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VOLUME 4

MALPIGHIACEAE-DICHAPETALACEAE

BOTANICAL SURVEY OF INDIA

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VOLUME 4

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MALPIGHIACEAE - DICHAPETALACEAE

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ABBREVIATIONS
of
INDIAN LANGUAGES

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

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Impatiens sulcata Wall. (Balsaminaceae)



Impatiens sulcata Hook f. (Balsaminaceae)



Impatiens tangachee Beddome (Balsaminaceae)



Impatiens hensloviana Arn. (Balsaminaceae)



Malphigia glabra L.-Fruits (Malphigiaceae)



Averrhoa carambola L. (Averrhoaceae)



Paramignya andamanica (King) Tanaka (Rutaceae)



Quaicum officinale L. (Zygophyllaceae)



Xylocarpus granatum J. Koenig (Meliaceae)



Zanthoxylum rhetsa (Roxb.) DC. (Rutaceae)



Zanthoxylum ovalifolium Wight (Rutaceae)



Ochna integerrima (Lour.) Merrill (Ochnaceae)



Ochna gamblei King ex Brandis (Ochnaceae)



Clausena austroindica Stone & K.N. Nair (Rutaceae)



Toddalia asiatica (L.) Lam. (Rutaceae)



Citrus reticulata Blanco (Rutaceae)



Citrus karna Raf. (Rutaceae)



Citrus limon (L.) Burm.f. (Rutaceae)



Citrus limon (L.) Burm.f. (Rutaceae)



Citrus maxima (Burm.) Merr. Var. *uvacarpa* Merr. & Lee (Rutaceae)



Citrus maxima (Burm.) Merr. var. *uvacarpa* Merr. & Lee (Rutaceae)

MALPIGHIACEAE

(R.C. Srivastava)

Woody climbers, shrublets, shrubs or trees; indumentum of appressed medifixed (T-shaped) hairs often mixed with simple hairs. Leaves usually opposite, rarely alternate or verticillate, mostly petioled, rarely sessile, simple, mostly entire, rarely sinuate-serrate or lobate; glands often present on petiole or on lower surface or margins of leaves; stipules deciduous, more rarely absent, sometimes large, connate and more or less persistent in leaf-axils. Inflorescence often terminal, sometimes axillary, racemose, corymbose or umbellate. Flowers bisexual, rarely polygamous, actinomorphic to zygomorphic; pedicels articulate, bracteolate; disk inconspicuous. Calyx usually 5-partite; segments imbricate, very rarely valvate, 1 or more furnished with a large gland, rarely eglandular. Petals 5, clawed or not, mostly equal, fimbriate or dentate. Stamens usually 10, equal or 1 or more longer than the rest; filaments often connate at base; anthers 2-locular, introrse, dehiscing lengthwise. Ovary superior, generally 3-locular, rarely 2- or 4-locular; ovules 1 in each locule; styles mostly 3, rarely 2 or 4, free, rarely connate, very rarely solitary and then other locules without styles; stigma terminal or subterminal, inconspicuous. Fruit a schizocarp; mericarps mostly winged in various ways (samara); seeds without endosperm; embryo mostly straight, rarely curved; cotyledons often unequal.

Tropical America, Old World tropics and subtropics; ca 60 genera and ca 80 species, in India 2 genera and 23 species indigenous and 6 genera and 13 species cultivated.

Literature. CANDOLLE, A.P. de (1824). Malpighiaceae. Prodr. 1: 577-592. JACOBS, M. (1955). Malpighiaceae. In: STEENIS, Fl. Males. ser. I. 5(2): 125-145. LOBREAU, D. (1967). Contribution a l'etude du pollen des Malpighiaceae d'Afrique. Pollen et Spores 9(2): 241-277. NASIR, Y. (1973). Malpighiaceae. In: NASIR, E. & S.I. ALI, Fl. W. Pakistan 45: 1-4. NIEDENZU, F. (1928). Malpighiaceae. In: ENGLER, Pflanzenr. 91, 93, 94: (IV 141): 1-246, 247-572, 573-870, fig. 1-48.

KEY TO THE GENERA

- | | |
|---|-------------------------|
| a. Climbers or stragglers; fruits winged | 2 |
| b. Erect shrubs or small trees; fruits wingless | 6 |
| 2a. Stipules free, inserted on stem between petioles, sometimes reduced or absent; indigenous | 3 |
| b. Stipules connate with petiole-base; cultivated | 4 |
| 3a. Flowers actinomorphic; styles 3; samaras surrounded by a disk-like lateral wing | 1. <i>Aspidopteryx</i> |
| b. Flowers zygomorphic; style 1 (rarely 2); samaras with one long median wing and two shorter lateral wings | 2. <i>Hiptage</i> |
| 4a. Samaras stellately winged; lateral wings well developed | 8. <i>Tristellateia</i> |
| b. Samaras winged but not stellate; lateral wings suppressed | 5 |

- 5a. Inflorescence racemose or paniculate or flowers solitary at ends of branchlets; style subulate, hooked
5. *Heteropteris*
- b. Inflorescence umbellate or corymbose; style produced into foliaceous hook
7. *Stigmaphyllon*
- 6a. Leaves herbaceous, each with 2 glands at base; calyx eglandular
4. *Galphimia*
- b. Leaves coriaceous, glandular; calyx glandular
7
- 7a. Filaments hairy and bearded at base; cotyledons terete
3. *Byrsonima*
- b. Filaments glabrous; cotyledons plano-convex
6. *Malpighia*

1. *Aspidopterys* A. Juss.

Climbing shrubs. Leaves opposite, entire, eglandular; stipules absent. Flowers in panicles or racemes, axillary or terminal; pedicels usually slender, bracteate at base, 2-bracteolate in middle or at apex. Calyx short, 5-partite, eglandular. Petals entire. Stamens 10, all perfect; filaments filiform, free or connate at base; anthers ovate, glabrous. Ovary 3-lobed; lobes flattened on back, winged along sides; styles 3, glabrous; stigmas capitellate. Samaras 3, surrounded by a wing; wing scutiform, ovate or orbicular, membranous, sometimes shortly crested in middle; seeds oblong, subterete; cotyledons straight, equal.

Tropical Asia, ca 32 species, 14 species in India of which 6 species and 1 variety are endemic to India.

Literature. HUTCHINSON, J. (1917). A revision of *Aspidopterys*. Bull. Misc. Inform. 1917: 91-103.

KEY TO THE SPECIES

- 1a. Leaves glabrous or sparsely pubescent on nerves beneath
2
- b. Leaves densely pubescent beneath
8
- 2a. Inflorescence reduced to axillary fascicles; samaras truncate at apex
2. *A. canarensis*
- b. Inflorescence well-developed, paniculate or many-branched cymes; samaras not truncate at top, or merely sinuate-truncate
3
- 3a. Samaras oblong, linear-oblong or ovate-lanceolate
4
- b. Samaras orbicular or suborbicular
7
- 4a. Calyx and pedicels glabrous above articulation
5
- b. Calyx and pedicels pubescent above articulation
6
- 5a. Leaves lanceolate; pedicels in fruits 15-18 mm long; samaras ovate-elliptic
9. *A. jainii*
- b. Leaves elliptic or ovate-elliptic; pedicels in fruits up to 8 mm long; samaras oblong or oblong-lanceolate
5. *A. floribunda*
- 6a. Samaras elongate and narrow, almost equally broad at both ends
8. *A. indica*
- b. Samaras ovate or lanceolate, narrow towards apex
6. *A. glabriuscula*
- 7a. Samaras 4.5-6.5 x 5-6 cm, coriaceous
4. *A. elliptica*
- b. Samaras ca 3 x 1.5-2.5 cm, membranous
12. *A. oxyphylla*
- 8a. Branches and leaves covered with long, flaccid spreading hairs; samaras linear-oblong
7. *A. hirsuta*
- b. Branches and leaves not as above; samaras orbicular to suborbicular
9

- | | |
|--|-----------------------------|
| 9a. Leaves abruptly terminated by broad-based acuminate tip | 3. <i>A. cordata</i> |
| b. Leaves not as above | 10 |
| 10a. Samara wings auricled at base | 1. <i>A. balakrishnanii</i> |
| b. Samara wings not auricled at base | 11 |
| 11a. Leaves coriaceous, abruptly cuspidate at apex | 13. <i>A. tomentosa</i> |
| b. Leaves herbaceous, acuminate at apex | 12 |
| 12a. Samaras cristate on dorsal wing | 11. <i>A. orbiculata</i> |
| b. Samaras ecristate | 13 |
| 13a. Leaves and inflorescences white-woolly or tomentose; samaras retuse at apex | 14. <i>A. wallichii</i> |
| b. Leaves and inflorescences rusty or flavid-villous; samaras rounded at apex | 10. <i>A. nutans</i> |

1. *Aspidopterys balakrishnanii* Srivastava in J. Econ. Tax. Bot. 4(3): 1003. 1983.

Climbers; branches slender, villous when young. Leaves broadly elliptic or ovate, rounded or shallowly cordate at base, acuminate at apex, 9-12 x 7-8.5 cm, glabrous above, sparsely villous beneath, hairs dense and rusty-brown on midnerves and lateral nerves. Panicles 12-16 cm long, rusty-villous. Buds 1.5-3 x 1-2 mm, glabrous; pedicels in buds 2.5-6 mm long, villous, in fruits ca 1.8 cm long, glabrous, articulate at ca 1 cm from base. Calyx-lobes ca 1 x 0.5 mm, glabrous. Samaras ovate, 2-3 x 2-2.5 cm, each wing extended into an ovate auricle at base; auricles ca 1- 1.2 x 0.5-0.7 cm; carpophore ca 2.5 mm long.

Fl. & Fr. Aug. - Dec.

Uttar Pradesh and W. Bengal.

Endemic.

2. *Aspidopterys canarensis* Dalz. in Hooker's J. Bot. Kew Gard. Misc. 3: 37. 1851; Hook. f., Fl. Brit. India 1: 420. 1874. *A. glomerata* Wight, Ic. t. 1986. 1853. Fig. 1.

Climbing shrubs; branches with wrinkled bark, glabrous. Leaves ovate, elliptic-lanceolate, sometimes elliptic-obovate, rounded or subacute at base, obtusely acuminate at apex, repand along margins, 5.5-10.5 x 2.5-5 cm, glabrous, sparingly clothed with fusiform hairs when young; petioles 3-8 mm long, channelled, glabrous. Inflorescence reduced to axillary 5-10-flowered fascicles borne on main stems. Flowers 4-5 mm across; buds 3.5 x 2-3 mm; pedicels filiform, 4-5 mm long, rusty puberulous, not articulate. Calyx-lobes ovate, obtuse, ca 1 x 0.75 mm. Petals oblong, obtuse, ca 4 x 2 mm, white. Filaments ca 1 mm long; anthers oblong, ca 1.5 x 0.5 mm. Ovary glabrous; styles 3; stigma capitate. Samaras suborbicular, truncate² at tip, 3.5- 4 x 3-3.5 cm, membranous.

Fl. & Fr. Feb. - May.

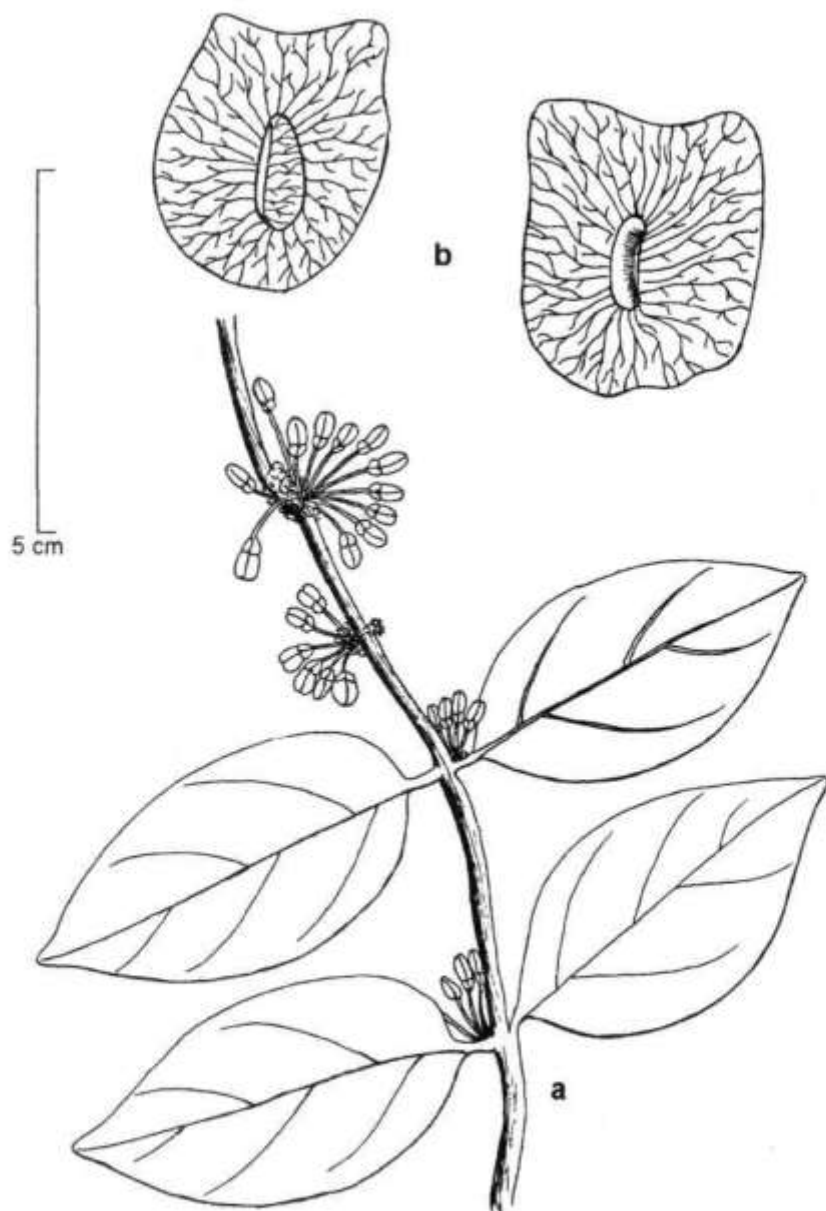


Fig. 1. *Aspidopterys canarensis* Dalz. : a. habit; b. samara.

Distrib. India: Evergreen forests in ghats at ca 800 m. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic and rare.

3. *Aspidopterys cordata* (Heyne ex Wallich) A. Juss. in Ann. Sci. Nat. Bot. ser. 2. 13: 267. 1840; Hook. f., Fl. Brit. India 1: 421. 1874. *Hiraea cordata* Heyne ex Wallich, Pl. Asiat. Rar. 1: 13. 1829.

Guj.: *Ghativel*; Mar.: *Buvel*, *Buryel*; Tel.: *Erikata*.

Slender climbers; young branches white silky-tomentose, glabrescent with age. Leaves orbicular or broadly ovate-cordate, deeply cordate or rounded at base, abruptly acuminate at apex with broad acuminate tip, 5-14 x 4-13 cm, glabrous above, white silky-tomentose beneath; petioles 3.5-4 cm long. Panicles 9-20 cm long, white or flavid-tomentose; peduncles decomposed or compound. Flowers ca 1 cm across; buds oblong, 2-3 x 1.5-2 mm; pedicels 3-6 mm long in flowers, 11-14 mm long in fruits, slender, filiform, articulate below middle at about 5-6 mm from base, white-tomentose above articulation. Calyx-lobes ovate or elliptic, 2-3 x ca 1 mm, glabrous. Petals broadly oblong or oblong-elliptic, obtuse, 4-5 x 2-2.5 mm, white or pale yellow. Filaments 2-5 mm long; anthers pale yellow, 1-1.5 x ca 0.5 mm. Ovary villous. Samaras suborbicular or slightly elliptic, tapering at base and membranous along margins, 2-3 x 1.5-2.2 cm, brown, glabrous.

KEY TO THE VARIETIES

- | | |
|---|--------------------------|
| 1a. Peduncles decomposed; samaras smaller, tapering at base, wavy along margins | 3.1. var. <i>cordata</i> |
| b. Peduncles compound; samaras larger; rounded at base, entire along margins | 3.2. var. <i>vermae</i> |

3.1. var. *cordata*

Fl. & Fr. Aug. - Dec. (up to Feb.).

Distrib. India: In mixed dry deciduous forests between 700-1000 m. Maharashtra, Andhra Pradesh, Goa and Karnataka.

Endemic.

3.2. var. *vermae* Srivastava & Balakr. in Bull. Bot. Surv. India 25: 228. 1983.

Fl. & Fr. Aug. - Nov.

Distrib. India: Gujarat (Dangs forest, Ahwa).

4. *Aspidopterys elliptica* (Blume) A. Juss. in Ann. Sci. Nat. Bot. ser. 2. 13: 266. 1840 & in Arch. Mus. Hist. Nat. Paris 3: 509. 1843; Kanj. et al., Fl. Assam 1: 190. 1936. *Hiraea elliptica* Blume, Bijdr. 255. 1825. *Aspidopterys andamanica* Hutch. in Bull. Misc. Inform. 1917: 99. 1917; Parkinson, For. Fl. Andam. Isl. 107. 1922.

Kh.: *Ka-chali*.

Climbers; branches terete; young parts sparsely and appressedly pale hairy. Leaves ovate or ovate-elliptic, rounded or slightly cordate at base, rounded and acuminate at apex, 10-15 x 6-8 cm, glabrous; petioles 1-2.5 cm long. Panicles 17-19 cm long, glabrous. Floral buds ovate-elliptic, 3-6 x 2.5-4 mm; pedicels slender, 0.6-3 cm long, elongating with growing buds, appressed-tomentose, articulate below middle at about 6-8 mm (in fruits) from base. Calyx-lobes oblong, rounded at apex, 2-3 x 1-1.5 mm, greyish-tomentose above. Petals oblong, rounded at apex, 5-7 x 2-3 mm, glabrous, white. Filaments 1.2-1.5 mm long; anthers 1.5-2 x ca 1 mm. Ovary glabrous. Samaras suborbicular or orbicular, mostly emarginate, 4.5-6.5 x 5-6 cm across, coriaceous, pale translucent to shiny brown; carpophores ca 4-5 mm long.

Fl. & Fr. Feb. - June.

Distrib. India: In evergreen or mixed evergreen forests at 200-300 m. Assam, Meghalaya and Andaman Islands.

Indonesia, Malesia, Philippines, Vietnam.

Uses. The bark is said to be chewed with betel leaves in Khasi hills.

5. *Aspidopterys floribunda* Hutch. in Bull. Misc. Inform. 1917: 95. 1917. *A. glabriuscula* A. Juss. var. *brevicuspis* Niedenzu in Arbeitn Bot. Inst. Koenigl. Lyceums Hosianum Braunsberg 6: 15. 1915.

Climbers; young branches almost glabrescent. Leaves elliptic or ovate-elliptic, rounded to subcordate at base, acute or acuminate at apex, 7-11 x 4-6.5 cm, glabrous above, appressed pubescent on nerves beneath; petioles 7-10 mm long. Panicles ca 30 x 15 cm, rusty-pubescent; pedicels fasciculate, ca 2-5 mm long, rusty-pubescent below, glabrescent above articulation. Calyx-lobes elliptic-obovate, rounded at apex, ca 1 mm long, glabrous. Petals elliptic-obovate, ca 3 mm long, glabrous. Filaments ca 1 mm long, glabrous; anthers ca 0.6 mm long. Ovary glabrous. Samaras oblong or oblong-lanceolate, 4-5 x 1.5-2.5 cm, pale brown.

Fl. & Fr. May-Nov. (-Jan.).

Distrib. India: Assam, Meghalaya and Sikkim.

China.

6. *Aspidopterys glabriuscula* (Wallich) A. Juss. in Ann. Sci. Nat. Bot. ser. 2. 13: 267. 1840 & in Arch. Mus. Hist. Nat. Paris 3: 511. 1843. *Aspidopterys roxburghiana* A. Juss. var. *glabriuscula* Hook. f., in Fl. Brit. India 1: 420. 1874. *A. oxyphylla* Niedenzu in Arbeitn Bot. Inst. Koenigl. Lyceums Hosianum Braunsberg 6: 13. 1915.

Kh: *Mei-Thit*.

Climbers; young parts pubescent but soon becoming glabrescent. Leaves elliptic or elliptic-lanceolate to ovate, obtuse at base, shortly or abruptly acuminate at apex, 5-11 x 1.6-5.6 cm, glabrous; petioles 6-14 mm long. Panicles rusty-tomentose, branches usually verticillate. Flowers ca 2 mm across; buds ovoid, ca 2-2.5 x 1.5-2 mm; pedicels subumbellately crowded or racemed on ultimate branches of panicles, 4-5 mm long in buds, ca 14 mm long in fruits, filiform, articulate below middle at about 5 mm from base. Calyx-lobes obovate, oblong to elliptic, ca 1.5 mm long, pubescent or glabrescent. Petals ovate-oblong, oblong-elliptic or ovate, rounded at apex, reflexed, 2-6 mm long, white. Filaments ca 1 mm long; anthers ovoid, ca 1 mm long. Ovary pilose. Samara wings ovate-oblong to ovate-lanceolate or elliptic-oblong, broader at base, rounded and narrow at apex, 3.5-4.6 x 1.5-2 cm, membranous, pale brown; carpophore ca 1 mm long.

KEY TO THE VARIETIES

- | | |
|--|-------------------------------|
| 1a. Samaras 35-45 x 15-20 mm; rounded and narrow at apex | 6.1. var. <i>glabriuscula</i> |
| b. Samaras 20-25 x 8-10 mm, truncate or truncate-sinuate at apex | 6.2. var. <i>lohitensis</i> |

6.1. var. *glabriuscula*

Fl. & Fr. May-Nov. (Sometimes up to January).

Distrib. India: Chiefly in scrub forests and old village sites up to 300 m. W. Bengal, Arunachal Pradesh, Sikkim, Meghalaya and Nagaland.

Bhutan, China.

6.2. var. *lohitensis* Srivastava in Nat. Acad. Sci. Letters 6(7): 223. 1983.

Fl. & Fr. Aug.-Dec.

Distrib. India: Arunachal Pradesh (Lohit Dt., forest around Kalai village).

Endemic.

7. *Aspidopterys hirsuta* (Wallich) A. Juss. in Ann. Sci. Nat. Bot. ser. 2. 13: 267. 1840 & in Arch. Mus. Hist. Nat. Paris 3: 512. 1843; Hook. f., Fl. Brit. India 1: 421. 1874. *Hiraea hirsuta* Wallich, Pl. Asiat. Rar. 1: 13, t. 13. 1830.

Climbers; stems and branches clothed with long spreading flaccid hairs. Leaves broadly obovate, oblong or orbicular- obovate, cordate at base, abruptly acuminate at apex, 7-11 x 5-6.5 cm, membranous, villous on both surfaces, dense along margins; petioles ca 7-8 mm long. Panicles lax, branches opposite, spreading. Flowers subumbellate, ca 4-5 mm across; flower-buds 3 x 2 mm; pedicels rusty-brown, 3-5 mm long in buds, ca 22 mm long in fruits, articulate below middle at 8-10 mm from base, hirsute above articulation. Calyx-lobes ovate, 1.5- 2 mm long, glabrous, white. Petals obovate, 4-5 x 2-2.5 mm, glabrous. Filaments 1.5-2 mm long; anthers ovoid, 1-1.5 mm long. Ovary glabrous. Samaras linear-oblong, rounded at apex, 3.5-6 x 1.3-2.3 cm, glabrous, brown; carpophores ca 1 mm long.

Fl. & Fr. Aug.-Dec.

Distrib. India: W. Bengal and Meghalaya.

Myanmar.

8. *Aspidopterys indica* (Roxb.) Hochr. in Bull. Inst. Bot. Buitenzorg 19: 45. 1904. *Triopteris indica* Roxb., Pl. Coromandel t. 160. 1798. *Aspidopterys roxburghiana* A. Juss. in Ann. Sci. Nat. Bot. ser. 2. 13: 267. 1840; Hook. f., Fl. Brit. India 1: 420. 1874, excl. var. et syn.

Kh.: *Mei-thit*; Tel.: *Bariki, Erikata, Reguvakuttige*.

Climbing shrubs; branches slender. Leaves ovate, elliptic- ovate, oblong or sometimes orbicular, rounded at base, acuminate at apex, entire along margins, 6-12 x 3-8 cm, glabrous, slightly pubescent below nerves on lower surface; petioles 8-15 mm long, rusty-pubescent. Panicles 10-12 cm long (up to 28 cm in fruits), rusty-tomentose. Flowers ca 2 mm across; buds subglobose or oblong, 1.5-2.5 x ca 1 mm; pedicels ca 16 mm long in fruits, articulate below middle at about 5 mm from base, sparsely tomentose to glabrescent above articulation. Calyx-lobes ovate, obtuse, 0.5-1 mm long, tomentose. Petals ovate to obovate, concave, ca 3 mm long, white. Filaments ca 1 mm long, connate at base; anthers ovoid, ca 1 mm long. Ovary pilose; styles 3, slightly longer than stamens; stigma capitate. Samara wings linear-oblong, equally broader on both sides or slightly narrower, 2.5-5.5 x 1-1.75 cm, membranous, glabrous; carpophore concave, ca 2 mm long.

Fl. & Fr. April-Jan.

Distrib. India: In open areas and forest margins. In primary and secondary forests, up to 1650 m. Madhya Pradesh, Orissa, Assam, Meghalaya, Nagaland, Andhra Pradesh and Tamil Nadu.

Endemic.

9. *Aspidopterys jainii* Srivastava in J. Jap. Bot. 59(11): 329. 1984.

Climbers; branches glabrous. Leaves lanceolate, obtuse at base, acuminate at apex 7-17 x 1-5 cm, glabrous; petioles ca 2 cm long, glabrous. Panicles compound, shorter than leaves, pubescent when young, glabrescent when mature; bracts foliaceous; bracteoles acute, ca 1-5 mm long; pedicels 1.5-1.8 cm long (in fruits), articulate above middle, glabrous. Samaras ecristate, membranous, ovate or elliptic, narrower at apex, 2-3.5 x 1.3-2.2 cm, glabrous, brown.

Fl. & Fr. Aug.-Oct.

Distrib. India: In hills at an altitude of ca 900 m. Meghalaya (Mahadeo hills).

Endemic and rare.

10. *Aspidopterys nutans* (Roxb.) A. Juss. in Ann. Sci. Nat. Bot. ser. 5. 13: 267. 1840; Hook. f., Fl. Brit. India 1: 421. 1874 p.p. *Hiraea nutans* Roxb., Fl. Ind. 2: 448. 1824.

Climbers; branches grey or brownish silky-tomentose. Leaves ovate, elliptic or orbicular, obtuse or rounded at base, not cordate, acuminate at apex with broad-based acumen, 7-19 (-25) x 2.5-9 cm, silky-pubescent beneath, rusty-tomentose with thin long hairs on nerves. Panicles 14-30 cm long, lax. Flowers ca 8 mm across; pedicels ca 3 mm long in buds, 1.5-1.9 cm long in fruits, rusty-tomentose, articulate slightly above middle at 8-10 mm from base. Calyx lobes ovate, ca 1 x 0.5 mm, glabrous or glabrescent. Petals obovate, 4-5 x 2-2.5 mm, white. Filaments ca 1.5 mm long; anthers ovoid, ca 1 mm long. Ovary villous. Samara wings elliptic to orbicular-oblong, slightly narrow above, retuse at apex, 3-4 x 2-3 cm, brown; carpophore 2-2.5 mm long.

Fl. & Fr. June - Oct.

Distrib. India: At ca 675 m. W. Bengal, Sikkim, Assam and Meghalaya.

Bangladesh, Myanmar, Cambodia, Laos and Thailand.

11. *Aspidopterys orbiculata* (Roxb. ex Wallich) Niedenzu in Arbeitn Bot. Inst. Koenigl. Lyceums Hosianum Braunsberg 6: 14. 1915 & in Engl., Pflanzenr. 4 (141): 81. 1928. *Hiraea orbiculata* Roxb. ex Wallich, Pl. Asiat. Rar. 1: 13. 1831. *H. rotundifolia* Roxb., Fl. Ind. 2: 448. 1824. *Aspidopterys rotundifolia* (Roxb.) A. Juss. in Ann. Sci. Nat.

Bot. ser. 2. 13: 267. 1840. *A. nutans* Hook.f. var. *rotundifolia* Hook. f., Fl. Brit. India 1: 421. 1874.

Climbers; branches glabrate. Leaves ovate to orbicular, rounded or cordate at base, acute at apex, 10-15 x 6-10 cm, glabrous above, white villous beneath; petioles 1-1.5 cm long, villous. Panicles 10-22 mm long, villous. Flowers ca 1 cm across; buds ca 3 mm long; pedicels ca 2 cm long (in fruits), articulate above middle at about 9 mm from base, white-villous above articulation. Calyx-lobes ovate, ca 1.5 mm long. Petals ovate or obovate, ca 3 x 2 mm. Anthers ovoid, ca 1 mm long. Ovary sericeous. Samaras ovate to orbicular, 2.5-4 x 2-3 cm, dorsal wing cristate on nucleus, sparsely villous; carpophore ca 4 mm long.

Distrib. India: Rare. Uttar Pradesh, Sikkim and Meghalaya.

Bangladesh (Chittagong) and China.

12. *Aspidopterys oxyphylla* A. Juss. in Ann. Sci. Nat. Bot. ser. 2. 2(13): 267. 1840 & in Arch. Mus. Hist. Nat. Paris 3: 510. 1843. *Hiraea oxyphylla* Wallich, Cat. 7264. 1828, nom. nud. *Aspidopterys roxburghiana* var. 3. Hook. f., Fl. Brit. India 1: 420. 1874.

Climbers; branches glabrescent. Leaves oblong, ovate, obovate or rounded, acute at base, acuminate at apex, 7-11 cm long, glabrous above, minutely tomentose on nerves beneath; petioles 0.8-1.7 cm long. Panicles decompose, 12-20 cm long, grey-tomentose. Pedicels slender, 5-9 mm long, articulate below middle at about 3 mm from base, glabrescent above articulation. Calyx-lobes ovate, ca 1 x 0.75 mm. Petals ovate, ca 2.5 mm long, white. Filaments ca 1.2 mm long; anthers ovoid, ca 1 mm long. Ovary glabrous; styles ca 2 mm long; stigma capitate. Samaras ovate or orbicular, ca 3 x 1.5-2.5 cm, obtuse at apex.

Fl. & Fr. Sept. - Dec.

Distrib. India: In hill country up to 900 m. Meghalaya.

Bangladesh.

13. *Aspidopterys tomentosa* (Blume) A. Juss. var. *hutchinsonii* (Haines) Srivastava in J. Bombay Nat. Hist. Soc. 81(3): 728. 1984. *A. hutchinsonii* Haines in Bull. Misc. Inform. 1920: 66-67. 1920. **Fig. 2.**

Climbers. Leaves elliptic-obovate, rounded at base, cuspidate at apex, 8-10 x 7-8 cm, glabrous above, tomentose beneath; petioles ca 2 cm long, tomentose. Panicles lateral, 12-28 cm long, rusty-tomentose. Floral buds oblong, ca 3 x 2 mm; pedicels ca 15 mm long, articulate below middle at about 3 mm from base, sparsely pubescent above articulation. Calyx-lobes ovate, acute, ca 1 mm long, glabrous above. Petals oblong or

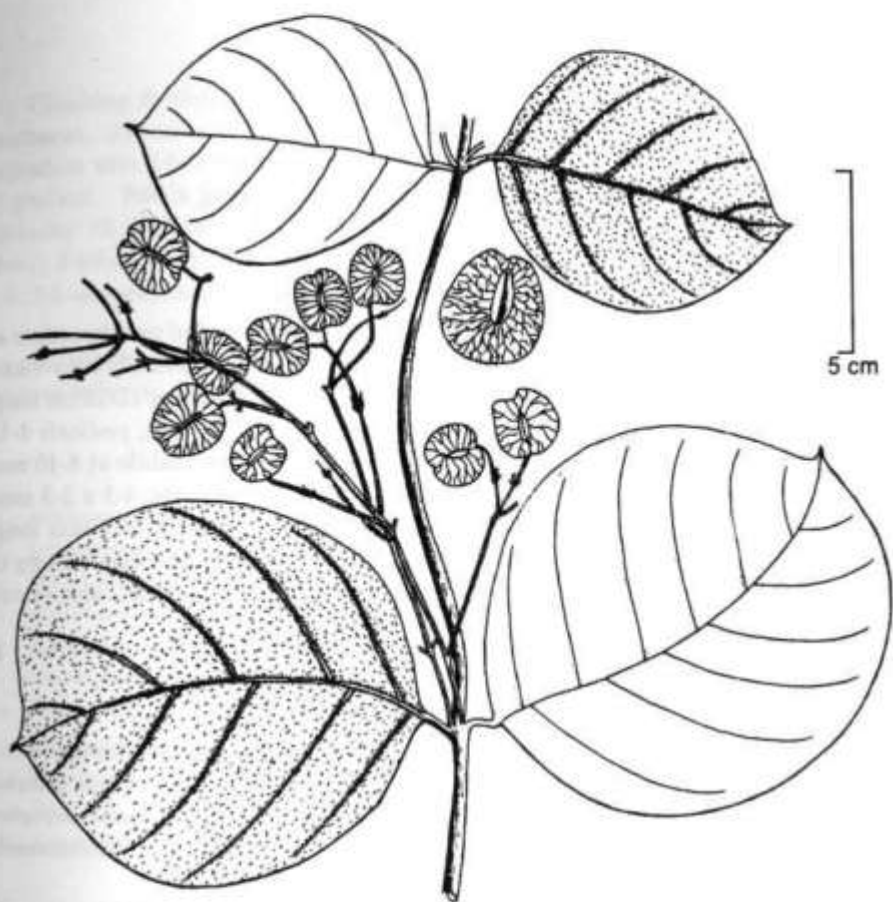


Fig. 2. *Aspidopteris tomentosa* (Blume) A. Juss. var. *hutchinsonii* (Haines) Srivastava : habit.

elliptic-oblong, 4.5-5 mm long. Filaments ca 2 mm long; anthers oblong, 1-1.5 x 0.5-0.75 mm. Ovary glabrous; styles ca 3 mm long. Samaras ovate, rounded at base, deeply notched at apex, wavy at basal margins, 2.8-3 x 2.2-2.5 cm, pale brown; cristae ca 12 x 3 mm; carpophore acuminate, ca 5 mm long.

