-lanceolate, 3 - 6 mm long. Male flowers: pedicels 4 - 10 mm long; calyx flat, discoid, unlobed, 2.5 - 5 mm in diam., entire or repand along margins, stiff; anthers ca 0.2 mm long, horizontal. Female flowers: pedicels 5 - 12 mm long, rarely puberulous; calyx-segments linear, ovate, narrowly elliptic, obovate or oblanceolate, acute, obtuse to rounded at apex, 2.5 - 5 x 1 - 2 mm; ovary turbinate, ca 1.5 mm in diam.; styles ca 1 mm long, bifid at apex. Fruits

somewhat depressed, ca 10 x 17 mm, rarely lobed, thin-walled, brown; pedicels 5 - 20 mm long.

*Fl. & Fr.* May - Nov.

*Distrib.* India: Tropical to subtropical forests, between 200 - 1525 m altitudes. Sikkim.

Bhutan, Nepal and China (Yunnan).

**9. *Sauropus rhamnoides*** Blume, Bijdr. Fl. Ned. Ind. 596. 1826; Pax & K. Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 219. 1922 (excl. syn. *S. macranthus* Hassk.); Chakrab. & M. Gangop. in J. Econ. Taxon. Bot. 20: 539. f. 11. 1996. *S. androgynus* sensu Chakrab. & N.P. Balakr. in J. Econ. Taxon. Bot. Addit. Ser. 9: 99. 1992, non (L.) Merr, 1903.

Scandent shrubs or climbers, up to 6 m high, entirely glabrous; leaf-bearing branchlets up to 30 cm long, quadrangular to terete. Leaves ovate to oblong or sometimes suborbicular, truncate, rounded, obtuse or subacute at base, acuminate or caudate-acuminate at apex, 5.5 - 12.5 x 3.5 - 5.5 cm, chartaceous; lateral nerves 5 or 6 pairs; petioles 3 - 6 mm long; stipules triangular-subulate to somewhat strongly falcate, ca 1 mm long. Flowers: greenish yellow to reddish, in small groups on up to 5 mm long inflorescences. Male flowers: pedicels 7 - 10 mm long; calyx 5 - 15 mm in diam. Female flowers: pedicels 8 - 18 mm long; calyx 6 - 9 mm in diam. Fruits subglobose, 13 - 15 mm in diam., somewhat fleshy, white or pale yellow; persistent calyx 20 - 22 mm in diam.; segments spathulate-obovate, 6 - 10 x 4 - 8 mm, thin, with prominent venation; seeds strongly hollow on inside, blackish.

*Fr.* March - April.

*Distrib.* India: Inland forests as undergrowth at low altitudes. Arunachal Pradesh and Nicobar Islands (Katchal).

Myanmar, Thailand, Cambodia, Vietnam, Malaysia, Indonesia, Philippines and Lesser Sunda Islands.

**10. *Sauropus saksenanus*** Manilal, Prasann. & Sivar. in J. Indian Bot. Soc. 64: 294. 1985; Chakrab. & M. Gangop. in J. Econ. Taxon. Bot. 20: 531, f. 8. 1996. *S. androgynus* auct. non (L.) Merr. 1903; Gamble, Fl. Madras 7: 1303. 1925 (repr. ed. 2: 911. 1957), p. p.

Shrubs, 2 - 3 m high, entirely glabrous; branches terete; leaf-bearing branchlets 15 - 45 cm long, 2-winged. Leaves ovate-lanceolate, acute to obtuse or truncate at base, caudate-acuminate at apex, 4 - 12 x 2 - 5 cm, thinly chartaceous to thinly coriaceous, often glaucous beneath; lateral nerves 4 - 7 pairs; petioles 2 - 3 mm long; stipules triangular-lanceolate to linear, 2 - 6 mm long. Male flowers: pedicels 4 - 8 mm long; calyx cupular to obconic in outline, 2 - 3.5 x 2 - 4 mm, deeply 6-lobed; segments oblong-oblancheolate or flabellate-oblancheolate, emarginate to bilobulate at apex, 1.5 - 2.5 x 0.5 - 1.3 mm; staminal column ca 0.5 mm long; anthers erect, ca 0.6 mm long. Female flowers: pedicels 5 - 12 mm long; calyx-segments orbicular to flabellate, rounded to obtuse at apex, 1.5 - 3 x 1.5 - 3 mm, thin; ovary subglobose, 1 - 1.5 mm in diam.; styles ca 1 mm long, erect, bifid to midway. Fruits globose to pyriform, 15 - 20 x 18 - 25 mm, rounded or slightly intruded at apex; pedicels 10 - 12 mm long.

*Fl. & Fr.* March - Dec.

*Distrib.* India: Evergreen forests, between 775 - 1900 m altitudes. Very common in the Palakkad district of Kerala, scarce elsewhere. Kerala and Tamil Nadu.

Endemic.

**11. *Sauropus stipitatus*** Hook.f., Fl. Brit. India 5: 333. 1887; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 20: 542, f. 10 F - K. 1996. *S. androgynus* sensu Gamble, Fl. Madras 7: 1303. 1925 (repr. ed. 2: 911. 1957), p. p., non (L.) Merr., 1903.

Shrubs, 1 - 1.5 m high, entirely glabrous; branches terete; leaf-bearing branchlets 15 - 35 cm long, terete. Leaves oblong-lanceolate to lanceolate or sometimes ovate-lanceolate, acute, obtuse to rounded or often unequal at base, caudate or acuminate at apex, 4 - 11 x 1.5 - 3 cm, membranous to thinly chartaceous; lateral nerves 5 - 9 pairs; petioles 1.5 - 3 mm long; stipules triangular-acuminate, 2 - 3 mm long. Male flowers: pedicels 4 - 7 mm long; calyx subglobose, 1.5 - 3 x 2.5 - 3 mm, stiff; lobes inconspicuous, rounded; staminal column ca 1 mm long; anthers ca 0.5 mm long, horizontal. Female flowers: pedicels 5 - 8 mm long; calyx segments linear-lanceolate, oblanceolate to spatulate, 2 - 4 x 0.6 - 1.5 mm, sometimes sinuate along margins; ovary globose, ca 1.5 mm in diam.; styles ca 0.5 mm long, bifid at apex. Fruits subglobose, ca 6 x 10 - 12 mm, scarcely lobed, thin-walled, splitting into 6 segments forming a star-shaped structure of 2.5 - 3 cm in diam.; stipe ca 2 mm long; pedicels 8 - 12 mm long.

*Fl. & Fr.* May - Dec. (Jan. - Feb. in Tamil Nadu).

*Distrib.* India: Reported to occur up to about 800 m altitude in NE. India, 2100 m in the Himalayas and at about 1200 m in South India. West Bengal, Tripura, Mizoram and Tamil Nadu.

Bhutan and SW. China (Yunnan).

**12. *Sauropus trinervis*** Hook.f. & Thomson ex Müll.Arg. in Linnaea 32: 72. 1863 & in DC., Prodr. 15(2): 242. 1866 (as *trinervius*); Hook.f., Fl. Brit. India 5: 334. 1887, p. p. (excl. Sikkim specimens); Kanjilal et al., Fl. Assam 4: 173. 1940; Chakrab. & M.Gangop. in J. Econ. Taxon. Bot. 20: 542, f. 13. 1996.

Shrubs, 1 - 1.5 m high, almost entirely glabrous; leaf-bearing branchlets up to 40 cm long, terete in age, often papillose puberulous when young. Leaves narrowly ovate, ovate-lanceolate, triangular-lanceolate, oblong-lanceolate or lanceolate, acute, obtuse, rounded to subtruncate or broadly cuneate or often unequal at base, caudate-acuminate at apex, 3.5 - 12 x 1.5 - 4.5 cm, membranous to thinly chartaceous, strongly trinerved at base; lateral nerves 3 or 4 pairs above the basal; petioles 1.5 - 3 mm long; stipules linear to linear-lanceolate, 3 - 7 mm long. Male flowers: pedicels 6 - 15 mm long; calyx flattened, star-shaped, 4 - 10 mm in diam.; segments 6, narrowly oblong to linear, 1.5 - 4 x 0.5 - 1.3 mm, narrowly rounded to obtuse at apex; staminal column ca 0.5 mm long; anthers ca 0.3 mm long, horizontal. Female flowers: pedicels 4 - 15 mm long, often puberulous; calyx segments elliptic, ovate, oblong or suborbicular, 1.5 - 5 x 1 - 3 mm, somewhat accrescent; ovary turbinate, ca 1 x 1.5 mm; styles ca 1 mm long, bifid at apex. Fruits subglobose, depressed, 10 - 12 x ca 20 mm, obscurely lobed, thin-walled; pedicels 7 - 15 mm long.

*Fl. & Fr.* April - Oct.

*Distrib.* India: Primary forests, up to 1300 m altitude. Assam, Arunachal Pradesh and Meghalaya.

Bangladesh and China (Yunnan).

**Tribe 7. WIELANDIEAE** Baill. ex Hurus.  
(**T. Chakrabarty & N. P. Balakrishnan**)

Trees or shrubs, monoecious or dioecious; indumentum simple. Leaves alternate, simple, entire, penninerved, eglandular; stipules deciduous. Inflorescences axillary; flowers in glomerules or the female flowers solitary; bracts inconspicuous. Male flowers: sepals 4 - 6, imbricate; petals usually 5; disc usually annular; stamens 5 - 10, free or filaments united at base into a column; anthers longitudinally dehiscent; connective not enlarged; pollen grains 3-colporate, semitectate, reticulate; pistillode present. Female flowers: sepals, petals and disc as in male flowers; ovary 3 - 5-locular; locules biovulate; ovules anatropous, usually with a single obturator; styles bifid. Fruits capsular; seeds 1 or 2 per locule; endosperm present or absent; cotyledons flat or folded, larger than the radicle.

Mainly in Southern Hemisphere, South America, Africa and the Indian Ocean Islands, one extending to Northern hemisphere, 10 genera; one genus in India.

**Actephila** Blume

Evergreen shrubs or trees, monoecious, glabrous or occasionally puberulous with simple hairs. Leaves long or short petiolate, entire, penninerved; stipules caducous. Inflorescences axillary or ramiflorous; bracts triangular or subulate. Male flowers: pedicellate; sepals 5 or 6, shortly connate at base; petals 5 or 6 or absent, shorter than sepals; disc extra-staminal, flat, entire or lobed along margins with the lobes episealous; stamens usually 5, inserted on the disc, free or shortly connate; anthers orbicular; pistillode trifid. Female flowers: pedicellate; sepals and petals as in male; disc flat or cupular; ovary 3 (or 4)-locular; styles 3, free or shortly connate at base, each entire or bifid. Fruits capsular, verrucose or smooth; seed solitary in each cocci, 3-gonous, exarillate; testa thin, brittle; cotyledons thick and fleshy.

Asia and Australia, ca 20 species; one species in India.

**Actephila excelsa** (Dalzell) Müll.Arg. in *Linnaea* 32: 78. 1863 & in DC., *Prodr.* 15(2): 222. 1866; Hook.f., *Fl. Brit. India* 5: 283. 1887; Gamble, *Fl. Madras* 2(7): 1283. 1925 (repr. ed. 2: 898. 1957). *Anomospermum excelsum* Dalzell in Hooker's *J. Bot. Kew Gard. Misc.* 3: 228. 1851. *Actephila neilgherrensis* Wight, *Icon. Pl. Ind. Orient.* t. 1910. 1852.

Shrubs or trees, 1 - 5 m high, almost entirely glabrous. Leaves elliptic to cuneate-obovate or obovate-elliptic, cuneate, acute, obtuse or rounded to subcordate at base, entire along margins, obtuse, apiculate or acuminate at apex, 4 - 45 x 2 - 20 cm, membranous or coriaceous to chartaceous, mostly glossy; lateral nerves 5 - 12 pairs; petioles 0.2 - 8.5 cm long; stipules minute, triangular or ovate. Inflorescences axillary. Male flowers: in fascicles; pedicels 2 - 5 mm long, slender; sepals 5, ovate or oblong, 1.5 - 3 x 0.8 - 2 mm; petals 5, spatulate, 1 - 2 x 0.3 - 1 mm; disc 5-lobed; stamens 2.5 - 3 mm long; filaments connate below into a column; anthers ca 0.7 mm long; pistillode ovoid. Female flowers: solitary; pedicels 1 - 5 cm long; sepals 5, ovate, elliptic or oblong, 2 - 3.5 x 1 - 2 mm; petals 5, spatulate-unguiculate, 1.5 - 2 x 0.5 - 1 mm; disc flat; ovary subglobose, 1.5 - 2 mm in diam.; styles 1.5 - 2 mm long, bifid above. Fruits subglobose, depressed, 1.5 - 3 cm in diam., 3 (or 4)-lobed, usually verrucose; pedicels 1 - 5 cm long.

## KEY TO THE VARIETIES

- 1 a. Leaves large, up to 45 cm long; petioles 2 – 8 cm long **3. var. javanica**  
 b. Leaves smaller; petioles 0.2 – 3.5 cm long 2
- 2 a. Branchlets, petioles and female pedicels brownish puberulous; leaves mostly rounded to subcordate at base, mostly membranous **4. var. puberula**  
 b. Branchlets, petioles and female pedicels glabrous; leaves cuneate, acute or obtuse at base, stiffer in texture 3
- 3 a. Leaves 4 – 9 x 1.5 – 3.5 cm; lateral nerves 5 – 7 per side **1. var. brevifolia**  
 b. Leaves 8 – 30 x 4 - 15 cm; lateral nerves 8 – 12 per side **2. var. excelsa**

**1. var. brevifolia** N. Balach., Maheswaran & Chakrab. in J. Econ. Taxon. Bot. 33: 717, f. 1. 2009.

*Fr.* Dec.

*Distrib.* India: Stunted evergreen forests on moist clayey loam at about 650 m altitude. Scarce. Andaman Islands.

Sri Lanka.

**2. var. excelsa**

(See Chakrab. & N.P.Balacr. in J. Econ. Taxon. Bot. Addit. Ser. 9: 11. 1992).

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

*Distrib.* India: Coastal and inland evergreen forests, up to 2000 m altitude. W. Peninsular India (Maharashtra, Karnataka and Kerala), NE. India, Andaman & Nicobar Islands.

Bangladesh, Myanmar, Thailand and China.

**3. var. javanica** (Miq.) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 192. 1922; Chakrab. & N.P.Balacr. in J. Econ. Taxon. Bot. Addit. Ser. 9: 12. 1992. *Actephila javanica* Miq., Fl. Ned. Ind. 1(2): 356. 1859.

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

*Distrib.* India: Coastal and inland forests, up to 100 m altitude. Andaman & Nicobar Islands.

Thailand, Malaya and W. Malesia.

**4. var. puberula** (Kurz) Pax & K.Hoffm. in Engl., Pflanzenr. IV.147.xv (heft 81): 193. 1922. *Actephila puberula* Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42(2): 236. 1873; Hook.f., Fl. Brit. India 5: 283. 1887.

*Distrib.* India: Coastal and inland forests, up to 100 m altitude. Andaman & Nicobar Islands.

Endemic.

**DAPHNIPHYLLACEAE****(T. Chakrabarty & N. P. Balakrishnan)**

Evergreen shrubs or small trees, dioecious, rarely polygamo-dioecious, inermous, glabrous, without milky latex, sometimes containing very poisonous alkaloids. Leaves crowded towards the apices of branchlets, spirally arranged or pseudo-verticillate or subopposite, simple, usually entire and revolute along margins, exstipulate, penninerved. Inflorescences axillary, rarely subterminal, racemiform, few-flowered, sometimes the upper flowers umbelliform; bracts at the base of inflorescences, in 1- several whorls, imbricate, caducous. Flowers: small, unisexual, actinomorphic, pedicels angular or flat, rarely pendent. Male flowers: sepals absent or 3–8, free or shortly connate at base, imbricate, persistent or caducous; petals and disc absent; stamens (5 -) 6–12 (- 14), free, whorled and radiating from apex of receptacle; filaments free or connate at base; anthers 2-locular, lunate, introrse or extrorse, opening by lateral longitudinal slits; the connective prominent below thecae, sometimes apiculate or produced at apex; pistillode absent. Female flowers: sepals as in male; petals and disc absent; staminodes absent or rarely small, 5 – 10 on ovary; ovary superior, imperfectly 2-locular; styles 1 or 2 (- 4), shorter than ovary, recurved; stigmas 2 (- 4), divaricate, enlarged, recurved or circinnate, mostly persistent; ovules 2 or rarely 1 per locule, axile or parietal, anatropous, pendulous with dorsal raphe, bitegmic, crassinucellate. Fruits drupaceous, obovoid, oblong-ellipsoid or subglobose, 1-locular; seeds 1 (or 2), with thin testa; endosperm copious, bluish, fleshy and oily; embryo straight, cylindrical, minute; cotyledons not broadened.