Fl. Dec. - Feb.; *Fr.* April - June.

Distrib. India: 650-1000 m, Orissa (Mayurbhanj hills).

Endemic.

14. *Aspidopterys wallichii* Hook. f., *Fl. Brit. India* 1: 421. 1874.

Hindi: *Jugger*.

Climbers; branches slender, white-woolly. Leaves ovate, rounded or subcordate at base, acute or acuminate at apex, 10-17.5 x 3-6 cm, glabrous above, densely silky-white tomentose beneath; petioles 10-12 mm long, white-tomentose. Panicles 12-28 cm long, lax. Flowers ca 8 mm across; buds oblong or obovate, 4-5 x 1.75-3 mm; pedicels 4-12 mm long in buds, 17-22 mm long in fruits, articulate slightly below middle at 8-10 mm from base. Calyx lobes ovate, 1-1.5 x 1 mm, glabrous. Petals obovate, 4-5 x 2-3 mm, white or creamy-yellow. Filaments 1.5-2 mm long; anthers ovoid, ca 0.75 mm long. Ovary white-woolly; styles ca 3 mm long; stigma capitate. Samaras orbicular-oblong to ovate, rounded at base, retuse at apex, 2-4.5 x 1.8-3.5 cm, pale grey, ecristate; carpophore ca 3.5 mm long.

KEY TO THE VARIETIES

- 1a. Samaras orbicular-oblong to ovate, 2-4.5 x 1.8-3.5 cm, pale grey; pedicels short, stout; carpophore ca 3.5 mm long **14.2 var. wallichii**
- b. Samaras elliptic, 1.6-2.4 x 1.3-2 cm, deep brown with white shades; pedicels longer, slender; carpophore ca 3 mm long **14.1 var. dehradunensis**

14.1. var. dehradunensis Srivastava in *J. Econ. Tax. Bot.* 4(3): 1025. 1983.

Fl. & Fr. Nov. - Dec.

Distrib. India: Uttar Pradesh (Dehra Dun, near Gorkha Lines).

Endemic.

14.2. var. wallichii

Fl. & Fr. Aug. - March.

Distrib. India: Hedges and open forests. W. tropical Himalayas ascending up to 1500 m. Punjab (Hoshiarpur), Uttar Pradesh (Dehra Dun, near Mussorie and Rishikesh).

Endemic.

2. *Hiptage* Gaertner

Climbing shrubs. Leaves opposite, entire, coriaceous; stipules minute, gland-like or absent. Racemes terminal and axillary, sometimes branched; peduncles bracteate, articulate with 2-bracteate pedicels. Calyx 5-partite with one large gland partly adnate to pedicel. Petals 5, clawed, unequal, silky, white, fragrant, fifth petal discoloured. Stamens 10, declinate, all fertile, one much longer than rest; filaments connate at base. Ovary 3-lobed; styles 1-2, filiform, circinate when young; stigma capitellate. Samaras 1-3, 2-3-winged; seeds subglobose; cotyledons unequal, curved, thick.

W. China, subtropical Asia, Taiwan, Malay and Pacific islands; ca 30 species, 9 species in India.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Inflorescence white appressed-pubescent (softly tomentose or silky-white woolly) | 2 |
| b. Inflorescence rusty- or flavid-tomentose | 6 |
| 2a. Branches elongate, twiggy; leaves 5.5-8.5 x 1.5-3.7 cm; racemes 4-16-flowered | 3 |
| b. Branches stout; leaves 9-21 x 4-9 cm; racemes 10-30-flowered | 5 |
| 3a. Leaves linear-elliptic, shortly acuminate at apex; petioles 3-4 mm long | 4. <i>H. jacobsii</i> |
| b. Leaves ovate-oblong or ovate-elliptic, acuminate or acute at apex; petioles more than 5 mm long | 4 |
| 4a. Leaves long-acuminate at apex; pedicels articulate above middle; calyx-lobes greenish, tomentose; glands ovoid | 7. <i>H. parvifolia</i> |
| b. Leaves acute or obtuse at apex; pedicels articulate at middle; calyx-lobes red, glabrous; glands oblanceolate | 9. <i>H. thothathrii</i> |
| 5a. Leaves long-acuminate at apex; glands ca 4.5 x 2 mm; median wings of samaras 40-60 x 10-15 mm | 2. <i>H. benghalensis</i> |
| b. Leaves abruptly shortly and obtusely acuminate at apex; glands ca 2 x 0.75 mm; median wings of samaras ca 13 x 3 mm | 6. <i>H. obtusifolia</i> |
| 6a. Trees; leaves flavid-tomentose on both surfaces when young, glabrous above when old | 3. <i>H. candicans</i> |
| b. Dense bushy shrubs or climbers; leaves glabrous and glossy on both surfaces | 7 |
| 7a. Foliar glands deeply placed on intrastaminal nervules; racemes fascicled | 1. <i>H. acuminata</i> |
| b. Foliar glands absent; racemes not fascicled | 8 |
| 8a. Leaves ovate, abruptly acute or retuse at apex, tomentose above when young; sparsely pubescent on nerves beneath when old; calyx glands circular | 5. <i>H. nayarii</i> |
| b. Leaves oblong, elliptic-ovate, acuminate at apex, glabrous; calycinal glands oblong | 8. <i>H. sericea</i> |

1. *Hiptage acuminata* Wallich ex A. Juss. in Ann. Sci. Nat. Bot. ser. 2. 13: 269. 1840; Hook. f., Fl. Brit. India 1: 419. 1874. Fig. 3.

Kh.: *Jeremai-Soh-Pad-Purao*.

Shrubs, rarely climbers; branches scabrid; branchlets pubescent when young. Leaves linear-lanceolate, caudate-acuminate at apex, 6-14 x 2.2-4.5 cm, coriaceous, glabrous; foliar glands often present in intramarginal nervules; petioles ca 5 mm long, glabrescent. Racemes axillary, 2.5-6 cm long, rusty-tomentose; pedicels stout, ca 8 mm long in buds, 2-2.5 cm long in fruits, articulate at 1-1.2 cm below calyx; bracts ca 2.3 mm long; bracteoles ca 1 mm long. Flowers ca 1.7 cm across. Calyx-lobes ca 4 x 2 mm, tomentose above; glands ovoid, ca 3 x 2 mm. Petals suborbicular. Filaments 5-10 mm long; anthers ovoid, 1-2 mm long. Styles ca 1.25 cm long. Samaras dark brown; median wing oblanceolate-obovate, ca 3.5 x 1.7 cm; lateral wings oblique-oblong, 1.8-2 x 0.5-0.8 cm; crista sometimes present, ca 4 x 2 mm.

Fl. & Fr. Feb. - Aug.

Distrib. India: Along evergreen forest margins up to 1350 m. Assam, Manipur, Meghalaya and Nagaland.

Endemic.

2. *Hiptage benghalensis* (L.) Kurz in J. Asiat. Soc. Bengal Part 2, Nat. Hist. 43: 136. 1874. *Banisteria benghalensis* L., Sp. Pl. 427. 1753. *Hiptage madablota* Gaertner, Fruct. 2: 169, t. 116. 1791; Hook. f., Fl. Brit. India 1: 418. 1874.

Asm.: *Kareklata*; Ben.: *Madhivilata, Basanti*; Guj.: *Autala, Ragatpir*; Hindi: *Madhivilata*; Kan.: *Adimurte, Adirganti, Madhavi, Vasantaduti*; Mal.: *Sitampu*; Man.: *Madhivilata*; Ori.: *Baromali*; San.: *Madhivilata*; Tam.: *Adigan, Kurukkathi, Kavipakkukodi, Madavi, Vasandi*.

Large woody climbing shrubs; young parts silky. Leaves ovate-lanceolate or elliptic-oblong, cuneate at base, acute or acuminate at apex, 9-21 x 4-9 cm, subcoriaceous to coriaceous, glabrous; petioles ca 1 cm long, silky-pubescent. Racemes 10-20 cm long, erect, tomentose; pedicels 1.5-2 cm long, thickened towards apex. Flowers 1.5-2 cm across. Calyx-lobes ovate, elliptic or oblong, 8-10 x 2-4 mm, fulvous-sericeous outside; glands oblong, elliptic or lanceolate, 4-5 mm long, half decurrent on pedicels. Petals suborbicular to obovate, clawed, fringed on margins, ca 1 cm long, hairy outside, white, fragrant. Filaments ca 6 mm long in shorter ones, ca 10 mm long in longer ones; anthers ovoid, ca 2 mm long. Ovary pubescent; style terete, acute, 14-15 mm long, slightly curved. Samaras variable; middle wing oblanceolate or linear-oblong, acute, obtuse or rounded at apex, 4-6 x 1-1.5 cm; lateral wings lanceolate, oblong, 2-3 x 0.8-1.5 cm; dorsal crista ca 11 mm long.



Fig. 3. *Hiptage acuminata* Wallich ex A. Juss. : a. twig; b. bud; c. samara.

KEY TO THE VARIETIES

- 1a. Leaves ovate-lanceolate or oblong-lanceolate 2
 b. Leaves linear-lanceolate, 3-6 times longer than broad 2.2. var. *longifolia*
 2a. Median wing oblanceolate, acute and narrow at apex 2.1. var. *benghalensis*
 b. Median wing obovate, broader at apex 2.3. var. *rothinii*

2.1. var. *benghalensis***Fig. 4.***Fl. & Fr.* Jan.- April.

Distrib. India: Throughout hotter parts of India in ravines, swampy localities and hill forests up to 1800 m.

Myanmar, S. China, Taiwan, Indonesia, Malesia, Philippines and Sri Lanka.

Uses. This plant is used in chronic rheumatism and asthma. Leaves are used in cutaneous diseases. Leaf-juice possesses insecticidal properties and is used as an application for scabies. Wood is used for tool-handles and as fuel. This plant is also cultivated in gardens for its attractive flowers.

2.2. var. *longifolia* (Niedenzu) Srivastava in J. Econ. Tax. Bot. 4(3): 1025-1026. 1983.
H. benghalensis f. *longifolia* Niedenzu in Arbeit Bot. Inst. Koenigl. Lyceums Hosianum Braunsberg 6: 40. 1915. **Fig. 5.**

Fl. & Fr. March - May.*Distrib.* India: Uttar Pradesh, W. Bengal and Assam.

Indonesia.

2.3. var. *rothinii* Srivastava in Natl. Acad. Sci. Letters 6(7): 223. 1983. **Fig. 6.**

Fl. & Fr. Feb. - April.*Distrib.* India: Manipur (Imphal, Lemokong).

Endemic.

3. *Hiptage candicans* Hook. f., Fl. Brit. India 1: 419. 1874. **Fig. 7.**

Small trees; young branches densely flavid-tomentose. Leaves ovate-lanceolate, ovate-oblong or elliptic-lanceolate, acute or obtuse at base, acute or shortly acuminate at apex, 6-9.5 x 1.5-5 cm, coriaceous, densely flavid-tomentose on both surfaces when

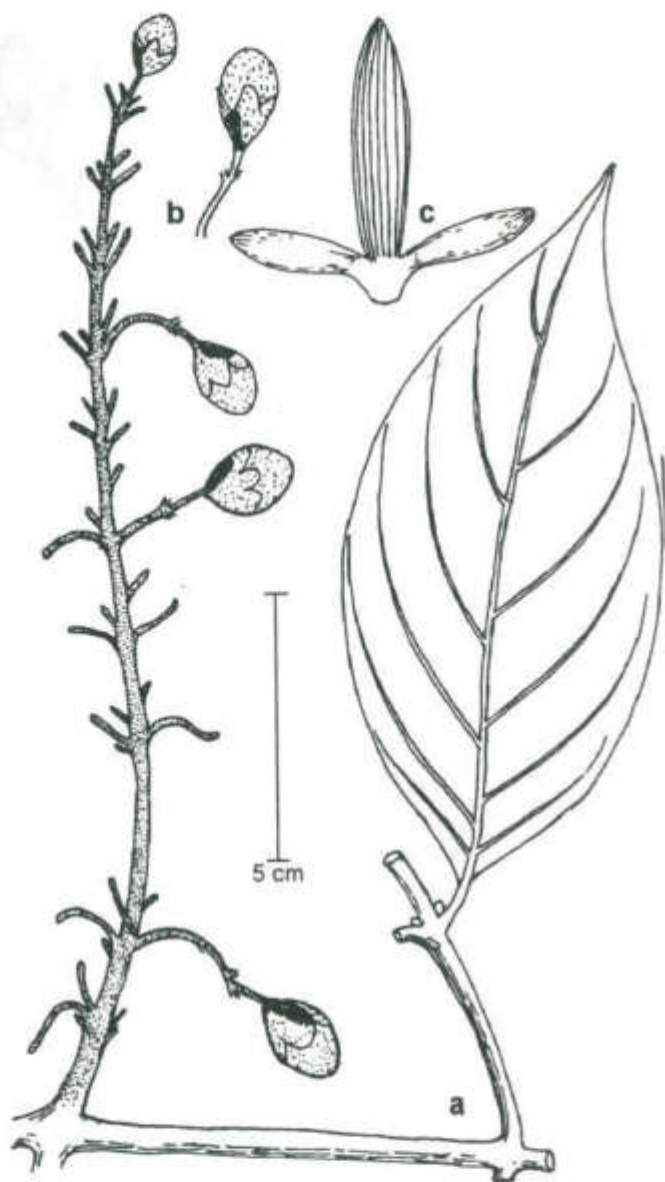


Fig. 4. *Hiptage benghalensis* (L.) Kurz var. *benghalensis* : a. twig; b. bud showing calycinal gland; c. samara.

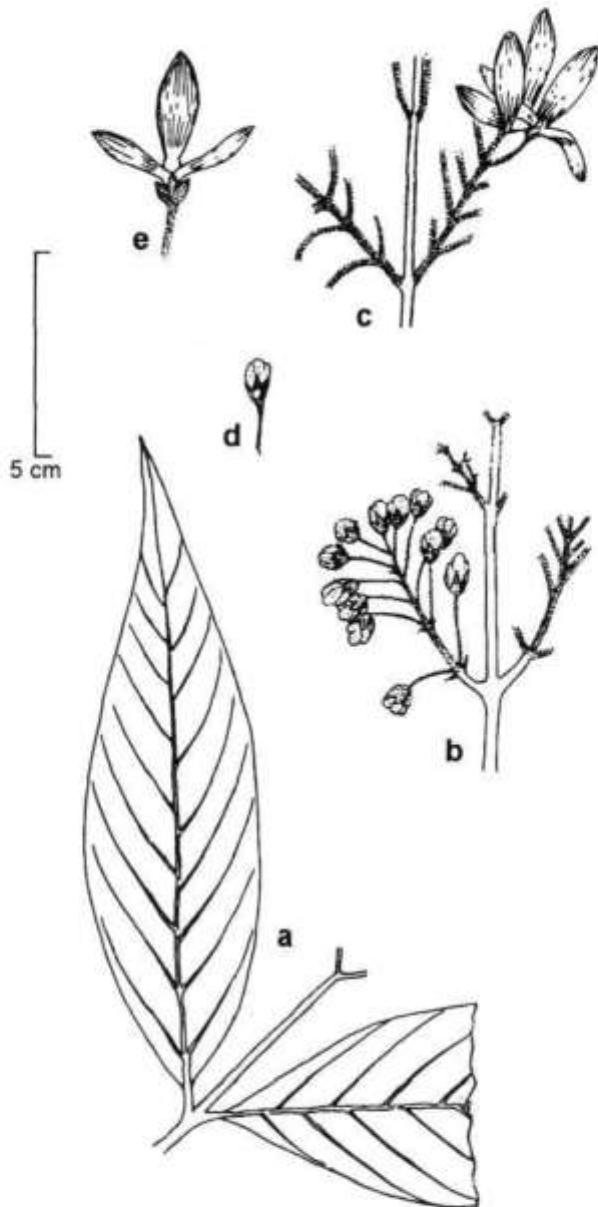


Fig. 5. *Hiptage benghalensis* (L.) Kurz var. *longifolia* (Niedenzu) Srivastava : a. leaves; b. twig with buds; c. twig with samaras; d. bud; e. samara.



Fig. 6. *Hiptage benghalensis* (L.) Kurz var. *rothinii* Srivastava : twig with samara.

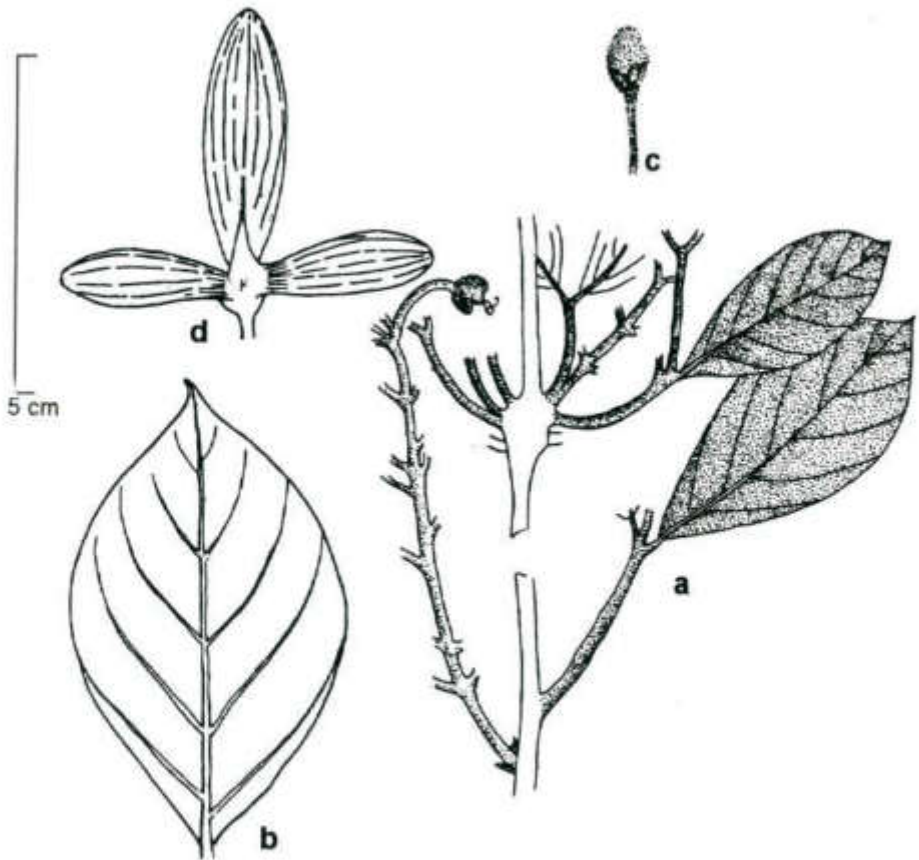


Fig. 7. *Hiptage candicans* Hook. f. : a. twig with young leaves; b. adult leaf; c. bud; d. samara.

young, glabrous above when mature; petioles ca 5 mm long, tomentose. Racemes 9-14 cm long; pedicels 14-17 mm long; bracts lanceolate-ovate, 3-4 mm long; bracteoles lanceolate, 2-2.5 mm long. Flowers 2-3 mm across; buds subglobose to ovoid, 0.75-1 x 0.6-0.8 cm. Calyx-lobes ovate, 5-6 x ca 2 mm; glands ovoid, ca 3 x 0.25 mm, decurrent on pedicels. Petals fimbriate, ca 1 cm across, white. Filaments ca 11 mm long; anthers ovoid, 1-2 mm long. Styles ca 1.5 cm long. Samaras pilose; median wings lanceolate or oblanceolate-oblong, 2.5-4 x 6-14 mm; lateral wings ovate, 6-14 x 5-11 mm.

Fl. & Fr. March - May.

Distrib. India: River banks and sandy woods. Nagaland.

Myanmar and Vietnam.

4. *Hiptage jacobsii* Srivastava in Indian Forester 110(5): 499. 1984.

Fig. 8.

Climbing shrubs; branches glabrous. Leaves linear-elliptic, acute at base, shortly acuminate at apex, 5.5-8.5 x 1.5-2.5 cm, subcoriaceous, glabrous; petioles 3-4 mm long, glabrous. Panicles axillary or terminal; peduncles 3.5-9 cm long, appressedly white-tomentose; bracts ca 1.75 mm long; bracteoles ca 1 x 0.75 mm. Flower buds globose or subglobose, 4-8 x 4-5 mm. Calyx-lobes 1.5- 2 x 1-1.5 mm; glands ca 2 x 1 mm. Petals 10-11 mm long, denticulate. Filaments ca 5 mm long; anthers ovoid, 1 x 0.5 mm. Styles 12-13 mm long. Samaras ecristate, pale brown; middle wing elliptic or oblanceolate, sometimes slightly broader in middle, tapering at both ends, subacute or rounded at apex, 38-43 x 10-11 mm, glabrous; lateral wings obovate, 18-20 x 7-8 mm.

Fl. & Fr. March - May.

Distrib. India: Evergreen forests at ca 1000 m. Mizoram (Lushai Hills, Acar forest, Lunglai).

Endemic.

5. *Hiptage nayarii* Srivastava in Indian Forester 110(5): 499. 1984.

Fig. 9.

Shrubs; branches woody, rusty-tomentose when young, glabrescent when mature. Leaves ovate, obtuse or acute at base, abruptly acute at apex, sometimes retuse, 7-8.5 x 3-5 cm, softly tomentose when young, old ones glabrous, shining above, yellowish-brown or dull grey-brown beneath, sparsely pubescent on nerves beneath when mature; petioles ca 5 x 1.5 mm, appressed-tomentose; bracts foliaceous, ovate, 5-6 x ca 2 mm; bracteoles minute. Flower-buds oblong, ca 10 x 5 mm; pedicels 25-37 mm long, thickened below calyx, brown-tomentose. Calyx-lobes ovate, 4-5 x 1.5-2 mm, white-tomentose; glands circular, ca 2-2.5 mm across. Petals obovate or suborbicular, ca 10 x 4 mm, denticulate,



Fig. 8. *Hiptage jacobsii* Srivastava : a. twig; b. samara; c. bud.

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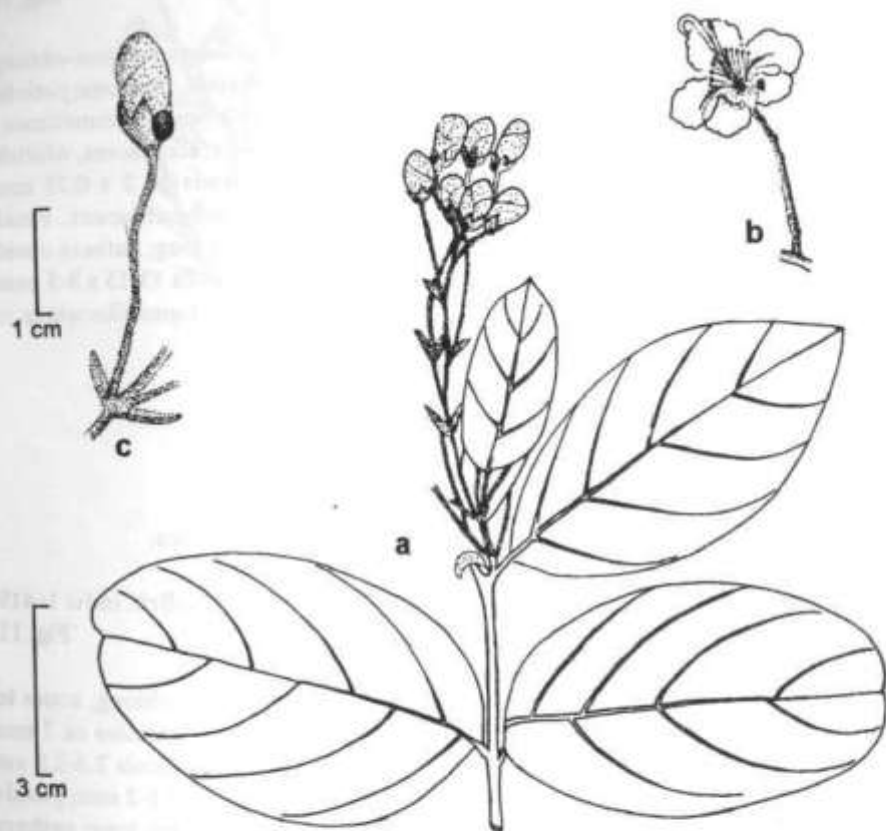


Fig. 9. *Hiptage nayarii* Srivastava : a. twig; b. flower; c. bud showing calycinal gland

dorsally tomentose, white. Anthers ovoid, broader at base, ca 10-11 mm long, glabrous. Ovary sericeous; styles sericeous at base, 10-12 mm long; stigma linear.

Fl. & Fr. June - Aug.

Distrib. India: Semievergreen forests at about 1200 m. Tamil Nadu (Tirunelveli Dt., Kil-Manimuthar Bridge falls).

Endemic.

6. *Hiptage obtusifolia* DC., Prodr. 1: 583. 1824; Niedenzu in Engl., Pflanzenr. 4(141): 79. 1928. Fig. 10.

Climbers; young branches silky-white pubescent. Leaves oblong to elliptic-oblong, acute or obtuse at base, apiculate at apex, 9-10 x 3.5-7 cm, coriaceous, glabrous; petioles 5-20 mm long, glabrous. Racemes axillary, 7-14 cm long, whitish-woolly, sometimes a spurious terminal panicle; pedicels slender, 5-14 mm long in buds, accrescent, whitish-woolly slightly above middle. Flower buds 3-4 x 2-3 mm; glands ca 2 x 0.75 mm. Calyx-lobes concave, rounded, obtuse, ca 3 x 2 mm, densely greyish-pubescent. Petals rounded, ca 1.4 cm long, fringed, villous, white. Filaments 4-8 mm long; anthers ovoid, ca 1 mm long. Styles ca 8 mm long. Samaras brown; median wings ca 13-15 x 3-5 mm; lateral wings ca 10 x 2.5 mm, glabrous; dorsal crista sometimes developed like wings, ca 10 x 2.5 mm.

Fl. & Fr. March - June.

Distrib. India: ca 300 m. Assam and Andamans.

Myanmar, Thailand, China, Taiwan, Java, Celebes and Philippines.

7. *Hiptage parvifolia* Wight & Arn., Prodr. 107. 1834; Hook. f., Fl. Brit. India 1: 419. 1874. Fig. 11.

Climbing shrubs; branches and shoots elongate. Leaves ovate-oblong, acute to acuminate at base, acuminate at apex, 6-8.5 x 2.7-3.7 cm, glabrous; petioles ca 7 mm long, glabrescent. Racemes 4-5 cm long, appressed-pubescent; pedicels 2.5-2.8 cm long, articulate at about 1 cm below calyx. Calyx lobes ovate, 3-3.5 x 1.5-2 mm; glands ovoid, ca 3 mm long. Petals 7-9 x 1-1.2 mm, white. Filaments 5-11 mm long; anthers ovoid, 1-1.5 mm long. Styles 1-1.5 cm long. Samaras light brown; median wing obovate, rounded at apex, 2-3.5 x 0.8-1.4 cm; lateral wings elliptic, 1.5-2 x 0.75 cm.

Fl. & Fr. Feb. - May.

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



Fig. 10. *Hiptage obtusifolia* DC. : a. twig; b. bud; c. samara.



Fig. 11. *Hiptage parvifolia* Wight & Arn.: twig with samara.

Sri Lanka and Timor.

8. *Hiptage sericea* Hook. f., Fl. Brit. India 1: 419. 1874.

Fig. 12.

Climbers; branches densely covered with short brown tomentum. Leaves oblong, elliptic or ovate, acute to rounded at base, acuminate at apex, 7.5-12.5 x 2.2-3.5 cm, glabrous; foliar glands absent; petioles 5-6 mm long, densely fulvous-pubescent. Racemes 3-6 cm long, rusty-brown, softly-tomentose; pedicels ca 2.8 cm long, articulate at ca 1.3 cm below calyx, brown-tomentose. Flower-buds sub-globose to ovoid, 5-6 mm long. Calyx-lobes elliptic-ovate, rounded at apex, ca 3 x 2 mm, densely tomentose outside, glabrous inside; glands oblong, 2-3 mm long. Petals white; outer ones elliptic, inner ones orbicular, denticulate, 6-8 x 4-5 mm, tomentose outside, glabrous inside, white. Filaments 5-12 mm long; anthers ovoid, ca 1 mm long. Styles acute, ca 12 mm long. Samaras reddish-brown; median wings oblong, 3-4.5 x 0.75-1 cm; lateral wings ovate, 1.5-2.8 x 0.5-0.8 cm.

Distrib. India: Evergreen forests, 800-1200 m. Assam, Sikkim, Nagaland, Karnataka, Tamil Nadu and Kerala.

Myanmar, China and Malesia.

9. *Hiptage thothathrii* Balakr. & Srivastava in J. Econ. Tax. Bot. 4(3): 985. 1983.

Fig. 13.

Climbers. Leaves ovate-elliptic, obtuse at base, acute at apex, 4.5-5.5 x 2.5-3.5 cm, glabrous; petioles 5-6 mm long, glabrous. Inflorescence appressed-pubescent; pedicels 14-20 mm long, articulate at middle; bracts ca 2 mm long, pubescent; bracteoles abortive or very minute. Flower-buds globose. Calyx lobes ovate, rounded at apex, ca 4 x 2 mm, glabrous; glands ca 4 x 1 mm. Petals suborbicular, with fimbriate margins, ca 5 mm across, white-tomentose. Filaments in shorter stamens ca 6 mm long; in longer ones 10-11 mm long; anthers ovoid, 1 - 1.5 mm long. Ovary sericeous; styles ca 10 mm long. Fruits not seen.

Fl. March.

Distrib. India: Andaman Islands (N. Andamans, Saddle Peak).

Endemic, rare.

CULTIVATED GENERA & SPECIES

The following genera and species are found only as cultivated ornamentals in gardens.

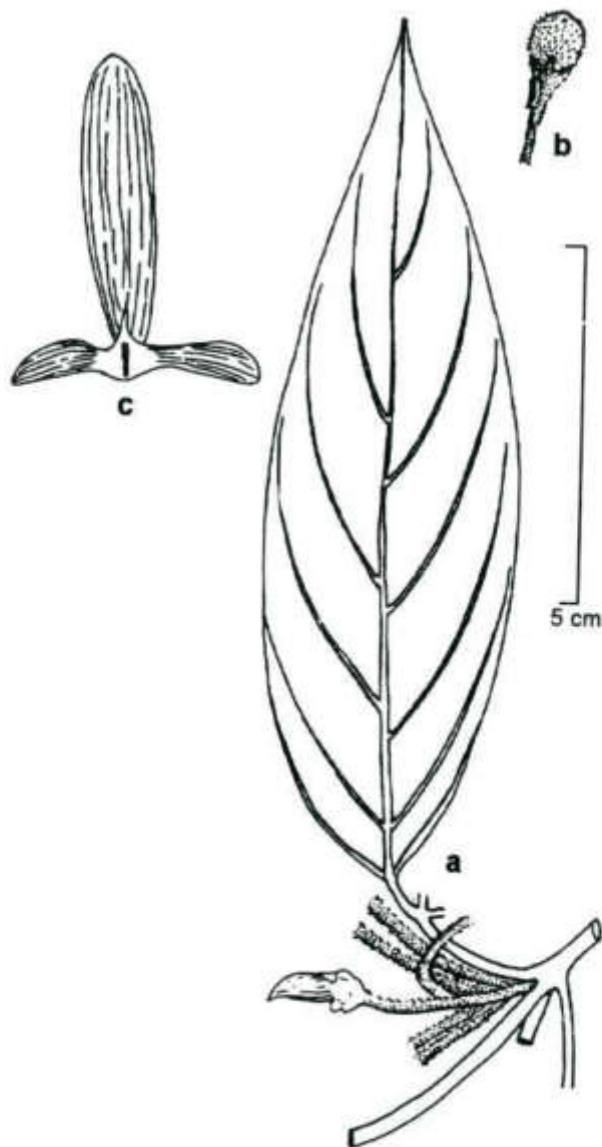


Fig. 12. *Hiptage sericea* Hook. f. : a. twig; b. bud showing calycinal gland; b. samara.

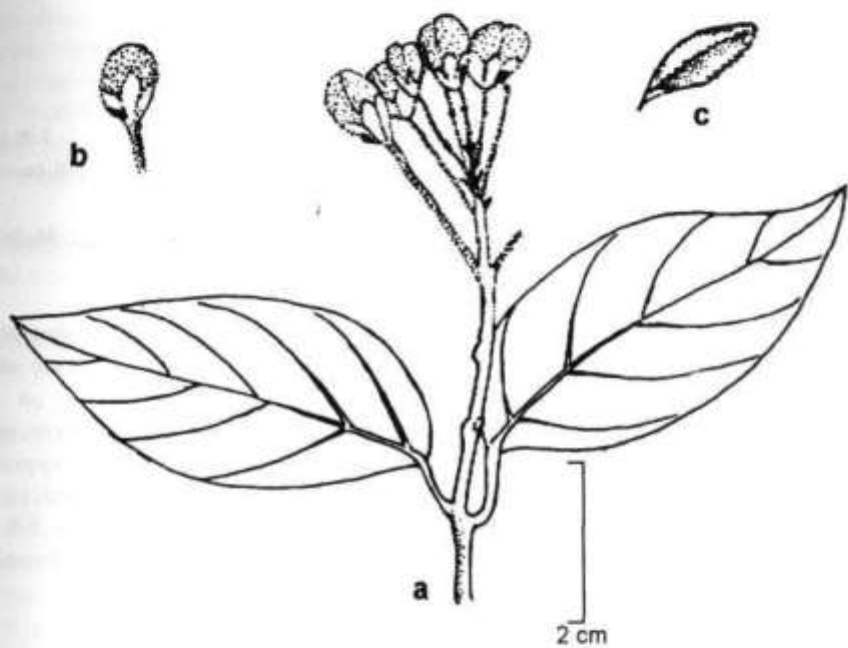


Fig. 13. *Hiptage thothathrii* Balakr. & Srivastava : a. twig; b. bud; c. petal.

3. *Byrsonima* L.C. Rich. ex H.B.K.

Trees or shrubs, often climbing. Leaves opposite, entire, eglandular; stipules often connate into one, axillary, rarely 2-lobed or free. Flowers bisexual, in terminal racemes. Calyx 5-partite, mostly glandular. Petals clawed, glabrous; claw reflexed; limb concave. Stamens 10, all perfect; filaments short, connate at base or almost free; anthers oblong or subulate. Stigmas acute. Drupes 3-locular; endocarp bony or woody, angular outside; seeds subglobose; embryo circinate; cotyledons linear, terete.

Tropical America, ca 100 species, 2 species grown in India.

KEY TO THE SPECIES

- | | |
|--|---------------------------------|
| 1a. Leaves spatulate-obovate, less than 7 x 2.5 cm; flowers pinkish | 2. <i>B. lucida</i> |
| b. Leaves elliptic, ovate or lanceolate, 8-18 x 4-5 cm; flowers yellow | 1. <i>B. crassifolia</i> |

1. *Byrsonima crassifolia* (L.) H.B.K., Nov. Gen. Sp. Pl. 5: 114. 1822. *Malpighia crassifolia* L., Sp. Pl. 425. 1753.

Trees. Leaves ovate, acute or somewhat obtusely acute at base, obtusely acute or shortly acuminate at apex, revolute along margins, 9-11 x 4-6 cm, glabrate above, sub-velutinous or partly glabrate beneath, velutinous on nerves, densely so on mid-nerve; petioles 1-2.5 cm long; stipules ovate, 3-5 mm long. Racemes elongate, many-flowered, 4-14 cm long; velutinous, pedicels 8-13 mm long, densely appressed brown-hairy; bracts ovate, 2-5 mm long. Flowers 1.5-2 cm across; buds ovoid, ca 5 x 3 mm across. Calyx-lobes ovate, 2-3 x 1.5-2.5 mm, glandular. Petals 4-5 x 5-9 mm, suborbicular. Filaments 2.5-3 cm long, pilose; anthers linear or oblong, 2.5-3.5 mm long. Ovary often glabrous. Drupes globose, 5-7 mm.

Fl. & Fr. May.

Cultivated in Uttar Pradesh and W. Bengal.

Tropical America.

2. *Byrsonima lucida* (Miller) L.C. Rich. in A.L. Juss., Ann. Mus. Hist. Nat. 18: 481. 1811. *Malpighia lucida* Miller, Gard. Dict. 8 ed. Fol. 82. n. 9. 1768.

Shrubs. Leaves obovate to oblanceolate, cuneate at base, rounded or obtuse at apex, 1-5 x 0.7-2.5 cm, chartaceous or sub-coriaceous, lucid above, glabrous on both surfaces; petioles 1-5 mm long; stipules broadly ovate, ca 1 mm long. Racemes about 12-flowered; pedicels slender, 9-13 cm long; bracts lanceolate, 2-4 mm long; bracteoles ovate, 1-2 mm long. Flowers 1-1.2 cm across; buds subglobose, ca 4 mm long. Calyx-lobes lanceolate, 2-2.5 mm long. Petals suborbicular, 3-4 x 3-5 mm. Filaments ca 2 mm

long, pilose; anthers ovoid or oblong-ovoid, 1.5-2.5 mm long. Drupes globose, ca 9 mm across.

Fl. & Fr. May - Oct.

Throughout West Indies from Bahamas to Barbados and Trinidad.

4. *Galphimia* Cav.

Shrubs. Leaves entire with two small glands at base of limb; stipules inserted at base of petiole. Inflorescence terminal, racemose, bracteate; pedicels 2-bracteolate below articulation. Flowers bisexual, actinomorphic. Calyx-lobes 5, eglandular, shorter than petals. Petals clawed, entire. Stamens 10, episepalous ones longest. Ovary globular, 3-lobed, 3-locular, sometimes 2 locules abortive; styles 3, free, coiled in bud, divergent, acute. Fruits dry, smooth, mericarps not winged, dehiscent.

California and Texas to Argentina, centering around Mexico; ca 10 species, one species is commonly cultivated in gardens in India.

Galphimia gracilis Bartling in *Linnaea* 13: 552. 1839. *G. glauca* Merr., *Fl. Manila* 277. 1912.

Shrubs; young parts appressedly reddish-hairy, glabrescent when mature. Leaves elliptic-oblong, acute at base, obtuse to rounded at apex with acute tip, 3-5 x 1-2 cm; petioles 6-9 mm long, glabrescent. Inflorescence overtopped by two lateral branches; pedicels 5-12 mm long, rusty-tomentose; bracts linear, acute, 3-4 mm long; bracteoles linear, acute, 2-3 mm long. Flowers 1-2 cm across. Calyx-lobes ovate, rounded or subacute at apex, sometimes recurved, ca 2 x 1 mm. Petals unequal, triangular, entire, clawed at base, ca 3-7 x 2-3 mm, yellow. Filaments ca 2.5 mm long; anthers oblong-lanceolate, ca 2 mm long. Ovary 2-3 mm across; styles terete, 5-6 mm long, caducous. Fruits globular, ca 5 mm across, brown.

Fl. & Fr. Throughout the year.

Native of tropical America. Commonly cultivated.

5. *Heteropteris* H.B.K.

Shrubs, rarely climbing. Leaves opposite, mostly entire, usually glandular below; stipules inconspicuous. Flowers bisexual, mostly paniculate or racemose; pedicels articulate at base or in middle, 2-bracteolate. Calyx 5-partite, often glandular. Petals clawed. Stamens 10, all perfect, unequal; filaments united at base; anthers unappendaged. Ovary 3-locular with lobes gibbous on back; styles 3, subulate, hooked at apex;

stigmas crest-like. Samaras 1-3, winged on back; wings thickened on lower margins; seeds oblong; cotyledons often unequal.

S. America and also in W. tropical Africa, ca 80 species; 2 species commonly grown in gardens in India. viz. *H. argentea* H.B.K was also recorded to be grown in the country but not seen commonly.

KEY TO THE SPECIES

- 1a. Erect, almost unbranched shrubs; leaves linear-oblong or linear-lanceolate, glabrous 1. *H. angustifolia*
 b. Climbing, profusely branched shrubs; leaves elliptic, ovate, obovate or orbicular, silky-tomentose beneath 2. *H. laevifolia*

1. *Heteropteris angustifolia* Griseb. in Linnaea 13: 233. 1839.

Erect shrubs. Leaves linear-oblong or linear-lanceolate, revolute along margins, 6-12 x 0.5-2 cm, glabrous; petioles ca 0.75 cm long, glabrous. Racemes terminal; pedicels 1-1.4 cm long, articulate at 5-9 mm from base; bracts linear-lanceolate, ca 4 mm long; bracteoles ovate, acute, ca 1 mm long. Flower-buds globose. Calyx-lobes ovate, acute at apex, ca 2 x 1 mm. Petals ca 6 x 3 mm, yellow. Filaments 1-1.5 mm long; anthers ovoid, ca 1 mm long. Ovary villous; styles ca 2 mm long; stigmas truncate. Samaras pale brown, 1.7-2 x 0.8-1 cm, glabrous.

Fl. & Fr. July - Sept.

Distrib. India: Cultivated at FRI Bot. Garden, Dehra Dun (U.P.).

2. *Heteropteris laevifolia* (A. Juss.) Srivastava Nat. Acad. Sci. Letters 7: 325. 1984.
Banisteria laevifolia A. Juss. in St.-Hil., Fl. Bras. Merid. 3: 82. 1832.

Climbing shrubs. Leaves elliptic-obovate or ovate-lanceolate, sometimes orbicular, cordate at base, acute or rarely retuse at apex, 4-10 x 2.5-5 cm, silky-tomentose beneath; petioles ca 5 mm long, white-tomentose. Inflorescence trichotomous umbellate panicles; pedicels 5-8 mm long; silky tomentose. Flowers ca 1 cm across; bracts and bracteoles yellowish, acute, ca 2 mm long, tomentose. Calyx-lobes ovate, acute, 3-4 mm long, silky-tomentose, 2-glandular at base. Petals orbicular to elliptic, concave, fimbriate or lacerate, ca 7 mm long, yellow. Filaments ca 2 mm long; anthers ca 1 mm long. Ovary tomentose; styles 2-3 mm long; stigmas truncate. Samara wings 2-2.5 x 1-1.5 cm, silky-pubescent, reddish-brown.

Fl. & Fr. Aug.-Oct.

Distrib. India: Cultivated in gardens; propagated by layering or seeds.

Indigenous to Brazil.

6. *Malpighia* L.

Small trees or shrubs. Leaves opposite, entire or spiny-dentate, hairs sometimes appressed and stinging, shortly petioled; stipules minute, caducous. Flowers bisexual, axillary or terminal, fasciculate or subumbellate-corymbose, rarely solitary. Calyx 5-partite, 6-10-glandular, 1-2 glands at base of each calyx-lobe. Petals unequal, clawed, denticulate, sometimes keeled, glabrous. Stamens 10, all perfect; filaments united at base, glabrous, sometimes unequal. Ovary 3-locular; styles 3, free, truncate at apex. Drupes fleshy, composed of 3 pyrenes, these at length scarcely coherent, with 3-5 crests or ribs on back; seeds ovoid; embryo straight; cotyledons plano-convex.

Tropical America and West Indies; ca 30 species, 5 species grown as ornamentals in India.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Leaf-margins projected into mucronate marginal teeth | 2. <i>M. coccigera</i> |
| b. Leaf-margins entire | 2 |
| 2a. Mature leaves usually 7.5-17 x 4.5-8.5 cm, obtuse or rounded at apex | 5. <i>M. urens</i> |
| b. Mature leaves usually less than 7 x 4 cm, acute or acuminate at apex (except <i>M. puniceifolia</i> var. obovata) | 3 |
| 3a. Corymbs usually 1-4-flowered; drupes more than 10 cm across | 4. <i>M. puniceifolia</i> |
| b. Corymbs usually more than 4-flowered; drupes less than 10 cm across | 4 |
| 4a. Leaves linear-oblong, less than 25 mm broad | 1. <i>M. angustifolia</i> |
| b. Leaves ovate-elliptic or oblong-lanceolate, more than 25 mm broad | 3. <i>M. glabra</i> |

1. *Malpighia angustifolia* L., Sp. Pl. ed. 2. 610. 1762.

Shrubs. Leaves linear-oblong, acute at base, acute or acuminate at apex, revolute along margins, 4.5-7 x 1.5-2.4 cm, glabrous; petioles 2-3 mm long, glabrous. Corymbs 4-8-flowered; peduncles 5-10 mm long; pedicels 5-10 mm long; bracts and bracteoles lanceolate, ca 0.5 mm long. Calyx-lobes lanceolate; glands ovate or obovate, 1.5-2.5 mm long. Petals pink; petal-limbs orbicular, ciliate-dentate along margins, 3-5 x 2-4 mm. Styles 0.5-1 mm long. Drupes pyramidal to subglobose, 8-9 mm across.

Fl. & Fr. Sept. - Nov.

Cultivated in gardens.

Native of West Indies.

2. *Malpighia coccigera* L., Sp. Pl. 426. 1753.

Tam.: *Simainelli*.

Shrubs; branches rough. Leaves suborbicular to elliptic, rounded to truncate at base, rounded to slightly notched at apex, 1-1.5 x 0.75-1.2 cm, glabrous, margin projected into mucronate marginal teeth, revolute between teeth; petioles 1-2 cm long, glabrous. Flower-buds globose to subglobose, 2-4 mm across; flowers on dwarf shoots, axillary, single or paired; pedicels 1.3-1.7 cm long, articulated below middle at 5-8 mm from base, glabrous; bracteoles ca 0.3 mm long. Calyx-lobes 2-2.5 mm long, blunt; glands 6-10, flat, elliptic, ca 1.5 mm across. Petals 7-11 x 3-7 mm, whitish to pale pink or light red. Filaments slightly unequal, ca 2-3 mm long; anthers ovoid, ca 1.5 mm long. Styles 3, two ascending in a row, ca 5 mm long, one abortive, ca 2 mm long. Fruits red, 8-10 mm across, only 1-2 mericarps develop.

Fl. & Fr. Oct. - Dec.

Native of C. America.

Uses. Cultivated for their edible fruits and as ornamental hedge plant.

3. *Malpighia glabra* L., Sp. Pl. 425. 1753.

Eng.: Barbados cherry.

Shrubs; branches glabrous. Leaves ovate-elliptic or almost oblong-lanceolate, acute at base, acuminate at apex, revolute along margins, 3-6 x 3-4 cm, chartaceous or subcoriaceous, glabrous; petioles 1-4 mm long, glabrous. Corymbs 4-12-flowered; pedicels 6-15 mm long, articulate below middle at about 2.6-5 mm from base; bracts ovate-lanceolate, 1.5-2.5 mm long; bracteoles lanceolate, scarcely 1 mm long. Flowers 12-16 mm across; flower-buds subglobose, 3-4 mm across. Calyx-lobes oblong to subelliptic; glands oblong, ca 2-3 mm long. Petals obovate, ovate or suborbicular, whitish-pink. Filaments 1-1.5 mm long; anthers ovoid, 0.75 mm long. Styles ca 4 mm long. Drupes ca 9 mm across.

Fl. & Fr. June - Nov.

Commonly cultivated in gardens.

Native of West Indies.

Uses. Fruits are eaten and also used in preserves and jellies. The fruits are considered useful in dysentery, diarrhoea and liver disorders. The bark is used for tanning hides.

4. *Malpighia puniceifolia* L., Sp. Pl. ed. 2. 609. 1762.

Kan.: *Simayaranelli*; Tel.: *Vallari*.

Shrubs or small trees. Leaves elliptic, obtuse or acute at apex, 4.5-6 x 1.5-2.5 cm, glabrous; petioles 2-4 mm long. Inflorescence corymbs or subumbels, 4-flowered; peduncles 3-7 mm long; pedicels 6-15 mm long, articulate below middle; bracts lanceolate, 1-1.5 mm long; bracteoles 0.5-1 mm long. Calyx-lobes ovate or oblong; glands oblong-ovate, ca 1.5-2 mm long. Petals pinkish; limb suborbicular or orbicular, 3-6 mm long. Filaments ca 2 mm long; anthers oblong, round, ca 1 mm long. Styles obtuse or swollen at apex. Drupes broadly ovoid or globose, obtuse at base, 10-16 mm across.

KEY TO THE VARIETIES

- | | |
|--|------------------------------|
| 1a. Leaves elliptic; umbels 4-flowered; styles obtuse or swollen at apex | 4.2. var. <i>punicifolia</i> |
| b. Leaves obovate; umbels 1-flowered; styles barbed or compressed | 4.1. var. <i>obovata</i> |

4.1. var. *obovata* Niedenzu in Ind. Lect. Lye. Braunsberg 1899: 8 & in Arbeiten Bot. Inst. Koenigl. Lyceums Hosianum Braunsberg 5: 35. 1914.

Fl. & Fr. Jan. - March.

Cultivated in gardens.

Native of tropical America.

4.2. var. *punicifolia*

Fl. & Fr. Jan. - March.

Cultivated in gardens.

Native of tropical America.

Uses. The plant is valued for its juicy fruit which resembles crab apple in flavour and is used in jams, preserves and sauces.

5. *Malpighia urens* L., Sp. Pl. 426. 1753.

Shrubs; branches glabrous; branchlets hispid. Leaves ovate, obtuse or rounded at base, acute at apex, 7.5-16 x 4.5-8.5 cm, subcoriaceous, glabrous; petioles 4-10 mm long, subglabrous. Corymbs 2-6-flowered; peduncles 4-11 mm long; pedicels 7-13 mm long, articulate below middle; bracts and bracteoles lanceolate or ovate, ca 1.5 x 0.75 mm. Flowers 13-16 mm across; flower-buds globose, 4-5 mm across. Calyx 10-glandular; calyx-lobes ovate, acute; glands ovoid or obovoid, posterior ones ca 2 mm long; anterior one ca 1 mm long. Petals orbicular, 4-6 mm long. Filaments ca 1.5 mm long; anthers

cordate-ovate, ca 1 mm long. Drupes broadly ovoid-pyramidal, 3-grooved, 9-ribbed, 7-9 mm across, deep red.

Fl. & Fr. April - July.

Rarely cultivated in gardens.

Native of tropical America.

7. *Stigmaphyllon* A. Juss.

Climbing shrubs. Leaves mostly opposite, entire or dentate, rarely lobed; petioles 2-glandular at apex; stipules minute. Corymbs umbel-like, axillary or terminal; pedicels minutely bracteate at base, articulate and 2-bracteolate below middle, thickened and bent at apex when young. Calyx 5-partite, 8-glandular. Petals clawed, unequal, glabrous. Stamens 10, unequal, 6 perfect, 4 antherless or deformed; filaments connate at base, glabrous; anthers broadly oblong, unappendaged, glabrous or setulose at apex. Ovary 3-lobed, 3-locular; lobes gibbous on back; styles 3, free; stigmas produced into a foliaceous globose or hooked appendage. Samaras 1-3, extended at apex into oblique wing, often crested at sides; seeds subglobose; cotyledons thick, often unequal, one folded over other.

Tropical America; ca 100 species, 2 species commonly grown in gardens in India.

KEY TO THE SPECIES

- | | |
|--|------------------------------|
| 1a. Leaves ovate-cordate; margins ciliate | 1. <i>S. ciliatum</i> |
| b. Leaves elliptic, oblong or linear; margins entire | 2. <i>S. periplocifolium</i> |

1. *Stigmaphyllon ciliatum* (Lam.) A. Juss. in St. Hil., Fl. Brazil Merid. 3: 49. 183. 1832. *Banisteria ciliata* Lam., Encycl. 1: 369. 1783.

Shrubs; branches white-sericeous when young, glabrescent when mature. Leaves ovate, deeply cordate and lobed at base, obtuse or rounded at apex, ciliate-glandular along margins, 3-8 x 2.5-7 cm, white appressed-pubescent when young, glabrescent with age; nerves produced beyond margins and ending in short red glandular processes; petioles ca 4 cm long, glabrate, 2-glandular at base; stipules minute, ca 0.3 mm long. Umbels 4-7-flowered; peduncles 1.5-6 cm long, sparsely pubescent; pedicels 6-13 mm long, articulate at 2-3 mm from base; bracts lanceolate, 1.5-2 mm long; bracteoles ca 1 mm long. Flowers 3.5-4 cm across; flower-buds globose, 3-4 mm across. Calyx-lobes broadly ovate, obtuse, 1.5-2.5 x 1.5-2 mm, glandular; glands 8, ovate. Petals unequal, yellow, one smaller; limbs orbicular or rounded-oblong, concave, irregularly fringed, ca 15 x 9 mm. Stamens unequal, 3 longer and thicker; filaments ca 2 mm long; anthers

oblong, blunt, ca 1 mm long. Ovary white-woolly; styles ca 5 mm long; stigma foliaceous. Samaras 2-2.5 x 1-1.5 cm.

Fl. & Fr. July - Nov.

A native of tropical America.

2. *Stigmaphyllon periplocifolium* (Desf.) A. Juss., *Malp. Syn.* 290. 1840 et in *Arch. Mus. Hist. Nat. Paris* 3: 380. 1843. *Banisteria periplocaefolia* Desf. in *Tab. Ec. Bot.* 136. 1804.

Twining shrubs; young branches white-sericeous. Leaves elliptic-oblong or linear, shallowly cordate or entire at base, emarginate or apiculate at apex, 1-14 x 0.5-9.5 cm, coriaceous, glabrous on both surfaces; petioles 8-25 mm long, 2-glandular at apex. Flowers arranged in more or less elongate racemes or subumbellate corymbs; pedicels 10-20 mm long; bracts and bracteoles lanceolate, ca 1 mm long. Flower-buds globose, 3-4 mm across. Calyx-lobes ovate, acute, 1.5-2 x 2-2.5 mm; glands 5(-9), situated below calyx. Petals clawed, 4 subequal, 1 smaller, yellow; limbs suborbicular, entire or crenulate along margins, 6-9 x 4-5 mm. Stamens 6 opposite to petals fertile, 4 sterile; filaments ca 2 mm long; anthers 1-1.5 mm long. Ovary white-woolly; styles ca 2 mm long; stigma foliaceous. Samaras 16-20 x 7-9 mm.

Fl. July.

A native of tropical America.

8. *Tristellateia* Thouars

Climbers. Leaves opposite, entire, membranous; petioles glandular, shortly stipulate. Inflorescence terminal or lateral racemes; pedicels long, 2-bracteolate upon articulation. Flowers bisexual, actinomorphic. Calyx eglandular or with very minute glands. Petals sagittate-ovate, clawed, keeled outside, entire, glabrous, yellow. Filaments unequal, united at base, introflexed, truncately jointed at apex, 5 larger, opposite to petals; anthers linear-oblong, acute, glabrous. Ovary globose, 3-lobed, many-appendaged on back; style 1, elongate, slender; stigma minute. Samaras 3, many-winged; wings narrow, elongate, spreading stellately; seeds obovoid; cotyledons hooked.

Tropical Africa, Australia, Malesia, Philippines, Taiwan and Vietnam; ca 40 species, 1 species cultivated in India.

Literature. ARNES, J. (1947). Monographie die genere *Tristellateia*. *Mem. Mus. Hist. Nat. (Paris)* n. ser. 21: 275. 330. SPRAGUE, T.A. (1910). *Tristellateia australis*. in *Curtis, Bot. Mag.* 136: pl. 8334.

Tristellateia australasiae A. Rich., *Sert. Austral.* t. 15. 1833.

Stems woody, glabrous. Leaves ovate, acute or shortly acuminate, somewhat recurved at margins, 5-12 x 3-7 cm, glabrous; petioles 10-15 mm long, puberulous when young, glabrescent when mature; stipules linear-lanceolate, acute, ca 1 mm long. Racemes terminal, 4-14 cm long; bracts lanceolate, ca 3 mm long; bracteoles ca 0.5 mm long; pedicels decussate, 1.5-2.5 cm long, articulate near base at ca 5 mm from base. Flowers ca 2.5 cm across; flower-buds oblong, ca 7 x 3-4 mm. Calyx-lobes triangular, blunt, ca 3 x 1.5 mm, glabrous, eglandular. Petals ovate, rounded at apex, 8-13 x 3-5 mm, yellow. Filaments ca 4 mm long; anthers oblong, ca 1.5 mm long. Ovary ca 1 mm across, provided with a whorl of papillae on 3 sides; styles 8-9 mm long. Samaras 1-2 cm across, coriaceous, stellate.

Fl. Oct., Feb.

Distrib. India: Cultivated in gardens.

Vietnam, Thailand, Taiwan, Malesia to Australia.

ZYGOPHYLLACEAE

(Paramjit Singh and V. Singh)

Annual or perennial herbs, shrubs or rarely trees; branches usually articulate or swollen at nodes. Leaves opposite or alternate (by suppression) or fasciculate, pinnate, rarely simple, entire, petiolate to subsessile; stipules free, foliaceous, sometimes fleshy or spinescent, rarely deciduous. Flowers solitary or in cymes, usually bisexual, regular or rarely irregular, hypogynous. Sepals usually 5, free or rarely connate at base, imbricate or valvate. Petals usually 5, free, often clawed, imbricate or convolute, rarely absent. Disk convex or concave, rarely annular or indistinct. Stamens in 1-3 whorls of 5 each, free, outermost whorl usually opposite petals and occasionally adnate at base; filaments appendaged at base or naked; anthers nearly basifixed to versatile, longitudinally dehiscent, introrse. Ovary sessile or rarely shortly stipitate, angled or winged, (2-) 6-10 (-12)-locular; placentation axile; style simple, angular or furrowed, rarely 5 and free; stigma simple, capitate or lobed. Fruits capsular or schizocarpic, rarely drupaceous or baccate; seeds 1-many in each locule; endosperm present or absent; cotyledons flat.

Widely distributed, but mainly in tropical and warm regions of both hemispheres with 26 genera and ca 250 species; 8 genera, 18 species and 4 varieties in India. One species viz. *Quaicum officinale* L., a native of America, is cultivated as an ornamental.

KEY TO THE GENERA

- | | |
|---|------------------------|
| 1a. Flowers solitary; fruits capsular or schizocarpic | 2 |
| b. Flowers in cymes; fruits drupaceous | 3 |
| 2a. Stipules not spiny | 4 |
| b. Stipules spiny | 2. <i>Fagonia</i> |
| 3a. Leaves bifoliolate; stamens 10 | 1. <i>Balanites</i> |
| b. Leaves simple; stamens 15 | 4. <i>Nitraria</i> |
| 4a. Petals present; stamens 10-15 | 5 |
| b. Petals absent; stamens 5 | 6. <i>Seetzenia</i> |
| 5a. Leaves simple; fruits capsular | 6 |
| b. Leaves compound; fruits schizocarpic | 7 |
| 6a. Leaves opposite, entire | 8. <i>Zygophyllum</i> |
| b. Leaves alternate, irregularly dissected | 5. <i>Peganum</i> |
| 7a. Intrastaminal glands present; fruits splitting into 4-5 mericarps | 7. <i>Tribulus</i> |
| b. Intrastaminal glands absent; fruits splitting into 10-12 mericarps | 3. <i>Kallstroemia</i> |

1. *Balanites* Del.

Africa, Myanmar, India, Palestine, Pakistan, S. Arabia and Syria, about 25 species, one species in India.

Notes. Bentham & Hooker (*Genera Plantarum* 1: 314. 1862) and Paris & Mue Aubrat (in *Bull. Soc. Bot. Fr.* 93: 202. 1946) place this genus in the family Simaroubaceae while Engl. (in Engler & Prantl, *Pflanzenfam.* ed. 2. 19a.: 179. 1931) treats it under Zygophyllaceae. Hutchinson (*Fam. Fl. Pl.* 3rd ed. 327. 1973) treats it under a separate family Balanitaceae. Following Bentham & Hooker, most authors of Indian Floras treat it as a member of Simaroubaceae. Hutchinson's treatment is followed here.

Balanites roxburghii Planchon in *Ann. Sc. Nat. Bot. ser.* 4. 2: 258. 1854; A.W. Bennett in *Hook.f., Fl. Brit. India* 1: 522. 1875. *B. aegyptiaca* auct. non (L.) Del. 1813; Basak in *Fasc. Fl. India* 4: 20. 1980.

Beng.: *Hingan*; Guj.: *Angario, Hingariyo, Ingorio, Regorea*; Hindi: *Hingan, Hingot, Hingua*; Mar.: *Hingunabet*; Sans.: *Ingudi*; Tam.: *Nanjunda*; Tel.: *Gari*.

Bushy shrubs or small trees, armed, deciduous, 3 - 5 m high; bark whitish, bitter; young parts pubescent; thorns up to 6 cm long, simple or forked or with smaller spines, often bearing leaves and flowers. Leaflets 2, elliptic-oblong or obovate-oblong or oblanceolate, rounded or cuneate at base, obtuse or acute or rarely mucronate at apex, 1 - 5 x 1 - 3 cm, glaucous green, pubescent; petiolules 3 - 5 mm long. Flowers pale-greenish yellow, fragrant, 4 - 12, in axillary fascicled cymes; pedicels 5 - 15 mm long, pubescent. Sepals 5, imbricate, elliptic-ovate, ca 3 mm long, densely pubescent outside, long silky hairy inside. Petals 5, elliptic-oblong, glabrous outside, silky hairy inside. Stamens 10, 2 - 3 mm long; filaments 1.5 - 2 mm long. Ovary globose, ca 2 mm across; style ca 1 mm long. Drupes ovoid or subspherical, 5-grooved, 3 - 6 x 2 - 4 cm, puberulous, yellow when ripe with foetid smelling pulp; seeds solitary, stony with fibrous testa.

Fl. & Fr. Almost throughout the year.

Distrib. India: Throughout in scrub forests, deciduous forests and sandy coasts. Kashmir, Punjab, Haryana, Delhi, Uttar Pradesh, Bihar, Orissa, W. Bengal, Sikkim, Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Pakistan and Myanmar.

Notes. Planchon (l.c.) bases his name *B. roxburghii* on *Ximenia aegyptiaca* sensu Roxb. (1832) and considers it distinct from *X. aegyptiaca* L. (1753). He points out that *B. roxburghii* differs from African *B. aegyptiaca* (L.) Del. in petals being villous on inner surface (Sprague in *Bull. Misc. Inform.* 1913: 135. 1913). The former also differs from latter in having shorter petiolule. Further, the ovary does not lengthen out after flowering. Hence treated as a distinct species here.

Uses. Pulp of fruit is edible and used for cleansing silk and cotton and for whooping cough. Bark used as anthelmintic for cattle and its juice used as fish poison; wood used

for making walking sticks and other parts as fuel. Fruits are made into garlands for cows and other animals.

2. *Fagonia* Tourn. ex L.

Annuals or perennials, spreading to upright herbs or undershrubs with woody stem at base, diffusely branched; branches terete or quadrangular, sulcate or striate. Leaves opposite, 1 - 3-foliolate, rarely simple, glandular hairy to glabrous; stipules usually spiny and acicular; leaflets subsessile or petiolulate, linear to broadly ovate, entire, mucronate. Flowers solitary, axillary, pedicellate, purplish-pink, violet or rarely yellow. Sepals 5, deciduous or persistent, imbricate. Petals 5, spatulate, clawed, caducous, imbricate. Disk short, inconspicuous. Stamens 10, inserted on disk; filaments filiform; anthers oblong. Ovary ovoid or obovoid, sessile, pentagonous, 5-celled; ovules 2 in each cell; style simple, persistent; stigma simple, capitate. Fruits globular or pyramidal, deeply 5-angled, glandular pubescent to glabrous, dehiscent septically into 5 basally dehiscent one-seeded cocci; seeds oblong-ovoid, compressed; testa mucilaginous; endosperm horny; cotyledons ovate.

Distrib. Widely distributed in deserts and dry regions of the World, excepting Australia; about 50 species; 4 species in India.

Chromosome no. $2n = 18, 20, 22, 24$ (Fedorov, Chrom. Numb. Fl. Pl. 727. 1974).

Uses. Among Indian species *F. indica* Burm. f. and *F. schweinfurthii* Hadidi are known to cure asthma, fever, vomiting, dysentery and urinary discharges and also to reduce tumours and purify blood.

KEY TO THE SPECIES

- | | |
|--|-----------------------------|
| 1a. Internodes terete; stipular spines equal to or shorter than leaves | 2 |
| b. Internodes quadrangular; stipular spines longer than leaves | 2. <i>F. bruguieri</i> |
| 2a. Calyx persistent | 3 |
| b. Calyx deciduous | 1. <i>F. arabica</i> |
| 3a. Fruiting pedicels equal to or shorter than fruits | 3. <i>F. indica</i> |
| b. Fruiting pedicels twice as long as fruits | 4. <i>F. schweinfurthii</i> |

1. *Fagonia arabica* L., Sp. Pl. 386. 1753. *F. cretica* L. var. *arabica* (L.) T. Anderson in J. Linn. Soc., Bot. 5: 12. 1868.

Guj.: Dhraman.

Shrublets, perennial, up to 50 cm high, suberect to erect, diffusely branched, glandular; internodes terete, 2 - 3 cm long, striate. Lower leaves trifoliolate, upper ones unifoliolate; petioles 3 - 5 mm long; leaflets linear-oblong, mucronate, 4 - 12 x 1.5 - 3 mm;

stipular spines 1 - 2 cm long. Sepals deciduous, oblong-lanceolate, ca 3 x 1.5 mm, glandular outside. Petals obtuse, 5 - 6 x 3 - 4 mm. Stamens ca 5 mm long. Capsules ca 5 mm across, glandular-pubescent.

Fl. & Fr. Oct. - March.