Himalayas, South-western hills of India, Sri Lanka, Myanmar, Thailand, Indo-china, China, Japan and Malesia, monotypic family with ca 10 species; 2 species in India.

*Literature.* HUANG, T. C. (1965 & 1966). A revision of the genus *Daphniphyllum* in Asia. *Taiwania* 11: 57 - 98 & 12: 137 - 234.

**Daphniphyllum Blume**

Characters as for the family.

## KEY TO THE SPECIES

- 1 a. Leaves rounded at apex; minor venation forming conspicuous reticulation on the upper surface **1. *D. glaucescens***  
 b. Leaves caudate, acuminate or cuspidate at apex; minor venation inconspicuous on the upper surface **2. *D. himalayense***

**1. *Daphniphyllum glaucescens*** Blume, Bijdr. Fl. Ned. Ind. 1153. 1826–27; Müll. Arg. in DC., Prodr. 16(1): 3. 1869; Hook. f., Fl. Brit. India 5: 353. 1887, sensu lato. *Goughia neilgherrensis* Wight, Icon. Pl. Ind. Orient. 5: 22, tt. 1878 & 1879. 1852. *Daphniphyllum neilgherrense* (Wight) Thwaites, Enum. Pl. Zeyl. 290. 1861; Gamble, Fl. Madras 2(7): 1311. 1925 (repr. ed. 2: 917. 1957). *D. roxburghiana* sensu Bedd., Fl. Sylv. S. India t. 288. 1872, non Baill., 1838. *D. glaucescens* ssp. *neilgherrense* (Wight) Huang in *Taiwania* 12: 195. 1966.

Badaga (Nilgiri hills): *Nir-chappay*, *Nir-kocki*.

Trees, 3 – 4 m high. Leaves oblong-obovate to elliptic-oblong, acute to sub-cuneate at base, rounded and occasionally apiculate at apex, 7 – 20 x 2 – 8 (- 11) cm, coriaceous, often



glaucous beneath; lateral nerves 7 – 12 per side, prominent; tertiary nerves prominent above and beneath, reticulate; minor venation usually forming conspicuous reticulum on the upper surface; petioles 1.5 – 5 cm long, purplish towards upper portion. Inflorescences axillary; male racemes 2 – 3 cm long; female racemes ca 2 cm long, sometimes umbellate. Male flowers: pedicels 3 – 5 mm long; calyx irregularly 4 – 6-lobed; lobes ovate, 1 – 1.5 x 0.6 – 1 mm; stamens 5 – 8; filaments ca 0.5 mm long; anthers 1 – 2 mm long. Female flowers: pedicels 2.5 – 8 mm long, elongating up to 13 mm in fruit; calyx irregularly 4 – 6-lobed; lobes ovate to oblong-elliptic, 1 – 2 x 0.6 – 1.2 mm; ovary ovoid, ca 1 x 0.6 mm; stigmas 2, ca 1 mm long, divergent, recurved, papillose, carinate beneath. Fruits oblong-ellipsoid, 10 – 13 x 6 – 9 mm, black or brown when dry, 1-seeded.

*Fl. & Fr.* Jan. – June; also Oct. – next year April.

*Distrib.* India: Common in evergreen shola forests, between (1200 -) 1500 – 2500 m altitudes. Karnataka, Kerala and Tamil Nadu.

Sri Lanka, China and Indonesia.

**2. *Daphniphyllum himalayense*** (Benth.) Müll.Arg. in DC., Prodr. 16(1): 4. 1869; Hook.f., Fl. Brit. India 5: 354. 1887; Kanjilal et al., Fl. Assam 4: 170. 1940. *Goughia himalayensis* Benth. in Hooker's J. Bot. Kew Gard. Misc. 6: 9. 1854.

Nep.: *Lal chandan*.

Shrubs (at high altitudes) or trees, 1 – 8 (- 15) m high; scales of terminal buds obtuse. Leaves oblong-elliptic (or narrowly so), oblong to oblanceolate, narrowly to broadly cuneate, or acute at base, caudate, acuminate or cuspidate at apex, 12 – 30 x 2.5 – 9 cm, thinly to stiffly coriaceous, glaucous beneath; lateral nerves 8 – 16 pairs, faint above, faint to prominent beneath; tertiary nerves obscure (often prominent in var. *chartaceum*) above, inconspicuous (prominent in var. *chartaceum*) beneath; petioles 2 – 7 cm long. Male inflorescences 2 – 4 (- 7) cm long. Flowers: pedicels 2 – 7 mm long; sepals 5 – 8, oblong to suborbicular, 2 – 3 x 1 – 2 mm; stamens 5, subsessile; anthers broadly oblong, 2 – 2.5 mm long. Female inflorescences 4 – 15 cm long, often corymbose or sub-umbellate towards apices. Flowers: pedicels 5 – 25 mm long, usually recurved (in fruiting); sepals as in male, caducous; ovary ovoid to globose, 1.5 – 2 x ca 1.5 mm; stigmas 2, free, 1 – 1.5 mm long. Fruits ellipsoid, oblong-ellipsoid, ovoid-ellipsoid or often obovoid, rounded at apex, 10 – 12 x 6 – 9 mm, brown, dark brown or black when dry.

#### KEY TO THE VARIETIES

1 a. Tertiary nerves of leaves prominent beneath; fruiting pedicels usually erect

**2.1. var. *chartaceum***

b. Tertiary nerves of leaves inconspicuous beneath; fruiting pedicels usually recurved

**2.2. var. *himalayense***

**2.1. var. *chartaceum*** (K.Rosenthal) Huang in Taiwania 12: 209, f. 42. 1966. *Daphniphyllum chartaceum* K.Rosenthal in Engl., Pflanzenr. IV. 147a (heft 68): 11. 1919. *D. bengalense* K.Rosenthal, l. c. 11. 1919.

Trees, 5 – 12 m tall; scales of terminal buds apiculate. Leaves elliptic-oblong, broadly cuneate at base glossy above, pale and obscurely papillate beneath; female racemes erect.

*Fl. & Fr.* April – Oct.

*Distrib.* India: Scarce in broad-leaved and temperate forests between 1600 – 2900 m altitudes. Uttarakhand, West Bengal, Sikkim, Meghalaya and Arunachal Pradesh.

Nepal, Bhutan, China (Tibet).

**2.2. var. himalayense**

*Fl. & Fr.* April – Dec.

*Distrib.* INDIA: Common in broad-leaved and pine forests at 1500 – 2950 m altitudes. Uttarakhand, West Bengal, Sikkim, Meghalaya and Arunachal Pradesh.

Nepal, Bhutan, Myanmar and China (Tibet).

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<i>wallichiana</i> Royle	347	var. <i>wightianum</i> (Müll.Arg.) Hook.f.	420
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*Ostodes paniculata*  
*Homonoia riparia*  
*Chrozophora prostrata*  
*Glochidion heyneanum*  
*Jatropha curcas*  
*Baliospermum solanifolium*  
*Glochidion hohenackeri*  
*Glochidion lanceolarium*  
*Trevia nudiflora*  
*Jatropha gossypifolia*

- Bherenda* (Beng.)  
*Bhillaru* (Hindi)  
*Bhoma* (Kon.)  
*Bhoma* (Mar.)  
*Bhonyaabali* (Hindi)  
*Bhonya-anmali* (Guj.)  
*Bhoota-thamara* (Mal.)  
*Bhoryaanmali* (Guj.)  
*Bhubi* (Sylh.)  
*Bhubi* (Tripura)  
*Bhuiamla* (Beng.)  
*Bhuiamla* (Urdu)  
*Bhuiola* (Or.)  
*Bhuiavala* (Mar.)  
*Bhuiavali* (Mar.)  
*Bhui-erandi* (Mar.)  
*Bhuinanla* (Or.)  
*Bhuivali* (Mar.)  
*Bhutala-bhairi* (Tel.)  
*Bhutan-kusam* (Tel.)  
*Bichuti* (Beng.)  
*Bilati-sisoo* (Beng.)  
*Bilee-chitrapala* (Kan.)  
*Bili-horli* (Kan.)  
*Bilikoomme* (Kan.)  
*Billisgodi gida* (Kan.)  
*Billisulli* (Kan.)  
*Bira* (Tel.)  
 Birch-leaved *Acalypha* (Eng.)  
*Birikhamara* (Asm.)  
 Black currant tree (Eng.)  
*Boddi* (Tel.)  
*Bodliga* (Kan.)  
*Boinokhap* (Garo)  
*Bola* (Asm.)  
*Bol-aborak* (Garo)  
*Bol-ajak* (Garo)
- Bolchiring* (Garo)  
*Bolchiring* (Garo)  
*Bol-diktak* (Garo)  
*Bol-jakru* (Garo)  
*Bol-mang-cham* (Garo)  
*Bomvaro* (Kan.)  
*Bon-babri* (Asm.)  
*Bon-heloch* (Asm.)  
*Bonotihudi* (Or.)  
*Bontakalli* (Kan.)
- Ricinus communis*  
*Treva nudiflora*  
*Glochidion hohenackeri*  
*Glochidion hohenackeri*  
*Phyllanthus amarus*  
*Phyllanthus fraternus*  
*Macaranga indica*  
*Phyllanthus amarus*  
*Baccaurea ramiflora*  
*Baccaurea ramiflora*  
*Phyllanthus amarus*  
*Phyllanthus amarus*  
*Phyllanthus amarus*  
*Phyllanthus amarus*  
*Phyllanthus simplex* var. *simplex*  
*Microstachys chamaelea*  
*Phyllanthus urinaria*  
*Phyllanthus fraternus*  
*Croton persimilis*  
*Croton persimilis*  
*Tragia involucrata*  
*Triadica sebifera*  
*Euphorbia thymifolia*  
*Flueggea virosa*  
*Antidesma acidum*  
*Flueggea leucopyros*  
*Breynia vitis-idaea*  
*Drypetes sepiaria*  
*Acalypha fruticosa*  
*Tolypanthus involucratus*  
*Antidesma ghaesembilla*  
*Macaranga peltata*  
*Scleropyrum pentandrum*  
*Treva nudiflora*  
*Endospermum chinense*  
*Antidesma bunius*  
*Macaranga denticulata*  
     var. *denticulata*  
*Glochidion daltonii*  
*Glochidion heyneanum*  
*Treva nudiflora*  
*Glochidion sphaerogynum*  
*Croton persimilis*  
*Treva nudiflora* var. *polycarpa*  
*Phyllanthus simplex* var. *simplex*  
*Antidesma bunius*  
*Phyllanthus reticulatus*  
*Euphorbia tirucalli*

<i>Bonthakalli</i> (Tel.)	<i>Euphorbia antiquorum</i>
<i>Bontha-yepi</i> (Tel.)	<i>Bridelia retusa</i>
<i>Booambilla-gass</i> (Sind.)	<i>Antidesma ghaesembilla</i>
Box-wood Tree (Eng.)	<i>Buxus papillosa</i>
Brazilian Arrowroot (Eng.)	<i>Manihot esculenta</i>
<i>Buinowla</i> (Hindi)	<i>Phyllanthus reticulatus</i>
<i>Bureh</i> (Abor)	<i>Baccaurea ramiflora</i>
<i>Buri-tokon</i> (Asm.)	<i>Mallotus roxburghianus</i>
<i>Burmaparokupi</i> (Asm.)	<i>Croton persimilis</i>
<i>Burno</i> (Beng.)	<i>Macaranga denticulata</i> var. <i>denticulata</i>
<i>Caicotten-pala</i> (Mal.)	<i>Euphorbia thymifolia</i>
Candle-nut tree (Eng.)	<i>Aleurites moluccana</i>
<i>Carmashva</i> (Sans.)	<i>Euphorbia cornigera</i>
Cassava (Eng.)	<i>Manihot esculenta</i>
Castor-bean plant (Eng.)	<i>Ricinus communis</i>
Castor-oil plant (Eng.)	<i>Ricinus communis</i>
<i>Cattimandoo</i> (Tel.)	<i>Euphorbia cattimandoo</i>
Ceara rubber (Eng.)	<i>Manihot glaziovii</i>
<i>Chagru</i> (Garo)	<i>Macaranga denticulata</i> var. <i>denticulata</i>
<i>Chagul-putpputi</i> (Hindi)	<i>Euphorbia rothiana</i>
<i>Chagul-putput</i> (Beng.)	<i>Euphorbia dracunculoides</i>
<i>Chahe-lewa</i> (Asm.)	<i>Croton caudatus</i>
<i>Chaiang</i> (Naga)	<i>Glochidion sphaerogynum</i>
<i>Chakdiduhi</i> (Mar.)	<i>Euphorbia thymifolia</i>
<i>Chalmeri</i> (Hindi)	<i>Phyllanthus acidus</i>
<i>Cham chalja</i> (Garo)	<i>Aporosa wallichii</i>
<i>Chamdan</i> (Kon.)	<i>Santalum album</i>
<i>Chamoli</i> (Hindi)	<i>Glochidion heyneanum</i>
<i>Chanda</i> (Mar.)	<i>Macaranga peltata</i>
<i>Chandakanne</i> (Kan.)	<i>Macaranga peltata</i>
<i>Chandan</i> (Hindi)	<i>Santalum album</i>
<i>Chandan</i> (Mar.)	<i>Santalum album</i>
<i>Chandana</i> (Sans.)	<i>Santalum album</i>
<i>Chandanam</i> (Mal.)	<i>Santalum album</i>
<i>Chandanam</i> (Tam.)	<i>Santalum album</i>
<i>Chandanam</i> (Tel.)	<i>Santalum album</i>
<i>Chandanum</i> (Kan.)	<i>Santalum album</i>
<i>Chandkal</i> (Kan.)	<i>Macaranga peltata</i>
<i>Chandora</i> (Mar.)	<i>Macaranga peltata</i>
<i>Chandra-badamika</i> (Tel.)	<i>Viscum orientale</i>
<i>Chandwar</i> (Mar.)	<i>Macaranga peltata</i>
<i>Charati</i> (Sans.)	<i>Phyllanthus urinaria</i>
<i>Chathura-kalli</i> (Mal.)	<i>Euphorbia antiquorum</i>
<i>Chatriwal</i> (Punj.)	<i>Euphorbia helioscopia</i>
<i>Chemudy</i> (Tel.)	<i>Euphorbia tirucalli</i>