Distrib. India: Gujarat.

Pakistan, Arabia, N. Africa.

2. *Fagonia bruguieri* DC., Prodr. 1: 704. 1824; Edgew. & Hook.f. in Hook. f., Fl. Brit. India 1: 425. 1874. *F. echinella* Boiss., Diagn. Pl. Orient. Nov. ser. 1. 8: 123. 1849.

Raj.: *Dhamasa*.

Shrublets, biennial or perennial, profusely branched, up to 30 cm high, pale green; branches distinctly sulcate, internodes up to 3 cm long, 4-angled. Basal leaves mostly trifoliolate and upper ones unifoliolate or all leaves unifoliolate; petioles up to 5 mm long; leaflets ovate-oblong, sharply mucronate, 4 - 12 mm long, fleshy; stipular spines mostly recurved, longer than leaves. Flowers ca 10 mm across, pale pink; pedicels up to 5 mm long. Sepals persistent, oblong-lanceolate, ca 2.5 x 1.5 mm, glandular outside. Petals spatulate, obtuse, 3.5 - 6 mm long. Stamens ca 4 mm long. Capsules ca 4 x 4 mm, pubescent.

KEY TO THE VARIETIES

- 1a. Plants glandular hairy; basal leaves trifoliolate, upper unifoliolate
 b. Plants glandular; all leaves unifoliolate

2.1. var. *bruguieri*

2.2. var. *rechingeri*

2.1. var. *bruguieri*

Fl. & Fr. Feb. - May.

Distrib. India: Rare. Rajasthan.

Pakistan, Afghanistan, Iran, Iraq, Arabia and Africa.

2.2 var. *rechingeri* Hadidi in Candollea 27: 91. 1972.

Fig. 14.

Fl. & Fr. Sept. - March.

Distrib. India: Very rare on gravel plains, Rajasthan.

Afghanistan, Iran, Iraq and Pakistan.

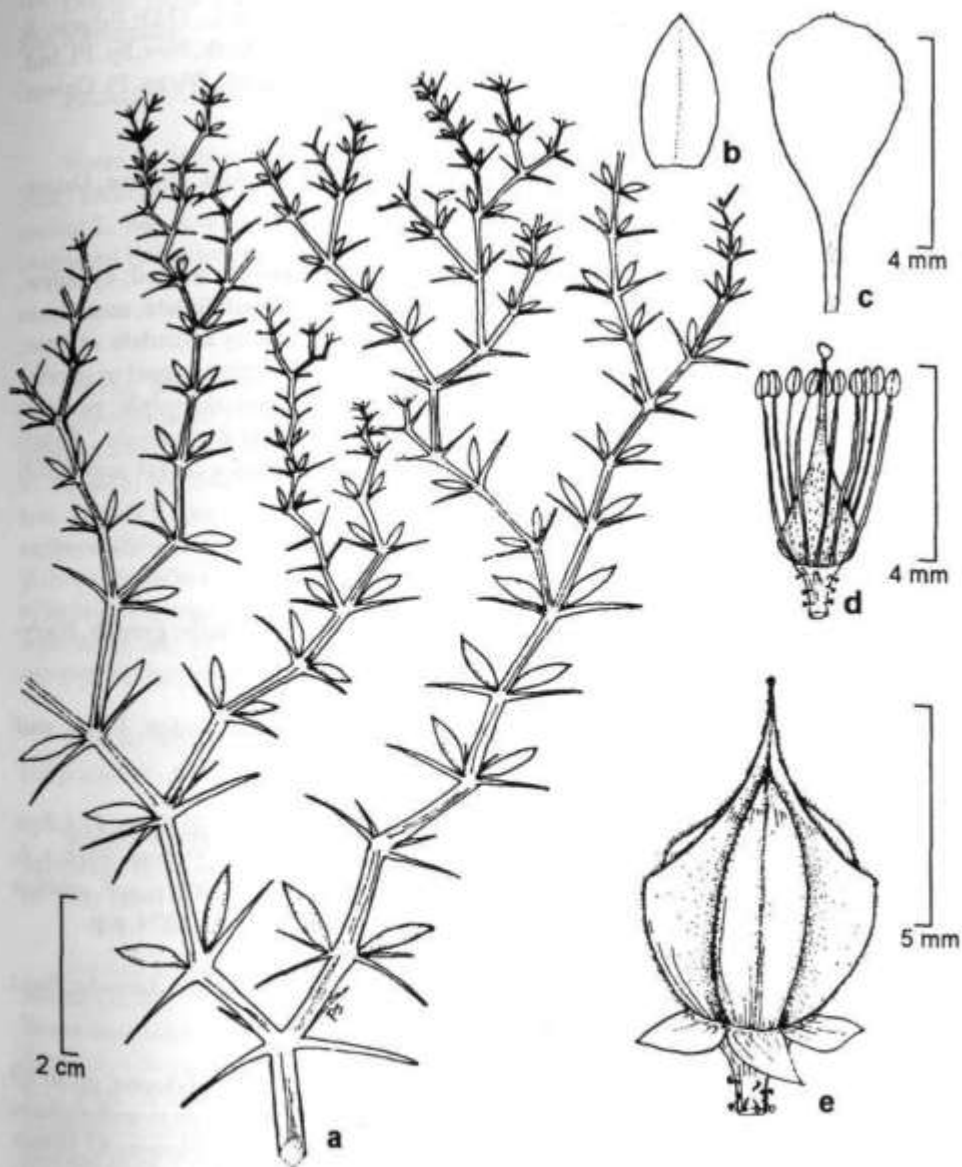


Fig. 14. *Fagonia bruguieri* DC. var. *rechingeri* Hadidi : a. habit; b. sepal; c. petal; d. gynoecium and stamens; e. capsule.

3. *Fagonia indica* Burm. f., Fl. Ind. 102. t. 34. f. 1. 1768. *F. cretica* auct. non L. 1753: T. Cooke, Fl. Pres. Bombay 1: 164. 1901, p.p. *F. arabica* auct. non L. 1753: Edgew. & Hook.f. in Hook. f., Fl. Brit. India 1: 425. 1874, p.p. *F. mysorensis* Roth, Nov. Sp. Pl. Ind. Or. 215. 1821. *F. persica* DC., Prodr. 1: 704. 1824. *F. parviflora* Boiss., Diagn. Pl. Orient. Nov. ser. 1. 8: 124. 1849.

Punj.: *Dama*; *Dhamarh*, *Samaba*; Raj.: *Dhamasa*; Tel.: *Chittigara*, *Hinuna*, *Ustarkhar*.

Shrublets, annual or perennial, up to 60 cm high. Profusely branched, cylindric, striate, pale green, glandular; internodes 2 - 5 cm long. Leaves unifoliolate, sometimes a few basal trifoliolate; petioles 2 - 8 mm long; leaflets distinctly articulate at base, narrowly ovate-lanceolate, mucronate, 8 - 16 x 3 - 4 mm; stipular spines equal or shorter than leaves, occasionally reduced. Flowers ca 12 mm across, pinkish-purple; pedicels 4 - 6 mm long. Sepals persistent, ovate, ca 3.5 x 1.5 mm, glandular outside. Petals spatulate, obtuse, ca 6 x 3 mm. Stamens ca 6 mm long. Capsules ca 4x4 mm, softly hairy, pedicels reflexed, equal to length of fruits.

Fl. & Fr. Almost throughout year.

Distrib. India: Occasionally found in gravelley to clayey sandy soils; Punjab, Haryana, Rajasthan, Andhra Pradesh and Karnataka.

Pakistan, Afghanistan, Iran, Iraq, Arabia, Somalia, Ethiopia, Sudan, Egypt and Libya.

4. *Fagonia schweinfurthii* (Hadidi) Hadidi ex Ghafoor in Jafri & El-Gadi, Fl. Libya 38: 31. 1977. *F. indica* Burm. f. var. *schweinfurthii* Hadidi in Reich. f., Fl. Iran. 98: 6. t. 6. 1972. *F. cretica* auct. non L. 1753: T. Cooke, Fl. Pres. Bombay 1: 164. 1901, p.p. *F. arabica* auct. non L. 1753: Edgew. & Hook.f. in Hook. f., Fl. Brit. India 1: 425. 1874, p.p.

Guj.: *Dharaman*, *Dhamaso*; Mar.: *Dhamaso*; Punj.: *Dama*, *Dhamarh*, *Samaba*; Raj.: *Dhamasa*; Tel.: *Chittigara*, *Hinguna*, *Ustarkhar*.

Shrublets, annual or perennial, prostrate to erect, glandular to glabrous, up to 50 cm high, internodes 1 - 3 cm long, striate. Leaves trifoliolate, upper ones unifoliolate; stipular spines patent, shorter than leaves, sometimes much reduced. Flowers 8 - 10 mm across, pinkish-purple; pedicels up to 8 mm long, glandular to glabrous. Sepals persistent, ovate, 3 - 4 x 1.5 - 2 mm, sparsely glandular outside. Petals obtuse, 4 - 6 x 2 - 3 mm. Stamens ca 5 mm long. Capsules ca 4 x 4 mm, softly hairy.

Fl. & Fr. Almost throughout the year.

Distrib. India: Punjab, Haryana, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh and Karnataka.

Pakistan, Afghanistan, Iran, Iraq, Arabia to southern Sahara and tropical Africa.

Notes. In Indian Floras *F. schweinfurthii* Hadidi and *F. indica* Burm. f. are erroneously identified either as *F. cretica* L. or *F. ambica* L. Examination of the type of *F. cretica* L. has revealed that it does not occur in Indian subcontinent and is probably restricted to mediterranean region (Hadidi, 1972).

3. *Kallstroemia* Scopoli

Herbs, prostrate to ascending, diffuse; branches herbaceous to suffrutescent, densely pubescent to glabrate. Leaves opposite, paripinnate, one of each pair alternatively smaller or sometimes abortive; leaflets (4-) 6 - 10(-12), opposite, subsessile, elliptic to obovate; terminal pair directed forward, falcate. Flowers solitary, axillary, pedicellate. Sepals 5, free, usually persistent. Petals 5. Stamens 10, rarely 12; filaments filiform, anthers globose to ovoid; extrastaminal glands truncate. Ovary ovoid or pyramidal, glabrous to pubescent, 10 - 12-lobed and loculed, each locule with one ovule; style simple, cylindrical to conical, persistent; stigma capitate or 10 - 12-lobed, papillose. Schizocarps separating into 10 - 12, triangular, wedge-shaped, tuberculate mericarps from a persistent styliiferous axis; seeds oblong-ovoid; endosperm absent.

Distrib. About 17 species, distributed in New World. Introduced (one species) into India and W. Africa.

Kallstroemia pubescens (G. Don) Dandy in Kew Bull. 10: 138. 1955. *Tribulus pubescens* G. Don, Gen. Syst. 1: 769. 1831. *Kallstroemia minor* Hook. f. in Hook., Niger Fl. 269. 1849. Fig. 15.

Herbs, annual, procumbent, up to 50 cm long. Leaves 2 - 5 cm long; leaflets subsessile, 0.5 - 2 x 0.3 - 1.2 cm, elliptic to obovate, spiculate; stipules 3 - 5 mm long, linear-lanceolate, hairy. Flowers ca 10 mm across, pale yellow; pedicels 1 - 2 cm long. Sepals 5, 4.5 - 6 x 1.5 - 1.7 mm, linear-lanceolate, acuminate, persistent. Petals 5, obovate, 6 - 7 x 4.5 - 5 mm. Stamens 10, ca 5 mm long. Ovary ca 1 mm across; style conical, 10 - 12-ridged, persistent; stigma capitate. Schizocarps ca 8 mm across, pyramidal, ribbed; mericarps ca 5 x 3 mm, 1-seeded.

Distrib. India: Maharashtra, Bihar and W. Bengal.

Mexico to C. & S. America and W. Africa.

Chromosome no. $2n = 32$ (Datta in Curr. Sci. 37: 477. 1968); $2n = 36$ (Pandey & Pal in Taxon 29: 545. 1980).

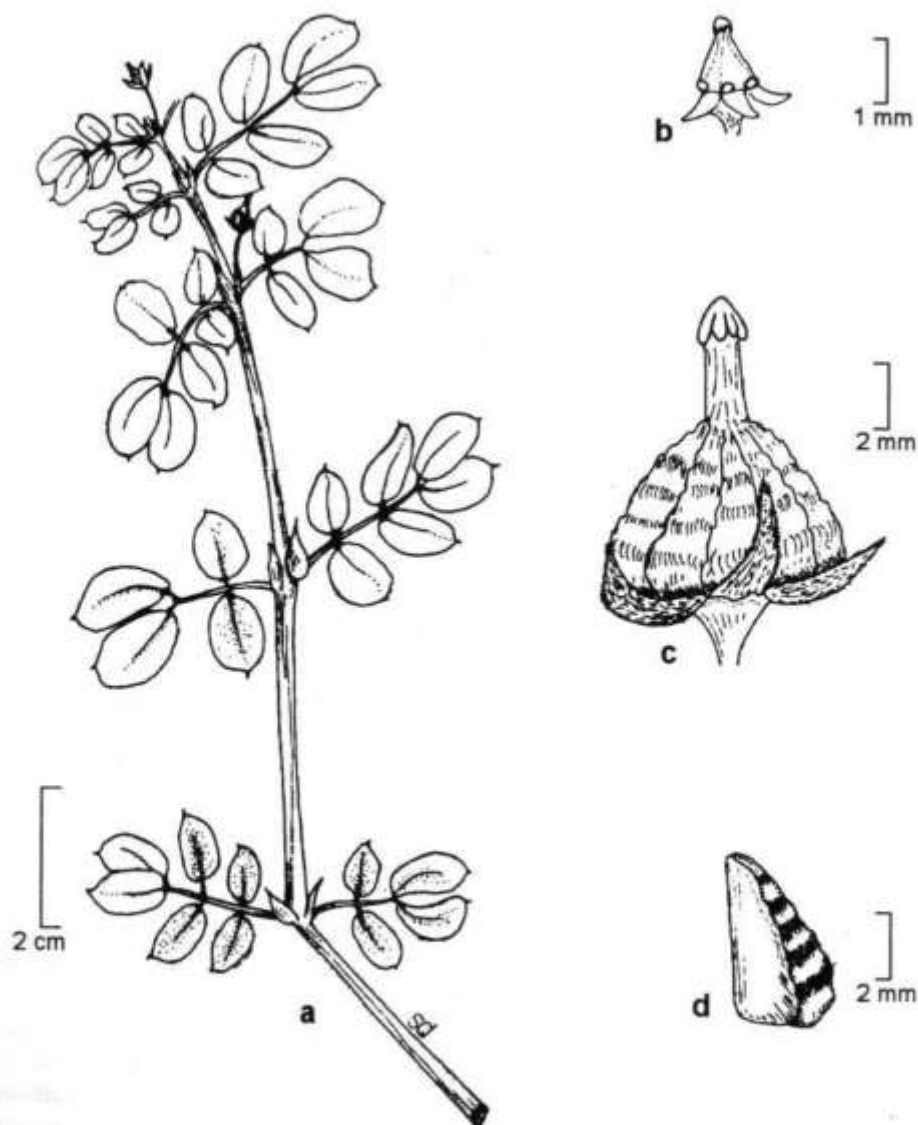


Fig. 15. *Kallstroemia pubescens* (G. Don) Dandy: a. habit; b. gynoecium; c. schizocarp; d. mericarp.

4. *Nitraria* L.

Shrubs, much branched, sometimes spinous. Leaves alternate or fasciculate, simple, fleshy, entire, rarely 3-lobed at apex. Inflorescence scorpioid cymes. Flowers sessile or short pedicelled, yellow to pale greenish. Sepals 5, free or connate at base, imbricate, fleshy, persistent. Petals 5, concave, cuculate. Disk small, fleshy. Stamens 5; anthers oblong. Ovary oblong-pyramidal, appressed long-silky hairy, 3-lobed, 3-locular; ovules solitary in each locule, pendulous; style simple; stigma 3-lobed, decurrent. Drupes ovoid, acuminate; endocarp bony; seeds ovoid; endosperm absent; embryo straight; cotyledons linear-ovate.

Distrib. About 7 species distributed from N.W. Africa to Siberia and Australia. One species in India (Kashmir).

Nitraria schoberi L., Syst. Nat. ed. 10. 1044. 1759.

Woody shrubs, ca 70-90 cm high; young branches greyish pubescent; spiny at apices. Leaves aciculate, sessile, oblong-spathulate, obtuse, mucronate, 20 - 50 x 3 - 8 mm, sparsely hairy; stipules minute. Flowers sessile, ca 4 mm across, pale yellow. Sepals slightly connate at base, broadly ovate, 1.5 - 2 x 1.2 mm, glabrous or glabrescent. Petals oblanceolate, incurved at apex, ca 3mm long, glabrous. Stamens in 3 whorls of 5 each; anthers versatile. Drupes ovoid-spherical, 5 - 15 mm across, glabrous, reddish-purple.

Fl. & Fr. Dec. - March.

Distrib. India: Rare, at higher altitudes. Jammu & Kashmir.

Pakistan, China, USSR, Iran, Israel, Syria and Turkey.

Notes. Only one collection (Baltistan Paiju, Baltoro glacier. *H. Hartman* 3480) from Jammu & Kashmir.

5. *Peganum* L.

Herbs, perennial, erect, pubescent or glabrous; root-stock woody. Leaves alternate, simple, irregularly multifid; stipules setaceous. Flowers white to yellow, solitary, terminal or on subterminal leaf-opposed peduncles. Sepals 4 - 5, free, foliaceous, entire or pinnatifid, persistent. Petals 4 - 5, subequal, free. Disk small, annular or angular. Stamens 12 - 15, filaments dilated at base; anthers linear-oblong. Ovary globose, sulcate, 3 - 4-locular; ovules many in each locule; style simple, 2 - 3-keeled above; keels stigmatose. Capsules globose, loculicidally dehiscent, rarely indehiscent; seeds angular, testa spongy; endosperm fleshy; embryo curved.

About 6 species distributed from Mangolia to N. Africa, S. Europe, tropical America and Australia. One species in India.

Peganum harmala L., Sp. Pl. 444. 1753; Hook.f., Fl. Brit. India 1: 486. 1875.

Hindi: *Hamal*.

5.1. var. *harmala*

Herbs, perennial, up to 1 m high, glabrous, woody at base, dichotomously and corymbosely branched; branches erect, terete, somewhat succulent. Leaves sessile, 3 - 7.5 cm long, multifid; lobes spreading, linear-lanceolate to elliptic, acute. Flowers solitary, in axils of branches, sessile or pedicelled, 2 - 3 cm across, creamy white to pale yellow; pedicels 1.5 - 2 cm long. Sepals 5, linear, 15 - 20 x 1 - 2 mm, usually pinnatifid, acute, persistent. Petals 5, oblong to oblong-elliptic, 10 - 17 x 4 - 6 mm. Stamens 12 - 15, ca 10 mm long; anthers 5 - 6 mm long. Ovary ca 3 mm across, globose; style ca 10 mm long, 3-keeled, upper half stigmatose, persistent. Capsules subglobose, deeply lobed, glabrous; seeds triangular, 2 - 3 x 1.5 - 2 mm, brownish-black.

Fl. & Fr. March - Oct.

Distrib. India: Usually in drier parts.

China, Mangolia, Russia, Pakistan, Afghanistan, Iran, Iraq, Syria, Turkey, Jordan, Israel, Greece and tropical Africa; introduced in America and Australia.

Chromosome no. n. 12 (Amin in Taxon 22: 115. 1973) and n = 24 (Henelt in Taxon 22: 649. 1973).

5.2. var. *stenophyllum* Boiss., Fl. Or. 1: 917. 1867.

Beng.: *Island*; Hindi, Punj.: *Humal*; Raj.: *Hamal Gandhiyo*; Tam.: *Sim ayalavinai*; Tel.: *Simagoronti*.

This variety can be distinguished from the species proper by the presence of narrower leaf-segments, shorter sepals and broader capsules.

Fl. & Fr. March - Oct.

Distrib. India: Usually in drier parts. Kashmir, Punjab, Haryana, Rajasthan, Uttar Pradesh, Gujarat, Maharashtra and Karnataka.

Pakistan, Afghanistan, Turkmania, Iran and Iraq.

Notes. J.D. Hooker (Flora of British India 1: 486. 1875) treats this genus under the Family Rutaceae.

Uses. The plant has several therapeutic properties and is useful in curing lumbago, paralysis, weakness of muscles and brain, ophthalmia, laryngitis, rheumatism, asthma and chronic bronchitis; sometimes used as abortifacient. Seeds are stimulent, emmenagogue, anthelmintic and mildly narcotic.

6. *Seetzenia* R. Br.

Herbs, perennial, spreading, woody, branches prostrate, glabrous to papillose. Leaves opposite, petiolate, trifoliolate; leaflets shortly petiolulate, apiculate, glabrous to pubescent above, papillose beneath, leathery; stipules triangular. Flowers solitary, axillary, greenish; pedicels reflexed at maturity. Sepals 5, free, deciduous. Petals absent. Disk small. Stamens 5, alternating with sepals; filaments filiform; anthers oblong to subglobose. Ovary oblong-clavate, 5-locular; ovules solitary in each locule; styles 5, free, divergent; stigma capitate. Capsules ovoid, 5-angled, pendulous, dehiscing into 5 cocci from persistent central axis; cocci thick and greenish on back, thin, muricate and straw-coloured on lateral walls; seeds flattened, elliptic-oblong, narrow at both ends; testa thick; endosperm present; cotyledons thick.

Distrib. India: A unitypic genus sporadically distributed; Rajasthan.

Pakistan, Afghanistan, Arabia and Africa.

Seetzenia lanata (Willd.) Bullock in Kew Bull. 19: 203. 1965. *Zygophyllum lanatum* Willd., Sp. Pl. 2: 564. 1799. *Z. prostratum* Thunb., Prodr. Fl. Cap. 189. 1800. *Seetzenia africana* R. Br. in Denham & Clapp., Narr. Travels Africa Bot. app. 231. 1826, nom. illegit. *S. prostratum* (Thunb.) Eckl. & Zeyh., Enum. Pl. Agric. Austr. 98. 1834. *S. orientalis* Decne. in Ann. Sc. Nat. Bot. ser. 2: 3: 281. t. 7. 1835; Edgew. & Hook. f. in Hook. f., Fl. Brit. India* 1: 424. 1874. Fig. 16.

Hindi: *Dhakari*.

Herbs, prostrate, perennial, papillate; stems up to 35 cm long; internodes 10 - 45 mm long, articulate. Leaves trifoliolate; 4 - 15 x 2 - 8 mm; petioles 2 - 4 mm long, thick, papillose; stipules 1 - 1.5 mm long, triangular, villous; central leaflets ovate-cuneate, emarginate, 5 - 10 x 2 - 8 mm; lateral ones obliquely oblong to reniform, 3 - 10 x 1 - 6 mm. Flowers solitary, axillary, ca 5 mm across, greenish; pedicels 6 - 10 mm long. Sepals elliptic-lanceolate, acute or apiculate and inflexed at apex, 2.5 - 4 x 1 - 1.5 mm. Stamens 5, 3 - 4 mm long. Ovary 2.5 - 3.5 mm long, ribbed; styles 5, short. Capsules 6.5 - 8 x 5 - 6 mm; seeds compressed, ovoid, 4 - 5 x 1.5 - 2 mm, smooth, brown to blackish-brown.

Fl. & Fr. Sept. - March.

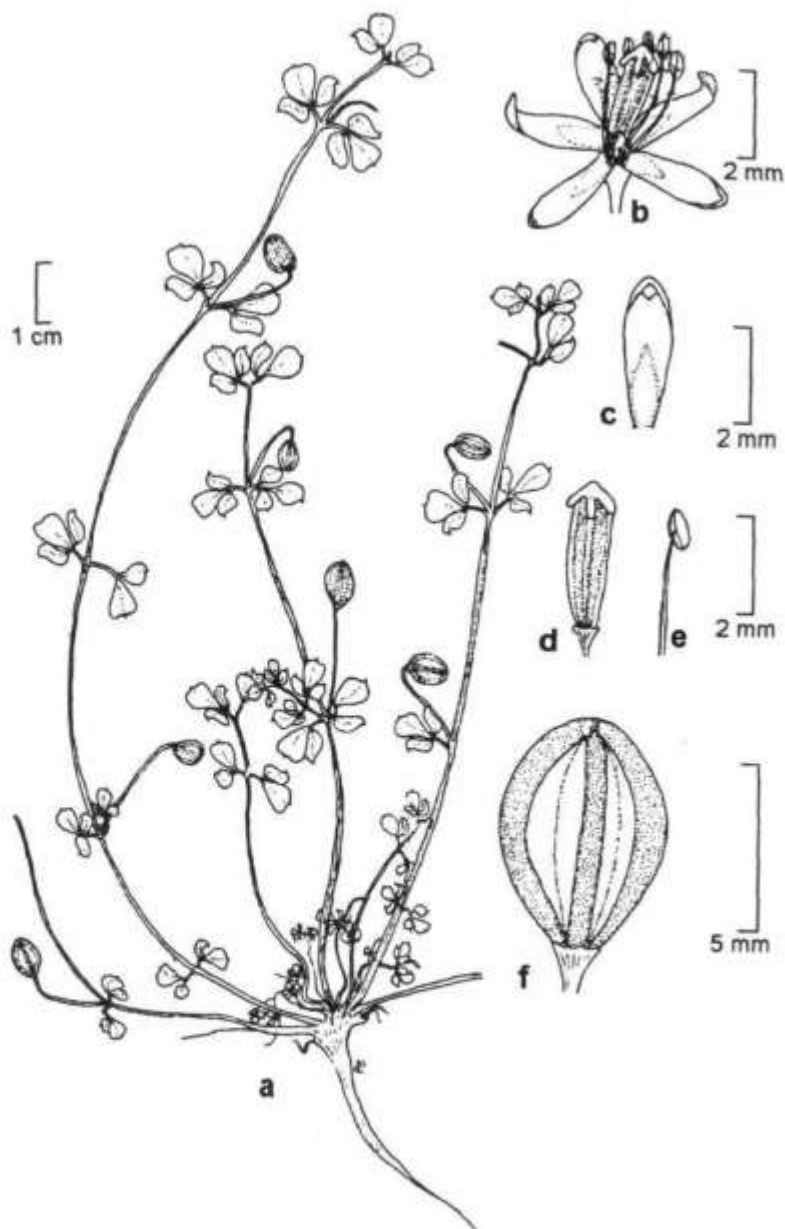


Fig. 16. *Seetzenia lanata* (Willd.) Bullock : a. habit; b. flower; c. sepal; d. gynoecium; e. stamen; f. fruit.

Distrib. Rare in gravelly habitats; same as genus.

Notes. Bullock (l.c.) recognised 2 species viz. *S. lanata* (Willd.) Bullock and *S. orientalis* Decne. Hadidi (in Bot. Notis. 125: 534. 1972) considers it as a unitypic genus as characters for separating the two species do not hold good. This view is followed here.

7. *Tribulus* Tourn. ex L.

Herbs, annual to perennial, prostrate to semi-erect, branching, hairy to glabrescent. Leaves opposite, one of each pair alternately smaller or sometimes abortive, paripinnate, stipulate; leaflets 6 - 20, opposite, subsessile to sessile. Flowers solitary, axillary, pedicellate, usually yellow. Sepals 5, pubescent, deciduous or persistent, imbricate. Petals 5, obovate to obovate-oblong, membranous. Disk annular, 10-lobed. Stamens 5 - 10, outer whorl of 5 slightly longer, opposite the petals; filaments filiform; anthers oblong to ovoid. Each of inner whorl of 5 stamens subtended adaxially by intrastaminal gland and abaxially by extrastaminal gland. Ovary globose, covered with bulbous-based stiff hairs, 5-locular; ovules 1 - 5 in each cell; style simple, cylindrical, 5-ridged; stigma 5-rayed. Schizocarps separating into 4 - 5, dorsally spiny, winged or tubercled, indehiscent, mericarps; seeds obliquely pendulous; endosperm absent; cotyledons ovoid.

Distrib. About 30 species, mainly in tropical and subtropical countries of the World. Five species in India.

Chromosome no. $n = 6$ (Mallick in Chrom. Inf. Serv. 7: 7. 1966)

KEY TO THE SPECIES

- | | |
|---|-----------------------------|
| 1a. Fruits with spiny mericarps | 2 |
| b. Fruits with winged mericarps | 2. <i>T. pentandrus</i> |
| 2a. Intrastaminal glands not ciliate, styles glabrous | 3 |
| b. Intrastaminal glands ciliate; style pubescent | 4. <i>T. subramanyamii</i> |
| 3a. Each mericarp with 4 spines, basal pair of spines sometimes reduced to tubercles | 4 |
| b. Each mericarp with 2 median and 20 - 30 dorsal spines, basal pair of spines absent | 3. <i>T. rajasthanensis</i> |
| 4a. Pedicels equal to or longer than subtending leaves; style longer than ovary | 1. <i>T. lanuginosus</i> |
| b. Pedicels shorter than subtending leaves; style shorter than ovary | 5. <i>T. terrestris</i> |

1. *Tribulus lanuginosus* L., Sp. Pl. 387. 1753; Nayar & Giri in Bull. Bot. Surv. India 24: 161. 1983.

Herbs, annual or biennial, usually prostrate, silky-pubescent. Leaves up to 5 cm long; leaflets 6 - 12, elliptic-oblong, oblique, acute, 3 - 10 x 2 - 5 mm; stipules lanceolate or falcate, ca 2.5 x 1 mm. Flowers ca 12 mm across, pale yellow; pedicels more than 10 mm

long. Sepals lanceolate, 5 - 7 x 2 - 3 mm. Petals obovate-oblong, obtuse-truncate, 5 - 6 x 2 - 3 mm. Stamens 10, ca 4 mm long; intrastaminal glands triangular, free; extrastaminal glands thick, truncate; anthers oblong. Ovary ca 1 mm across; style ca 2.5 mm long; stigma faintly 5-rayed or sub-capitate. Fruits disk-shaped; mericarps acuminate at apex, ca 4 x 2.5 mm, 2 - 4-spined.

Fl. & Fr. Almost throughout the year.

Distrib. India: In most of the states.

2. **Tribulus pentandrus** Forssk., Fl. Aegypt. - Arab. 88. 1775. *T. alatus* Del., Fl. Aegypt. 62. 1813; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 423. 1874. *T. longipetalus* Viv., Pl. Egypt. Dec. 10, t. 2. f. 5. 1831.

Hindi: *Gokhuri-kalan*; Punj.: *Bhakra, Hasak*; Raj.: *Bakda*.

KEY TO THE VARIETIES

- | | |
|--|------------------------------|
| 1a. Wings of mericarps up to 8 mm broad, pubescent, grey to greyish-yellow | 2 |
| b. Wings of mericarps more than 8 mm broad, glabrous, straw-yellow | 2.3. var. pterophorus |
| 2a. Flowers 6 - 8 mm across; wings of mericarps up to 4 mm broad | 2.2. var. pentandrus |
| b. Flowers 10 - 12 mm across; wings of mericarps 5 - 8 mm broad | 2.1. var. macropterus |

2.1. var. macropterus (Boiss.) P. Singh & V. Singh in J. Econ. Tax. Bot. 6(1): 159. 1985. *T. macropterus* Boiss., Diagn. Pl. Orient. Nov. ser. 1. 1: 61. 1843. *T. longipetalus* Viv. subsp. *macropterus* (Boiss.) Maire ex Ozenda & Quezel, in Trav. l'Inst. Rech. Sahar. 14: 75. 1956. *T. longipetalus* Viv. var. *macropterus* (Boiss.) Zohary, Fl. Palestina 2: 255. 1972.

Herbs, densely villous, greyish-green; branches procumbent. Flowers ca 1 - 1.2 cm across; pedicels ca 1.5 cm long. Stamens 5 - 10. Wings of mericarps irregularly dentate or rarely entire.

Fl. & Fr. Sept. - March.

Distrib. India: Common in sandy habitats. Rajasthan.

Pakistan, Afghanistan to N. Africa.

2.2. var. pentandrus

Herbs, annual or biennial, prostrate to procumbent, pilose to densely villous, greyish-white. Leaves up to 7 cm long; leaflets (6-)8 - 12(-14), elliptic-oblong, oblique, acute, 3 - 10(-13) x 1 - 5 mm; stipules ovate-lanceolate or falcate, acute, 2 - 5 mm long.

Flowers 6 - 12 mm across, yellow; pedicels up to 15 mm long. Sepals linear-lanceolate, 4 - 6 x 1.5 - 2 mm. Petals ovate-oblong, cuneate-truncate and wavy at apex, 4 - 7 x 2 - 3 mm. Stamens 5 - 10, 2.5 - 4 mm long; anthers oblong; intrastaminal glands triangular, free or slightly connate, glabrous; extrastaminal glands thick, slightly bilobed or truncate. Ovary ca 1.5 mm across, densely bulbous-based stiff hairy; style ca 1 mm long; stigma 5-rayed. Mericarps pubescent to pilose, winged; wings 2 - 15 mm broad, dentate to serrate; seeds 2 - 3.

Fl. & Fr. Sept. - March.

Distrib. India: Usually on sandy habitats; Punjab, Haryana and Rajasthan.

Pakistan, Afghanistan, Iran, Iraq, Israel, Arabia, Somalia, Sudan and N. Africa.