- Chendra* (Tel.)  
*Chenkolli* (Mal.)  
*Chenthakanni* (Kan.)  
*Chenthatti* (Tam.)  
*Cheppunjerinjal* (Tam.)  
*Cheru-kanjaru* (Tam.)  
*Cheru-kapanachi* (Mal.)  
*Cheru-kodithura* (Mal.)  
*Cheruseru* (Tam.)  
*Cherutali* (Mal.)  
*Chikni* (Or.)  
*Chilla* (Tel.)  
*Chilley-mallata* (Nep.)  
*Chilne* (Nep.)  
Chinese laurel (Eng.)  
Chinese Tallow tree (Eng.)  
Chinese Tung Oil (Eng.)  
*Chini-emrandi* (Kon.)  
*Chinna-duradagunta* (Tel.)  
*Chinna-patcharisi* (Tam.)  
*Chinni* (Kan.)  
*Chinni* (Tel.)  
*Chinthakanni* (Kan.)  
*Chipli* (Lep.)  
*Chipli* (Nep.)  
*Chiplikhari* (Nep.)  
*Chippulinellu* (Kan.)  
*Chita-kutei* (Or.)  
*Chitki* (Asm.)  
*Chittavanakku* (Mal.)  
*Chittrappala* (Mal.)  
*Cholavengai* (Mal.)  
*Chorikannan* (Mal.)  
*Chorikannan* (Mal.)  
*Choriyanam* (Mal.)  
*Choriyanvalli* (Mal.)  
*Chota-mal* (Beng.)  
*Chotto-kerui* (Beng.)  
*Chouding* (Kh.)  
*Christmas-chedi* (Mal.)  
*Chucka* (Beng.)  
*Chucka* (Hindi)  
*Chulu* (Hindi)  
*Chuvanna-niruri* (Mal.)  
*Cikkakadu-haralu* (Kan.)  
*Cini* (Tam.)  
*Cirru-kancharivay* (Tam.)  
*Mallotus philippensis*  
*Mallotus philippensis*  
*Macaranga peltata*  
*Tragia involucrata*  
*Homonoia riparia*  
*Tragia plukenetii*  
*Bridelia stipularis*  
*Tragia plukenetii*  
*Aporosa acuminata*  
*Antidesma bunius*  
*Glochidion lanceolarium*  
*Croton scabiosus*  
*Macaranga denticulata* var. *pustulata*  
*Sarcococca coriacea*  
*Antidesma bunius*  
*Triadica sebifera*  
*Vernicia fordii*  
*Jatropha multifida*  
*Tragia involucrata*  
*Euphorbia prostrata*  
*Acalypha fruticosa*  
*Acalypha fruticosa*  
*Macaranga peltata*  
*Antidesma ghaesembilla*  
*Antidesma ghaesembilla*  
*Aporosa octandra*  
*Phyllanthus reticulatus*  
*Euphorbia hirta*  
*Breynia retusa*  
*Ricinus communis*  
*Euphorbia thymifolia*  
*Bischofia javanica*  
*Tragia involucrata*  
*Tragia involucrata*  
*Tragia involucrata*  
*Tragia involucrata*  
*Balakata baccata*  
*Euphorbia serpens*  
*Antidesma acidum*  
*Euphorbia pulcherrima*  
*Croton persimilis*  
*Croton persimilis*  
*Euphorbia royleana*  
*Breynia vitis-idaea*  
*Jatropha gossypifolia*  
*Acalypha fruticosa*  
*Tragia plukenetii*

Coral Plant (Eng.)	<i>Jatropha multifida</i>
Country Goose-berry (Eng.)	<i>Phyllanthus acidus</i>
<i>Croton</i> (Eng.)	<i>Codiaeum variegatum</i>
<i>Curangicari</i> (Tam.)	<i>Mallotus philippensis</i>
<i>Dadano</i> (Guj.)	<i>Acalypha indica</i>
<i>Dadra</i> (Guj.)	<i>Acalypha ciliata</i>
<i>Dadro</i> (Guj.)	<i>Acalypha indica</i>
<i>Dalme</i> (Hindi)	<i>Flueggea leucopyrus</i>
<i>Dalme</i> (Hindi)	<i>Flueggea virosa</i>
<i>Daluwan</i> (Guj.)	<i>Phyllanthus reticulatus</i>
<i>Dampiya-arong</i> (Mik.)	<i>Baccaurea ramiflora</i>
<i>Dandalithora</i> (Guj.)	<i>Euphorbia tirucalli</i>
<i>Danti</i> (Beng.)	<i>Baliospermum solanifolium</i>
<i>Danti</i> (Hindi)	<i>Baliospermum solanifolium</i>
<i>Danti</i> (Kan.)	<i>Baliospermum solanifolium</i>
<i>Danti</i> (Kan.)	<i>Croton tiglium</i>
<i>Danti</i> (Mar.)	<i>Baliospermum solanifolium</i>
<i>Danti</i> (Or.)	<i>Baliospermum solanifolium</i>
<i>Danti</i> (Sans.)	<i>Croton tiglium</i>
<i>Dantibijam</i> (Mal.)	<i>Croton tiglium</i>
<i>Dantika</i> (Mal.)	<i>Baliospermum solanifolium</i>
<i>Dantika</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Dantimul</i> (Guj.)	<i>Baliospermum solanifolium</i>
<i>Dantimul</i> (Mar.)	<i>Baliospermum solanifolium</i>
<i>Darim Pate</i> (Nep.)	<i>Flueggea virosa</i>
<i>Datwan</i> (Guj.)	<i>Phyllanthus reticulatus</i>
<i>Dawadaree</i> (Tel.)	<i>Breynia retusa</i>
<i>Deerghadanda</i> (Sans.)	<i>Ricinus communis</i>
<i>Deing-ja-lonh-her</i> (Kh.)	<i>Balakata baccata</i>
<i>Devadai</i> (Tel.)	<i>Breynia retusa</i>
<i>Dhakki</i> (Hindi)	<i>Antidesma acidum</i>
<i>Dhakti-dudhi</i> (Mar.)	<i>Euphorbia hypericifolia</i>
<i>Dhatri</i> (Sans.)	<i>Phyllanthus emblica</i>
<i>Dhusparsha</i> (Sans.)	<i>Tragia involucrata</i>
<i>Diang-soh-kot</i> (Kh.)	<i>Trigonostemon semperflorens</i>
<i>Dieng-ja-cung</i> (Kh.)	<i>Ostodes paniculata</i>
<i>Dieng-jam</i> (Kh.)	<i>Excoecaria oppositifolia</i>
<i>Dieng-japue</i> (Kh.)	<i>Antidesma acidum</i>
<i>Dieng-jem</i> (Kh.)	<i>Glochidion acuminatum</i>
<i>Dieng-jem</i> (Kh.)	<i>Glochidion heyneanum</i>
<i>Dieng-jerti</i> (Kh.)	<i>Glochidion acuminatum</i>
<i>Dieng-jipti</i> (Kh.)	<i>Glochidion khasicum</i>
<i>Dieng-kharang</i> (Kh.)	<i>Croton lissophyllus</i>
<i>Dieng-kwai</i> (Kh.)	<i>Drypetes indica</i>
<i>Dieng-kyajut-paroh</i> (Kh.)	<i>Elytranthe psilantha</i>
<i>Dieng-kymbat-lasam</i> (Kh.)	<i>Croton tiglium</i>
<i>Dieng-lakhar</i> (Kh.)	<i>Macaranga denticulata</i>

## var. denticulata

- Dieng-lakhar* (Kh.)  
*Dieng-la-masu* (Kh.)  
*Dieng-lamosuh* (Kh.)  
*Dieng-long-kharai* (Kh.)  
*Dieng-mang-kariang* (Kh.)  
*Dieng-paklia* (Kh.)  
*Dieng-pankhar* (Kh.)  
*Dieng-pothar* (Kh.)  
*Dieng-rishan* (Kh.)  
*Dieng-shi-ip* (Kh.)  
*Dieng-soh-kassiu* (Kh.)  
*Dieng-soh-lang-ngiu* (Kh.)  
*Dieng-soh-lyndot* (Kh.)  
*Dieng-soh-matan* (Kh.)  
*Dieng-soh-mrit* (Kh.)  
*Dieng-soh-pit* (Kh.)  
*Dieng-soh-pyda* (Kh.)  
*Dieng-soh-ramding* (Kh.)  
*Dieng-soh-rin* (Kh.)  
*Dieng-soh-romai* (Kh.)  
*Dieng-soh-silli* (Kh.)  
*Dieng-soh-syllih* (Kh.)  
*Dieng-soh-um* (Kh.)  
*Dieng-tha-rong* (Kh.)  
*Divelo* (Guj.)  
*Dolfodi* (Mar.)  
*Dol-poduli* (Asm.)  
*Dondri* (Punj.)  
*Doohi* (Hindi)  
*Doola-gondi* (Tel.)  
*Dori* (Nep.)  
*Dud-bug* (Kash.-Johar)  
*Dudeli* (Guj.)  
*Dudani* (Mar.)  
*Dudheli* (Guj.)  
*Dudheli* (Raj.)  
  
*Dudheri* (Mar.)  
*Dudhgoch* (Asm.)  
*Dudhi* (Beng.)  
*Dudhi* (Hindi)  
*Dudhi* (Hindi)  
*Dudhi* (Mar.)  
*Dudhia* (Hindi)  
*Dudhill* (Mar.)  
*Dudla* (Mar.)  
  
*Mallotus nepalensis*  
*Croton persimilis*  
*Croton joufra*  
*Mallotus roxburghianus*  
*Scurrula parasitica*  
*Mallotus ferrugineus*  
*Drypetes assamica*  
*Antidesma montanum*  
*Bridelia retusa*  
*Aporosa wallichii*  
*Glochidion ellipticum*  
*Antidesma montanum*  
*Trevis nudiflora*  
*Phyllanthus glaucus*  
*Triadica cochinchinensis*  
*Sauropus androgynus*  
*Trigonostemon semperflorens*  
*Baccaurea ramiflora*  
*Croton lissophyllus*  
*Glochidion khasicum*  
*Antidesma bunius*  
*Antidesma khasianum*  
*Glochidion sphaerogynum*  
*Mallotus ferrugineus*  
*Ricinus communis*  
*Breynia retusa*  
*Glochidion heyneanum*  
*Euphorbia dracunculoides*  
*Euphorbia heterophylla*  
*Tragia involucrata*  
*Manihot esculenta*  
*Euphorbia tibetica*  
*Euphorbia hirta*  
*Euphorbia heterophylla*  
*Euphorbia hypericifolia*  
*Euphorbia granulata* &  
*E. jodhpurensis*  
*Euphorbia erythroclada*  
*Excoecaria oppositifolia*  
*Euphorbia indica*  
*Euphorbia hirta*  
*Euphorbia hypericifolia*  
*Euphorbia hirta*  
*Euphorbia prostrata*  
*Euphorbia rothiana*  
*Falconeria insignis*

<i>Dudloti</i> (Asm.)	<i>Mallotus repandus</i>
<i>Duduni</i> (Kan.)	<i>Euphorbia thymifolia</i>
<i>Dugudhika</i> (Sans.)	<i>Euphorbia hirta</i>
<i>Dukhoa</i> (Asm.)	<i>Drypetes assamica</i>
<i>Dulagondi</i> (Kan.)	<i>Tragia involucrata</i>
<i>Dulagondi</i> (Kan.)	<i>Tragia montana</i>
<i>Dumi-shak</i> (Garo)	<i>Croton caudatus</i>
<i>Durada-gondi</i> (Tel.)	<i>Tragia involucrata</i>
<i>Ekdania</i> (Hindi)	<i>Bridelia retusa</i>
<i>Ela-kalli</i> (Mal.)	<i>Euphorbia nivulia</i>
<i>Eldi</i> (Hindi)	<i>Ricinus communis</i>
<i>Eliama-nakku</i> (Tam.)	<i>Croton bonplandianus</i>
<i>Eliavanakku</i> (Tam.)	<i>Jatropha glandulifera</i>
<i>Eltikamoto</i> (Kon.)	<i>Scleropyrum pentandrum</i>
Emblic myrobalan (Eng.)	<i>Phyllanthus emblica</i>
<i>Eola</i> (Asm.)	<i>Phyllanthus emblica</i>
<i>Eradi</i> (Kon.)	<i>Ricinus communis</i>
<i>Erado</i> (Guj.)	<i>Ricinus communis</i>
<i>Eramundapu</i> (Tel.)	<i>Ricinus communis</i>
<i>Eranda-gach</i> (Beng.)	<i>Jatropha curcas</i>
<i>Erاندam</i> (Sans.)	<i>Ricinus communis</i>
<i>Erاندapatri</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Erandi</i> (Guj.)	<i>Jatropha gossypifolia</i>
<i>Erra-tandra</i> (Tel.)	<i>Dimorphocalyx kurnoolensis</i>
<i>Eruponaku</i> (Tel.)	<i>Trevisa nudiflora</i>
<i>Ettadundiga</i> (Tel.)	<i>Baliospermum solanifolium</i>
<i>Ettapurugudu</i> (Tel.)	<i>Breynia vitis-idaea</i>
<i>Ettausipika</i> (Tel.)	<i>Phyllanthus urinaria</i>
<i>Gayo</i> (Nep.)	<i>Bridelia retusa</i>
<i>Gada hallae</i> (Kan.)	<i>Flueggea virosa</i>
<i>Gamari</i> (Nep.)	<i>Trevisa nudiflora</i>
<i>Gambhar</i> (Hindi)	<i>Trevisa nudiflora</i>
<i>Gammong-asing</i> (Abor)	<i>Excoecaria oppositifolia</i>
<i>Ganasura</i> (Mar.)	<i>Croton persimilis</i>
<i>Gandharajan</i> (Mal.)	<i>Santalum album</i>
<i>Gandharya</i> (Sans.)	<i>Ricinus communis</i>
<i>Gandha-tulasi</i> (Or.)	<i>Croton bonplandianus</i>
<i>Gangai</i> (Asm.)	<i>Mallotus philippensis</i>
<i>Gangichu</i> (Punj.)	<i>Euphorbia neriifolia</i>
<i>Gangooa</i> (Hindi)	<i>Excoecaria agallocha</i>
<i>Gangwa</i> (Hindi)	<i>Excoecaria agallocha</i>
<i>Garahuru</i> (Mar.)	<i>Homonoia riparia</i>
<i>Garari</i> (Hindi)	<i>Cleistanthus collinus</i>
<i>Garrar</i> (Hindi)	<i>Cleistanthus collinus</i>
<i>Garum</i> (Nep.)	<i>Trevisa nudiflora</i>
<i>Garumora</i> (Asm.)	<i>Glochidion multiloculare</i>
<i>Geneo</i> (Beng.)	<i>Excoecaria agallocha</i>



<i>Gengwa</i> (Beng.)	<i>Excoecaria agallocha</i>
<i>Geogharia</i> (Hindi)	<i>Excoecaria agallocha</i>
<i>Geo-gheria</i> (Beng.)	<i>Excoecaria agallocha</i>
<i>Geon</i> (Hindi)	<i>Excoecaria agallocha</i>
<i>Germa-dhuka-guphu</i> (Asm.)	<i>Tragia involucrata</i>
<i>Germa-dukha-guphu</i> (Cachar)	<i>Tragia involucrata</i>
<i>Gewa</i> (Mar.)	<i>Excoecaria agallocha</i>
<i>Ghana</i> (Sans.)	<i>Phyllanthus acidus</i>
<i>Ghondurili</i> (Mar.)	<i>Antidesma acidum</i>
<i>Ghurnifal</i> (Beng.)	<i>Putranjiva roxburghii</i>
<i>Gol-kamila</i> (Punj.)	<i>Glochidion heyneanum</i>
<i>Goma</i> (Beng.)	<i>Excoecaria agallocha</i>
<i>Gondaguria</i> (Or.)	<i>Macaranga peltata</i>
<i>Gondui</i> (Hindi)	<i>Bridelia retusa</i>
<i>Gorumara</i> (Asm.)	<i>Glochidion oblatum</i>
<i>Gorumora</i> (Nep.)	<i>Glochidion acuminatum</i>
<i>Gowan</i> (Or.)	<i>Excoecaria agallocha</i>
<i>Gugario</i> (Raj.)	<i>Phyllanthus amarus</i>
<i>Guj</i> (Nep.)	<i>Croton tiglium</i>
<i>Gundada</i> (Kan.)	<i>Santalum album</i>
<i>Gunsur</i> (Mar.)	<i>Croton persimilis</i>
<i>Gurjor</i> (Sans.)	<i>Homonoia riparia</i>
<i>Gursotsul</i> (Kash.)	<i>Euphorbia helioscopia</i>
<i>Gurugu</i> (Kan.)	<i>Chrozophora rottleri</i>
<i>Haddin</i> (Kon)	<i>Breynia retusa</i>
<i>Haimvati</i> (Sans.)	<i>Euphorbia thomsoniana</i>
<i>Hakum</i> (Beng.)	<i>Baliospermum solanifolium</i>
<i>Hakum</i> (Hindi)	<i>Baliospermum solanifolium</i>
<i>Haligilu</i> (Kan.)	<i>Tragia involucrata</i>
<i>Halonge</i> (Nep.)	<i>Croton caudatus</i>
<i>Halud-chaki</i> (Asm.)	<i>Endospermum chinense</i>
<i>Hara-bepari</i> (Nep.)	<i>Cleidion javanicum</i>
<i>Haralu</i> (Kan.)	<i>Ricinus communis</i>
<i>Hare-kusum</i> (Nep.)	<i>Aporosa octandra</i>
<i>Hariphal</i> (Beng.)	<i>Phyllanthus acidus</i>
<i>Harital</i> (Nep.)	<i>Baliospermum solanifolium</i>
<i>Harita-manjari</i> (Sans.)	<i>Acalypha indica</i>
<i>Harogida</i> (Kan.)	<i>Excoecaria agallocha</i>
<i>Harparauri</i> (Hindi)	<i>Phyllanthus acidus</i>
<i>Harparawri</i> (Mar.)	<i>Phyllanthus acidus</i>
<i>Harpharuri</i> (Urdu)	<i>Phyllanthus acidus</i>
<i>Harthe</i> (Hindi)	<i>Flueggea leucopyrus</i>
<i>Hartho</i> (Hindi)	<i>Flueggea leucopyrus</i>
<i>Hasta</i> (Sans.)	<i>Ricinus communis</i>
<i>Hathile-heralu</i> (Kan.)	<i>Jatropha gossypifolia</i>
<i>Hazardana</i> (Punj.)	<i>Euphorbia hypericifolia</i>
<i>Hazarmani</i> (Hindi)	<i>Phyllanthus maderaspatensis</i>