23. var. pterophorus (Presl) P. Singh & V. Singh in *J. Econ. Tax. Bot.* 6(1): 159. 1985. *T. pterophorus* Presl, *Bot. Mem.* 30. 1844. *T. longipetalus* Viv. subsp. *pterophorus* (Presl) Hadidi in *Reich. f., Fl. Iran.* 98: 14. t. 20. f. 2. 1972.

Fl. & Fr. Aug. - Nov.

Distrib. India: Rajasthan.

Pakistan, Afghanistan and S.W. Africa.

3. *Tribulus rajasthanensis* Bhandari & Sharma in *Bot. Notis.* 129: 367. f.1. 1977.

Fig. 17.

Herbs, annual or perennial, prostrate to procumbent herbs; branches up to 50 cm long, hirsute. Leaves 2 - 5 cm long; leaflets 8 - 14, oblique, elliptic-oblong to ovate-oblong, 4 - 12 x 3 - 6 mm, pubescent above, villous beneath; stipules 5 - 7 x 1 - 2 mm. Flowers yellow, 10 - 15 mm across; pedicels 10 - 20 mm long. Sepals linear-lanceolate, acute, 5 - 7 x 1 - 2 mm, villous outside, pubescent inside. Petals obovate-cuneate, 5 - 7.5 x 3 - 5 mm. Stamens 10, ca 3.5 mm long; intrastaminal glands broadly triangular, free; extrastaminal glands round, truncate or emarginate; anthers oblong. Ovary ca 2 mm across; style ca 1 mm long; stigma 5-rayed. Mericarps 6 - 7 x 4 - 5 mm, densely hispid; major spines 2, ca 5 mm long, divergent; minor spines, 20 - 30, unequal, 2 - 3 mm long.

Fl. & Fr. July - Nov.

Distrib. India: Rajasthan and Gujarat.

Pakistan.

Chromosome no. n = 6 (Bhandari & Sharma l.c.).



Fig. 17. *Tribulus rajasthanensis* Bhandari & Sharma : a. habit; b. gynoecium; c. mericarp - lateral view; d. mericarp - dorsal view.

4. *Tribulus subramanyamii* P. Singh, Giri & V. Singh in Bull. Bot. Surv. India 25: 147. (1983) 1985. Fig. 18.

Herbs, annual, silky hairy; branches up to 40 cm long, striate. Leaves 4 - 6 cm long; leaflets elliptic to obovate, oblique, apiculate, 6 - 10, 8 - 15 x 6 - 9 mm, sparsely or densely pubescent above, silky villous beneath; stipules falcate or linear to ovate, 3.5 - 4.5 x 1.5 - 3 mm. Flowers 10 - 15 mm across; pedicels ca 10 mm long. Sepals linear-lanceolate, acute, 5 - 7 x 1.5 - 2 mm. Petals obovate, cuneate, 6 - 8 x 5 - 5.5 mm. Stamens 10, ca 5 mm long; anthers oblong; intrastaminal glands free, almost triangular; extrastaminal glands thick, orbicular to oblong. Ovary ca 2.5 mm across; style ca 1.5 mm long; stigma pyramidal, 5-rayed. Schizocarps ca 15 mm across; mericarps dorsally ridged, ca 10 x 6 mm, appressed-silky hairy, greenish-yellow; spines 4 or sometimes lower pair reduced.

Fl. & Fr. July.

Distrib. India: Common weed of wastelands. Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu.

Endemic.

Notes. This species is allied to *T. terrestris* L. but differs mainly in presence of pubescent style and ciliate intrastaminal glands.

5. *Tribulus terrestris* L., Sp. Pl. 387. 1753; Edgew. & Hook.f., Fl. Brit. India 1: 423. 1874, p.p.

Hindi: *Gohshura*, *Chota gokhru*, *Gokhru*, *Kanti*; Kan.: *Negalu*; Mal.: *Neringil*; Mar.: *Lahana gokhru*, *Sarate*; Punj.: *Bhakra*; Tam.: *Nerunji*; Tel.: *Palleru-mullu*, *Chinupalleru*.

Herbs, annual, prostrate to procumbent or sub-erect, hairy; branches up to 1 m long, hirsute to sericeous. Leaves 3 - 7 cm long; leaflets 8 - 14, ovate to elliptic, oblique, acute or obtuse, 4 - 11 x 2 - 5 mm; stipules subulate to falcate, 2 - 5 x 1 - 1.5 mm. Flowers 8 - 10 mm across, yellow; pedicels ca 10 mm long. Sepals ovate-lanceolate, acute, 2 - 4 x 1.5 - 2 mm, hirsute, scarious and minutely ciliate margins. Petals 2.5 - 5 x 1 - 3 mm. Stamens 10, 3 - 4 mm long; anthers oblong. Ovary ca 1.5 mm across, with stiff upward spreading bulbous-based hairs; style ca 1 mm long; stigma 5-rayed, slightly asymmetrical. Fruits 10 - 15 mm across excluding spines; mericarps 4 - 8 x 5 - 7 mm, dorsally tuberculate; spines 4 or 2.

Fl. & Fr. Almost throughout the year.

Distrib. India: Common weed of waste places, road-sides and fallow lands of sandy and gravelly habitats; throughout from sea level to 3500 m. Pantropical.

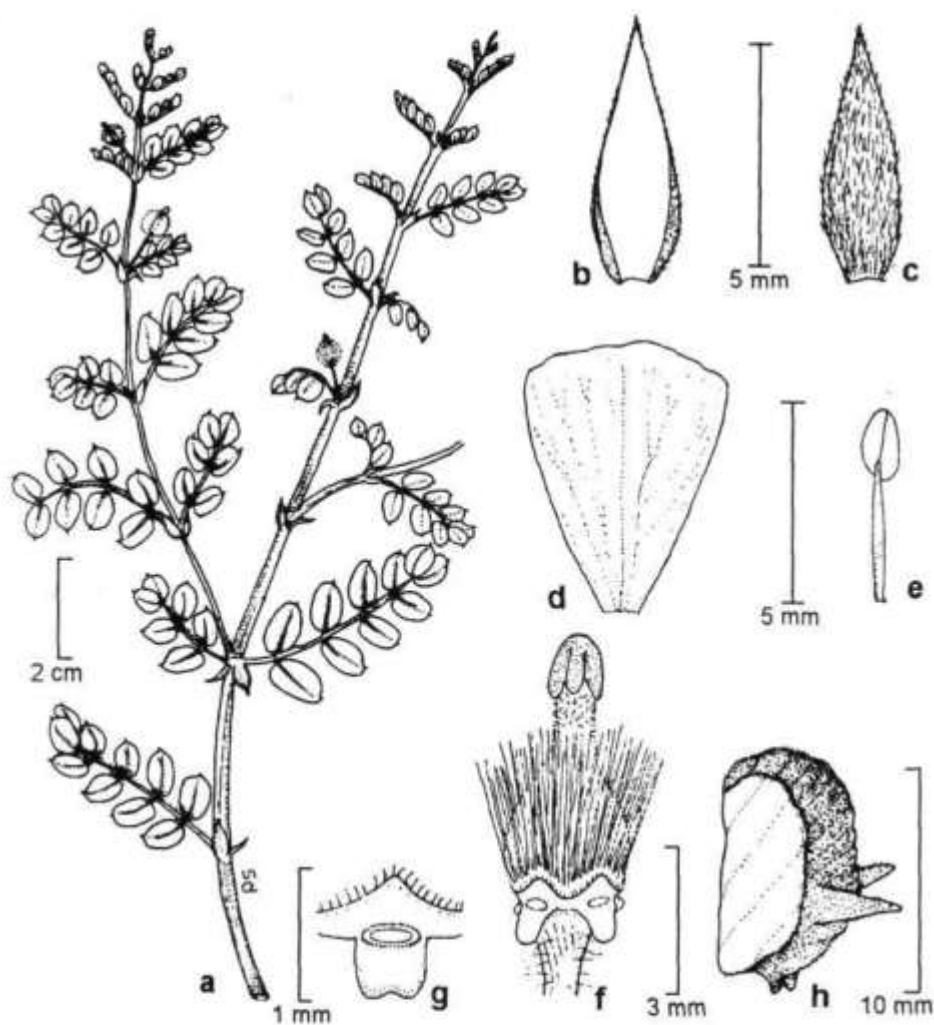


Fig. 18. *Tribulus subramanyamii* P. Singh, Giri & V. Singh : a. habit; b. sepal - ventral surface; c. sepal - dorsal surface; d. petal; e. stamen; f. gynoecium; g. intra and extra-staminal glands; h. mericarp - side view.

Notes. This is an exceedingly variable species in both vegetative and reproductive characters. Hadidi in Rech. f., Fl. Iran. No. 98: 15 - 18. 1972 recognised 4 varieties under this species viz. i) var. *orientalis* (Kerner) G. Beck., ii) var. *robustus* (Boiss. & Boe) Boiss., iii) var. *bicornutus* (Fischer & Mey) Hadidi and iv) var. *inermis* Boiss.; but the characters used for separating them are overlapping and variable. Hence not recognised here.

Chromosome no. $2n = 12, 24 - 36, 48$ (Fedorov, Chorm. Numb. Fl. Pl. 727. 1974); $n = 16$ (Sarkar et al. in Taxon 26: 443. 1977).

Uses. Young leaves and stems are used as vegetables. Fruits are used as tonic, aphrodisiac, diuretic, and are useful in cases of kidney diseases, chronic cystitis and gonorrhoea.

8. *Zygophyllum* L.

Annuals or perennials, prostrate or erect, undershrubs or herbs. Leaves opposite, palmately uni- or trifoliolate, fleshy, rarely simple to many-foliolate; leaflets flat or cylindrical; stipules 2, often spiny. Flowers solitary, axillary, pedicellate, white or yellow, with red or purple spots at base. Sepals 4 - 5, deciduous or persistent, imbricate. Petals 4 - 5, clawed, spatulate, imbricate and contorted. Disk, fleshy, angled, cup-shaped or concave. Stamens 8 - 10, inserted on disk, longer than petals; filaments filiform, usually with a scaly appendage at base; anthers oblong-ovate. Ovary angular, 4 - 5-locular, each locule with 2 or more pendulous ovules; styles angular; stigma small. Capsules 4- to 5-angled or -winged, indehiscent or septicidally dehiscent into 5 cocci or loculicidally 5-valved; seeds 1 to many in each locule; cotyledons oblong.

Distrib. About 100 species in deserts and steppes of Russia, Asia, Mediterranean region, Africa and Australia.

Uses. Seeds are collected by nomad tribes of Multan desert and eaten under the name Alathi.

Zygophyllum simplex L., Mant. Pl. 68. 1767; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 424. 1874. *Z. portulacoides* Forssk., Fl. Aegypt.-Arab. 88. 1875. **Fig. 19.**

Guj.: *Alathi, Alethi*; Hindi: *Kuni, Lunwo*; Raj.: *Lunwo*.

Herbs, annual, procumbent to subterete, glabrous, slender, much branched, 10 - 20 cm high; internodes up to 3 cm long, green to purple. Leaves simple, sessile, opposite, unequal, 10 - 20 x 1 - 2 mm, cylindrical, succulent; stipules lanceolate, acute. Flowers ca 5 mm across, yellow; pedicels slender, ca 2 mm long. Sepals 5, cucullate, obovate, obtuse, ca 2 x 1 mm. Petals 5, spatulate, ca 3 x 1 mm, membranous. Disk 10-lobed. Stamens 10, 2 - 3 mm long; staminal scales ca 1 mm long, bipartite; anthers oblong. Ovary ca 1 mm across, 5-loculed; style angular, ca 1 mm long, persistent; stigma minute. Capsules

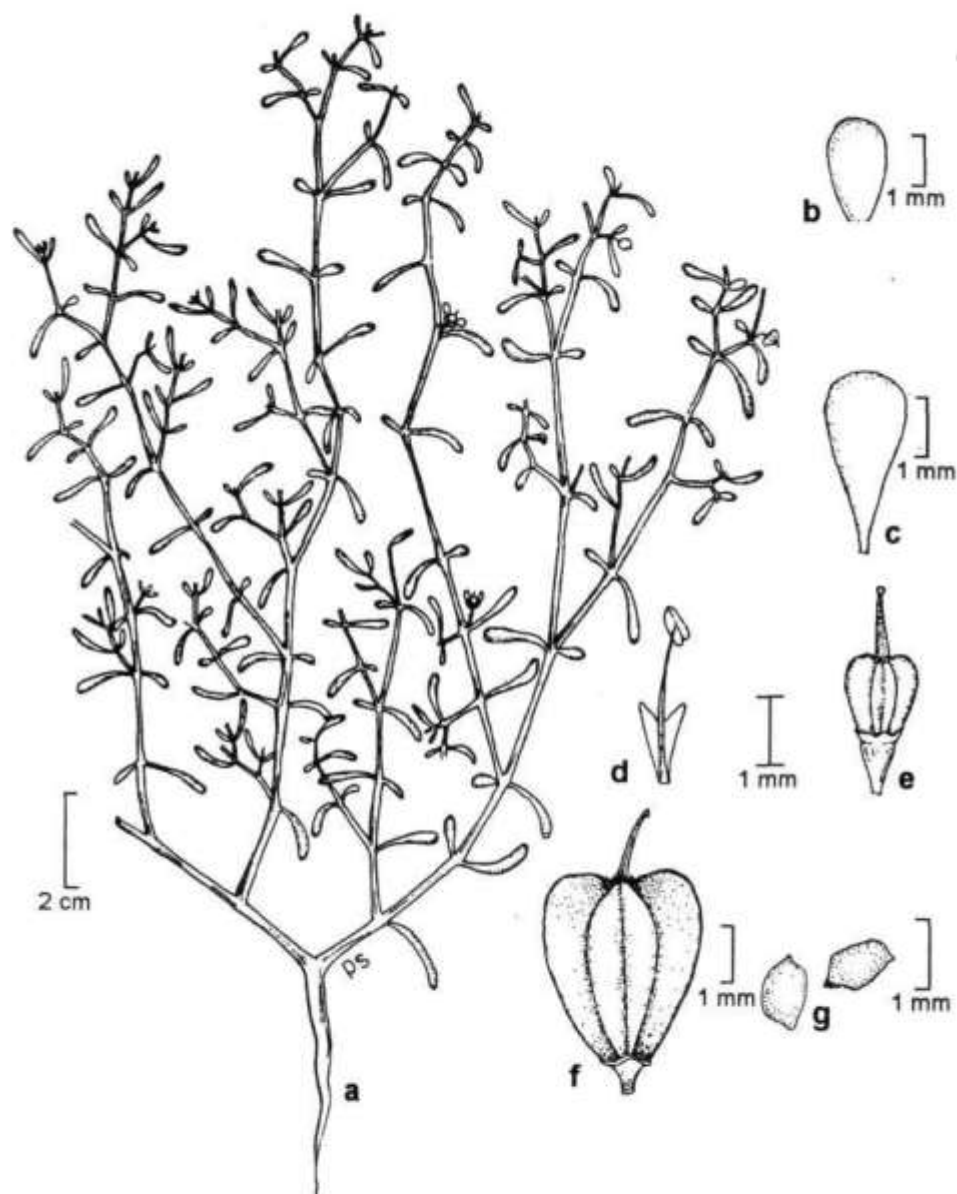


Fig. 19. *Zygophyllum simplex* L. : a. habit; b. sepal; c. petal; d. stamen; e. gynoecium; f. capsule; g. seeds.

turbinate, 5-angled, ca 3 mm across, rugulose, septicidally dehiscent into 5 cocci; seeds 2 - 3 per coccus, plano-convex, acute at both ends, brown.

Fl. & Fr. Aug. - Jan.

Distrib. India: Haryana, Rajasthan and Gujarat.

Pakistan, Afghanistan, Iran, Arabia to N. Africa & Namibia.

Chromosome no. $2n = 20$ (Fedorov, Chrom. Numb. Fl. Pl. 727. 1974, $n = 8$ (Eid in Taxon 19: 265. 1970).

CULTIVATED SPECIES

Quaicum officinale L.

A small tree with bluish purple flowers fading to white. Capsules compressed, winged, orange-yellow.

Commonly cultivated in gardens.

Native of S. America and West Indies.

EXCLUDED SPECIES

Edgeworth & J.D. Hooker (in Flora of British India 1: 423. 1874) reported *Tribulus cistoides* L. from Bengal and Western Peninsula. There are only 4 herbarium sheets of this taxon, deposited in CAL, BSI and MH. These collections are from plants grown in Botanic Garden, Howrah and probably introduced by W. Hamilton in 1799 from America (Roxburgh, Hort. Beng. 33. 1814).

No one has reported its occurrence in wild in India.

BIEBERSTEINIACEAE

(C.L. Malhotra)

Herbs, perennial, glandular, occasionally stemless with tuberous rhizomes. Leaves pinnate or paripinnate or sect; stipules usually much divided. Flowers in racemes or panicles. Sepals 5, imbricate. Petals 5, often denticulate at apex, imbricate. Stamens 10; filaments united into a ring at base with 5 alternipetalous glands. Ovary deeply 5-lobed, 5-locular; styles 5, connate above to form a capitate stigma, gynobasic, arising from base of lobes. Fruit of 5 indehiscent 1-seeded carpels separating from axis.

Allied to the Geraniaceae from which they differ in having flowers in spikes or racemes, stamens 10, stigma united, capitate, style gynobasic and fruits not beaked.

S.E. Europe to C. Asia and the Himalayas; one genus and 5 species; one species in India.

Biebersteinia Stephen ex Fischer

Biebersteinia odora Stephen ex Fischer in Mem. Soc. Imp. Naturalistes Moscou 1: 89. t. 9. 1806, non Royle 1834. *B. emodi* Jaub. & Spach, Ill. Pl. Orient. 2: 109. 1846; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 427. 1874. Fig. 20.

Ladakh: *Shekavpa*.

Herbs, suffrutescent, 10 - 40 cm high, glandular-pubescent; rootstocks tufted. Leaves 6 - 15 cm long, pinnatisect, linear with 12 - 18 pairs of small, broad irregularly lobed leaflets; lobes pinnatifid, 4 - 18 mm long; cauline leaves small. Flowers racemose, ca 10.5 mm across; bracts leafy, ovate-oblong, 4 - 6 mm long; bracteoles 2, lanceolate-ovate; pedicels equalling calyx, glandular-hairy. Sepals elliptic-oblong, 7 - 9 mm long, glandular-pubescent. Corolla yellow-orange in centre; petals nearly orbicular, narrow at base, sparsely ciliate. Filaments hairy. Styles slender, united at apex. Nutlets ca 3 mm long, rugose.

Fl. & Fr. July - Aug.

Distrib. India: Alpine regions of W. Himalayas, in dry rocky areas, 4300 - 5600 m.

W. Tibet.

Notes. This species resembles a *Potentilla* in many respects, and has a spicy odour.

Uses. In Ladakh an aqueous extract of powdered aerial part is used externally to cure ophthalmic diseases.

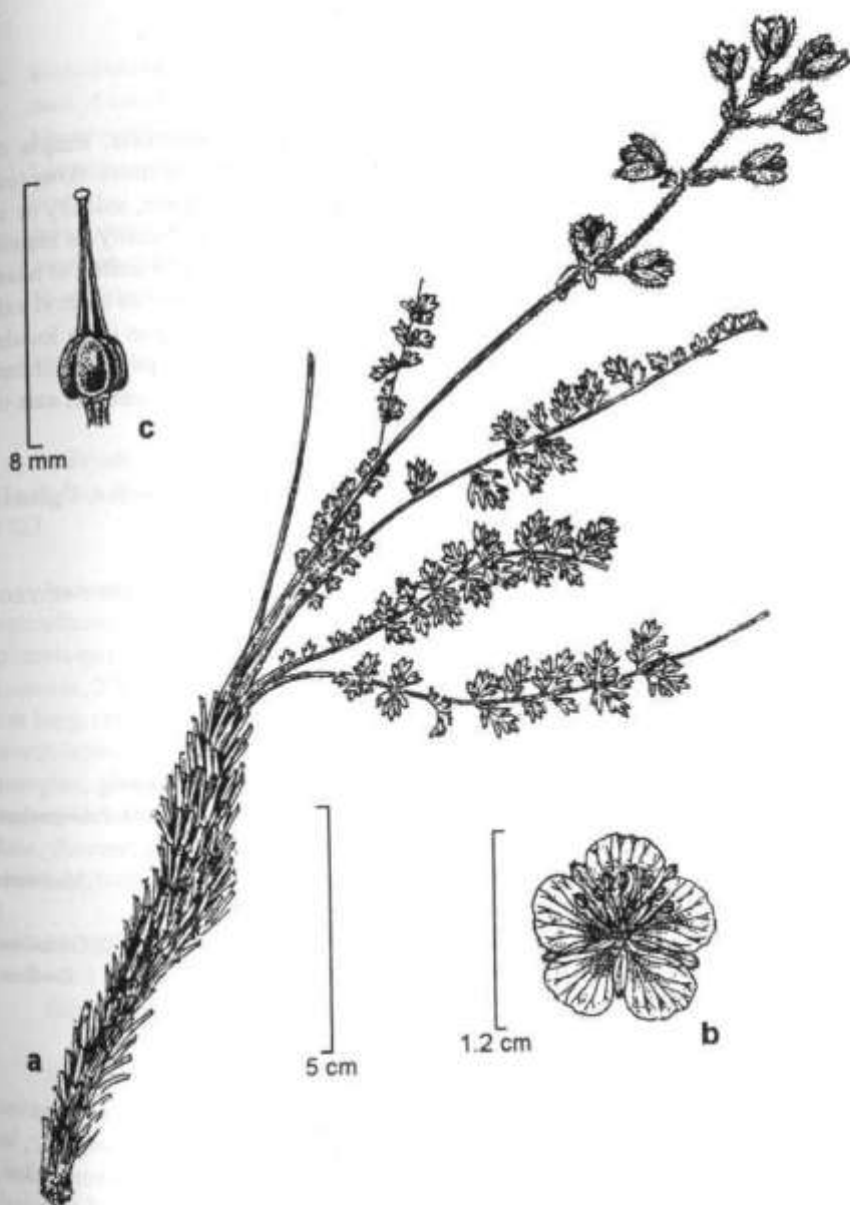


Fig. 20. *Biebersteinia odora* Stephen ex Fischer : a. habit; b. flower; c. sepal.

GERANIACEAE

(C.L. Malhotra)

Herbs, annual, biennial or perennial. Leaves opposite or alternate, simple or compound; stipules usually 2. Peduncles usually solitary or axillary, 1- or more-flowered. Flowers often showy, bisexual, usually regular, rarely irregular, axillary, solitary or in pairs, racemose or in umbel-like clusters. Sepals 5, free. Petals as many as sepals. Stamens 10 or 5; alternate ones antherless in *Erodium*; filaments free or united at base; anthers 2-celled, versatile. Carpels free; ovary 5-lobed; styles 5, adnate to central axis or partially united; stigma terminal, linear or capitate; ovules 4 - many in each locule. Fruits capsular, breaking up when ripe into 5 distinct, 1-seeded mericarps, often united to long-awned or opening by 5 valves; seeds few to many, attached to central axis of capsule.

Cosmopolitan, many are garden favourites; 5 genera and ca 750 species; 4 genera and 45 species in India including 11 cultivated species.

Literature. NASIR, Y.J. (1983). Geraniaceae. In: NASIR, E. & S.J. ALI, Fl. Pakistan 149: 1-43. YEO, P.F. (1986). Hardy Geraniums.

KEY TO THE GENERA

- | | |
|---|-----------------------|
| 1a. Flowers zygomorphic; posterior sepal produced into a slender nectariferous spur at base | 4. Pelargonium |
| b. Flowers actinomorphic; posterior sepal not produced into a spur | 2 |
| 2a. Perfect stamens 15, pentadelphous (5 sets of 3 stamens each) | 3. Monsonia |
| b. Perfect stamens 5 - 10, not pentadelphous | 3 |
| 3a. Leaves not longer than broad; stamens 10; stylar axis coiling upwards | 2. Geranium |
| b. Leaves longer than broad; stamens 5; stylar axis spirally twisted below | 1. Erodium |

1. *Erodium* L'Her. ex Aiton

Herbs, rarely undershrubs with branches swollen or jointed at nodes. Leaves opposite, often alternate, lobed or pinnatisect, stipulate. Flowers usually regular, in axillary 1 - 2-flowered or umbelliferous peduncles. Sepals 5, alternate with 5 staminodes. Ovary 5-lobed, 5-locular, long-beaked in fruit; styles 5. Capsules 5-lobed, 5-locular; locules 1-seeded. Carpels indehiscent, separating septically from axis, their beaks elastically coiling upwards from base to apex of axis, hairy on inner surface. Mericarps usually with 2 apical pits; seeds non-endospermous.

About 90 species in Europe, Mediterranean region, C. & S.W. Asia, Australia and tropical S. America; 5 in India.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Beak of mericarps plumose on ventral face with long soft cilia | 3. <i>E. oxyrrhynchum</i> |
| b. Beak of mericarps ventrally clothed with rigid setae that disappear towards tip | 2 |
| 2a. Leaves velvety beneath; sepals not awned; mericarps not pitted below beak | 5. <i>E. tibetanum</i> |
| b. Leaves not velvety beneath, shortly pubescent; sepals awned or mucronate; mericarps pitted below beak | 3 |
| 3a. Sepals awned; filaments toothed on one side | 4. <i>E. stephanium</i> |
| b. Sepals mucronate; filaments glabrous, not toothed | 4 |
| 4a. Most of the leaflets divided less than half-way to midnerve; apical pits of mericarps glandular | 2. <i>E. moschatum</i> |
| b. Most of the leaflets divided less than half-way to mid-nerve; apical pits of mericarps eglandular | 1. <i>E. cicutarium</i> |

1. *Erodium cicutarium* (L.) L'Her. ex Aiton, Hort. Kew. 2: 414. 1789; Edgew. & Hook.f. in Hook. f., Fl. Brit. India 1: 434. 1874. *Geranium cicutarium* L., Sp. Pl. 618. 1753. Fig. 21.

Annuals, 4 - 40(-60-120) cm high, erect or straggling, glandular-pubescent or eglandular. Leaves pinnatisect, 20 - 50 x 8 - 27 mm, glandular-pubescent; segments pinnati-partite or-sect into small acute lobes; stipules ovate-lanceolate, sometimes connate, 2.5 - 5 mm long, scarious, ciliate-pubescent. Peduncles 2 - 8-flowered, 1.5 - 6.5 cm long, reflexed in fruits, patent-glandular; bracts ovate, acute, connate, ciliate. Sepals ovate-lanceolate, apiculate, 3 - 4 mm long, up to 6 mm in fruits, membranous along margins, glandular-pubescent. Petals scarcely exceeding sepals, ciliate, apex 1 - 2-se-tose. Filaments dilated at base, ca 2.5 mm long, sparsely pubescent; staminodes lanceo-late, shorter, glabrous. Beak 2.5 - 3.5 mm long, appressed-pubescent. Mericarps ca 5.5 mm long with bristle-like suberect yellow hairs, faintly furrowed below pits.

Fl. & Fr. March - April.

Distrib. India: Punjab to Simla.

Pakistan, Europe, N. Africa, S.W. & C. Asia, temperate N. Asia and Siberia.

Uses. Young foliage is eaten raw or cooked. It is reported to be used as uterine sedative and haemostatic.

2. *Erodium moschatum* (L.) L'Her. ex Aiton, Hort. Kew. 2: 414. 1789; Fyson, Fl. Nilgiri Pulney Hill-tops 1: 53. 1915. *Geranium moschatum* L., Sp. Pl. 680. 1753.

Annuals or biennials with smell reminiscent of musk; stems 10 - 50 cm, hispid with usually deflexed hairs. Leaves oblong-lanceolate, up to 20 cm long, pinnate almost throughout their length; leaflets ovate. Umbels 5 - 12-flowered; bracts several, broadly



Fig. 21. *Erodium cicutarium* (L.) L'Her. ex Aiton : habit.

ovate, pale brown. Sepals 6 - 9 mm long. Petals ca 15 mm long, violet or purple. Mericarps 5 - 6 mm long, hairy with wide apical pits; beak 20 - 45 mm long.

Fl. & Fr. June - Oct.

Distrib. India: Frequently naturalized or casual everywhere; probably as a garden escape.

S. & W. Europe.

Uses. Leaves are edible; tincture of leaves is an excellent local application in sore throat and ulceration of mouth.

3. *E. oxyrrhynchum* M. Bieb., *Fl. Taur.-Cauc.* 2: 133. 1808.

Stems ascending, diffuse, yellowish brown, appressed-tomentose-pubescent. Leaves greenish-grey or greyish white, glabrous or appressed-villous; stipules wedge-shaped, 1.5 - 2 mm long, brown-ciliate. Peduncles 1 - 6 cm long, (1-) 2 - 3-flowered, appressed-pubescent; bracts similar to stipules. Sepals elliptic-lanceolate or broadly lanceolate, 4 - 6 mm long, 3-nerved, aristate, membranous along margins, pilose or tomentose. Petals slightly longer than sepals, deciduous, ovate, ciliate at base, pink-purple. Filaments 3 - 4 mm long, more or less glabrous or ciliate; staminodes small, with 2 - 3 aristae at apex. Mericarps ca 5.5 mm long with dense stiff hairs; pit apical with a solitary groove; beak 6 - 9 cm long, pubescent.

KEY TO THE VARIETIES

- | | |
|--|---|
| 1a. Leaves greenish-grey, not appressed-villous; filaments not ciliate | 3.2. subsp. <i>oxyrrhynchum</i> |
| b. Leaves greyish-white, appressed villous; filaments ciliate | 3.1. subsp. <i>bryoniifolium</i> |

3.1. subsp. *bryoniifolium* (Boiss.) Schon.-Tem. in *Rech.f.*, *Fl. Iran.* 69: 43. 1970. *E. bryoniifolium* Boiss., *Diagn. Pl. Orient. Nov. ser. 1.* 1: 61. 1844.

Differs from subsp. *oxyrrhynchum* in having shorter stems; bigger greyish white and appressed-villous leaves; less divided, cordate-ovate, crenate-subentire basal leaves and ciliate filaments.

Fl. & Fr. April - May.

Distrib. India, Sinai, Jordan, Iraq, Turkey, C. Asia, Afghanistan, Baluchistan, Bal-tistan, N. Africa, Arabia and Pakistan (Punjab beyond the Indus in Bannu).

3.2. subsp. *oxyrrhynchum*

Fl. & Fr. April - May.

Distrib. India, Sinai, Jordan, Iraq, Iran, Turkey, C. Asia, Afghanistan, Baluchistan and Baltistan.

4. *Erodium stephanianum* Willd., Sp. Pl. 3: 625. 1800; Edgew. & Hook.f. in Hook. f., Fl. Brit. India 1: 434. 1874.

Annuals, up to 40 cm high, pubescent to pilose; branches diffuse. Leaves 2-pinnatisect; segments pinnatifid-partite into linear acute lobes; stipules lanceolate, cuneate, acute, 5 - 7 mm long, ciliate. Peduncles 2 - 5-flowered; bracts similar to stipules but smaller, reflexed, scarious. Sepals lanceolate, oblong, 5 mm long, up to 7 mm in fruits, 5-nerved, hairy on nerves, broad along margins, membranous; awn 2.5 - 3 mm long. Petals broadly ovate, as long as sepals, pink nerves ciliate at base. Filaments 4 - 4.5 mm long, dilated at base, 2-toothed, ciliate. Beak 2.3 - 3.5 cm long, appressed-pubescent. Mericarps ca 6 mm long, white, setose with 2 pits.

Fl. & Fr. June - July.

Distrib. India: Kashmir.

Afghanistan, Pakistan, Tibet, C. Asia, W. Siberia and Mangolia.

5. *Erodium tibetanum* Edgew. & Hook.f., in Hook. f., Fl. Brit. India 1: 434. 1874.

Fig. 22.

Annuals, hoary, stemless. Leaves oblong-ovate, more or less inciso-crenate, 3-fid, velvety beneath; stipules obovate, cuneate, obtuse, not awned, scarious, ciliate. Peduncles shorter than leaves, 2- or more-flowered; bracts ciliate. Sepals pubescent with a small knob in place of a mucro. Petals elliptic, longer than sepals. Ovary silky, stipitate, not pitted, with stiff white hairs, split on back. Beak 17 - 25 mm long, 3 - 4 times the length of cell, rough on outer side, on inner side with long brown hairs and a few setae, hairy at apex.

Fl. & Fr. Aug. - Sept.

Distrib.: India: Kashmir(Ladakh).

W. Tibet.

2. *Geranium* L.

Herbs, erect, diffuse or procumbent, annual or perennial; joints swollen. Leaves opposite, petiolate, orbicular and palmately lobed or of triangular outline and divided

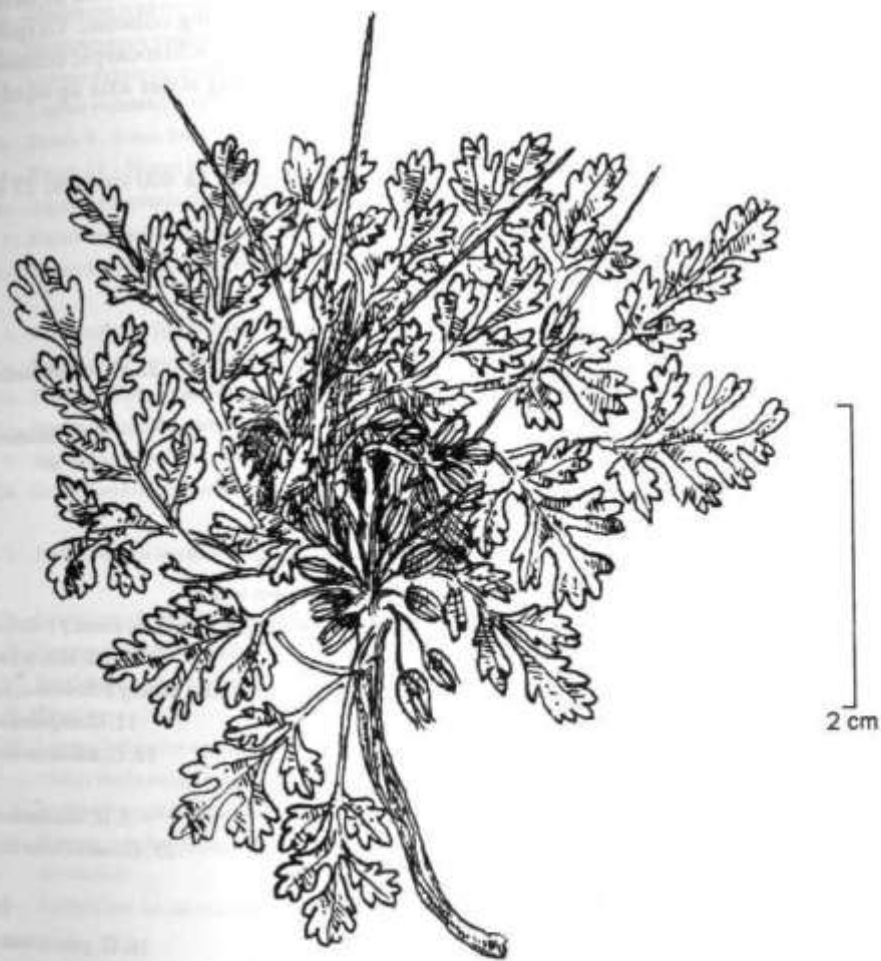


Fig. 22. *Erodium tibetanum* Edgew. Hook.f. : habit.

to base into 3 or 5 pinnatifid segments. Peduncles 1 - 2-flowered, axillary, bracteate. Flowers bisexual, regular, usually 5-merous. Sepals 5, free, ending in a short pointed tip. Petals 5, free, clawed, alternate with 5 nectariferous glands. Stamens (5-)10, 5 long and alternate with 5 short ones; staminodes occasional; filaments flattened, united at base. Receptacle prolonged upwards into a persistent 5-grooved tapering column. Carpels usually 5, adnate, separating septifragally from central axis. Fruits schizocarpic consisting of 5 mericarps which remain attached to an elastically coiling styler axis upwards; mericarps without apical pits.

Mainly distributed in the N. Hemisphere but also in tropics; ca 400 species; 27 in India.

KEY TO THE SPECIES

- | | |
|--|-----------------------------------|
| 1a. Leaves divided to base; discharged mericarps plumed | 21. <i>G. robertianum</i> |
| b. Leaves not divided quite to base; mericarps not plumed | 2 |
| 2a. Ribs of sepals carinate and with transverse inter-connections | 8. <i>G. lucidum</i> |
| b. Ribs of sepals neither carinate nor with transverse inter-connections | 3 |
| 3a. Calyx without glandular hairs | 4 |
| b. Calyx with glandular hairs | 8 |
| 4a. Sepals (including mucro) 5 - 6(-7) mm long; petals less than 10 mm long | 5 |
| b. Sepals (including mucro) 6.5 mm long or more; petals more than 11 mm long | 6 |
| 5a. Leaf-segments narrow, rhomboid, acute; inflorescence more or less diffuse; peduncles usually 1-flowered; sepal-awn 1 - 2 mm long | 24. <i>G. sibiricum</i> |
| b. Leaf-segments broad, rhomboid, obtuse-acute; inflorescence diffuse; peduncles usually 2-flowered; sepal-awn less than 1 mm long | 11. <i>G. nepalense</i> |
| 6a. Peduncles 1-flowered | 10. <i>G. nakaoanum</i> |
| b. Peduncles 2-flowered | 7 |
| 7a. Leaf-divisions subtruncate; stipules free | 5. <i>G. donianum</i> |
| b. Leaf-divisions acute or acuminate; stipules united in pairs | 27. <i>G. wallichianum</i> |
| 8a. Sepals (including mucro) less than 9 mm long | 9 |
| l. Sepals (including mucro) more than 10 mm long | 18 |
| 9a. Leaf-divisions tapered distally; stigmas 3.5 - 4.5 mm long | 16. <i>G. procurrens</i> |
| b. Leaf-divisions subtruncate; stigmas less than 1.5 mm long | 10 |
| 10a. Annuals | 13 |
| b. Perennials | 11 |
| 11a. Rhizomes elongated; peduncles bearing clusters of flowers amongst uppermost involucre-like leaves | 14. <i>G. polyanthes</i> |
| b. Rhizomes tuberous; peduncles not bearing clusters of flowers amongst uppermost leaves | 12 |
| 12a. Plants 30 - 60 cm high; petals 13 - 15 mm long; filaments densely long-ciliate; beak ca 2.5 cm long | 26. <i>G. tuberaria</i> |
| b. Plants up to 25 cm high; petals 8 - 11 mm long; filaments pubescent; beak ca 1.2 cm long | 1. <i>G. charlesii</i> |

- 13a. Petals with relatively larger black basal spot 12. *G. ocellatum*
 b. Petals without basal spot 14
- 14a. Mericarps hairy, not extensively ribbed 15
 b. Mericarp hairless, closely ribbed 17
- 15a. Mericarps transversely rugose, separating without a styler beak 4. *G. divaricatum*
 b. Mericarps not transversely rugose and with long styler beak 16
- 16a. Leaves orbicular-reniform, crenate; seeds prominently reticulate 22. *G. rotundifolium*
 b. Leaves palmatifid or -partite into 3 - 7, seeds smooth 17. *G. pusillum*
- 17a. Petals 4 - 6 mm long 9. *G. molle*
 b. Petals 14 - 16 mm long 20. *G. regelii*
- 18a. Sepals and petals slightly reflexed; petals 2 - 3 times as long as broad 19. *G. refractum*
 b. Sepals and petals subpatent; petals not more than 1 times as long as broad 19
- 19a. Stamens densely clothed with long white hairs; gynoecium blackish; stigmas ca 5 mm long 7. *G. lambertii*
 b. Stamens with fine forwardly directed hairs; gynoecium pinkish; stigmas 2.5 - 4 mm long 20
- 20a. Stems erect or ascending; pedicels short, deflexed in fruits 21
 b. Stems diffuse-ascending; pedicels long, spreading 23
- 21a. Stems ascending; petals up to 28 mm long; ripe fruits 40 - 47 mm long 6. *G. himalayense*
 b. Stems erect; petals not more than ca 20 mm long; ripe fruits not more than 38 mm long 22
- 22a. Inflorescence compact; pedicels shorter than calyx; flowers 3.5 - 4.5 cm across; immature fruits reflexed 15. *G. pratense*
 b. Inflorescence lax with longer pedicels; flowers 4.2 - 4.8 cm across; immature fruits slightly nodding 2. *G. clarkei*
- 23a. Leaves much deeply dissected; segments narrow, 4 - 5 mm broad 13. *G. pamicum*
 b. Leaves not much deeply dissected; segments more than 5 mm broad 24
- 24a. Petal-base pubescent on adaxial surface 25. *G. swatense*
 b. Petal-base ciliate 25
- 25a. Leaves orbicular-angled, 5 - 7-palmate-partite; sepal-awn 1 - 2 mm long; petals lilac-rose, sometimes white; seeds ca 2.5 mm long 3. *G. collinum*
 b. Leaves 5-angled; sepal-awn 2 - 4 mm long; petals pink; seeds ca 3 mm long 26
- 26a. Leaves membranous; stipules rarely 2-fid; pedicels and peduncles appressed-pubescent (rarely sparse-glandular) 18. *G. rectum*
 b. Leaves not membranous; stipules often 2-fid; pedicels and peduncles with stiff erect glandular hairs 23. *G. rubifolium*

1. *Geranium charlesii* (Aitch. & Hemsley) Vved. ex Nevski, in Acta Bot. Acad. Sci. URSS, ser. 1. 4: 304. 1937. *G. tuberosum* L. var. *charlesii* Aitch. & Hemsley in Bot. Mag. ser. 3. 42: 6910. 1866.

Herbs, perennial, ca 20 cm high; stems slender, ascending, branched. Basal leaves absent; cauline ones more or less orbicular, 1 - 3 cm, palmatifid. Petals 8.5 - 12 mm long. Beak 11 - 12 mm long.

Fl. & Fr. April-May.

Distrib. India: Kashmir (Chitral).

Afghanistan, Pamir (S. Alaj).

Related to *G. tuberaria* but differs from it in smaller size, smaller petals and beak, leaves less divided and filaments not dense-ciliate (vide, Nasir, in Nasir & S.J. Ali, *Fl. Pakistan* 149: 1 - 43. 1983).

2. *Geranium clarkei* Yeo, *Hardy Geraniums* 188. 1986.

Perennials with moderately stout rootstocks and creeping underground rhizomes. Basal leaves 5 - 15 cm across, 7-partite nearly to base; divisions attenuate both ways from about middle, deeply pinnately lobed; lobes mostly 2 - 3 times as long as broad with one or two teeth; teeth and tips of lobes acute. Peduncles 1.5 - 8 cm long; pedicels about as long as calyx or longer. Flowers inclined upwards, less shallow than in *G. pratense*. Sepals 1 - 3 mm long with 1.5 - 2.5 mm long mucro. Petals 22 - 29 x 18 - 22 mm, purplish-violet or white with lilac-pink nerves. Stamens shorter than sepals. Immature fruits slightly nodding on spreading pedicels. All other details like that of *G. pratense*.

Fl. & Fr. June - Aug.

Distrib. India: Kashmir, 2100 - 4200 m.

Endemic.

3. *Geranium collinum* Stephan ex Willd., *Sp. Pl.* 3: 705. 1800. *G. aconitifolium* sensu Edgew. & Hook. f. in Hook. f., *Fl. Brit. India* 1: 429. 1874, non L' Her. 1787-88.

Herbs, perennial, 15 - 60 cm high; rhizomes elongated; stems 15 - 25 cm long, divaricate, retrorsely pubescent or glandular. Leaves orbicular, 1.5 - 8 cm, 5 - 7-lobed up to below the middle; segments cuneate, obtusely 3 - 5-lobed; petioles of lower leaves up to 13 cm long; stipules subulate-lanceolate, entire, 5 - 7 mm long, pubescent. Peduncles 3 - 15 cm long, ascending, recurved. Sepals elliptic-oblong, 6 - 9 mm long, 3 - 5-nerved, pubescent or glandular-hairy; awn 1 - 2 mm long. Petals ovate, 1.4 - 2 cm long, lilac-rose, sometimes white; claw ciliate. Mericarps pubescent or glandular-pubescent; seeds oblong, ca 2.5 mm long, minutely reticulate, brownish-black.

Fl. & Fr. July - Aug.

Distrib. India: N.W. Himalayas.

C. & S. Russia, W. Siberia, Turkey, Iran, Caucasus, C. Asia and Afghanistan.

4. *Geranium divaricatum* Ehrh. in *Beitr. Naturk.* 7: 164. 1792.

Herbs, annual, branched, 20 - 60 cm high. Lower cauline leaves pentagonal, 3 - 10 cm broad, palmately dissected nearly to base into 5 rhombic, largely and obtusely incised, dentate lobes, appressed-hirsute, sometimes glandular-hairy along margins; petioles and peduncles with long thin spreading hairs and short glandular ones. Peduncles 1.5 - 5 cm long with 2 spreading pedicels; bracts linear-lanceolate. Sepals ovate, short-awned, dorsally and marginally hispid. Petals 6 - 8 mm long, slightly longer than sepals, pale-pink with more brightly coloured nerves. Beak rough-hairy. Mericarps transversely rugose, hairy above and along wrinkles; seeds nearly smooth.

Fl. & Fr. May - July.

Distrib. India: Kashmir.

Europe, Iran.

Shrubby formations along forest edges and sometimes along rocky shady places, often in parks and shady places or as a weed.

5. *Geranium donianum* Sweet, Geraniaceae 4: sub t. 338. 1826; H. Hara in Fl. Pl. Nepal Himal. 168. 1955 & in Fl. E. Himal. 3: 72. 1975. *G. collinum* sensu Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 429. 1874, p.p. *G. multifolium* D. Don, Prodr. Fl. Nepal. 207. 1825, non Sweet, 1825.

Herbs, slender, straggling, excessively branched, annual, glandular-hairy. Leaves orbicular or reniform, 1 - 5 cm, minutely pubescent, palmatifid or -partite or -lobed; lobes cuneate, 3 - 5-fid; upper cauline leaves sometimes ternate and with smaller stipules. Peduncles sometimes clustered and subumbelled, otherwise axillary and 1-flowered. Flowers 1 - 1.5 cm across. Sepals apiculate, 4 - 4.5 mm long, rigid after flowering. Petals obovate, broadly obcordate, twice as large as sepals, rose-coloured with a dark-purple eye. Fruits ca 2 cm long, erect; beak 7 - 15 mm long; mericarps transversely smooth; seeds 1.5 - 2 mm long, minutely reticulate.

Fl. & Fr. June - Aug.

Distrib. India: E. Himalayas, Sikkim.

Nepal, Bhutan, S. Tibet and S.W. China.

6. *Geranium himalayense* Klotzsch, Bot. Ergebn. Reise Waldemar 122, t. 16. 1862. *G. grandifolium* sensu Edgew. in Trans. Linn. Soc. London 20: 42. 1846, non L. 1753. *G. pratense* sensu Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 429. 1874, p.p., non L. 1753. *G. palustre* sensu Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 430. 1874, non L. 1753.

Herbs, perennial, pubescent with retrorse hairs. Leaves pentagonal, palmately 5-lobed; lobes rhomboid, pinnately incised, acute; stipules subulate-lanceolate, 6 - 9 mm long; petioles of radical leaves up to 23 cm long; uppermost cauline leaves sessile. Peduncles 3 - 14 cm long, 2-flowered, long-glandular-hairy, sometimes retrorsely pubescent; bracts similar to stipules. Flowers 3 - 3.5 cm across. Sepals ovate-lanceolate, 8 - 10 mm long, awned; awns 1.5 - 2.5 mm long. Petals obovate, rounded, 1.6 - 2.2 cm long; claw ciliate. Mericarps ca 4 mm long, glandular-pubescent; beak 0.8-2.2 cm long, glandular-pubescent; seeds minutely reticulate.

Fl. & Fr. July - Aug.

Distrib. India: N.W. temperate Himalayas.

Afghanistan.

7. **Geranium lambertii** Sweet, *Geraniaceae* 4: t. 338. 1827. *G. eriostemon* D. Don, *Prodr. Fl. Nepal.* 208. 1825, non Fischer ex DC. 1824. *G. grevilleanum* Wallich, *Pl. Asiat. Rar.* 3: 4. t. 209. 1831; Edgew. & Hook. f. in Hook. f., *Fl. Brit. India* 1: 430. 1874, p.p. *G. backhonsianum* Regel, *Descr. Pl. Nov.* 1: 32. 1873.

Herbs, 30 - 70 cm high, ascending, pubescent. Leaves reniform, 5.5 - 11 cm across, palmatipartite, 5-angled; lobes rhomboid, cuneate; lamina pubescent-villous; stipules broadly lanceolate, 9 - 14 mm long, pubescent to sparsely villous, sometimes 2-fid at apex; petioles up to 7 cm long, densely villous at base of lamina. Peduncles pubescent, glandular-hairy; bracts lanceolate, 7 - 14 mm long. Flowers 4 - 6 cm across, nodding. Sepals elliptic-ovate, glandular-hairy especially on nerves; awn ca 1 mm long. Petals 1.5 - 2 cm long, villous at base, pale pink or rarely white with purple nerves. Filaments 0.8 - 1.1 cm long, villous. Ovary black when dry.

Fl. & Fr. June - July.

Distrib. India: Himalayas.

C. Nepal to Bhutan and adjacent parts of Tibet.

8. **Geranium lucidum** L., *Sp. Pl.* 682. 1753; Edgew. & Hook.f. in Hook. f., *Fl. Brit. India* 1: 433. 1874. Fig. 23.

Herbs, suberect, branched, annual, glabrous to subglabrous, brittle; stems 10 - 30 cm, ascending, often with bright red branches. Leaves suborbicular to reniform, 1 - 4 cm broad, 5 - 7-lobed; lobes 5-fid, short, broadly cuneate, mucronate, broadly lanceolate, 1.5 - 2.5 mm long, glabrous; petioles and peduncles unilaterally pubescent. Peduncles longer than petioles; pedicels with a series of hairs. Flowers solitary or paired, 0.8 - 1.2 cm across. Sepals ovate, acuminate, 5 - 7 mm long, 3-nerved, glabrous, transversely

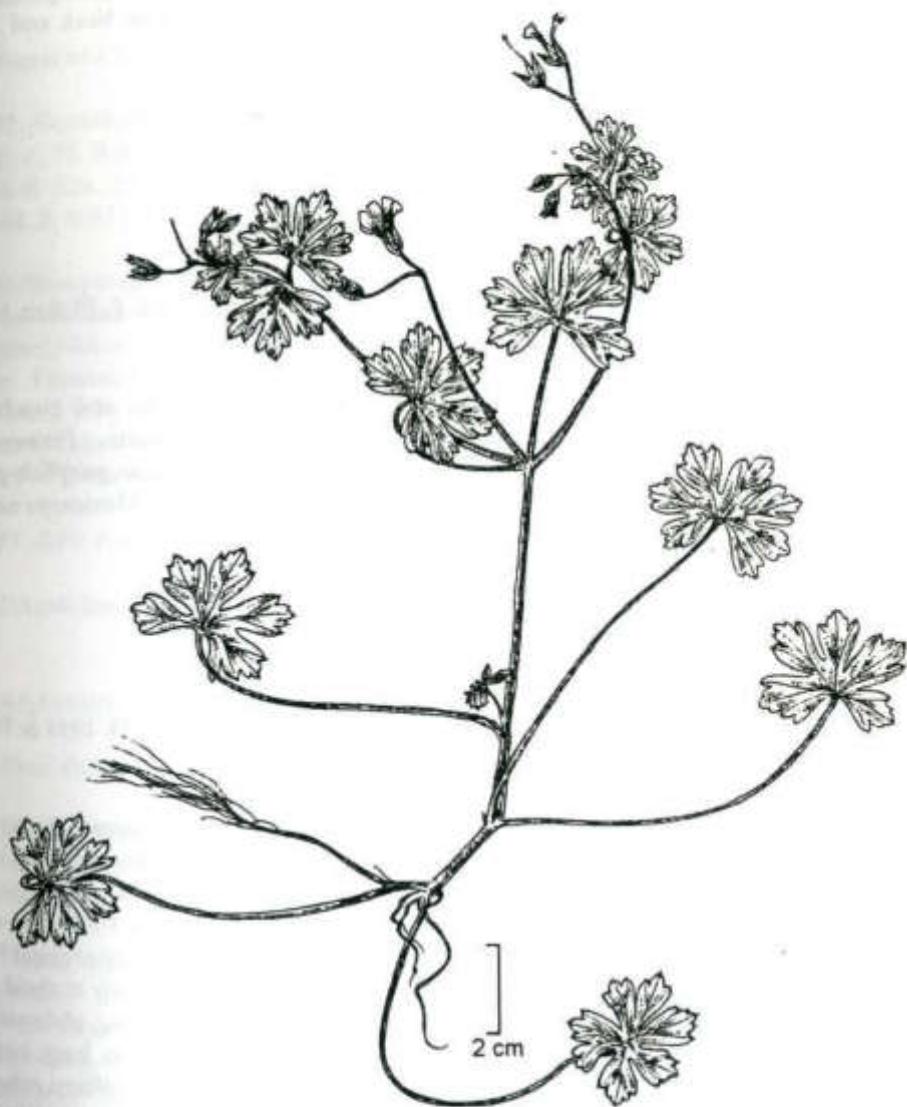


Fig. 23. *Geranium lucidum* L.: habit.

rugose. Petals 8 - 9 mm long, rose-red; claw glabrous. Beak 7 - 8 mm long, very slender. Mericarps keeled, rugose-reticulate, nearly glabrous, separating from beak and axis; seeds oblong, ca 3 mm long, glabrous.

Fl. & Fr. April-June.

Distrib. India: Temperate Himalayas.

N. Africa, Turkey, Iran, Siberia, C. Asia and Afghanistan.

9. *Geranium molle* L., Sp. Pl. 682. 1753; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 432. 1874.

Annuals; stems rather stout, diffuse or ascending, softly villous and glandular. Leaves orbicular, palmately 7 - 9-fid; lobes cuneate, obtusely lobulate. Flowers on axillary peduncles. Petals 3 - 5 mm long, exceeding sepals, ciliate at base, purplish-pink. Filaments glabrous. Carpels obliquely wrinkled. Beak 5 - 8 mm long. Mericarps nearly spherical; seeds smooth.

Distrib. India: Himalayas.

Westward to W. Asia and Europe.

10. *Geranium nakaoanum* H. Hara in Fl. Pl. Nepal Himal. 276. f. 23. 1955 & Fl. E. Himal. 3: 73. 1975.

Herbs, slender, 8 - 15 cm high, becoming brownish on drying; rhizomes 4 - 10 mm across, woody. Radical leaves numerous, long-petiolate; petioles slender, 4 - 15 cm long, becoming glabrous, very minutely dotted-hairy; lamina suborbicular, 2 - 3 cm, deeply cordate and to 3/4 - 9/10 palmate-partite; lobes rhombic-ovate, deeply 3-fid, long-cuneate; segments oblong, 1 - 2-serrulate with sparingly scattered strigose appressed hairs above and minutely pubescent along margins and nerves, very minutely scabrid and becoming glabrous beneath. Stems ascending, slender, up to 12 cm long, glabrescent. Leaves opposite; stipules lanceolate-oblong, acute or obtuse, 3 - 4 mm long, brown, membranous and densely ciliate along margins. Peduncles 1-flowered, axillary, subradical at first, elongate, 5 - 15 cm long, glabrescent; bracts ca 5 mm long, similar to stipules; pedicels shortly retrorse-pubescent. Flowers 2 - 3 cm across. Sepals elliptic, 6 - 7 mm, obtuse at apex, very shortly mucronate, 3-nerved, mucro 0.5 - 0.8 mm long, outer sepals minutely pilose along margins; inner ones somewhat membranous, glabrescent. Petals obovate, 1.2 - 1.6 x ca 0.8 cm, purple inside, spreading-pubescent at base. Lower filaments very long, setose-ciliate. Styles 5, branched, ca 2 mm long.

Fl. & Fr. July.

Distrib. India: E. Himalaya.

Nepal and Bhutan.

11. *Geranium nepalense* Sweet, Geraniaceae 1: t. 12. 1820; Edgew. & Hook.f. in Hook. f., Fl. Brit. India 1: 430. 1874. *G. radicans* DC., Prodr. 1: 639. 1824. *G. affine* Wight & Arn., Prodr. 133. 1834, non Ledeb. 1831. *G. amottianum* Steudel, Nomencl. Bot. ed. 2, 1: 677. 1840. **Fig. 24.**

Diffuse perennials, 15 - 25 cm high with slender rootstocks, pubescent or softly hairy. Leaves orbicular, 3 - 7.5 cm, palmately 3 - 5-lobed; segments equal or subequal, irregularly lobed and toothed, rather dark-green and often purple beneath, brownish above. Flowers 1 - 1.2 cm across, solitary or paired, on long axillary peduncles. Sepals 4.5 - 5 mm long. Petals rounded or slightly notched, 5 - 8.5 mm long, pink with 3 dark purple streaks inside. Anthers violet-blue. Immature fruits erect on reflexed pedicels. Beak 1 - 1.5 cm long. Mericarps 3 - 3.5 mm long.

Fl. & Fr. April - Sept.

Distrib. India: Temperate Himalayas and the Nilgiris on the W. Ghats, 1500 - 2900 m.

Afghanistan, China, Japan and Sri Lanka.

Uses. Roots used for colouring medicinal oils.

12. *Geranium ocellatum* Cambess. in Jacquem., Voy. 4 Inde: 33. t. 38. 1844; Edgew. & Hook.f. in Hook. f., Fl. Brit. India 1:433. 1874. *G. mascatense* Boiss., Diagn. Pl. Orient. Nov. ser. 1. 1: 59. 1842; Raiz., Suppl. Fl. Upper Gang. Plain 36. 1976. **Fig. 25.**

Herbs, diffuse, straggling, 12 - 20(-45) cm, hoary-pubescent. Leaves orbicular or reniform, 1 - 5 cm, palmatifid or partite, 5 - 7-lobed, minutely pubescent, lobes cuneate, 3 - 5-fid; stipules lanceolate or subulate, hairy. Peduncles sometimes clustered and subumbelled, otherwise axillary and 1-flowered. Flowers solitary or paired, 1 - 1.6 cm across, pink with dark-violet centre. Sepals apiculate, 4 - 4.5 mm long, ciliate, rigid after flowering. Petals obovate, broadly obcordate, twice as large as sepals. Filaments glabrous. Beak 7 - 15 mm long. Mericarps ca 2.5 cm long, transversely smooth; seeds 1.5 - 2 mm, minutely reticulate.

Fl. & Fr. March - April.

Distrib. India: Temperate and subtropical Himalayas (Swat, Hazara-Kashmir).

Highlands of E. Africa, Afghanistan and China (Yunan).

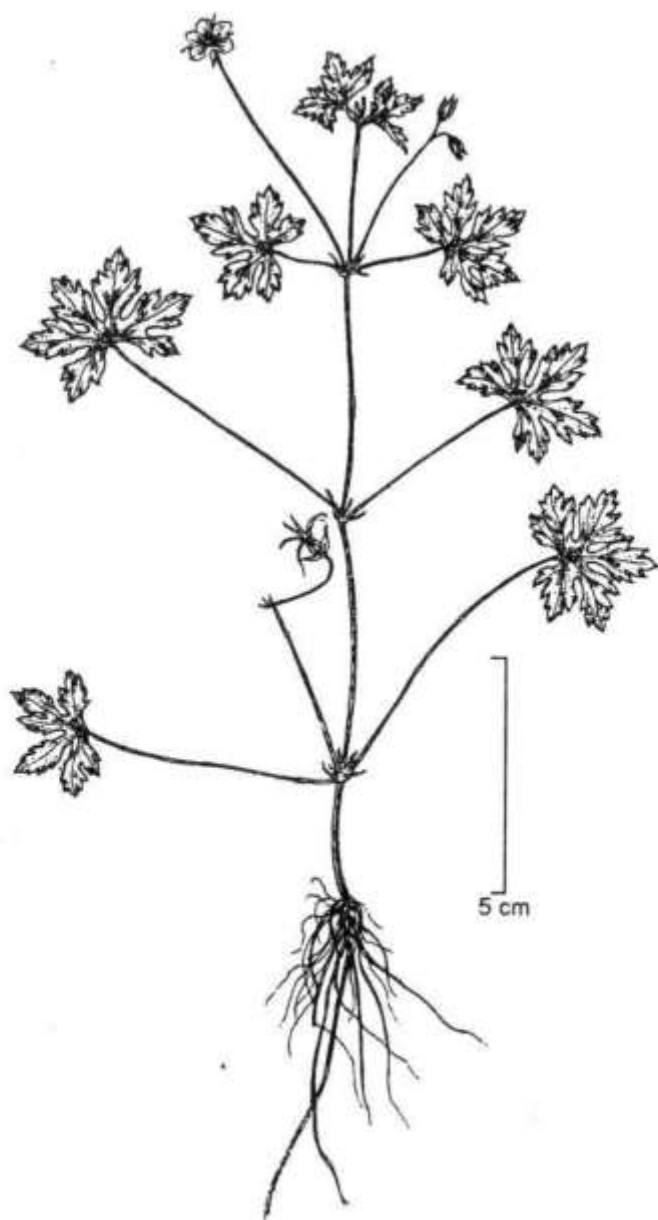


Fig. 24. *Geranium nepalense* Sweet : habit.

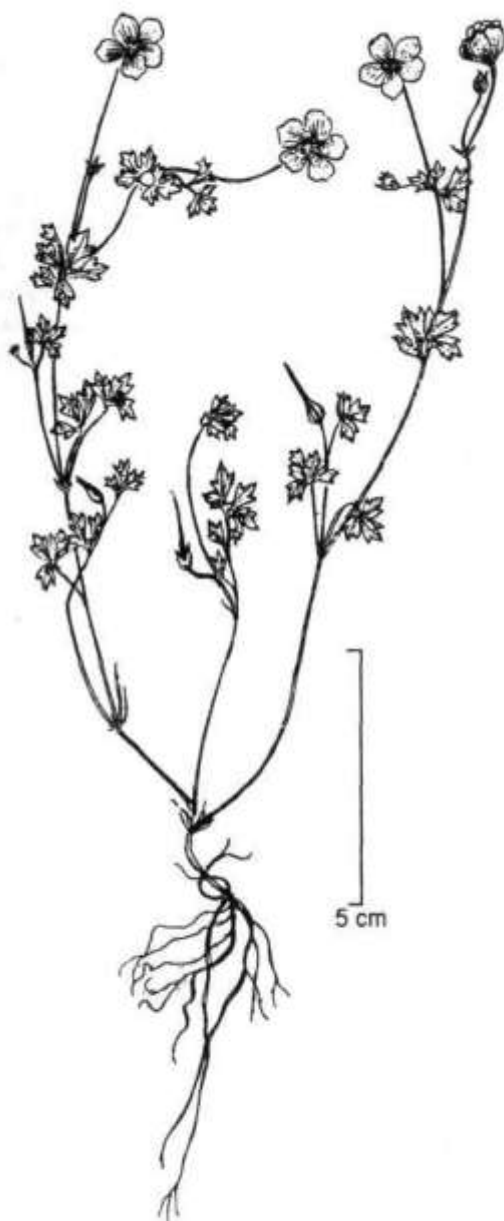


Fig. 25. *Geranium ocellatum* Cambess. : habit.

Notes. A species of variable size found at 1000 - 2400 m.

13. *Geranium pamiricum* Ikonn. in Novos. Sist. Vyss. Rast. 9: 301. 1972.

Herbs, perennial, ca 12 cm high, glabrous with stout roots; stems 2 - 3, leafy, compact, procumbent. Leaves palmately 5-lobed, suborbicular or angled, 1.2 - 1.8 cm across; segments rhombic, cuneate, pinnatifid to partite into obtuse or acute lobes, 4 - 7 mm long; stipules lanceolate-ovate, 6 - 8 mm long, brown; petioles of basal leaves 2 - 5 cm long. Peduncles 3.4 - 6.7 cm long; bracts linear-lanceolate, 3 - 3.5 mm long, ciliate, reddish-brown; pedicels 2.2 - 3 cm long, up to 3.7 cm in fruits, eglandular, erect after anthesis. Sepals ovate or ovate-lanceolate, 6 - 7 mm long, eglandular. Petals obovate, ca 1.2 cm long, puberulous, faintly nerved, white to pink; claw ciliate. Mericarps pubescent; beak ca 1.4 cm long, hispid.

Fl. & Fr. Aug. - Sept.

Distrib. India: W. Himalayas. Open places, 2500 - 3800 m, Kashmir (Upper Chitral).

Notes. Similar to *G. collinum*, but dwarf with ascending stems, much smaller leaves with narrow segments, flowers usually exerted above the foliage and of a pale pink or white colour, and seeds smaller.

14. *Geranium polyanthes* Edgew. & Hook.f. in Hook. f., Fl. Brit. India 1: 431. 1874.

Herbs, 15 - 25 cm high, sparingly hairy; stems slender, naked below, bearing clusters of flowers amongst uppermost involucre-like leaves. Leaves orbicular or reniform, 3.5 - 5 cm across, 7 - 9-partite or -lobed, more or less pilose; segments 3 - 7-fid, cuneate, obtuse; petioles of radical leaves very long; upper sessile and crowded under pedicels; stipules variable, ovate, acuminate, or subulate-lanceolate. Umbels 3 - 10-flowered; pedicels 7 - 25 mm long, glandular-hairy as sepals. Flowers funnel-shaped, 1 - 2 cm across. Sepals shortly awned. Petals reddish-purple. Filaments ciliate. Styles very short. Fruits ca 2.5 mm long; mericarps laterally compressed, keeled, strongly reticulate, glabrous; beak slender; seeds smooth.

Fl. & Fr. June - Aug.

Distrib. India: E. & W. Himalayas. Kumaon and Sikkim.

Bhutan and S. Tibet.

15. *Geranium pratense* L., Sp. Pl. 681. 1753; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 429. 1874, p.p. excl. syn. *G. himalayense* Klotzsch 1862.

Fig. 26.