<i>Hazarmani</i> (Beng.)	<i>Phyllanthus urinaria</i>
<i>Heloch</i> (Asm.)	<i>Antidesma ghaesembilla</i>
<i>Hiju</i> (Asm.)	<i>Euphorbia neriifolia</i>
<i>Hilhadam</i> (Asm.)	<i>Homonoia riparia</i>
<i>Himatchari</i> (Nep.)	<i>Antidesma bunius</i>
<i>Hinembilla</i> (Sinh.)	<i>Antidesma alexiteria</i>
<i>Hira</i> (Kan.)	<i>Drypetes sepiaria</i>
<i>Hiruseeah</i> (Hindi)	<i>Euphorbia helioscopia</i>
<i>Hirtiz</i> (Kash.)	<i>Euphorbia thomsoniana</i>
<i>Holdikath</i> (Nep.)	<i>Glochidion ellipticum</i>
<i>Holenage</i> (Kan.)	<i>Homonoia riparia</i>
<i>Holiballi</i> (Kan.)	<i>Phyllanthus reticulatus</i>
<i>Hunikay</i> (Badaga-Nilgiris)	<i>Glochidion candolleianum</i>
<i>Hurnabatul</i> (Beng.)	<i>Shirakiopsis indica</i>
<i>Ikti</i> (Lep.)	<i>Breynia retusa</i>
<i>Ila-kalli</i> (Tam.)	<i>Euphorbia nivulia</i>
<i>Ila-kalli</i> (Tam.)	<i>Euphorbia nivulia</i>
<i>Ilti</i> (Mal.)	<i>Dendrophthoe falcata</i>
Indian stinging nettle (Eng.)	<i>Tragia involucrata</i>
<i>Indul</i> (Tam.)	<i>Phyllanthus emblica</i>
<i>Indul-nelli</i> (Tam.)	<i>Phyllanthus emblica</i>
<i>Ing-sun-arong</i> (Mik.)	<i>Antidesma acidum</i>
<i>Inthap-ching</i> (Naga)	<i>Croton joufra</i>
<i>Iphek</i> (Tripura)	<i>Baccaurea ramiflora</i>
<i>Irubulai</i> (Tam.)	<i>Flueggea virosa</i>
<i>Irukolli</i> (Tam.)	<i>Putranjiva roxburghii</i>
<i>Itepulla</i> (Tel.)	<i>Glochidion zeylanicum</i>
<i>Ithi</i> (Mal.)	<i>Dendrophthoe falcata</i>
<i>Ithikanni</i> (Mal.)	<i>Dendrophthoe falcata</i>
<i>Ithyalkanni</i> (Mal.)	<i>Dendrophthoe falcata</i>
<i>Jaglo</i> (Asm.)	<i>Macaranga denticulata</i>
	var. <i>denticulata</i>
<i>Jagura</i> (Beng.)	<i>Macaranga denticulata</i>
	var. <i>denticulata</i>
<i>Jahazigaba</i> (Or.)	<i>Jatropha curcas</i>
<i>Jaichi</i> (Hindi)	<i>Euphorbia dracunculoides</i>
<i>Jaifal</i> (Beng.)	<i>Croton tiglium</i>
<i>Jaifala</i> (Sans.)	<i>Croton tiglium</i>
<i>Jaipal</i> (Asm.)	<i>Croton tiglium</i>
<i>Jaipal</i> (Hindi)	<i>Croton tiglium</i>
<i>Jaipala</i> (Or.)	<i>Croton tiglium</i>
<i>Jajan</i> (Or.)	<i>Breynia retusa</i>
<i>Jajan</i> (Or.)	<i>Breynia vitis-idaea</i>
<i>Ja-la-mat-kha</i> (Kh.)	<i>Phyllanthus pseudoparvifolius</i>
<i>Jamalgota</i> (Guj.)	<i>Jatropha curcas</i>
<i>Jamalgota</i> (Hindi)	<i>Croton tiglium</i>
<i>Jamalgota</i> (Hindi)	<i>Jatropha curcas</i>

- Jamalgota* (Mal.)  
*Jamalgota* (Mar.)  
*Jambada* (Tel.)  
*Jambla* (Or.)  
*Jamula* (Or.)  
*Janupolari* (Tel.)  
*Janupulisaru* (Tel.)  
*Japalabeeja* (Kan.)  
*Ja-pung-dih* (Kh.)
- Jar-amlā* (Hindi)  
*Jaronda* (Hindi)  
*Jatiphala* (Sans.)  
*Jaunchi* (Punj.)  
*Jayapala* (Sans.)  
*Jayfala* (Hindi)  
*Jemudu* (Tel.)  
*Jepal* (Mar.)  
*Jewanputr* (Mar.)  
*Jhankhri-kath* (Nep.)  
*Jhunjhuni* (Beng.)  
*Jiaputa, Juti* (Hindi)  
*Jogi-malata* (Nep.)  
*Joingheia* (Garo)  
*Jojangi* (Or.)  
*Jomdri* (Konk.)  
*Jondhra* (Mar.)  
*Jong-ma-sai* (Cachar)  
*Jong-masai* (Naga)  
*Jorat* (Asm.)  
*Joufra* (Beng.)  
*Jungli-akhrot* (Hindi)  
*Jungli-arandi* (Hindi)  
*Jungli-arandi* (Mar.)  
*Jungli-arundi* (Hindi)  
*Jungli-jamalgota* (Hindi)  
*Kaadukayi* (Kan.)  
*Kaanji* (Tam.)  
*Kabilam* (Tam.)  
*Kabonan* (Raj.)  
*Kach-kuile* (Mar.)  
*Kachora* (Mar.)  
*Kadalamanakku* (Tam.)  
*Kadalavanakku* (Mal.)  
*Kadam* (Or.)  
*Kaddu nugge* (Kan.)  
*Kadandla* (Kan.)
- Baliospermum solanifolium*  
*Croton tiglium*  
*Euphorbia nivulia*  
*Homonoia riparia*  
*Antidesma ghaesembilla*  
*Antidesma bunius*  
*Antidesma ghaesembilla*  
*Croton tiglium*  
*Baliospermum calycinum*  
     var. *micranthum*  
*Phyllanthus amarus*  
*Ricinus communis*  
*Phyllanthus emblica*  
*Euphorbia dracunculoides*  
*Baliospermum solanifolium*  
*Croton tiglium*  
*Euphorbia tirucalli*  
*Croton tiglium*  
*Putranjiva roxburghii*  
*Lasiococca symphyllifolia*  
*Croton bonplandianus*  
*Putranjiva roxburghii*  
*Mallotus ferrugineus*  
*Trevia nudiflora*  
*Phyllanthus reticulatus*  
*Antidesma ghaesembilla*  
*Antidesma ghaesembilla*  
*Tragia involucrata*  
*Tragia involucrata*  
*Mallotus philippensis*  
*Croton joufra*  
*Aleurites moluccana*  
*Jatropha glandulifera*  
*Jatropha glandulifera*  
*Jatropha curcas*  
*Baliospermum solanifolium*  
*Trevia nudiflora*  
*Trevia nudiflora* var. *polycarpa*  
*Mallotus philippensis*  
*Phyllanthus reticulatus*  
*Tragia praetervis*  
*Phyllanthus maderaspatensis*  
*Jatropha curcas*  
*Jatropha curcas*  
*Jatropha curcas*  
*Breynia vitis-idaea*  
*Jatropha curcas*

<i>Kadishe</i> (Tel.)	<i>Cleistanthus collinus</i>
<i>Kadrajivi</i> (Tel.)	<i>Putranjiva roxburghii</i>
<i>Kaduhalaru</i> (Kan.)	<i>Baliospermum solanifolium</i>
<i>Kadupala</i> (Sant.)	<i>Breynia vitis-idaea</i>
<i>Kaduvapudukkan</i> (Mal.)	<i>Drypetes malabarica</i>
<i>Kaghalai</i> (Nep.)	<i>Aporosa octandra</i>
<i>Kalemadhkaper</i> (Hindi)	<i>Phyllanthus reticulatus</i>
<i>Kagli</i> (Mar.)	<i>Breynia retusa</i>
<i>Kaimlar</i> (Kash.)	<i>Mallotus philippensis</i>
<i>Kair-kung</i> (Lep.)	<i>Glochidion acuminatum</i>
<i>Kaisalppodi</i> (Tam.)	<i>Mallotus philippensis</i>
<i>Kaj</i> (Hindi)	<i>Bridelia retusa</i>
<i>Kakaipalai</i> (Tel.)	<i>Suregada angustifolia</i>
<i>Kalakalatha</i> (Tam.)	<i>Antidesma montanum</i>
<i>Kalamahomad</i> (Hindi)	<i>Breynia retusa</i>
<i>Kalchu</i> (Or.)	<i>Glochidion lanceolarium</i>
<i>Kalisitki</i> (Beng.)	<i>Breynia vitis-idaea</i>
<i>Kalladamba</i> (Mal.)	<i>Drypetes malabarica</i>
<i>Kallalari</i> (Tam.)	<i>Homonoia riparia</i>
<i>Kallamanakku</i> (Tam.)	<i>Jatropha curcas</i>
<i>Kalli</i> (Mal.)	<i>Euphorbia neriifolia</i>
<i>Kalli</i> (Mal.)	<i>Euphorbia santapau</i>
<i>Kalli</i> (Mal.)	<i>Euphorbia vajravelui</i>
<i>Kalli</i> (Tam.)	<i>Euphorbia neriifolia</i>
<i>Kalli</i> (Tam.)	<i>Euphorbia santapau</i>
<i>Kalli</i> (Tam.)	<i>Euphorbia susan-holmesiae</i>
<i>Kalli</i> (Tam.)	<i>Euphorbia vajravelui</i>
<i>Kallimullu</i> (Mal.)	<i>Euphorbia trigona</i>
<i>Kalli-pala</i> (Mal.)	<i>Euphorbia nivulia</i>
<i>Kalmeg-lek-thai</i> (Burm.)	<i>Phyllanthus columnaris</i>
<i>Kalo-bilauni</i> (Nep.)	<i>Antidesma montanum</i>
<i>Kalo-ochrad</i> (Guj.)	<i>Chrozophora rottleri</i>
<i>Kaloor-vanchi</i> (Mal.)	<i>Homonoia riparia</i>
<i>Kalpottan</i> (Tam.)	<i>Dimorphocalyx glabellus</i>
<i>Kamal</i> (Punj.)	<i>Mallotus philippensis</i>
<i>Kamala</i> (Beng.)	<i>Mallotus philippensis</i>
<i>Kamala</i> (Hindi)	<i>Mallotus philippensis</i>
<i>Kamala-vaikala</i> (Sans.)	<i>Phyllanthus acidus</i>
<i>Kambal</i> (Punj.)	<i>Mallotus philippensis</i>
<i>Kambhi</i> (Hindi)	<i>Breynia retusa</i>
<i>Kambhoji</i> (Sans.)	<i>Phyllanthus reticulatus</i>
<i>Kamboi</i> (Guj.)	<i>Breynia retusa</i>
<i>Kamela</i> (Punj.)	<i>Mallotus philippensis</i>
<i>Kamila</i> (Kash.)	<i>Mallotus philippensis</i>
<i>Kamkatajuli</i> (Beng.)	<i>Breynia vitis-idaea</i>
<i>Kamli</i> (Nep.)	<i>Mallotus roxburghianus</i>
<i>Kamorcha</i> (Guj.)	<i>Phyllanthus maderaspatensis</i>

<i>Kampalai</i> (Tam.)	<i>Putranjiva roxburghii</i>
<i>Kampetti</i> (Tam.)	<i>Excoecaria agallocha</i>
<i>Kanakapala</i> (Tel.)	<i>Baliospermum solanifolium</i>
<i>Kanakaphala</i> (Sans.)	<i>Croton tiglium</i>
<i>Kananeranda</i> (Sans.)	<i>Jatropha curcas</i>
<i>Kanchori</i> (Tam.)	<i>Tragia involucrata</i>
<i>Kanchupranti</i> (Kan.)	<i>Macaranga peltata</i>
<i>Kanda-veltu</i> (Tel.)	<i>Mallotus repandus</i>
<i>Kandochha</i> (Guj.)	<i>Phyllanthus maderaspatensis</i>
<i>Kanibhi</i> (Asm.)	<i>Croton tiglium</i>
<i>Kanjuruthan</i> (Tam.)	<i>Tragia plukenettii</i>
<i>Kannadikkalli</i> (Tam.)	<i>Pedilanthus tithymaloides</i>
<i>Kannichi</i> (Tam.)	<i>Tragia involucrata</i>
<i>Kanocha</i> (Hindi)	<i>Phyllanthus maderaspatensis</i>
<i>Kanodcha</i> (Urdu)	<i>Phyllanthus maderaspatensis</i>
<i>Kantjer</i> (Lep.)	<i>Antidesma acidum</i>
<i>Kapila</i> (Mal.)	<i>Mallotus philippensis</i>
<i>Kapila</i> (Mar.)	<i>Mallotus philippensis</i>
<i>Kapilgundi</i> (Or.)	<i>Mallotus philippensis</i>
<i>Kapilo</i> (Guj.)	<i>Mallotus philippensis</i>
<i>Kapli</i> (Tam.)	<i>Mallotus philippensis</i>
<i>Kappa</i> (Mal.)	<i>Manihot esculenta</i>
<i>Kappa-kizhangu</i> (Tam.)	<i>Manihot esculenta</i>
<i>Kapu</i> (Naga)	<i>Macaranga denticulata</i> var. <i>denticulata</i>
<i>Karawala kabella</i> (Sinh.)	<i>Antidesma bunius</i> ,
<i>Karevalichedi</i> (Tam.)	<i>A. puncticulatum</i>
<i>Kargalli</i> (Sant.)	<i>Mallotus resinous var. stenanthus</i>
<i>Karghatia</i> (Hindi)	<i>Cleistanthus collinus</i>
<i>Karihalsoppu</i> (Kan.)	<i>Bridelia retusa</i>
<i>Karikoomma</i> (Kan.)	<i>Euphorbia hirta</i>
<i>Karinelli</i> (Kan.)	<i>Antidesma bunius</i>
<i>Karinjikkada</i> (Tam.)	<i>Phyllanthus acidus</i>
<i>Karippalai</i> (Tam.)	<i>Epiprinus mallotiformis</i>
<i>Karki</i> (Sant.)	<i>Putranjiva roxburghii</i>
<i>Karlajuri</i> (Beng.)	<i>Breynia vitis-idaea</i>
<i>Karnocchi</i> (Kan.)	<i>Cleistanthus collinus</i>
<i>Karoda</i> (Or.)	<i>Jatropha curcas</i>
<i>Karosada-bonyamali</i> (Guj.)	<i>Cleistanthus collinus</i>
<i>Karrihulipa</i> (Kan.)	<i>Phyllanthus urinaria</i>
<i>Karshaphala</i> (Sans.)	<i>Antidesma acidum</i>
<i>Karumpoola-chedi</i> (Tam.)	<i>Phyllanthus emblica</i>
<i>Karunchenthatti</i> (Tam.)	<i>Flueggea virosa</i>
<i>Karunelli</i> (Tam.)	<i>Tragia plukenettii</i>
<i>Karupala</i> (Tam.)	<i>Phyllanthus reticulatus</i>
<i>Karuppupilanji</i> (Tam.)	<i>Putranjiva roxburghii</i>
	<i>Phyllanthus reticulatus</i>

*Karupu-mambalai* (Tam.)

*Kasal* (Hindi)

*Kasre-malata* (Nep.)

*Kasreto* (Nep.)

*Kassi* (Hindi)

*Katakrote* (Tam.)

*Katamanakku* (Tam.)