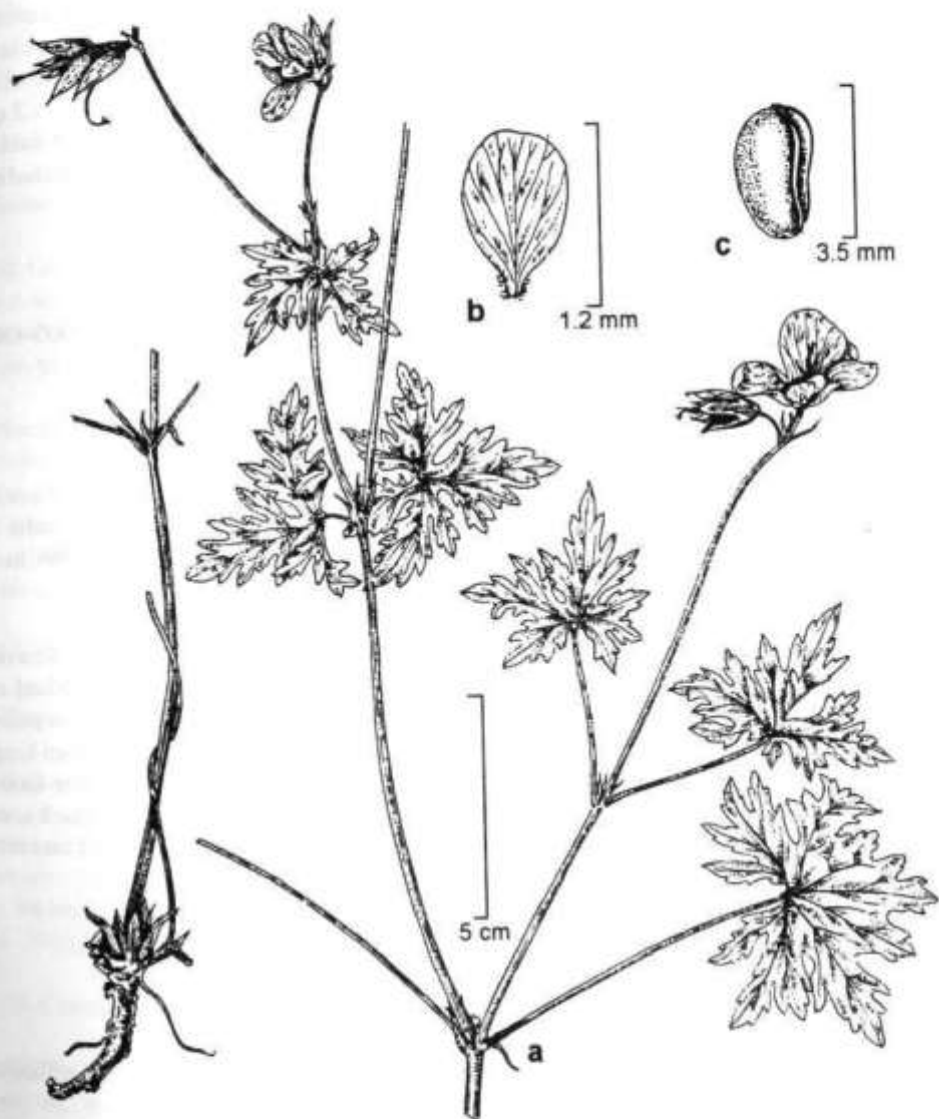


Fig. 26. *Geranium pratense* L. a. habit; b. petal; c. fruit.

Stout, erect perennials; rootstocks short, covered with stipules of basal leaves; stems 15 - 40 cm, with spreading hairs. Leaves 3 - 5 cm across, 7 - 9-palmatisect; lobes ovate, further deeply cut into oblong, acute toothed-segments; stipules subulate-lanceolate, rarely bifid; ca 1.3 cm long. Inflorescence lax, 2-flowered, becoming reflexed after flowering, erect in fruits; bracts subulate. Flowers 2.5 - 4 cm across. Sepals 1 - 1.2 cm long, awned. Petals entire or notched, ciliate at base, usually bluish-purple with darker veins but colour varying from almost red to blue to white. Fruits ca 3.5 cm long including beak; mericarp and beak glandular-hairy.

Fl. & Fr. June - Aug.

Distrib. India: Along irrigation channels in drier areas, N.W. Himalayas, 3000-4500 m.

Pakistan, Nepal and temperate Eurasia.

16. *Geranium procurrens* Yeo in Bot. Mag. (Tokyo) 179: t. 644. 1973; H. Hara in Fl. E. Himal. 3: 73. 1975. *G. grevilleanum* sensu Edgew. & Hook.f. in Fl. Brit. India 1: 430. 1874, non Wallich, 1831. *G. lambertii* sensu H. Hara in Fl. E. Himal. 133. 1966, incl. var. *backhousianum* (Regel.) H. Hara, non Sweet, 1827.

Trailing perennials; stems sometimes scrambling through bushes, up to 1 m. Leaves 3 - 6 cm across, 5-lobed to 3/4 of their width; lobes rhombic, further cut into blunt or acute shallow ultimate segments; stipules 4 - 9 mm long, some free, some united in pairs. Peduncles 5 - 8 cm long, densely hairy with mostly glandular-hairs; bracts 3 - 6 mm long. Flowers 2.5 - 3.5 cm across. Sepals 6 - 8 mm long with long soft spreading glandular-hairs. Petals 1.6 - 1.8 x 8.5 - 1.2 cm, rather dull, deep pinkish-purple with V-shaped black area at base and black nerves. Filaments not enlarged at base. Immature fruits erect on erect pedicels; beak ca 1.8 cm long; mericarps ca 4 mm long, black, hairy.

Fl. & Fr. July-Sept.

Distrib. India: Himalayas (Nepal to Bhutan) and N. Assam.

17. *Geranium pusillum* L., Syst. Nat. ed. 10, 1144. 1759; Edgew. & Hook. f., in Hook. f., Fl. Brit. India 1: 432. 1874.

Annuals, prostrate, very slender, much-branched, glandular-pubescent. Leaves reniform-orbicular, 10 - 27 mm broad, deeply 5 - 9-lobed or partite; segments cuneate, 3-lobed; stipules ovate-lanceolate, 1.5 - 2 mm long, sometimes 2-fid. Peduncles 2-flowered; bracts ovate-lanceolate, 1 - 1.5 mm long. Flowers ca 4 mm across. Sepals ovate or oblong, 1.5 - 3 mm long, glandular-pubescent. Petals obcordate, slightly exceeding mucronate sepals, pink or blue-purple. Petals and filaments ciliate at base; base 6 - 8

mm long, glandular-pubescent. Mericarps appressed-pubescent; seeds ca 1.5 mm long, very minutely granulate.

Fl. & Fr. April - May.

Distrib. India: W. temperate Himalayas, 800 - 2700 m.

Europe(except the north), W. & C. Asia, Africa and Syria.

18. *Geranium rectum* Trautv. in Bull. Soc. Nat. Moscou 33(2): 459. 1860; Edgew. & Hook.f. in Fl. Brit. India 1: 429. 1874, p.p.

var. ***glabrata*** Trautv., l.c.

Herbs, slender, up to 25 cm high; stems sparingly leafy, apparently ribbed, almost glabrous, 5-angled. Leaves opposite, 7 - 10 cm across, membranous, sparingly hairy on both surfaces; petioles of radical leaves very long and slender. Peduncles up to 20 cm long; bracts subulate; pedicels very variable. Flowers ca 3.5 cm across. Sepals narrow, oblong with a stout awn, membranous, glabrous. Petals obovate, retuse, ciliate at base. Filaments gradually narrowed upwards. Seeds smooth.

Fl. & Fr. July - Aug.

Distrib. India: N.W. Himalayas.

Asia and USSR.

Notes. This variety resembles *G. rubifolium* from which it differs in slender habit, appressed-pubescent pedicels and peduncles (rarely glandular), more or less membranous leaves with deeper and irregularly divided segments. Sepal-awn is shorter (2-3 mm). Stipules rarely 2-fid.

19. *Geranium refractum* Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 428. 1874.

Shrubs or undershrubs, perennial, 60 - 120 cm high, glandular-hairy. Leaves ca 7.5 cm across, shortly pubescent on both surfaces, 5 - 7-partite; segments obtuse, deeply lobed and cut; lower petioles long; stipules broadly oblong or ovate, obtuse, ca 1.25 cm long. Peduncles axillary and terminal, solitary, 2-flowered; pedicels long, clothed with spreading hairs. Flowers 2 - 3 cm across, nodding, reflexed. Sepals ca 1.2 cm long, membranous, glandular-hairy, shortly and stoutly awned, broad margined. Petals linear-oblong, obtuse, twice as long as sepals, 5-nerved, villous on each side at base, reflexed, white with purple nerves. Filaments 0.9 - 1.1 cm long, gradually narrowed upwards, nearly glabrous. Styles slender, ca 4 mm long; branches ca 3 mm long. Immature fruits on reflexed pedicels.

Fl. & Fr. June - Aug.

Distrib. India: E. Himalayas. 3600 - 4500 m. Sikkim.

Nepal, Bhutan, S. Tibet, N. Myanmar.

20. *Geranium regelii* Nevski in Trudy Bot. Inst. Akad. Nauk. SSSR ser. 1. Fl. Sist. Vyss. Rast. 4: 304. 1937.

Plants 5 - 12(-20) cm high with aerial stems much reduced, or absent; rhizomes well-developed, branched. Leaves basal, 5(-7)-angled, orbicular to subreniform, 0.9 - 1.4 x 1.5 - 2.4 cm, pubescent; segments obovate-cuneate. Bracts similar to stipules, but smaller (up to 3 mm long) and narrower. Sepals ovate to ovate-lanceolate, glandular, apiculate, white along margins, 0.6 - 1 cm long. Petals obovate-cuneate, 1.4 - 1.6 cm long, bluish-violet, dense-ciliate at base.

Fl. & Fr. June - July.

Distrib. India: W. Himalayas. Kashmir.

E. & N.E. Afghanistan and Soviet C. Asia.

21. *Geranium robertianum* L., Sp. Pl. 681. 1753; Edgew. & Hook.f. in Hook. f., Fl. Brit. India 1: 432. 1874. *G. lindleyanum* Royle, Ill. Bot. Himal. Mts. 150. t. 27. 1834.

Fig. 27.

Herbs, annual or biennial, often reddish, up to 40 - 50 cm high, hairy. Leaves triangular-ovate to pentagonal-orbicular, 2 - 7 x 3 - 8 cm, basal rosette and upper opposite, palmatisect; segments incised or pinnatifid; petioles up to 15 cm long, glandular-hispid; stipules triangular, ovate to lanceolate, 2 - 4 mm long. Peduncles 6 - 7 cm long, slender, 2-flowered, glandular-hairy; bracts ca 1.5 mm long, akin to stipules. Flowers 2 - 2.5 cm across. Sepals narrowly to broadly lanceolate-ovate, 5 - 7 x 1.5 - 2.5 mm, 3-nerved, glandular-hairy. Petals obovate-cuneate, twice as long as sepals; claw narrow, reddish-pink. Beak 0.8 - 1.1 cm long, glabrous. Mericarps 2.5 - 3 mm long, glabrous; seeds ellipsoid, ca 2 mm long, reddish-brown.

Fl. & Fr. May - June.

Distrib. India: Himalayas.

N. America, The Canary Islands, C.&S. Europe, Turkey, Iran, Caucasus, Siberia and C. Asia.

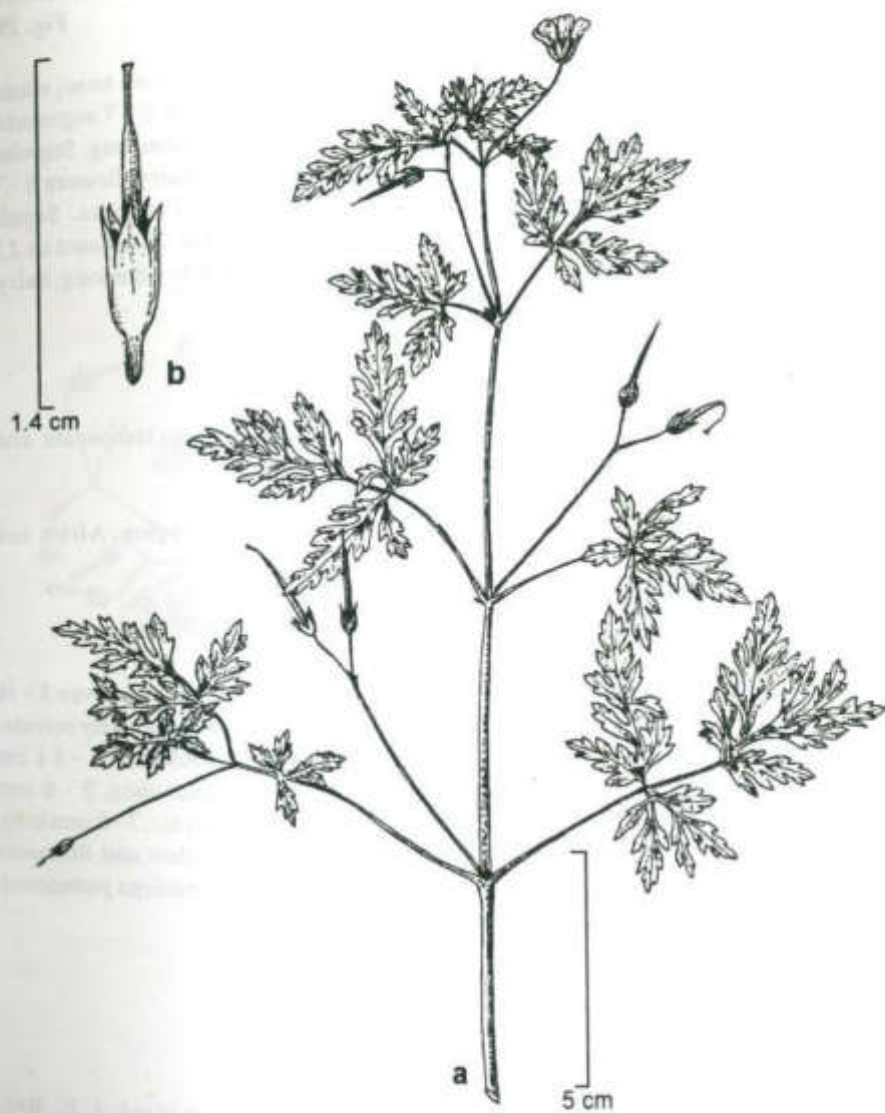


Fig. 27. *Geranium robertianum* L. : a. habit; b. fruiting calyx.

22. *Geranium rotundifolium* L., Sp. Pl. 683. 1753; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 432. 1874. *G. potentilloides* Klotzch, Bot. Ergebn. Reise Waldemar 123. t. 17. 1862. **Fig. 28.**

Herbs, slender, annual, glandular-hairy, often branching near reddish base; stems 10 - 40 cm, ascending or erect. Leaves 2 - 5 cm across, reniform with 5 - 7 segments; segments broad, obtusely lobulate, usually red-dotted; petioles 2 - 16 cm long. Stipules wedge-shaped, acuminate, 1.5 - 3.5 mm long. Peduncles glandular-hairy; flowers 6 - 7 mm across, in 2s on long, slender, axillary pedicels; pedicels deflexed in fruits. Sepals retuse, 3.5 - 4.5 mm long, lilac. Petals cuneate, entire, exceeding calyx. Filaments ca 2.5 mm long, gradually dilated towards base; dilated part ciliate. Beak 0.8 - 1 cm long, hairy. Mericarps hairy; seeds subglobose, deeply pitted, brown.

Fl. & Fr. March-April.

Distrib. India: An undergrowth in shaded places, up to 3000 m, temperate and tropical Himalayas.

W. & C. Europe, Siberia, Turkey, Iran, W. & E. Mediterranean region, Africa and Afghanistan.

23. *Geranium rubifolium* Lindley in Edward's Bot. Reg. 26: t. 67. 1840.

Perennials, up to 90 cm high; stems appressed-pubescent to villous. Leaves 3 - 10 x 4.5 - 14 cm, palmatipartite, 5-angled, pubescent, pilose; segments irregularly serrate, acute-mucronate, petioles 4.5 - 13 cm long; stipules lanceolate-subulate, 0.8 - 1.1 cm long, sometimes 2-fid. Peduncles (1-) 2-flowered; bracts linear-lanceolate, 3 - 6 mm long, ciliate. Flowers ca 2 cm across. Sepals broadly lanceolate to elliptic, 7 - 8 mm long, glandular-pubescent. Petals obovate, 1.2 - 1.3(-1.7) cm long, pink; claw and filaments ciliate at base. Beak 1.8 - 2(-2.5) cm long, glandular-pubescent. Mericarps pubescent; seeds oblong, ca 3 mm long, minutely pitted, brownish-black.

Fl. & Fr. July - Aug.

Distrib. India: 2500 - 2800 m. Himalayas.

24. *Geranium sibiricum* L., Sp. Pl. 683. 1753; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 431. 1874. **Fig. 29.**

Slender, excessively branched, hairy, sprawling perennial. Leaves 5-partite, 2 - 2.5 x 3 - 7 cm; segments rhomboid, acute at apex, acutely incised; petioles up to 6 cm long, densely patent-pubescent at base of lamina; stipules and bracts similar to that of *G. nepalense*. Peduncles slender, 1-flowered. Sepals 4 - 5 mm long, awned, equalling or



Fig. 28. *Geranium rotundifolium* L. : habit.

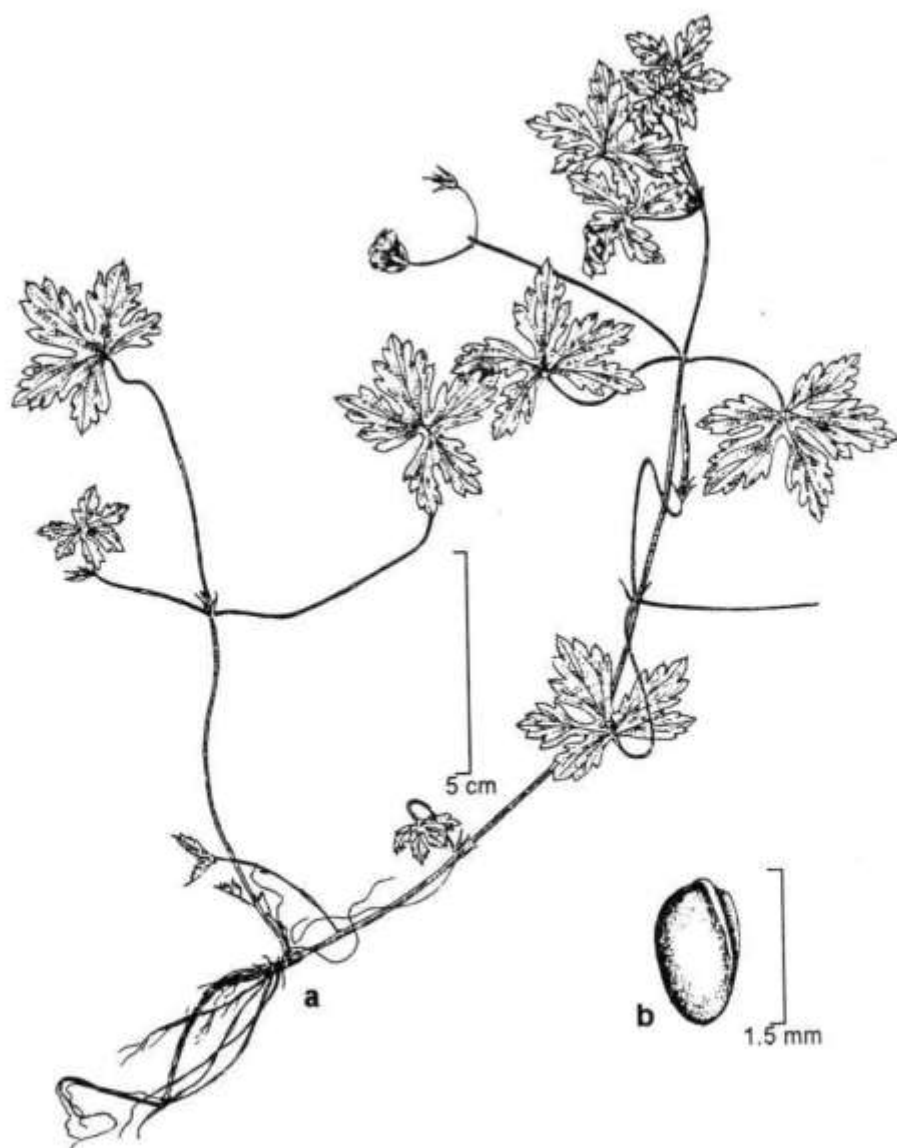


Fig. 29. *Geranium sibiricum* L.: a. habit; b. seed.

exceeding notched petals. Petals 5 - 7 mm long, white or pale pink, with 3 - 5 purple nerves. Mericarps 3 - 3.5 mm long.

Fl. & Fr. June-July.

Distrib. India: 2000 - 4000m. W. Himalayas.

E. & C. Europe, most of Asiatic USSR, China and Japan, introduced into N. America.

It resembles *G. nepalense* but can be distinguished from it by sharply lobed, narrow leaf divisions, constantly 1-flowered cymules and less prominent seed reticulations.

25. *Geranium swatense* Schonb.-Tem. in Rech.f., Fl. Iran. 69: 22. 1970.

Herbs, perennial, 45 cm or higher; rhizomes slender, vertical; stems 1 - 2(-3), ascending, diffuse, slender, glandular-villous. Cauline leaves 5 - 7-angled, reniform, palmatipartite, 1.5 - 4 x 3 - 7 cm across, pilose; segments rhomboid, cuneate; upper half 3-lobed; terminal lobe 3-fid, acutish or obtuse; petioles appressed-pubescent or patent-hairy; stipules ovate, acuminate, 4.5 - 6 mm long, some 2-partite or 2-fid, pubescent. Peduncles up to 10 cm long, 2-flowered, glandular; pedicels spreading, glandular-pubescent, deflexed in fruits; bracts subulate-lanceolate, 5 - 6.5 mm long, glandular. Sepals ovate-lanceolate, 0.7 - 1 cm long, glandular-pubescent; awn 0.8 - 1.5 mm long. Petals obovate, 1 - 1.4 cm long, ciliate, pink-purple. Filaments as long as sepals; dilated part ciliate-pubescent. Beak ca 2 cm long, patent-glandular. Mericarps ca 4 mm long, glandular-hairy; seeds minutely reticulate.

Fl. & Fr. June - Aug.

Distrib. India: Kashmir.

26. *Geranium tuberaria* Cambess. in Jacquem., Voy. Inde 4: 33. t. 37. 1844; Edgew. & Hook.f., in Hook. f., Fl. Brit. India 1: 431. 1874.

Herbs, slender, erect, glandular, 30 - 60 cm high, with tuberous rootstocks. Leaves orbicular-reniform, 3 - 4 cm across, 5 - 7-partite, segments pinnatifid, subacuminate, ca 2 mm long, pubescent; petioles 3 - 4 cm long; stipules ovate. Peduncles 2-flowered, terminal, umbelled or fascicled, very hairy and glandular; bracts leafy, pinnatifid, 1 - 2 mm long. Flowers 1.3 - 1.5 cm across. Sepals obtuse, awned or apiculate, 3.5 - 8 mm long, very hairy. Petals obtuse, retuse, 1.3 - 1.5 cm long, ciliate at base; claw well-developed, reddish-pink. Filaments ciliate with very long hairs. Beaks ca 2.5 cm long, pubescent, villous. Mericarps sparsely hairy; seeds oblong, ca 2.5 mm long, smooth.

Fl. & Fr. May - June.

Distrib. India: Temperate W. & N.W. Himalayas.

27. ***Geranium wallichianum*** D. Don ex Sweet, Geraniaceae 1: t. 90. 1822; Edgew. & Hook.f. in Hook. f., Fl. Brit. India 1:430. 1874. **Fig. 30.**

Herbs, erect or trailing, perennial, 30 - 60(-120) cm high, branched, hairy, with thick rootstocks. Leaves orbicular, 4 - 12.5 cm, palmately 3 - 5-lobed; stipules elliptic or oblong, obtuse, 0.8 - 2 x 0.6 - 1.2 cm; petioles 3 - 12 cm long, retrorsely pubescent. Peduncles 2-flowered, up to 13 cm long. Flowers 2.7 - 3.6 cm across, with a small dark violet centre. Sepals 6 - 9 mm long, bristly-hairy on nerves. Petals slightly notched, 1.6 - 1.7 x 1.3 - 1.6 cm, rather deep-pink or purplish-pink; claw densely ciliate. Filaments and styles reddish. Beak 2.5 - 3 mm long, pubescent or puberulous inside on dehiscence. Mericarps 4 - 5 mm long, patently hairy; seeds oblong, ca 5 mm long, minutely reticulate.

Distrib. India: Temperate Himalayas.

Nepal.

Little known or unknown species

Geranium heterotrichon Smith; Royle, Ill. Bot. Himal. Mts. 150.

Geranium pedunculatum Royle, l.c.

It appears that these two names were never validly published.

Geranium pinetophilum Knuth, in Notizbl. Bot. Gart. Berlin 14: 352. 1939; Y.J. Nasir in Nasir & Ali, Fl. Pakistan 149: 29. 1983.

Type: Astor District, near Naga Parbat, Rakhiot Valley.

Troll 7637(B). Knuth's material was destroyed in the Berlin fire.

3. *Monsonia* L.

Herbs or undershrubs. Leaves opposite or alternate, stipulate. Peduncles axillary, bracteate. Flowers solitary or umbelled. Sepals 5, imbricate. Petals 5, imbricate, alternate with 5 small glands. Stamens 15, all fertile, shortly monadelphous, 5 of them opposite petals. Ovary 5-lobed, 5-locular. Fruits schizocarpic with a very long beak of 5, 1-seeded mericarps; mericarps with 5 elastic tails as long as the beak; seeds non-dospermous.

Africa, especially S. Madagascar, S.W. Asia, N.W. India and Pakistan; 2 species in India.

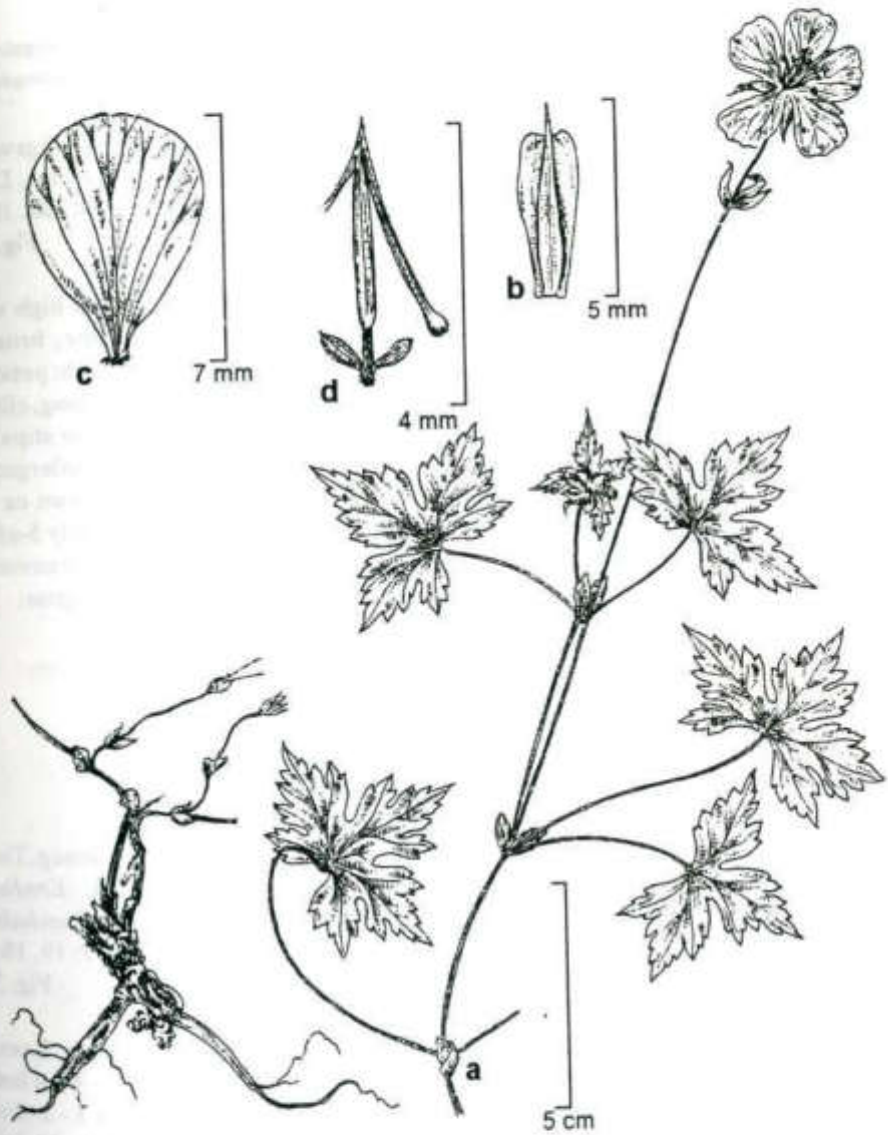


Fig. 30. *Geranium wallichianum* D. Don ex Sweet : a. habit; b. sepal; c. petal; d. fruit.

KEY TO THE SPECIES

- 1a. Plants glandular; peduncles 1 - 2-flowered, deflexed
 b. Plants eglandular; peduncles 3 - 13-flowered, erect

2. *M. senegalensis*
 1. *M. heliotropioides*

1. ***Monsonia heliotropioides*** (Cav.) Boiss., Fl. Orient. 1: 897. 1867; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 428. 1874. *Geranium heliotropioides* Cav., Diss. 4:220. t. 113, fig. 2. 1787. *Monsonia mallica* Edgew. in J. Linn. Soc., Bot. 6: 200. 1862.

Fig. 31.

Herbs, annual or perennial, prostrate or decumbent, white, 7 - 30 cm high with well-developed rootstocks. Leaves chiefly radical, very variable in shape, broadly ovate-cordate, 1 - 3 x 0.8 - 2.8 cm, coriaceous, densely silky and villous beneath; petioles up to 10 cm with dense spreading white hairs; stipules lanceolate, 2.5 - 5 mm long, ciliate and pubescent. Peduncles up to 20 cm long, patent-hairy; bracts similar to stipules. Flowers 2.5 - 3.5 cm across, umbelled. Sepals elliptic-oblong, ca 5 mm long, enlarged in fruit, up to 7 mm long, appressed-pubescent, membranous along margins; awn ca 0.5 mm long. Petals shorter than sepals, pink; claw narrow. Stamens 15, slightly 5-adelphous at base. Mericarps ca 5 mm long, narrow-stipitate, hairy, keeled with 2 transverse wrinkles at top; beak 6 - 8 mm long, plumose inside on dehiscence; seeds strigose.

Fl. & Fr. Feb. - April.

Distrib. India: Plants of dry rocky areas, found up to 1100 m.

N. Africa, S. Iran, Jordan, Arabia and Pakistan.

2. ***Monsonia senegalensis*** Guillemin & Perrottet in Guillemin et al., Fl. Seneg. Tent. 1: 131. 1831; Edgew. & Hook. f. in Hook. f., Fl. Brit. India 1: 427. 1874. *Erodium chumbulense* Munro in Wight, Ic. Pl. Ind. Orient. t. 1074. 1846 (as *Monsonia chumbalensis* (Munro) Wight in text p.5). *M. lawiana* Stocks in Calcutta J, Nat. Hist. 7: 19. 1847

Fig. 32.

Herbs, diffuse, annual, or undershrubs; branches pubescent or glandular. Leaves petiolate, repand or toothed along margins, obtuse or mucronate at apex, 2 - 4 cm long, glabrous above, pilose or pubescent beneath; stipules subulate. Peduncles 1 - 2-flowered, sharply deflexed at bracteoles. Sepals ovate, awned, densely pubescent with long hairs. Petals 1 - 1.2 cm long, 3-nerved, crumpled, scarcely exceeding sepals, violet or pink. Filaments ciliate. Mericarps stipitate, obliquely truncate with 2 - 3 wrinkles at top, 8 - 9 mm long; beak 5 - 8 cm long, rough-hairy.

Distrib. India: In dry places. Upper Gangetic Plains and Deccan.

Africa, Arabia and Pakistan.