*Kath-jamrala* (Or.)

*Kathupulitsi* (Tel.)

*Kati* (Mar.)

*Katkumbala* (Kan.)

*Kattai-jemadu* (Tel.)

*Kattalari* (Mal.)

*Kattamanak* (Mal.)

*Kattamanakku* (Tam.)

*Kattimandu* (Tel.)

*Kattimantu* (Tam.)

*Kattu-avanakku* (Mal.)

*Kattu-avanakku* (Tam.)

*Kattukkattai* (Tam.)

*Kattu-kumi* (Mal.)

*Kattunelli* (Mal.)

*Kattunelli* (Tam.)

*Kattu-niruri* (Mal.)

*Kattuniruri* (Mal.)

*Kattuniruri* (Tam.)

*Kattupira* (Tam.)

*Kattupulasai* (Tam.)

*Katu-manwa* (Hindi)

*Kaudenivdung* (Mar.)

*Kayara* (Mal.)

*Keathekkayyaa* (Tam.)

*Keela-nelli* (Tam.)

*Kempu-kiranelli* (Kan.)

*Kenlo* (Asm.)

*Keonara* (Beng.- Tripura)

*Kerui* (Beng.)

*Khabi-loboi* (Mani.)

*Khad-sherni* (Mar.)

*Khaja* (Hindi)

*Khajakolti* (Mar.)

*Khajavani-vel* (Guj.)

*Khaji* (Nep.)

*Khajkolti* (Mar.)

*Khajoti* (Guj.)

*Euphorbia corrigioloides*

*Bridelia retusa*

*Mallotus ferrugineus*

*Bridelia stipularis*

*Bridelia retusa*

*Aleurites moluccana*

*Baliospermum solanifolium*

*Antidesma montanum*

*Antidesma ghaesembilla*

*Phyllanthus lawii*

*Trevisa nudiflora*

*Euphorbia caducifolia*

*Homonoia riparia*

*Jatropha curcas*

*Jatropha curcas*

*Euphorbia lacei*

*Euphorbia trigona*

*Jatropha curcas*

*Jatropha curcas*

*Croton tiglium*

*Trevisa nudiflora*

*Phyllanthus polyphyllus*

*Phyllanthus emblica*

*Breynia vitis-idaea*

*Phyllanthus reticulatus*

*Breynia vitis-idaea*

*Koilolepas calycinum*

*Mallotus resinosa* var. *stenanthus*

*Glochidion heyneanum*

*Euphorbia nivulia*

*Glochidion heyneanum*

*Antidesma acidum*

*Phyllanthus fraternus*

*Phyllanthus urinaria*

*Trevisa nudiflora*

*Glochidion multiloculare*

*Euphorbia hirta*

*Mallotus roxburghianus*

*Phyllanthus lawii*

*Bridelia retusa*

*Tragia involucrata*

*Dalechampia scandens*

var. *cordofana*

*Bridelia stipularis*

*Tragia montana*

*Dalechampia scandens*

var. *cordofana*

<i>Khakra</i> (Urdu)	<i>Suregada multiflora</i>
<i>Khali</i> (Nep.)	<i>Croton caudatus</i>
<i>Khattaphal</i> (Hindi)	<i>Baccaurea ramiflora</i>
<i>Khatua</i> (Hindi)	<i>Antidesma acidum</i>
<i>Khirkanda</i> (Mar.)	<i>Euphorbia fusiformis</i> var. <i>khandallensis</i>
<i>Khirni</i> (Hindi)	<i>Falconeria insignis</i>
<i>Khokle</i> (Hindi)	<i>Acalypha indica</i>
<i>Khokora</i> (Asm.)	<i>Aporosa octandra</i>
<i>Khokte</i> (Mar.)	<i>Acalypha indica</i>
<i>Khola-ruis</i> (Nep.)	<i>Homonoia riparia</i>
<i>Khopli</i> (Mar.)	<i>Acalypha indica</i>
<i>Khudi-jam</i> (Beng.)	<i>Antidesma ghaesembilla</i>
<i>Khumbhi</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Kilanelli</i> (Mal.)	<i>Phyllanthus reticulatus</i>
<i>Kilanelli</i> (Tam.)	<i>Phyllanthus amarus</i>
<i>Kilarnelli</i> (Mal.)	<i>Phyllanthus polyphyllus</i>
<i>Kilkkaynell</i> (Tam.)	<i>Phyllanthus polyphyllus</i>
<i>Kiranelligida</i> (Kan.)	<i>Phyllanthus amarus</i>
<i>Kiranelligida</i> (Kan.)	<i>Phyllanthus amarus</i>
<i>Kirganelli</i> (Mal.)	<i>Phyllanthus fraternus</i>
<i>Kiriberalu</i> (Kan.)	<i>Phyllanthus amarus</i>
<i>Kiriturachi</i> (Tam.)	<i>Tragia involucrata</i>
<i>Kirkundi</i> (Mar.)	<i>Tragia plukenetii</i>
<i>Kishur</i> (Beng.)	<i>Jatropha nana</i>
<i>Kizharnelli</i> (Mal.)	<i>Mallotus philippensis</i>
<i>Kizharnellii</i> (Tam.)	<i>Phyllanthus amarus</i>
<i>Kliviol</i> (Tel.)	<i>Phyllanthus amarus</i>
<i>Kodigandlam</i> (Tel.)	<i>Euphorbia granulata</i>
<i>Kodithoova</i> (Mal.)	<i>Plukenetia corniculata</i>
<i>Kogri</i> (Mar.)	<i>Tragia involucrata</i>
<i>Kojuka</i> (Garo)	<i>Putranjiva roxburghii</i>
<i>Kokali</i> (Punj.)	<i>Baccaurea ramiflora</i>
<i>Kokkamani-maram</i> (Tam.)	<i>Acalypha ciliata</i>
<i>Kokkamani-marum</i> (Tam.)	<i>Glochidion zeylanicum</i>
<i>Kokra</i> (Beng.)	<i>Glochidion ellipticum</i>
<i>Kolavacchi</i> (Mal.)	<i>Aporosa octandra</i>
<i>Koli-kuki</i> (Kan.)	<i>Croton malabaricus</i>
<i>Kol-kalli</i> (Mal.)	<i>Baccaurea courtallensis</i>
<i>Kolli-kizhangu</i> (Mal.)	<i>Euphorbia tirucalli</i>
<i>Kolti</i> (Mar.)	<i>Manihot esculenta</i>
<i>Koluvasi</i> (Mal.)	<i>Tragia involucrata</i>
<i>Komathi</i> (Mal.)	<i>Croton malabaricus</i>
<i>Komatti</i> (Mal.)	<i>Bridelia retusa</i>
<i>Kombu-kalli</i> (Tam.)	<i>Excoecaria agallocha</i>
<i>Konamaram</i> (Mal.)	<i>Euphorbia tirucalli</i>
	<i>Drypetes venusta</i>

<i>Kondajaphara</i> (Tel.)	<i>Macaranga peltata</i>
<i>Kondamudam</i> (Tel.)	<i>Baliospermum solanifolium</i>
<i>Kondatamara</i> (Tel.)	<i>Macaranga peltata</i>
<i>Konibih</i> (Asm.)	<i>Mallotus repandus</i>
<i>Konika</i> (Or.)	<i>Croton tiglium</i>
<i>Konpal-sehund</i> (Hindi)	<i>Euphorbia tirucalli</i>
<i>Korada</i> (Urdu)	<i>Cleistanthus collinus</i>
<i>Koramaddi</i> (Tel.)	<i>Bridelia retusa</i>
<i>Korei</i> (Tel.)	<i>Cleistanthus collinus</i>
<i>Korha</i> (Asm.)	<i>Triadica cochinchinensis</i>
<i>Koria</i> (Hindi)	<i>Glochidion heyneanum</i>
<i>Kosi</i> (Or.)	<i>Bridelia retusa</i>
<i>Kosi</i> (Urdu)	<i>Bridelia retusa</i>
<i>Kosni-ronda</i> (Mar.)	<i>Jatropha gossypifolia</i>
<i>Kote</i> (Mal.)	<i>Croton persimilis</i>
<i>Kotili</i> (Mal.)	<i>Aporosa cardiosperma</i>
<i>Kottaiathanakku</i> (Tam.)	<i>Givotia rottleriformis</i>
<i>Kottam</i> (Mal.)	<i>Bridelia stipularis</i>
<i>Krishna-Kaambhoji</i> (Sans.)	<i>Phyllanthus reticulatus</i>
<i>Krishna nelli</i> (Kan.)	<i>Phyllanthus polyphyllus</i>
<i>Kudivaala-soppa</i> (Kan.)	<i>Antidesma montanum</i>
<i>Kuduru</i> (Tel.)	<i>Putranjiva roxburghii</i>
<i>Kuhin</i> (Nep.)	<i>Bridelia retusa</i>
<i>Kuhir</i> (Asm.)	<i>Bridelia retusa</i>
<i>Kukka-mirapa</i> (Tel.)	<i>Croton bonplandianus</i>
<i>Kukri-hari</i> (Or.)	<i>Lasiococca comberi</i>
<i>Kulsera</i> (Beng.)	<i>Jatropha curcas</i>
<i>Kulthi</i> (Mar.)	<i>Tragia praetervisa</i>
<i>Kuluchand</i> (Mal.)	<i>Glochidion hohenackeri</i>
<i>Kumala</i> (Or.)	<i>Mallotus philippensis</i>
<i>Kumati</i> (Kan.)	<i>Mallotus repandus</i>
<i>Kumbala</i> (Tam.)	<i>Glochidion zeylanicum</i>
<i>Kumbal-maram</i> (Tam.)	<i>Glochidion zeylanicum</i>
<i>Kumbhi</i> (Sans.)	<i>Ricinus communis</i>
<i>Kumila</i> (Punj.)	<i>Mallotus philippensis</i>
<i>Kumkuma</i> (Tel.)	<i>Mallotus philippensis</i>
<i>Kumkumadamara</i> (Kan.)	<i>Mallotus philippensis</i>
<i>Kumkum-arong</i> (Mikir)	<i>Croton caudatus</i>
<i>Kunchur-kung</i> (Lep.)	<i>Antidesma bunius</i>
<i>Kunchur-kung</i> (Lep.)	<i>Antidesma montanum</i>
<i>Kundigi</i> (Tel.)	<i>Euphorbia trigona</i>
<i>Kundui</i> (Or.)	<i>Antidesma acidum</i>
<i>Kungumam</i> (Tam.)	<i>Mallotus philippensis</i>
<i>Kunhir</i> (Asm.)	<i>Bridelia retusa</i>
<i>Kuppaimeni</i> (Tam.)	<i>Acalypha indica</i>
<i>Kuppameni</i> (Mal.)	<i>Acalypha indica</i>
<i>Kuppi</i> (Hindi)	<i>Acalypha indica</i>



- Kuppi* (Mar.)  
*Kuppi* (Punj.)  
*Kuppichettu* (Tel.)  
*Kuppigida* (Kan.)  
*Kuramadakku* (Mal.)  
*Kurda* (Kan.)  
*Kuriganda* (Kan.)  
*Kurong* (Nep.)  
*Kuruthu-nelli* (Mal.)  
*Kusmari-phang* (Cach.)  
*Kusum* (Nep.)  
*Kusum-tenga* (Beng.)  
*Laam-dumuin* (Kh.)  
*Laghududhika* (Sans.)  
*Lahara-gayo* (Nep.)  
*Lakoi* (Mani.)
- Lal chandan* (Nepali)  
*Lal-bherenda* (Beng.)  
*Lalbhuinamula* (Guj.)  
*Lali* (Mik.)  
*Lalmundajanvali* (Mar.)  
*Lalpata* (Beng.)  
*Lalpatti* (Nep.)  
*Lanka-sij* (Beng.)  
*Lari* (Asm.)  
*Late-gneo* (Beng.)  
*Latikath* (Nep.)  
*Lati-mauwa* (Nep.)  
*Latka* (Beng.)  
*Latok-tenga* (Asm.)  
*Lauri-bandha* (Asm.)  
*Lavani* (Sans.)  
*Lawa* (Asm.)  
*Leik-gyi* (Burm.)  
*Lendwa* (Hindi)  
*Lepchabis* (Nep.)  
*Leteku* (Asm.)  
*Litilli, Litali* (Mar.)  
*Loda* (Beng.)  
*Lodam* (Hindi)  
*Losan* (Asm.)  
*Lota-mahudi* (Asm.)  
*Maasu-kodi* (Tam.)  
*Madlatah* (Oudh)  
*Madpulanti* (Tam.)  
*Magali-erandi* (Guj.)  
*Mahasindhu* (Or.)
- Acalypha indica*  
*Acalypha ciliata*  
*Acalypha indica*  
*Acalypha indica*  
*Mallotus philippensis*  
*Falconeria insignis*  
*Osyris quadripartita*  
*Trevis nudiflora*  
*Phyllanthus lawii*  
*Baccaurea ramiflora*  
*Baccaurea ramiflora*  
*Baccaurea ramiflora*  
*Baliospermum solanifolium*  
*Euphorbia thymifolia*  
*Bridelia stipularis*  
*Macaranga denticulata* var.  
*denticulata*  
*Daphniphyllum himalayense*  
*Jatropha gossypifolia*  
*Phyllanthus urinaria*  
*Drypetes assamica*  
*Phyllanthus urinaria*  
*Euphorbia pulcherrima*  
*Euphorbia pulcherrima*  
*Euphorbia tirucalli*  
*Homonoia riparia*  
*Excoecaria cochinchinensis*  
*Glochidion acuminatum*  
*Glochidion ellipticum*  
*Baccaurea ramiflora*  
*Baccaurea ramiflora*  
*Mallotus ferrugineus*  
*Phyllanthus acidus*  
*Balakata baccata*  
*Bridelia retusa*  
*Falconeria insignis*  
*Croton tiglium*  
*Baccaurea ramiflora*  
*Euphorbia perbracteata*  
*Phyllanthus acidus*  
*Glochidion lanceolarium*  
*Mallotus philippensis*  
*Croton caudatus*  
*Dalechampia velutina*  
*Bridelia stipularis*  
*Flueggea leucopyrus*  
*Jatropha curcas*  
*Croton persimilis*

- Mah-kola* (Asm.)  
*Mahudi* (Asm.)  
*Mahunda* (Asm.)  
*Makariang* (Kh.)  
*Makhi* (Hindi)  
*Malai-amanakku* (Tam.)  
*Mala-kumi* (Mal.)  
*Malamgouri* (Tam.)  
*Malamvetti* (Mal.)  
*Mala-payin* (Mal.)  
*Malata* (Nep.)  
  
*Malata* (Nep.)  
*Malata* (Nep.)  
*Malatta* (Nep.)  
Malay Gooseberry (Eng.)  
*Malayala-alu* (Hindi-Andam.)  
*Malchia* (Nep.)  
*Malenkizhanelli* (Mal.)  
*Mallatta* (Nep.)  
*Mama* (Burm.)  
*Manchana* (Mal.)  
*Mancherai* (Tam.)  
*Manchevi* (Tam.)  
*Manchina* (Beng.)  
*Mandagalli* (Kan.)  
Manioc (Eng.)  
*Manipulanti* (Tam.)  
*Manmuri* (Or.)  
*Mannana* (Mal.)  
*Mansa* (Beng.)  
*Marachini* (Mal.)  
*Maraharalu* (Kan.)  
*Maravalli-kizhangu* (Tam.)  
*Marleya* (Beng.)  
*Marthu-arong* (Mikir)  
*Martu-arong* (Mikir)  
*Masundi* (Or.)  
*Mataun* (Lush.)  
*Matha-arak* (Sant.)  
*Mathagach* (Beng.)  
*Mavil-ithil* (Tam.)  
*Melanelli* (Tam.)  
*Melanelli* (Tam.)  
*Melarnelli* (Mal.)  
*Meral* (Sant.)  
*Milachityan* (Tam.)  
  
*Falconeria insignis*  
*Croton joufra*  
*Croton persimilis*  
*Helixanthera ligustrina*  
*Phyllanthus reticulatus*  
*Jatropha multifida*  
*Trevisa nudiflora*  
*Croton malabaricus*  
*Aporosa bourdillonii*  
*Drypetes oblongifolia*  
*Macaranga denticulata* var.  
*denticulata*  
*Macaranga indica*  
*Mallotus nepalensis*  
*Macaranga denticulata* var. *pustulata*  
*Phyllanthus acidus*  
*Manihot esculenta*  
*Glochidion sphaerogynum*  
*Phyllanthus heyneanus*  
*Mallotus roxburghianus*  
*Glochidion multiloculare*  
*Mallotus philippensis*  
*Agrostistachys meeboldii*  
*Euphorbia nivulia*  
*Triadica sebifera*  
*Euphorbia trigona*  
*Manihot esculenta*  
*Breynia vitis-idaea*  
*Antidesma acidum*  
*Mallotus philippensis*  
*Euphorbia neriifolia*  
*Manihot esculenta*  
*Jatropha curcas*  
*Manihot esculenta*  
*Mallotus ferrugineus*  
*Croton persimilis*  
*Croton joufra*  
*Croton persimilis*  
*Croton caudatus*  
*Antidesma acidum*  
*Antidesma acidum*  
*Helicanthes elastica*  
*Phyllanthus maderaspatensis*  
*Phyllanthus reticulatus*  
*Phyllanthus tenellus*  
*Phyllanthus emblica*  
*Bischofia javanica*

<i>Milagu-nari</i> (Tam.)	<i>Croton persimilis</i>
<i>Millakumari</i> (Tam.)	<i>Croton persimilis</i>
<i>Mingut</i> (Mar.)	<i>Euphorbia neriifolia</i>
<i>Moarivegai</i> (Tam.)	<i>Bridelia retusa</i>
<i>Mogali-eranda</i> (Mar.)	<i>Jatropha curcas</i>
<i>Mogali-erandi</i> (Kon.)	<i>Jatropha curcas</i>
<i>Moktok</i> (Manip.)	<i>Baccaurea ramiflora</i>
<i>Monda</i> (Or.)	<i>Trevia nudiflora</i>
<i>Mondu</i> (Urdu)	<i>Trevia nudiflora</i>
<i>Mongthel-kung</i> (Lep.)	<i>Homonoia riparia</i>
<i>Monyosha</i> (Hindi)	<i>Phyllanthus maderaspatensis</i>
<i>Mootapalam</i> (Tam.)	<i>Baccaurea courtallensis</i>
<i>Moralia</i> (Asm.)	<i>Macaranga denticulata</i> var. <i>denticulata</i>
<i>Moralia</i> (Asm.)	<i>Mallotus ferrugineus</i>
<i>Mossn</i> (Or.)	<i>Aporosa octandra</i>
<i>Motibhonyaamali</i> (Guj.)	<i>Phyllanthus simplex</i> var. <i>simplex</i>
<i>Moti-khajavani-vel</i> (Guj.)	<i>Tragia plukenetii</i>
<i>Mottithuri</i> (Mal.)	<i>Baccaurea courtallensis</i>
<i>Moyra-tikoni</i> (Asm.)	<i>Phyllanthus sikkimensis</i>
<i>Mukkayini</i> (Mal.)	<i>Bridelia retusa</i>
<i>Mukta-jhuri</i> (Beng.)	<i>Acalypha indica</i>
<i>Mukunda</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Mulaje-mudu</i> (Kan.)	<i>Euphorbia antiquorum</i>
<i>Mulbara-maram</i> (Tam.)	<i>Hura crepitans</i>
<i>Mulimpala</i> (Mal.)	<i>Agrostistachys meeboldii</i>
<i>Mullarasanam</i> (Tam.)	<i>Hura crepitans</i>
<i>Mullu-maruthu</i> (Tam.)	<i>Bridelia retusa</i>
<i>Mullu-polavu</i> (Tam.)	<i>Mallotus ferrugineus</i>
<i>Mulluvenga</i> (Mal.)	<i>Bridelia retusa</i>
<i>Munsasej</i> (Hindi)	<i>Euphorbia neriifolia</i>
<i>Muse-gayo</i> (Nep.)	<i>Bridelia tomentosa</i> var. <i>tomentosa</i>
<i>Murukalli</i> (Mal.)	<i>Euphorbia tortilis</i>
<i>Mutta</i> (Beng.)	<i>Antidesma acidum</i>
<i>Muttapazham</i> (Mal.)	<i>Baccaurea courtallensis</i>
<i>Muttathuri</i> (Mal.)	<i>Baccaurea courtallensis</i>
<i>Muttikeipu</i> (Mal.)	<i>Baccaurea courtallensis</i>
<i>Muttithuri</i> (Tam.)	<i>Baccaurea courtallensis</i>
<i>Naarkuli</i> (Or.)	<i>Phyllanthus acidus</i>
<i>Nagadanti</i> (Mal.)	<i>Baliospermum solanifolium</i>
<i>Nagadanti</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Nagadanti</i> (Sans.)	<i>Croton persimilis</i>
<i>Naga-kalli</i> (Tam.)	<i>Euphorbia nivulia</i>
<i>Naganam</i> (Tam.)	<i>Croton tiglium</i>
<i>Nagasphota</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Nai-milagai</i> (Tam.)	<i>Croton bonplandianus</i>
<i>Nala-amadam</i> (Tel.)	<i>Jatropha gossypifolia</i>

<i>Nalaballi</i> (Tel.)	<i>Phyllanthus rheedei</i>
<i>Nala-userekee</i> (Tel.)	<i>Phyllanthus maderaspatensis</i>
<i>Nallapulatti</i> (Tam.)	<i>Phyllanthus heyneanus</i>
<i>Nallapuli</i> (Tel.)	<i>Phyllanthus reticulatus</i>
<i>Nalla-purugudu</i> (Tel.)	<i>Phyllanthus reticulatus</i>
<i>Nanangalli</i> (Tam.)	<i>Euphorbia nivulia</i>
<i>Nan-bhantur</i> (Beng.)	<i>Croton caudatus</i>
<i>Nanbhantur</i> (Kan.)	<i>Mallotus repandus</i>
<i>Nanchu</i> (Mal.)	<i>Croton klotzschianus</i>
<i>Nanha-baniakandhum</i> (Sant.)	<i>Glochidion multiloculare</i>
<i>Narsej</i> (Mar.)	<i>Euphorbia antiquorum</i>
<i>Nayikoote</i> (Kan.)	<i>Antidesma bunius</i>
<i>Nedbadi</i> (Raj.)	<i>Phyllanthus reticulatus</i>
<i>Neela-amidam</i> (Tel.)	<i>Jatropha glandulifera</i>
<i>Neepal</i> (Guj.)	<i>Croton tiglium</i>
<i>Neepala</i> (Kan.)	<i>Croton tiglium</i>
<i>Neepala</i> (Sans.)	<i>Croton tiglium</i>
<i>Neepala-vema</i> (Tel.)	<i>Croton tiglium</i>
<i>Neepala-vitua</i> (Tel.)	<i>Croton tiglium</i>
<i>Neppalam</i> (Tel.)	<i>Croton tiglium</i>
<i>Neerahanchi-mara</i> (Kan.)	<i>Antidesma montanum</i>
<i>Neerkottampala</i> (Mal.)	<i>Euphorbia indica</i>
<i>Neeru kuku</i> (Kan.)	<i>Glochidion zeylanicum</i>
<i>Neervalam</i> (Mal.)	<i>Croton tiglium</i>
<i>Neervalam</i> (Tam.)	<i>Croton tiglium</i>
<i>Nekham-tenga</i> (Asm.)	<i>Antidesma acidum</i>
<i>Nela-amida</i> (Tel.)	<i>Jatropha gossypifolia</i>
<i>Nelajidi</i> (Tel.)	<i>Baliospermum solanifolium</i>
<i>Nelausiri</i> (Tel.)	<i>Phyllanthus amarus</i>
<i>Nelausirika</i> (Tel.)	<i>Phyllanthus amarus</i>
<i>Nelavusari</i> (Tel.)	<i>Phyllanthus amarus</i>
<i>Nelli</i> (Kan.)	<i>Phyllanthus emblica</i>
<i>Nelli</i> (Mal.)	<i>Phyllanthus emblica</i>
<i>Nelli</i> (Tam.)	<i>Phyllanthus emblica</i>
<i>Nelli</i> (Tel.)	<i>Phyllanthus emblica</i>
<i>Nellika</i> (Kan.)	<i>Phyllanthus emblica</i>
<i>Nellikka</i> (Mal.)	<i>Phyllanthus emblica</i>
<i>Nellikka-maram</i> (Mal.)	<i>Phyllanthus emblica</i>
<i>Nelli-mara</i> (Kan.)	<i>Phyllanthus emblica</i>
<i>Nellippuli</i> (Mal.)	<i>Phyllanthus acidus</i>
<i>Neoli-tali</i> (Mal.)	<i>Antidesma bunius</i>
<i>Nepalam</i> (Tel.)	<i>Jatropha curcas</i>
<i>Nepalamu</i> (Tel.)	<i>Jatropha gossypifolia</i>
<i>Nera-khar-shing</i> (Nep.)	<i>Jatropha curcas</i>
<i>Neruvam</i> (Mal.)	<i>Baliospermum solanifolium</i>
<i>Nervalam</i> (Guj.)	<i>Croton tiglium</i>
<i>Nervalam</i> (Kan.)	<i>Croton tiglium</i>

<i>Nervalam</i> (Tel.)	<i>Croton tiglium</i>
<i>Nevil</i> (Mar.)	<i>Euphorbia tirucalli</i>
<i>Newrang</i> (Mar.)	<i>Euphorbia nivulia</i>
<i>Nigumbam</i> (Tam.)	<i>Croton tiglium</i>
<i>Nikumbhi</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Nilappala</i> (Tam.)	<i>Cleistanthus collinus</i>
<i>Nilapala</i> (Mal.)	<i>Euphorbia hirta</i>
<i>Nilapala</i> (Mal.)	<i>Euphorbia rothiana</i>
<i>Nilapala</i> (Mal.)	<i>Euphorbia thymifolia</i>
<i>Nim-puteli</i> (Beng.)	<i>Mallotus roxburghianus</i>
<i>Nira</i> (Mal.)	<i>Bischofia javanica</i>
<i>Niradimuthu</i> (Tam.)	<i>Baliospermum solanifolium</i>
<i>Nirantimuttu</i> (Mal.)	<i>Baliospermum solanifolium</i>
<i>Nir-chappay</i> (Badaga):	<i>Daphniphyllum glaucescens</i>
<i>Nirehelli</i> (Kan.)	<i>Glochidion hohenackeri</i>
<i>Nirethimuthu</i> (Tam.)	<i>Baliospermum solanifolium</i>
<i>Nirganagile</i> (Kan.)	<i>Homonoia riparia</i>
<i>Nirjani</i> (Kan.)	<i>Glochidion hohenackeri</i>
<i>Nir-kocki</i> (Badaga):	<i>Daphniphyllum glaucescens</i>
<i>Nirnelli</i> (Mal.)	<i>Phyllanthus reticulatus</i>
<i>Nironda</i> (Mar.)	<i>Ricinus communis</i>
<i>Niruri</i> (Sind.)	<i>Phyllanthus amarus</i>
<i>Nirvetti</i> (Mal.)	<i>Aporosa indo-acuminata</i>
<i>Nirvetti</i> (Mal.)	<i>Glochidion zeylanicum</i>
<i>Nishakumbha</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Nishalya</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Nisrinsapatra</i> (Sans.)	<i>Euphorbia royleana</i>
<i>Nivdung</i> (Mar.)	<i>Euphorbia nivulia</i>
<i>Niwala</i> (Mar.)	<i>Euphorbia tirucalli</i>
<i>Niwarang</i> (Mar.)	<i>Euphorbia tirucalli</i>
<i>Noari</i> (Beng.)	<i>Phyllanthus acidus</i>
<i>Noga-jegru</i> (Asm.)	<i>Macaranga lowii</i>
<i>Nolaitali</i> (Tam.)	<i>Antidesma bunius</i>
<i>Nolathalli</i> (Tam.)	<i>Antidesma bunius</i>
<i>Noolitali</i> (Mal.)	<i>Antidesma bunius</i>
<i>Nuniari</i> (Or.)	<i>Antidesma acidum</i>
<i>Nuniari</i> (Urdu)	<i>Antidesma acidum</i>
<i>Nuniari</i> (Urdu)	<i>Antidesma ghaesembilla</i>
<i>Odhuvanthalai</i> (Tam.)	<i>Cleistanthus collinus</i>
<i>Odivamaram</i> (Tam.)	<i>Cleistanthus collinus</i>
<i>Odugu</i> (Mal.)	<i>Cleistanthus collinus</i>
<i>Oduvan</i> (Tam.)	<i>Cleistanthus collinus</i>
<i>Oothoni</i> (Mal.)	<i>Macaranga peltata</i>
<i>Orer</i> (Nep.)	<i>Ricinus communis</i>
<i>Ounla</i> (Urdu)	<i>Phyllanthus emblica</i>
<i>Oura</i> (Urdu)	<i>Phyllanthus emblica</i>
<i>Paalmaram</i> (Tam.)	<i>Excoecaria oppositifolia</i> var. <i>crenulata</i>

*Pachan-kalli* (Tam.)  
*Paei-eechchi* (Tam.)  
*Pagvi* (Mar.)  
*Painia* (Or.)  
*Paishavdia* (Urdu)  
*Paklau-arong* (Asm.)  
*Pakok-toung* (Lep.)  
*Palagadda* (Tel.)  
*Palakani* (Mal.)  
*Palkalli* (Tam.)  
*Palaku* (Tel.)  
*Palla-kanni* (Tam.)  
*Palma-Christi* (Eng.)  
*Palame* (Nep.)  
*Pambara-kumbil* (Mal.)  
*Pambara-kumbil* (Mal.)  
*Pancharrsha* (Sans.)  
*Pandharisala* (Mal.)  
*Pandhar-palli* (Mar.)  
*Panduray* (Mal.)  
*Pangkai* (Lush.)  
*Panialla* (Beng.)  
*Paniccavu* (Tam.)  
*Panichhitiki* (Asm.)  
*Pani-heloch* (Asm.)  
*Pani-heloch* (Asm.)  
*Paniholos* (Asm.)  
*Panimudi* (Asm.)  
*Panimudi* (Asm.)  
  
*Panippoduk-kaanai* (Tam.)  
*Panjali* (Hindi)  
*Panjangulum* (Sans.)  
*Panjuli* (Beng.)  
*Panjuli* (Hindi)  
*Panpoi* (Konk.)  
*Pantenga* (Tel.)  
*Para-rubber* (Eng.)  
*Paringambhar* (Beng.)  
*Paritza* (Mar.)  
*Parvataranda* (Sans.)  
*Pashanabedaka* (Sans.)  
*Patabahar* (Beng.)  
*Patala* (Hindi)  
*Pattavani* (Mal.)  
*Pavalapulah* (Mal.)  
*Pavalapulah* (Mal.)

*Euphorbia tirucalli*  
*Antidesma montanum*  
*Putranjiva roxburghii*  
*Macaranga peltata*  
*Putranjiva roxburghii*  
*Endospermum chinense*  
*Ostodes paniculata*  
*Euphorbia fusiformis* var. *fusiformis*  
*Drypetes venusta*  
*Euphorbia trigona*  
*Euphorbia hirta*  
*Drypetes venusta*  
*Ricinus communis*  
*Flueggea virosa*  
*Trevia nudiflora*  
*Trevia nudiflora* var. *polycarpa*  
*Phyllanthus emblica*  
*Croton zeylanicus*  
*Flueggea virosa*  
*Croton zeylanicus*  
*Baccaurea ramiflora*  
*Glochidion lanceolarium*  
*Glochidion heyneanum*  
*Glochidion ellipticum*  
*Antidesma bunius*  
*Antidesma montanum*  
*Homonoia riparia*  
*Glochidion multiloculare*  
*Glochidion zeylanicum*  
     var. *tomentosum*  
*Glochidion ellipticum*  
*Phyllanthus reticulatus*  
*Ricinus communis*  
*Phyllanthus reticulatus*  
*Phyllanthus reticulatus*  
*Phyllanthus reticulatus*  
*Bridelia montana*  
*Hevea brasiliensis*  
*Trevia nudiflora*  
*Glochidion heyneanum*  
*Jatropha curcas*  
*Homonoia riparia*  
*Codiaeum variegatum*  
*Flueggea virosa*  
*Macaranga peltata*  
*Breynia retusa*  
*Breynia vitis-idaea*

- Pavan* (Mar.)  
*Pavana* (Mar.)  
*Pavilapulu* (Mal.)  
*Pedda-jamadu* (Tel.)  
*Pella-gumudu* (Tel.)  
*Perinclavu* (Mal.)  
*Perinclavu* (Mal.)  
*Periseelai* (Tam.)  
*Perunelli* (Tam.)  
*Peruniruri* (Mal.)  
*Petari* (Mar.)  
*Petari* (Mar.)  
*Peyamanakku* (Tam.)  
*Phajoli* (Or.)  
*Phalan-cokriti* (Or.)  
*Phang-gait-arong* (Mik.)  
*Phan-kah* (Kh.)  
*Phirphire* (Nep.)  
*Phulisaar* (Tel.)  
*Phuljelong* (Asm.)  
*Phungali* (Mar.)  
*Phungi* (Asm.)  
*Phusri-malata* (Nep.)  
*Phutkia* (Kum.)  
 Physic nut (Eng.)  
*Pilluli* (Tam.)  
*Pimbaram* (Mal.)  
*Pimt-khatkhutli* (Kon.)  
*Pindara* (Hindi)  
*Pipalpate* (Nep.)  
*Pippinta* (Tel.)  
*Pitali* (Beng.)  
*Pitali* (Nep.)  
*Pithakuma-kendlow* (Asm.)  
*Pithaliya-panijambhar* (Or.)  
*Plavithil* (Tam.)  
 Poison nut (Eng.)  
*Poitundia* (Or.)  
*Polari* (Tel.)  
*Polki* (Mar.)  
*Pomarai* (Tam.)  
*Pondhari* (Mal.)  
*Ponnagam* (Mal.)  
*Ponnai-kanjan* (Tam.)  
*Ponsum* (Cach.)  
*Poola* (Tam.)  
*Poola-kizhangu* (Mal.)  
*Phyllanthus reticulatus*  
*Phyllanthus reticulatus*  
*Breynia vitis-idaea*  
*Euphorbia tortilis*  
*Antidesma acidum*  
*Flueggea leucopyrus*  
*Flueggea virosa*  
*Breynia retusa*  
*Phyllanthus emblica*  
*Breynia retusa*  
*Trevia nudiflora*  
*Trevia nudiflora* var. *polycarpa*  
*Baliospermum solanifolium*  
*Phyllanthus reticulatus*  
*Croton caudatus*  
*Drypetes assamica*  
*Manihot esculenta*  
*Triadica cochinchinensis*  
*Phyllanthus reticulatus*  
*Baliospermum solanifolium*  
*Excoecaria agallocha*  
*Macaranga lowii*  
*Mallotus roxburghianus*  
*Excoecaria acerifolia*  
*Jatropha curcas*  
*Viscum orientale*  
*Croton malabaricus*  
*Tragia montana*  
*Trevia nudiflora*  
*Triadica cochinchinensis*  
*Acalypha indica*  
*Trevia nudiflora*  
*Trevia nudiflora*  
*Trevia nudiflora*  
*Trevia nudiflora*  
*Trevia nudiflora*  
*Dendrophthoe falcata*  
*Jatropha curcas*  
*Putranjiva roxburghii*  
*Antidesma ghaesembilla*  
*Givotia rottleriformis*  
*Breynia vitis-idaea*  
*Croton zeylanicus*  
*Mallotus philippensis*  
*Tragia involucrata*  
*Excoecaria oppositifolia*  
*Phyllanthus reticulatus*  
*Manihot esculenta*

<i>Poonakkachi</i> (Tam.)	<i>Tragia plukenettii</i>
<i>Popli</i> (Mar.)	<i>Osyris quadripartita</i>
<i>Portugalem-chinem</i> (Kon.)	<i>Manihot esculenta</i>
<i>Pratyakaparni</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Pubeer</i> (Kan.)	<i>Givotia rottleriformis</i>
<i>Puddum</i> (Asm.)	<i>Mallotus philippensis</i>
<i>Pula</i> (Tam.)	<i>Phyllanthus reticulatus</i>
<i>Pulanji</i> (Tam.)	<i>Flueggea leucopyrus</i>
<i>Pulanti</i> (Tam.)	<i>Flueggea leucopyrus</i>
<i>Pulichin-jalamu</i> (Tel.)	<i>Macaranga peltata</i>
<i>Pulival-kodi</i> (Tam.)	<i>Dalechampia velutina</i>
<i>Pullanti</i> (Tam.)	<i>Phyllanthus reticulatus</i>
<i>Pullapurasi-gida</i> (Kan.)	<i>Antidesma ghaesembilla</i>
<i>Pullayusinika</i> (Tel.)	<i>Phyllanthus emblica</i>
<i>Pullurivi</i> (Tam.)	<i>Viscum monoicum</i>
<i>Pulluruvi</i> (Tam.)	<i>Dendrophthoe falcata</i>
<i>Pulsur</i> (Tel.)	<i>Antidesma ghaesembilla</i>
<i>Pundna</i> (Punj.)	<i>Glochidion heyneanum</i>
<i>Pung-tung</i> (Beng.)	<i>Mallotus philippensis</i>
<i>Puputi</i> (Beng.)	<i>Euphorbia dracunculoides</i>
<i>Purging Nut</i> (Eng.)	<i>Jatropha curcas</i>
<i>Purugudu</i> (Tel.)	<i>Phyllanthus reticulatus</i>
<i>Putharaval</i> (Mal.)	<i>Antidesma montanum</i> var. <i>montanum</i>
<i>Putijia</i> (Hindi)	<i>Putranjiva roxburghii</i>
<i>Putol</i> (Mal.)	<i>Croton persimilis</i>
<i>Putrajivika</i> (Tel.)	<i>Putranjiva roxburghii</i>
<i>Putranjiva</i> (Beng.)	<i>Putranjiva roxburghii</i>
<i>Putranjiva</i> (Sans.)	<i>Putranjiva roxburghii</i>
<i>Putri</i> (Beng.)	<i>Croton persimilis</i>
<i>Putri</i> (Beng.-And.)	<i>Croton sublyratus</i>
<i>Puvan</i> (Guj.)	<i>Phyllanthus reticulatus</i>
<i>Pyetung-bording</i> (Kh.)	<i>Elytranthe psilantha</i>
<i>Raajni</i> (Tam.)	<i>Trevisa nudiflora</i> var. <i>polycarpa</i>
<i>Rachayusirika</i> (Tel.)	<i>Phyllanthus acidus</i>
<i>Raghumala</i> (Asm.)	<i>Macrosolen ampullaceus</i>
<i>Raini</i> (Hindi)	<i>Mallotus philippensis</i>
<i>Rainvala</i> (Mar.)	<i>Phyllanthus acidus</i>
<i>Rajamvali</i> (Kon.)	<i>Phyllanthus acidus</i>
<i>Raktadanti</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Ramrita</i> (Nep.)	<i>Trevisa nudiflora</i>
<i>Rana-erandi</i> (Mar.)	<i>Jatropha curcas</i>
<i>Ranavali</i> (Guj.)	<i>Phyllanthus maderaspatensis</i>
<i>Rand</i> (Mar.)	<i>Ricinus communis</i>
<i>Randi</i> (Hindi)	<i>Ricinus communis</i>
<i>Rangchita</i> (Beng.)	<i>Pedilanthus tithymaloides</i>
<i>Rani-jadha</i> (Hindi)	<i>Jatropha gossypifolia</i>
<i>Ratanjot</i> (Nep.)	<i>Jatropha curcas</i>



<i>Ratanjota</i> (Hindi)	<i>Jatropha curcas</i>
<i>Ratsamsirika</i> (Tel.)	<i>Phyllanthus acidus</i>
<i>Rayaranelli</i> (Kan.)	<i>Phyllanthus acidus</i>
<i>Raypkunul</i> (Tam.)	<i>Trevis nudiflora</i>
<i>Rechmi</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Reddinanabrolu</i> (Tel.)	<i>Euphorbia hirta</i>
<i>Reddivar-manubala</i> (Tel.)	<i>Euphorbia thymifolia</i>
<i>Redi</i> (Beng.)	<i>Ricinus communis</i>
<i>Rehri</i> (Hindi)	<i>Ricinus communis</i>
<i>Reil-poondu</i> (Tam.)	<i>Croton bonplandianus</i>
<i>Reri</i> (Nep.)	<i>Ricinus communis</i>
<i>Rerri</i> (Beng.)	<i>Ricinus communis</i>
<i>Roem</i> (Mar.)	<i>Mallotus philippensis</i>
<i>Rohini</i> (Hindi)	<i>Mallotus philippensis</i>
<i>Rokte</i> (Nep.)	<i>Glochidion sphaerogynum</i>
<i>Roli</i> (Hindi)	<i>Mallotus philippensis</i>
<i>Rubber-maram</i> (Mal.)	<i>Hevea brasiliensis</i>
<i>Rubber-maram</i> (Tam.)	<i>Hevea brasiliensis</i>
<i>Ruina</i> (Hindi)	<i>Mallotus philippensis</i>
<i>Ruksha</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Runchalo-dadri</i> (Guj.)	<i>Acalypha ciliata</i>
<i>Sabar</i> (Hindi-Andam.)	<i>Euphorbia epiphyllodes</i>
<i>Sabheli-bhaja</i> (Hindi)	<i>Antidesma acidum</i>
<i>Sadadaaram</i> (Tam.)	<i>Phyllanthus acidus</i>
<i>Sadagam</i> (Tam.)	<i>Phyllanthus acidus</i>
<i>Sadahajarmoni</i> (Beng.)	<i>Phyllanthus amarus</i>
<i>Sadura-kalli</i> (Tam.)	<i>Euphorbia antiquorum</i>
<i>Safed hajarmari</i> (Hindi)	<i>Phyllanthus amarus</i>
<i>Safed-arand</i> (Hindi)	<i>Jatropha curcas</i>
<i>Safed-chandan</i> (Hindi)	<i>Santalum album</i>
<i>Safed-doochi</i> (Hindi-Bihar)	<i>Euphorbia thymifolia</i>
<i>Safed-erandi</i> (Hindi)	<i>Jatropha curcas</i>
<i>Sair</i> (Hindi)	<i>Euphorbia tirucalli</i>
<i>Sakkarakkalli</i> (Tam.)	<i>Falconeria insignis</i>
<i>Sal</i> (Konk.)	<i>Aporosa cardiosperma</i>
<i>Salaei</i> (Goa)	<i>Aporosa cardiosperma</i>
<i>Salamander tree</i> (Eng.)	<i>Antidesma bunius</i>
<i>Sali</i> (Goa)	<i>Aporosa cardiosperma</i>
<i>Sali</i> (Kan.)	<i>Aporosa cardiosperma</i>
<i>Sali</i> (Punj.)	<i>Euphorbia royleana</i>
<i>Sama</i> (Punj.)	<i>Glochidion heyneanum</i>
<i>Sambari</i> (Tam.)	<i>Croton tiglium</i>
<i>Sambhyo-kung</i> (Lep.)	<i>Baccaurea ramiflora</i>
<i>Sam-sim</i> (Garo)	<i>Balakata baccata</i>
<i>Sanaushonta</i> (Or.)	<i>Croton caudatus</i>
<i>Sandal</i> (Urdu)	<i>Santalum album</i>
<i>Sandanam</i> (Tam.)	<i>Santalum album</i>

*Sandana-maram* (Tam.)  
 Sandbox tree (Eng.)  
*Sannagalli* (Tel.)  
*Sannagooje* (Kan.)  
*Sannaturachi* (Kan.)  
*Sanu-aijaru* (Nep.)  
*Sanu-malata* (Nep.)  
*Sapranji* (Tel.)  
*Sarali* (Kan.)  
*Sarni* (Mar.)  
*Savrigidda* (Kan.)  
*Sayabalam* (Tam.)  
*Sayord* (Hindi)  
*Sehnd* (Hindi)  
*Sehund* (Hindi)  
*Sehund* (Hindi)  
*Seikuhi* (Burm.)  
*Seleng* (Asm.)  
*Senegel-sing* (Sant.)  
*Senhur* (Hindi)  
*Senthatti* (Tam.)  
*Sentungrung* (Lep.)  
*Seppulae* (Tam.)  
*Seti-kath* (Nep.)  
*Sevalangoltai* (Tam.)  
*Shadevi* (Hindi)  
*Shendri* (Mar.)  
*Sheran* (Mar.)  
*Sherni* (Mar.)  
*Sherudd* (Mar.)  
*Shighara* (Sans.)  
*Shinavi* (Guj.)  
*Shivappunelli* (Tam.)  
*Shoura* (Mar.)  
*Shweta-ghanta* (Sans.)  
*Shwet-kerucie* (Beng.)  
*Siduram* (Tam.)  
*Sihund* (Hindi)  
*Sij* (Hindi)  
*Siji* (Beng.)  
*Siji* (Beng.)  
*Silpati* (Beng.)  
*Simal-tarul* (Nep.)  
*Simbed-daru* (Hindi)  
*Sindur* (Hindi)  
*Sindure* (Nep.)  
*Sinduri* (Or.)

*Santalum album*  
*Hura crepitans*  
*Euphorbia tirucalli*  
*Antidesma acidum*  
*Tragia plukenetii*  
*Helixanthera parasitica*  
*Alchornea tiliifolia*  
*Suregada angustifolia*  
*Aporosa cardiosperma*  
*Homonoia riparia*  
*Glochidion zeylanicum*  
*Croton tiglium*  
*Euphorbia antiquorum*  
*Euphorbia tirucalli*  
*Euphorbia neriifolia*  
*Euphorbia nivulia*  
*Bridelia retusa*  
*Balakata baccata*  
*Tragia involucrata*  
*Euphorbia nivulia*  
*Tragia involucrata*  
*Sauropus androgynus*  
*Breynia vitis-idaea*  
*Endospermum chinense*  
*Croton tiglium*  
*Chrozophora rotterli*  
*Mallotus philippensis*  
*Homonoia riparia*  
*Homonoia riparia*  
*Euphorbia fusiformis* var. *fusiformis*  
*Baliospermum solanifolium*  
*Phyllanthus reticulatus*  
*Phyllanthus urinaria*  
*Glochidion heyneanum*  
*Baliospermum solanifolium*  
*Euphorbia thymifolia*  
*Croton tiglium*  
*Euphorbia royleana*  
*Euphorbia nivulia*  
*Euphorbia neriifolia*  
*Euphorbia nivulia*  
*Breynia vitis-idaea*  
*Manihot esculenta*  
*Glochidion lanceolarium*  
*Mallotus philippensis*  
*Mallotus philippensis*  
*Mallotus philippensis*

<i>Sinduri</i> (Tel.)	<i>Mallotus philippensis</i>
<i>Sinduri</i> (Urdu)	<i>Mallotus philippensis</i>
<i>Sinni</i> (Tam.)	<i>Acalypha fruticosa</i>
<i>Siria-amanakku</i> (Tam.)	<i>Jatropha gossypifolia</i>
<i>Siridamani</i> (Tel.)	<i>Homonoia riparia</i>
<i>Sirukaanchori</i> (Tam.)	<i>Tragia plukenettii</i>
<i>Sirukurunjan</i> (Tam.)	<i>Acalypha alnifolia</i>
<i>Sirunelli</i> (Tam.)	<i>Phyllanthus polyphyllus</i>
<i>Sithuruvam</i> (Tam.)	<i>Breynia vitis-idaea</i>
<i>Sittamanakku</i> (Tam.)	<i>Ricinus communis</i>
<i>Sittarapaladai</i> (Tam.)	<i>Euphorbia thymifolia</i>
<i>Slipper-flower</i> (Eng.)	<i>Pedilanthus tithymaloides</i>
<i>Soh-kymphira</i> (Kh.)	<i>Croton lissophyllus</i>
<i>Soh-kyrmoit-blang</i> (Kh.)	<i>Euphorbia khasyana</i>
<i>Soh-lam-brang</i> (Kh.)	<i>Croton caudatus</i>
<i>Soh-matiar-syurang</i> (Kh.)	<i>Breynia retusa</i>
<i>Soh-meka-riang</i> (Kh.)	<i>Taxillus vestitus</i>
<i>Soh-myr-lain</i> (Kh.)	<i>Phyllanthus emblica</i>
<i>Soh-pydung-lording</i> (Kh.)	<i>Elytranthe psilantha</i>
<i>Soh-sa-kuriau</i> (Kh.)	<i>Phyllanthus clarkei</i>
<i>Solai-karupuchedi</i> (Tam.)	<i>Mallotus resinusus</i> var. <i>stenanthus</i>
<i>Sontul</i> (Lus.)	<i>Aporosa octandra</i>
<i>Soraiguti-koa</i> (Asm.)	<i>Bridelia assamica</i>
<i>Sotega</i> (Kan.)	<i>Paracroton pendulus</i>
<i>Sottukoyina</i> (Kan.)	<i>Glochidion heyneanum</i>
<i>Srigandam</i> (Tam.)	<i>Santalum album</i>
<i>Srigandha</i> (Kan.)	<i>Santalum album</i>
Star Gooseberry (Eng.)	<i>Phyllanthus acidus</i>
<i>Sulla</i> (Kan.)	<i>Aporosa cardiosperma</i>
<i>Sullal</i> (Kan.)	<i>Glochidion hohenackeri</i>
<i>Sullai-mara</i> (Kan.)	<i>Glochidion heyneanum</i>
<i>Sumbling</i> (Lep.)	<i>Baccaurea ramiflora</i>
<i>Sundara-badanika</i> (Tel.)	<i>Viscum orientale</i>
<i>Sundaragundi</i> (Or.)	<i>Mallotus philippensis</i>
<i>Sunukui</i> (Sans.)	<i>Homonoia riparia</i>
<i>Suom</i> (Lep.)	<i>Phyllanthus emblica</i>
<i>Superai</i> (Nep.)	<i>Croton caudatus</i>
<i>Suragada</i> (Tel.)	<i>Suregada angustifolia</i>
<i>Suravalli</i> (Kon.)	<i>Chrozophora rottleri</i>
<i>Surra</i> (Hindi)	<i>Homonoia riparia</i>
<i>Surund</i> (Mar.)	<i>Excoecaria agallocha</i>
<i>Suryavarti</i> (Mar.)	<i>Chrozophora rottleri</i>
<i>Suthekmi-songepa</i> (Garo)	<i>Helixanthera ligustrina</i>
<i>Suvarnaksiri</i> (Sans.)	<i>Euphorbia thomsoniana</i>
<i>Swarnavetti</i> (Mal.)	<i>Aporosa indo-acuminata</i>
<i>Sweta-kambhoja</i> (Sans.)	<i>Flueggea leucopyrus</i>
<i>Tabitasing</i> (Asm.)	<i>Homonoia riparia</i>

<i>Tak-chabrik</i> (Lep.)	<i>Croton caudatus</i>
<i>Talibda</i> (Burm.-And.)	<i>Croton argyratus</i>
<i>Talikkorik</i> (Lep.)	<i>Croton caudatus</i>
<i>Tamalika</i> (Sans.)	<i>Phyllanthus urinaria</i>
<i>Ta-ma-pen</i> (Burm.)	<i>Phyllanthus emblica</i>
<i>Ta-ma-sik</i> (Burm.)	<i>Glochidion coccineum</i>
<i>Tameinzoke</i> (Burm.)	<i>Glochidion nubigenum</i>
<i>Tamfathu</i> (Nicobar.)	<i>Alchornea rugosa</i>
<i>Tamlai</i> (Naga)	<i>Mallotus roxburghianus</i>
<i>Tamsir-arong</i> (Mik.)	<i>Aporosa octandra</i>
<i>Tandameral</i> (Sans.)	<i>Phyllanthus simplex</i> var. <i>simplex</i>
<i>Tangapo</i> (Andaman - Jarawa)	<i>Glochidion jarawae</i>
<i>Tani</i> (Tam.)	<i>Croton klotzschianus</i>
<i>Taniki</i> (Tel.)	<i>Homonoia riparia</i>
<i>Tansil-arong</i> (Mik.)	<i>Aporosa wallichii</i>
<i>Tapioca</i> (Eng.)	<i>Manihot esculenta</i>
<i>Tardot-asa-asing</i> (Abor)	<i>Ostodes paniculata</i>
<i>Taruni</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Teegadura-dagunta</i> (Tel.)	<i>Tragia involucrata</i>
<i>Tella-duradagunta</i> (Tel.)	<i>Tragia plukenetii</i>
<i>Tella-pali</i> (Tel.)	<i>Flueggea leucopyrus</i>
<i>Tella-puliki</i> (Tel.)	<i>Givotia rotteriformis</i>
<i>Tella-pulugudu</i> (Tel.)	<i>Flueggea leucopyrus</i>
<i>Tella-purugudu</i> (Tel.)	<i>Flueggea leucopyrus</i>
<i>Tellavusirika</i> (Tel.)	<i>Sauropus quadrangularis</i>
<i>Tendi</i> (Tam.)	<i>Croton tiglium</i>
<i>Teng-num-ching</i> (Naga)	<i>Mallotus ferrugineus</i>
<i>Teppadai</i> (Tam.)	<i>Croton aromaticus</i>
<i>Tetrikair</i> (Lep.)	<i>Glochidion acuminatum</i>
<i>Tew-khap-nip</i> (Kh.)	<i>Phyllanthus pseudoparvifolius</i>
<i>Thalamaram</i> (Tam.)	<i>Givotia rotteriformis</i>
<i>Thambugam</i> (Sans.)	<i>Ricinus communis</i>
<i>Thanakku</i> (Tam.)	<i>Jatropha villosa</i>
<i>Thar</i> (Punj.)	<i>Euphorbia royleana</i>
<i>Tharuna</i> (Sans.)	<i>Ricinus communis</i>
<i>Thauang</i> (Man.)	<i>Croton joufra</i>
<i>Thavatti</i> (Mal.)	<i>Mallotus repandus</i>
<i>Thavattu-polavu</i> (Tam.)	<i>Croton malabaricus</i>
<i>Thenadal</i> (Mal.)	<i>Croton malabaricus</i>
<i>Theng-bri</i> (Mikir)	<i>Excoecaria oppositifolia</i>
<i>Theng-kong-arong</i> (Mik.)	<i>Glochidion sphaerogynum</i>
<i>Theng-merok-arong</i> (Mik.)	<i>Antidesma ghaesembilla</i>
<i>Theng-moite</i> (Asm.)	<i>Cleidion javanicum</i>
<i>Thijigrey-phang</i> (Cach.)	<i>Bridelia retusa</i>
<i>Thilla</i> (Kan., Tel.)	<i>Excoecaria agallocha</i>
<i>Thilliski</i> (Kh.)	<i>Baliospermum calycinum</i> var. <i>micranthum</i>

- Thilpagan* (Burm.)  
*Thimbiliya* (Sinh.)  
*Thinakolli* (Tam.)
- Thing-aiveng* (Asm.)  
*Thing-ban-lin* (Naga)  
*Thirakkoli* (Tam.)  
*Thirippu* (Mal.)  
*Thirukukalli* (Tam.)  
*Thondi* (Tam.)  
*Thor* (Guj.)  
*Thor* (Hindi)  
*Thor* (Hindi)  
*Thor* (Hindi)  
*Thorkantalo* (Guj.)  
*Thuar* (Hindi)  
*Thungplam* (Lep.)  
*Tikhar* (Hindi)  
*Tiktala* (Sans.)  
*Tillai* (Tam.)  
*Tillai* (Tam.)  
*Tillai* (Tel.)  
*Timtoa* (Beng.)  
*Tinsibi* (Mani.)  
*Tiri-calli* (Mal.)  
*Tirsibiris* (Hindi)  
*Tiru-calli* (Mal.)  
*Tiru-kalli* (Tam.)  
*Tiw-deng-pah* (Kh.)  
*Toitil* (Lush.)
- Toppi-nelli* (Tam.)  
*Torspodla* (Guj.)  
*Totkabendi* (Beng.)  
*Tridhara* (Hindi)  
*Tridhara-sehnd* (Hindi)  
*Tridharisend* (Guj.)  
*Trikantaka* (Sans.)  
*Tseip-che* (Burm.)  
*Tuipui-suhala* (Asm.)  
*Tumri* (Hindi)  
*Tumri* (Kan.)  
*Tuntung-arong* (Mik.)  
*Turukuharalu* (Kan.)  
*Tuthekmi* (Garo)  
*Uchchiyusirika* (Tel.)  
*Uding-that* (Kh.)
- Phyllanthus columnaris*  
*Antidema comptum*  
*Glochidion hohenackeri* var.  
*hohenackeri*  
*Endospermum chinense*  
*Croton persimilis*  
*Glochidion ellipticum*  
*Bischofia javanica*  
*Euphorbia tortilis*  
*Bischofia javanica*  
*Euphorbia neriifolia*  
*Euphorbia caducifolia*  
*Euphorbia nivulia*  
*Euphorbia royleana*  
*Euphorbia nivulia*  
*Euphorbia neriifolia*  
*Trevis nudiflora*  
*Breynia vitis-idaea*  
*Euphorbia cornigera*  
*Excoecaria oppositifolia*  
*Excoecaria crenulata*  
*Excoecaria agallocha*  
*Antidesma ghaesembilla*  
*Aporosa octandra*  
*Euphorbia tirucalli*  
*Phyllanthus lawii*  
*Euphorbia tirucalli*  
*Euphorbia tirucalli*  
*Sarcococca coriacea*  
*Glochidion zeylanicum* var.  
*arborescens*  
*Phyllanthus emblica*  
*Jatropha gossypifolia*  
*Jatropha curcas*  
*Euphorbia lacei*  
*Euphorbia antiquorum*  
*Euphorbia antiquorum*  
*Euphorbia tirucalli*  
*Bridelia retusa*  
*Homonoia riparia*  
*Trevis nudiflora*  
*Trevis nudiflora* var. *polycarpa*  
*Bridelia retusa*  
*Jatropha curcas*  
*Dendrophthoe falcata*  
*Phyllanthus simplex* var. *simplex*  
*Glochidion heyneanum*

<i>Udirika</i> (Tel.)	<i>Phyllanthus emblica</i>
<i>Ukveti</i> (Mar.)	<i>Aporosa cardiosperma</i>
<i>Umithini-kodi</i> (Mal.)	<i>Croton caudatus</i>
<i>Umtoa</i> (Hindi)	<i>Antidesma ghaesembilla</i>
<i>Unaravan</i> (Guj.)	<i>Euphorbia elegans</i>
<i>Undergupa</i> (Oudh)	<i>Bridelia stipularis</i>
<i>Upachita</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Uppaligi</i> (Kan.)	<i>Macaranga peltata</i>
<i>Uppila</i> (Mal.)	<i>Macaranga peltata</i>
<i>Uppoothi</i> (Mal.)	<i>Macaranga peltata</i>
<i>Uri</i> (Mal.)	<i>Phyllanthus lawii</i>
<i>Usiriki</i> (Tel.)	<i>Phyllanthus emblica</i>
<i>Uso</i> (Kon.)	<i>Falconeria insignis</i>
<i>U-soh-matiar</i> (Kh.)	<i>Phyllanthus glaucus</i>
<i>Utir</i> (Mal.)	<i>Dendrophthoe falcata</i>
<i>Utharappalatai</i> (Tam.)	<i>Euphorbia rosea</i>
<i>Vajra-kantaka</i> (Sans.)	<i>Euphorbia antiquorum</i>
<i>Vajra-tunda</i> (Sans.)	<i>Euphorbia tortilis</i>
<i>Vajra-vriksa</i> (Sans.)	<i>Euphorbia trigona</i>
<i>Valaka</i> (Sans.)	<i>Aporosa cardiosperma</i>
<i>Valam</i> (Mal.)	<i>Croton tiglium</i>
<i>Valia-kuppameni</i> (Mal.)	<i>Acalypha paniculata</i>
<i>Valia-kuppameni</i> (Tam.)	<i>Acalypha paniculata</i>
<i>Valli-choriyanam</i> (Mal.)	<i>Tragia involucrata</i>
<i>Vanda</i> (Mal.)	<i>Dendrophthoe falcata</i>
<i>Vanda</i> (Sans.)	<i>Dendrophthoe falcata</i>
<i>Vando</i> (Guj.)	<i>Dendrophthoe falcata</i>
<i>Vando</i> (Guj.)	<i>Viscum articulatum</i>
<i>Varadbula</i> (Tam.)	<i>Flueggea virosa</i>
<i>Varahangi</i> (Sans.)	<i>Baliospermum solanifolium</i>
<i>Vardhamanam</i> (Sans.)	<i>Ricinus communis</i>
<i>Vasunthagunda</i> (Tel.)	<i>Mallotus philippensis</i>
<i>Vathani</i> (Tel.)	<i>Euphorbia perbracteata</i>
<i>Vatikanni</i> (Tam.)	<i>Macaranga peltata</i>
<i>Vatta</i> (Mal.)	<i>Macaranga peltata</i>
<i>Vatta</i> (Tam.)	<i>Macaranga peltata</i>
<i>Vattakumbil</i> (Mal.)	<i>Mallotus ferrugineus</i>
<i>Vattathali</i> (Mal.)	<i>Acalypha hispida</i>
<i>Vattitutti</i> (Tam.)	<i>Macaranga peltata</i>
<i>Vattu-nelli</i> (Tam.)	<i>Phyllanthus lawii</i>
<i>Veeraimarom</i> (Tam.)	<i>Drypetes sepiaria</i>
<i>Velati</i> (Guj.)	<i>Jatropha gossypifolia</i>
<i>Vella-elumbu</i> (Tam.)	<i>Drypetes malabarica</i>
<i>Vellai-candanum</i> (Tam.)	<i>Glochidion zeylanicum</i> var. tomentosum
<i>Vellai-kattukottai</i> (Tam.)	<i>Jatropha glandulifera</i>
<i>Vellai-poothali</i> (Tam.)	<i>Givotia rottleriformis</i>

*Vella-kasavu* (Mal.)  
*Vella-kasavu* (Mal.)  
*Vellei-pillai* (Mal.)  
*Velleipula* (Tam.)  
*Velleipuli* (Mal.)  
*Vellelambu* (Tam.)  
*Vellelambu* (Tam.)  
*Vendalai* (Tam.)  
*Venm-pala* (Mal.)  
*Ven-pala* (Mal.)  
*Verri karaka* (Tel.)  
*Vetti* (Mal.)  
*Vettikan* (Tam.)  
*Vettimarom* (Tam.)  
*Vid-pune* (Tam.)  
*Vilaiti-sisham* (Hindi)  
*Vilankalli* (Hindi)  
*Vilayati-sher* (Mar.)  
*Vinchikanto* (Guj.)  
*Virai* (Tam.)  
*Vishalaya* (Sans.)  
*Vishodhini* (Sans.)  
*Vittil* (Tam.)  
*Vrischikali* (San.)  
*Wah-puriem* (Kh.)  
 Wild olive(Eng.)  
*Wodan* (Tam.)  
*Wodayu* (Tam.)  
*Wodesta* (Tel.)  
 Wood Oil Tree (Eng.)  
*Wusta* (Or.)  
*Yellari* (Mal.)  
*Yellari* (Tel.)  
*Yelli-kalli* (Kan.)  
*Yerrichilla* (Tel.)  
*Yetagyi* (Lep.)  
*Yettimara* (Kan.)  
*Zibyu* (Burm.)  
*Zizaung* (Burm.-Andam.)

*Drypetes sepiaria*  
*Drypetes wightii*  
*Drypetes gardneri*  
*Dimorphocalyx glabellus*  
*Drypetes venusta*  
*Drypetes venusta*  
*Drypetes wightii*  
*Givotia rottleriformis*  
*Euphorbia rosea*  
*Euphorbia pallens*  
*Bridelia retusa*  
*Aporosa cardiosperma*  
*Aporosa cardiosperma*  
*Aporosa acuminata*  
*Croton aromaticus*  
*Triadica sebifera*  
*Euphorbia tortilis*  
*Pedilanthus tithymaloides*  
*Acalypha indica*  
*Drypetes sepiaria*  
*Baliospermum solanifolium*  
*Baliospermum solanifolium*  
*Aporosa cardiosperma*  
*Tragia involucreta*  
*Glochidion heyneanum*  
*Putranjiva roxburghii*  
*Cleistanthus collinus*  
*Cleistanthus collinus*  
*Cleistanthus collinus*  
*Vernicia montana*  
*Croton caudatus*  
*Cleidion javanicum*  
*Breynia vitis-idaea*  
*Euphorbia nivulia*  
*Croton scabiosus*  
*Homonoia riparia*  
*Cleistanthus malabaricus*  
*Phyllanthus emblica*  
*Euphorbia epiphylloides*