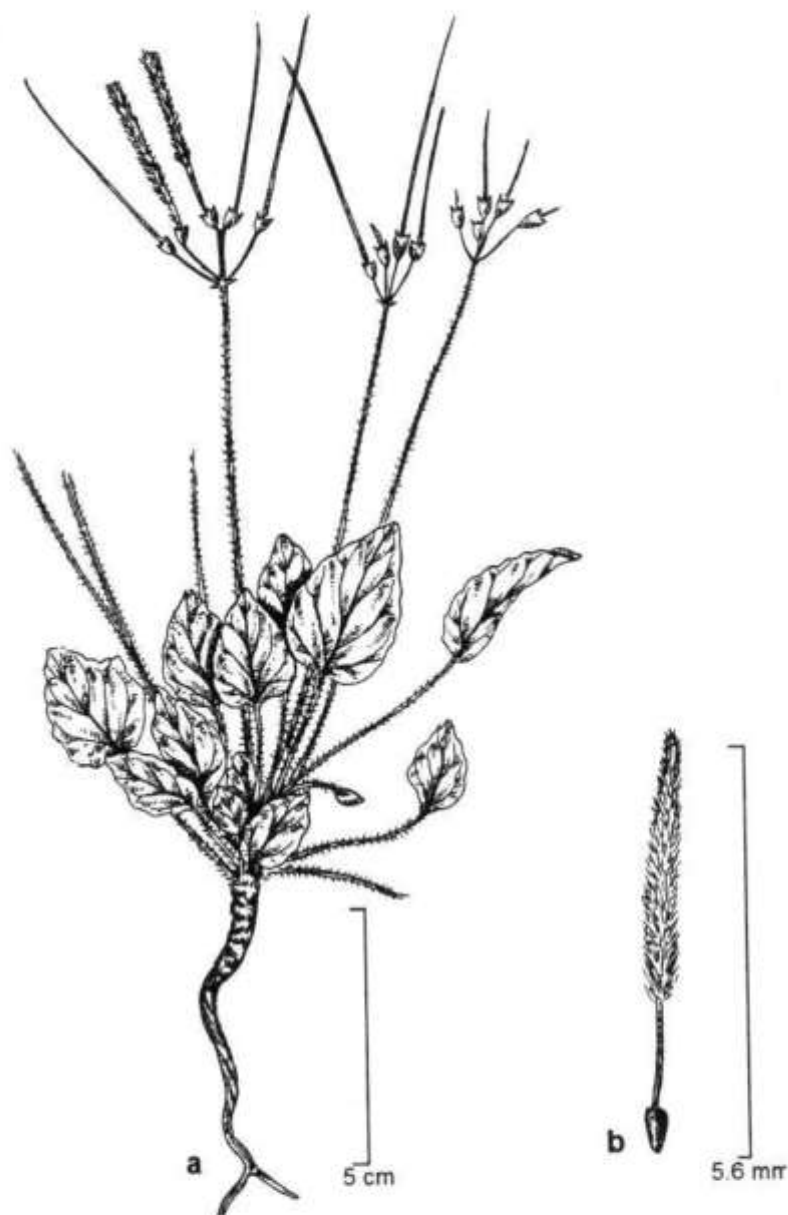


Fig. 31. *Monsonia heliotropioides* (Cav.) Boiss. : a. habit; b. plumose beak.



Fig. 32. *Monsonia senegalensis* Guillemain & Perrottet : a. habit; b. flower.

4. *Pelargonium* L'Her. ex Aiton

Plants of various habits, some fleshy and tuberous and treated as succulents, but those commonly grown are erect or trailing, leafy herbs or woody below. Leaves mostly opposite, entire to decompose, stipulate. Inflorescence mostly umbel-like on axillary peduncles. Flowers irregular. Calyx 5-partite (or sepals said to be connate at base); the uppermost segment produced at base into a slender, nectar-bearing tube or spur adnate to pedicel. Petals 5 (rarely less by abortion), the 2 upper ones usually larger and more prominently coloured, the lower mostly narrow and rarely very small, pink, red, purple or white, sometimes yellow. Stamens 10, 7 or less anther-bearing and fertile. Fruits of 5 valves, each 1-seeded and separating from beak; apex mostly coiling more or less hygrometrically.

Commonly known as *Geraniums*, the plants are grown for ornamental purposes; some of the species are aromatic and cultivated for their volatile oil.

A large genus with ca 250 species, nearly all *Pelargoniums* are distributed chiefly in S. Africa and a few in tropical Africa, Syria and Australia. Twelve species and one hybrid have been introduced into India and grown in gardens, some of which are found to run wild on Nilgiri hills in peninsular India.

The following 12 species and one hybrid are in cultivation in India.

1. *Pelargonium capitatum* (L.) Sol. in Aiton, Hort. Kew. 2: 425. 1789. *Geranium capitatum* L., Sp. Pl. 678. 1753.

Roots used for colouring medicinal oils.

2. *Pelargonium cucullatum* (L.) Aiton, Hort. Kew. 2: 426. 1789; B. Sharma et al. in Biol. Mem. 2: 23. 1977. *Geranium cucullatum* L., Sp. Pl. 677. 1753.

Run wild on the Nilgiris.

3. *Pelargonium graveolens* L'Her., Geraniologia t. 17. 1792; Fyson, Fl. Nilgiri Pulney Hill-tops 1: 54. 1915.

Uses. The leafy twigs yield an essential oil which is used in soap and toilet preparations. *Geranium* oil is used for adulterating otto of rose and also for flavouring tobacco products, tooth powder etc.

4. *Pelargonium grossularioides* (L.) Aiton, Hort. Kew. 2: 420. 1789. *Geranium grossularioides* L., Sp. Pl. 679. 1753.

5. *Pelargonium inquinans* (L.) Sol. in Aiton, Hort. Kew. 2: 424. 1789. *Geranium inquinans* L., Sp. Pl. 676. 1753.

6. *Pelargonium laterines* L'Her., Geraniologia t. 24. 1792.

7. *Pelargonium odoratissimum* (L.) Sol. in Aiton, Hort. Kew. 2: 419. 1789. *Geranium odoratissimum* L., Sp. Pl. 679. 1753. Used as a vegetable.

8. *Pelargonium peltatum* (L.) Sol. in Aiton, Hort. Kew. 2: 427. 1789. *Geranium peltatum* L., Sp. Pl. 678. 1753.

9. *Pelargonium quercifolium* (L.f.) L'Her., Geraniologia t. 14. 1792. *Geranium quercifolium* L. f., Suppl. Pl. 306. 1782.

10. *Pelargonium radula* (Cav.) L'Her., Geraniologia t. 16. 1792. *Geranium radula* Cav., Diss. 4: 262. 1787.

11. *Pelargonium vitifolium* (L.) Aiton, Hort. Kew. 2: 425. 1789. *Geranium vitifolium* L., Sp. Pl. 678. 1753.

12. *Pelargonium zonale* L'Her. ex Sol. in Aiton, Hort. Kew. 2: 424. 1789. *Geranium zonale* L., Sp. Pl. 678. 1753.

Reportedly used as a vegetable.

13. *Pelargonium inquinans* (L.) Sol. x *P. zonale* (L.) Aiton

BALSAMINACEAE

K. Vivekananthan, N.C. Rathakrishnan, M.S. Swaminathan and L.K. Ghara*

Herbs, annual or perennial, rarely shrubby, terrestrial or epiphytic; rootstock tuberous or rhizomatous. Stems succulent, swollen at nodes, rarely woody below, upright or procumbent, often rooting at lower nodes, occasionally acaulous. Leaves simple, alternate, or opposite, verticillate or spirally arranged, margins crenate, dentate or serrate, teeth or crenations generally apiculate, lowermost often gland-tipped or filiform, glabrous or pubescent, petiolate or sometimes sessile; petiole occasionally with short capitate or fimbriate glands; stipules absent but often with simple or branched stipule-like structures. Flowers bisexual, zygomorphic, resupinate, often showy and brightly coloured, solitary or binate or fascicled in racemes or umbels; bracts entire, rarely toothed. Sepals 3 or 5, free, often coloured; lateral sepals small, green or coloured; lip (lower sepal) resupinate, larger, always coloured, navicular to bucciniform or saccate, tapering or abruptly constricted into a nectariferous spur; spur short or long, filiform, straight or curved, swollen at tip or pointed, rarely bilobed. Petals 3-5, usually coloured, sometimes white; standard (dorsal petal) resupinate, free, flat or cucullate, often keeled dorsally and rarely spurred on back. Wings (lower 4 petals that are free or connate into lateral pairs at or below middle) entire or 2-3-lobed. Stamens 5, alternating with petals; filaments short and broad, connate or subconnate into a ring and hood surrounding ovary and stigma; anthers 2-locular. Ovary superior, 5-locular with axile placentation; style 1, very short or absent; stigmas 1 - 5, more or less sessile; ovules 5 to many, anatropous. Fruits succulent; capsules opening elastically into 5 twisted valves; valves opening and coiling elastically with an explosive dehiscence for seed ejection, rarely a berry; seeds warted or smooth, with simple one to many-celled hairs; endosperm absent; testa smooth; embryo straight.

Tropical Asia and Africa, a few species in cooler regions in Europe and N. America, usually growing in moist places, in partial or complete shade, rarely semi-aquatic; 2 genera and about 900 species; 2 genera and ca 203 species in India.

Literature. GREY-WILSON, C. (1979). Balsaminaceae. In: *Fl. Iranica* 143: 1-12. t. 1-3; (1985). *Balsaminaceae*. In: *Fl. Ceylon* 5: 76-120. f. 1-7. & (1991). *Balsaminaceae*. In: *Fl. Bhutan* 2: 82-104. DURDANA YUNUS & P.K.K. NAIR (1988). Pollen morphology of Indian Geraniales 15 & 16: 30. 1988-1989. HOOKER, J.D. & T. THOMSON (1859). *Præcursores ad florum Indicum*. *J. Linn. Soc., Bot.* 4: 106-105. HUYNH, K.L. (1968). Morphologie du pollen des Tropaeolaceae et des Balsaminaceae - I & II. *Grana Palynologia* 8: 88-184, 277-516; (1969) 9: 34-39. YASIN J. NASIR (1980). *Balsaminaceae*. In: *Fl. Pakistan* 133: 1-17. WALKER-ARNOTT, G.A. (1836) *New species of Indian Balsaminaceae*. *Companion Bot. Mag.* 1: 320-325. t. 18.

*North-East Indian species mostly by L.K. Ghara

KEY TO THE GENERA

- 1a. Petals all free; anthers longitudinally dehiscent; fruits pentagonal pseudoberries or capsular berries with a bony pyrene 1. *Hydrocera*
- b. Petals not all free; anthers opening by terminal pore; fruits elastically dehiscent capsules 2. *Impatiens*

1. *Hydrocera* Blume ex Wight & Arn.

Herbs, perennial, erect, glabrous, rather succulent, aquatic. Stems 5-angular, fistular in internodal region. Leaves spirally arranged, alternate, linear, serrate with a glandular leaf-base, exstipulate. Inflorescence axillary, cymose. Flowers on short axillary 1-5 (-10)-flowered cymes or in short axillary racemes. Sepals 5, petaloid, imbricate; two outer lateral ones flat, almost as large as petals, becoming anterior due to resupination; posterior produced into a short, hollow spur. Petals 5, free, two outer posterior ones longer, concave, coloured. Disk absent. Stamens 5; filaments short, broad and united towards connective; anthers connate around pistil. Ovary superior, 5-celled; stigmas 5, sessile and persisting in fruit; ovules 2-3 in each cell borne on axile placentae. Fruit berry-like or pseudoberry, truncate at base and with a short bent beak of persisting stigmas, purplish-red; seed solitary in each cell, curved, corrugated; albumen absent; cotyledons plano-concave, thick; radicle short, superior.

India, Sri Lanka, S.E. Asia, Malay Peninsula and Java; chiefly at low altitudes in aquatic and marshy conditions; untypic.

Notes. Backer & Bakhuizen (Fl. Java 1: 251. 1963) pointed out that Blume (Bijdr. 241. 1825) did not publish the generic name *Hydrocera* validly since he gave only the family description of Hydroceraceae and neither a generic description nor a specific one. *Hydrocera* was first validly published by Wight & Arn. (Prodr. Fl. Pen. Ind. Orient. 140. 1834) but they cited *Tytonia* G. Don (Gen. Syst. Gard. Bot. 1: 479. 1831) in synonymy, thus making *Hydrocera* Blume, superfluous and illegitimate. Hence, C.E. Wood (J. Arnold Arb. 56: 413-414. 1975) made a new combination: *Tytonia triflora* (L.) C.E. Wood based on *Impatiens triflora* L. Sp. Pl. 2: 938. 1753. However, the name *Tytonia* is not found in any of the subsequent taxonomic works and as such it becomes necessary to take steps to conserve the generic name *Hydrocera*.

Fruits of this genus have been variously described as a drupe (Bentham & Hooker, 1862-1893), a 5-seeded stone (Dunn, 1915), capsular berry (Venkateswarlu & Dutt, 1961) drupe-like berry (Hutchinson, 1979), 5-seeded indehiscent berry (Grey-Wilson, 1980), fleshy pseudoberry with a pentagonal berry-like drupe with the stone separating into one-seeded pyrenes (Cronquist, 1981) and berry with 5 stony seeds (Rama Devi & Narayana, 1990; Mamatha Raghuvver, Narayana & Dutt, 1993).

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***Hydrocera triflora* (L.) Wight & Arn., Prodr. 140. 1834 emend. Venkatesw. & Dutt in J. Bombay Nat. Hist. Soc. 58 (2): 544-546. 1961; Hook. f., Fl. Brit. India 1: 483. 1875. *Impatiens triflora* L., Sp. Pl. 938. 1753. *Tytonia triflora* (L.) C.E. Wood in J. Arn. Arb. 56(4): 413. 1975.**

Fig. 33.

Beng.: *Domuti*.

Herbs, perennial, semi-aquatic, up to 1 m high; stems erect, 5-angular; lower nodes bearing long fibrous roots; internodes hollow, fistular, floating. Leaves spirally arranged or alternate, linear or linear-lanceolate to linear-elliptic, cuneate at base, acute to long-acuminate at apex, serrate along margins, 11-28 x 0.6-3.7 cm, glabrous, deep-green above, pale beneath, base and midnerve sometimes tinged red; lateral nerves 10-17 pairs, oblique; sessile or with petiole up to 1 cm long, base with a pair of sessile glands. Inflorescence axillary, short, 3-5 (-10)-flowered raceme or cyme. Flowers pink, tinged with carmine or purple, inside of throat yellowish or greenish-yellow with reddish-purple nerves; bracts lanceolate, acute to acuminate, 6-9 mm long. Sepals 5, petaloid, imbricate; lateral sepals 4, in 2 pairs; lower pair elliptic to elliptic-oblong, obtuse; upper pair elliptic-oblong, obtuse; lower sepal navicular, spurred; spur 6-8 mm long, curved, slightly swollen at tip. Petals 5, free; lower and outer narrowly oblong, unevenly bilobed; upper lobe entire, lower lobe irregular, toothed, emarginate and apiculate. Stamens 5, filaments slightly shorter than gynoecium, broader and united towards connective; anthers connate. Ovary glabrous, 5-locular with 3 ovules in each locule on axile placenta. Stigma 5, sessile, persisting in fruit. Fruit fleshy pseudoberry, 8-10 x 7-8 mm, pentagonal in cross section, truncate at base, short-beaked, pale green becoming reddish or purplish-red with a hard endocarp; dehiscent septicidally leaving the seeds attached



Fig. 33. *Hydrocera triflora* (L.) Wight & Arn. : a. basal portion and flowering shoot; b. flower; c & d. stamens; e. pistil.

to column; seed usually solitary in each cell, curved, corrugated; albumen absent; cotyledons thick, radicle short.

Fl. & Fr. June - Oct.

Distrib. India: Marshy places, ditches, stagnant pools, ponds and paddy fields, chiefly at low altitudes. Uttar Pradesh, W. Bengal, Assam, Andhra Pradesh, Tamil Nadu and Kerala.

Sri Lanka, S. China (Hainan), Thailand, Cambodia, Laos, Malay Peninsula, S.W. Celebes and Java.

Notes. This plant is often confused in herbaria with *Impatiens balsamina* L. However, the two are quite distinct. The latter has a distinct tomentose ovary and fruits. In certain parts of Andhra Pradesh the flowers are apparently eaten by water birds.

2. *Impatiens* L.

Herbs, annual or perennial, terrestrial or occasionally epiphytic, growing in moist, often shaded places. Leaves simple, spirally arranged, alternate or opposite or in verticils, or all radical, exstipulate or with stipular glands at base of petiole. Flowers zygomorphic, resupinate, in axillary racemes or umbels, or solitary or sometimes scapose. Sepals 3, rarely 5, coloured, imbricate. Lateral sepals small, flat, usually green. Lip large, petaloid, often spurred. Petals 3 or 5. Anterior standard erect. Lateral ones (wings) entire or 2-3-lobed, sometimes with a short or long and slender dorsal auricle. Stamens 5; filaments short and broad; anthers cohering. Ovary oblong, 5-celled; ovules many, 1-seriate in each cell; stigma sessile, 5-toothed. Capsules short or long, loculicidally dehiscent; valves 5, elastically springing away from a placentiferous axis; seeds smooth or tubercled, glabrous or hairy; albumen absent.

Scattered throughout wet tropical and subtropical regions (especially montane forests) of Asia and Africa, a few species in temperate regions of Asia, Europe and N. America; about 900 species, ca 240 in India.

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KEY TO THE SPECIES

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|---|---------------------------------|
| 1a. Plants scapigerous; leaves radical | 2 |
| b. Plants not scapigerous; leaves cauline | 17 |
| 2a. Leaves palmately 3 - 9-lobed | 26. I. chandrasekharanii |
| b. Leaves not lobed | 3 |
| 3a. Wings 2-lobed | 4 |
| b. Wings 3-lobed | 6 |
| 4a. Flowers white or cream-coloured | 126. I. neo-barnesii |
| b. Flowers deep pink, mauve, reddish-brown or pale brown, not white | 5 |

- | | |
|---|-----------------------------|
| 5a. Lip spurred; flowers deep pink or mauve | <i>I. I. acaulis</i> |
| b. Lip not spurred; flowers reddish-brown or pale-brown | 133. <i>I. orchioides</i> |
| 6a. Dorsal auricle of wings produced into spur of lip | 7 |
| b. Dorsal auricle of wings not produced into spur of lip | 9 |
| 7a. Dorsal auricle of wings spiniferous | 96. <i>I. lawsonii</i> |
| b. Dorsal auricle of wings long and slender | 8 |
| 8a. Leaves ovate, cordate and deeply two-lobed at base; spur of lip long | 45. <i>I. denisonii</i> |
| b. Leaves orbicular, not cordate or deeply two-lobed at base; spur of lip short | 16. <i>I. barberi</i> |
| 9a. Standard crenate | 37. <i>I. crenata</i> |
| b. Standard not crenate | 10 |
| 10a. Lip spurless | 137. <i>I. pandata</i> |
| b. Lip spurred | 11 |
| 11a. Lobes of wings subequal | 12 |
| b. Lobes of wings clearly unequal | 13 |
| 12a. Terrestrial plants; spur ca 1 cm long, incurved, flat at apex; lateral sepals obliquely ovate | 30. <i>I. clavicornu</i> |
| b. Epiphytes; spur very short, straight, obtuse at apex; lateral sepals ovate | 121. <i>I. modesta</i> |
| 13a. Spur of lip more than 1 cm long | 14 |
| b. Spur of lip less than 1 cm long | 15 |
| 14a. Spur of lip atleast 2.5 cm long; flowers deep pink; leaves not pendulous; terrestrial plants | 164. <i>I. scapiflora</i> |
| b. Spur of lip 1 - 1.5 cm long; flowers white; leaves pendulous; epiphytes | 44. <i>I. dendricola</i> |
| 15a. Leaves acute at base; spur of lip ca 5 mm long; dorsal auricle prominent, ca 4 mm long; capsules ovoid | 5. <i>I. agumbeana</i> |
| b. Leaves cordate at base; dorsal auricle obscure; capsules ellipsoid | 16 |
| 16a. Bracts ovate or suborbicular, not semiamplexicaulous; scapes 1 - 2 | 128. <i>I. nilgirica</i> |
| b. Bracts oblong, semiamplexicaulous; scapes solitary | 92. <i>I. laticornis</i> |
| 17a. Plants epiphytic | 18 |
| b. Plants terrestrial | 22 |
| 18a. Wings 3-lobed | 89. <i>I. kulamavuensis</i> |
| b. Wings 2-lobed | 19 |
| 19a. Flowers completely green | 198. <i>I. viridiflora</i> |
| b. Flowers not completely green; floral parts variously coloured | 20 |
| 20a. Wings purple | 13. <i>I. auriculata</i> |
| b. Wings yellow | 21 |
| 21a. Lateral sepals elliptic; capsules ellipsoid | 81. <i>I. jerdoniae</i> |
| b. Lateral sepals linear; capsules gibbous | 139. <i>I. parasitica</i> |
| 22a. Standard bigger than all other petals and sepals, ca 2.5 cm across | 196. <i>I. vexillaria</i> |
| b. Standard not bigger than all other petals and sepals | 23 |
| 23a. Flowers epedunculate, solitary, binate or fascicled | 24 |
| b. Flowers pedunculate, in racemes, umbels or subumbels, at times solitary or binate then distinctly pedunculate with bracts (when present) in the middle | 82 |
| 24a. Spur of lip absent or extremely minute | 25 |

- b. Spur of lip present and well-developed 32
- 25a. Leaves petiolate; petioles flattened and decurrent on stems; bottom of lip with a small pit in place of spur **122. I. munnarensis**
- b. Leaves sessile or subsessile or petiolate; petioles when not flattened and decurrent on stems; bottom of lip not with a small pit 26
- 26a. Leaves opposite 27
- b. Leaves alternate 30
- 27a. Flowers large, ca 2 cm across 28
- b. Flowers minute, less than 5 mm across 29
- 28a. Flowers rose-pink or purplish; standard not winged **160. I. rufescens**
- b. Flowers yellow; standard winged **95. I. lawii**
- 29a. Leaves linear or narrowly linear-lanceolate **73. I. herbicola**
- b. Leaves ovate or ovate-lanceolate **77. I. inconspicua**
- 30a. Plants prostrate; leaves whitish beneath **130. I. occultans**
- b. Plants erect; leaves not whitish beneath 31
- 31a. Flowers ca 1.2 cm across, usually hairy; standard winged on back, not spurred; capsules villous; seeds tubercled **163. I. scabriuscula**
- b. Flowers ca 0.6 cm across, glabrous; standard spurred on back; capsules glabrous; seeds not tubercled **141. I. pendula**
- 32a. Aestivation either alternate or opposite 33
- b. Aestivation of different types on same plant, opposite and whorled or alternate and whorled or opposite, alternate and whorled 72
- 33a. Leaves all opposite 34
- b. Leaves all alternate 53
- 34a. Spur of lip much shorter than wings 35
- b. Spur of lip subequal, equal or longer than wings 43
- 35a. Spur of lip coiled into a ring **27. I. chinensis (var. brevicornis)**
- b. Spur of lip not coiled into a ring 36
- 36a. Lip minute, yellow; spur placed slightly above base of lip **156. I. radiana**
- b. Lip well-developed; spur basal 37
- 37a. Spur short, hooked 38
- b. Spur straight or curved, not hooked 39
- 38a. Flowers white, standard not keeled on dorsal side; lateral sepals not ciliate; lip funnel-shaped, not hairy outside **125. I. nataliae**
- b. Flowers pink, standard keeled on dorsal side; lateral sepals ciliate; lip saccate, hairy outside **180. I. tomentosa**
- 39a. Standard oblate and more or less plicate; dorsal auricle about half as long as wings, strap-shaped with the edges folding into form a tube with the base descending into spur **6. I. aliciae**
- b. Standard not oblate or plicate, dorsal auricle absent or very small not forming a tube or descending into spur 40
- 40a. Wings 3-lobed **132. I. oppositifolia**
- b. Wings 2-lobed 41
- 41a. Lateral sepals ovate or ovate-lanceolate **33. I. concinna**
- b. Lateral sepals linear or linear-lanceolate 42

- 42a. Leaves nearly entire, flowers pink 161. *I. rupicola*
 b. Leaves distinctly serrate; flowers yellow 41. *I. dalzellii*
- 43a. Leaves entire or subentire 44
 b. Leaves serrate or crenate 45
- 44a. Leaves elliptic or oblong, glabrous 49. *I. diversifolia*
 b. Leaves linear, pubescent on both sides 71. *I. helferi*
- 45a. Leaves linear or linear-elliptic 46
 b. Leaves not linear or linear-elliptic 47
- 46a. Stems stiff, usually simple; lateral sepals linear, up to 7 mm 27. *I. chinensis*
 b. Stems not stiff, usually branched; lateral sepals lanceolate, ca 1 cm long 36. *I. craddockii*
- 47a. Lateral sepals ovate 116. *I. masonii*
 b. Lateral sepals linear or linear-lanceolate 48
- 48a. Basal lobes of wings well-developed 49
 b. Basal lobes of wings minute or absent 50
- 49a. Wings long stipitate; pedicels longer than leaves, glabrous; dorsal auricle of wings not decurved 99. *I. lenta*
 b. Wings sessile or shortly stipitate; pedicels shorter than leaves, dorsal auricles of wings decurved 177. *I. tenella*
- 50a. Dorsal auricle of wings present 51
 b. Dorsal auricle of wings absent 52
- 51a. Dorsal auricle of wings filiform; lip saccate 104. *I. ligulata*
 b. Dorsal auricle of wings not filiform; lip boat-shaped 135. *I. pallidiflora*
- 52a. Leaves elliptic-lanceolate; capsules ca 1.2 cm long 119. *I. minor*
 b. Leaves oblong-lanceolate; capsules ca 1.8 cm long 158. *I. rheedii*
- 53a. Lateral sepals 4 54
 b. Lateral sepals 2 55
- 54a. Flowers yellow; bracts obliquely ovate, bracts and bracteoles not twisted 9. *I. angustiflora*
 b. Flowers lilac; bracts setaceous, bracts and bracteoles twisted 11. *I. arguta*
- 55a. Basal lobe of wings cuspidate on outer margins 39. *I. cuspidifera*
 b. Basal lobe of wings not cuspidate on outer margins 56
- 56a. Spur of lip much shorter than lip 57
 b. Spur of lip equalling or longer than lip 59
- 57a. Spur of lip straight; lateral sepals minute 124. *I. mysorensis*
 b. Spur of lip hooked or incurved; lateral sepals well-developed 58
- 58a. Standard ca 7 mm across; lateral sepals ovate, not greenish; dorsal lobe of wings semilunate or dolabriliform; spur of lip incurved 182. *I. trichocarpa*
 b. Standard ca 1.6 cm across; lateral sepals orbicular, greenish; distal lobe of wings obliquely oblong; spur of lip hooked 149. *I. psittacina*
- 59a. Standard inflated, funnel-shaped 75. *I. humilis*
 b. Standard not inflated or funnel-shaped 60
- 60a. Lateral sepals as large as wings 123. *I. munronii*
 b. Lateral sepals smaller than wings 61
- 61a. Stems stout; plants shrubby 62
 b. Stems slender; plants herbaceous 63

- 62a. Standard orbicular, 2-lobed, neither winged nor spurred; bracteate 61. *I. fruticosa*
 b. Standard suborbicular, emarginate, dorsally spurred; ebracteate 72. *I. henslowiana*
- 63a. Flowers blue 2. *I. acmanthera*
 b. Flowers pink, purple or white, not blue 64
- 64a. Wing-lobes subequal 65
 b. Wing-lobes unequal, basal lobe smaller than distal one 66
- 65a. Spur of lip less than 1.5 cm long 42. *I. dasysperma*
 b. Spur of lip more than 1.5 cm long 56. *I. flaccida*
- 66a. Basal lobe of wings subquadrate 175. *I. talbotii*
 b. Basal lobe of wings not subquadrate 67
- 67a. Capsules not turgid in middle, linear or narrowly fusiform 68
 b. Capsules turgid in middle, ovoid, oblong or elliptic 70
- 68a. Lower surface of leaves white 150. *I. puberula*
 b. Lower surface of leaves pale greenish 69
- 69a. Spur of lip less than 1.5 cm long; dorsal auricle of wings prominent, more or less globular 172. *I. stricta*
 b. Spur of lip more than 1.5 cm long; dorsal auricle of wings not globular 70
- 70a. Lateral sepals lanceolate; flowers binate 55. *I. falcifer*
 b. Lateral sepals ovate; flowers solitary 43. *I. decipiens*
- 71a. Capsules tomentose 15. *I. balsamina*
 b. Capsules glabrous 151. *I. pulcherrima*
- 72a. Standard spurred on dorsal side 72
 b. Standard not spurred on dorsal side 76
- 73a. Basal lobe of wings equalling or larger than distal lobe 38. *I. cuspidata*
 b. Basal lobe of wings smaller than distal lobe 74
- 74a. Lamina decurrent on petioles 58. *I. floribunda*
 b. Lamina not decurrent on petioles 75
- 75a. Leaves 2.5 - 5 cm long; petioles short; stems reddish 103. *I. leschenaultii*
 b. Leaves 5 - 10 cm long; petioles long; stems often with sulphery covering 94. *I. latifolia*
- 76a. Basal lobe of wings subequal or larger than distal lobe 77
 b. Basal lobe of wings much smaller than distal lobe 80
- 77a. Basal lobe of wings larger than distal lobe 110. *I. macrocarpa*
 b. Basal lobe of wings equal or subequal to distal lobe 78
- 78a. Lateral sepals ciliate along margins 64. *I. gardneriana*
 b. Lateral sepals not ciliate along margins 79
- 79a. Lip pubescent 31. *I. cochinica*
 b. Lip glabrous 107. *I. lucida*
- 80a. Lateral sepals ciliate along margins 82. *I. johnii*
 b. Lateral sepals not ciliate along margins 81
- 81a. Flowers pink; lip with spur half as long as its limb 106. *I. longirama*
 b. Flowers white; lip with spur as long as its limb 117. *I. meeboldii*
- 82a. Lateral sepals 4 83
 b. Lateral sepals 2 93
- 83a. Capsules turgid in middle; wing-lobes subequal 90. *I. laevigata*

- b. Capsules linear or clavate; wing-lobes unequal 84
- 84a. Spur of lip hooked or twisted 105. *I. longipes*
- b. Spur of lip not hooked or twisted 85
- 85a. Wings 3-lobed 202. *I. wattii*
- b. Wings 2-lobed 86
- 86a. Distal lobe of wings unevenly bilobed 165. *I. scitula*
- b. Distal lobe of wings entire or rarely emarginate but not lobed 87
- 87a. Stems hirsute 183. *I. trichocladon*
- b. Stems not hirsute 88
- 88a. Basal lobe of wings triangular 89
- b. Basal lobe of wings broadly oblong, rotundate or ovate, not triangular 90
- 89a. Distal lobe of wings orbicular, not recurved or twisted 113. *I. manipurensis*
- b. Distal lobe of wings linear, acute, recurved or twisted 170. *I. stenantha*
- 90a. Dorsal auricle of wings absent 65. *I. gibbispala*
- b. Dorsal auricle of wings present 91
- 91a. Lateral sepals winged; dorsal auricle of wing petals crest-like 129. *I. nummularifolia*
- b. Lateral sepals not winged; dorsal auricle of wings not crest-like 92
- 92a. Dorsal auricle of wings rotundate; standard not spurred on back 159. *I. rubro-lineata*
- b. Dorsal auricle of wings curved; standard spurred on back 120. *I. mishmiensis*
- 93a. Flowers small, less than 1 cm (0.3 - 0.8 cm) 94
- b. Flowers large, more than 1 cm 105
- 94a. Dorsal auricle of wings filiform, extending into spur 95
- b. Dorsal auricle of wings when present not filiform or extending into spur 97
- 95a. Stems and petioles viscid-pubescent 96
- b. Stems and petioles not viscid-pubescent 68. *I. goughii*
- 96a. Leaves usually opposite; capsules ovoid; seeds echinate 200. *I. viscosa*
- b. Leaves alternate; capsules ellipsoid; seeds hairy 199. *I. viscida*
- 97a. Capsules turgid in middle 98
- b. Capsules linear or clavate, not turgid in middle 99
- 98a. Leaves opposite 87. *I. kleiniformis*
- b. Leaves alternate 134. *I. pahalgamensis*
- 99a. Bracts minute and setaceous 21. *I. brachycentra*
- b. Bracts neither minute nor setaceous 100
- 100a. Lip not spurred 101
- b. Lip spurred 102
- 101a. Standard shallowly emarginate at apex 63. *I. gammiei*
- b. Standard shortly and acutely pointed at apex 118. *I. minimiflora*
- 102a. Bracts lanceolate 103
- b. Bracts ovate 104
- 103a. Bracts deciduous; lateral sepals oblong 4. *I. aganantha*
- b. Bracts persistent; lateral sepals ovate 63. *I. gammiei*
- 104a. Standard beaked 145. *I. polysciadia*
- b. Standard not beaked 144. *I. podocarpa*
- 105a. Capsules not turgid in middle, linear or clavate 106

- b. Capsules turgid in middle 166
- 106a. Lip not spurred 107
- b. Lip spurred 110
- 107a. Leaves all whorled 197. *I. violoides*
- b. Leaves not all whorled 108
- 108a. Flowers yellow or white 166. *I. serrata*
- b. Flowers lilac or red 109
- 109a. Petioles winged; bracts navicular, long-pointed 40. *I. cymbifera*
- b. Petioles not winged; bracts linear-lanceolate, not long-pointed 179. *I. thomsonii*
- 110a. Spur of lip S-shaped 84. *I. kaliensis*
- b. Spur of lip not S-shaped 111
- 111a. Spur of lip annular, spiral or coiled 112
- b. Spur of lip straight, curved or hooked, but not annular, spiral or coiled 117
- 112a. Standard deeply emarginate to bilobed 168. *I. spirifer*
- b. Standard acute, acuminate or rounded 113
- 113a. Distal lobe of wings coiled 105. *I. longipes*
- b. Distal lobe of wings not coiled 114
- 114a. Standard green-coloured 192. *I. uncipectala*
- b. Standard yellow, orange or white, not green-coloured 115
- 115a. Standard with a red dorsal spur 83. *I. jurpia*
- b. Standard without a dorsal spur 116
- 116a. Leaves and petioles pubescent; lateral sepals navicular, pubescent 108. *I. lutea*
- b. Leaves and petioles glabrous; lateral sepals ovate, obliquely elliptic or lanceolate, glabrous 167. *I. serratifolia*
- 117a. Basal lobe of wings produced upwards anteriorly into decurved lobule 52. *I. edgeworthii*
- b. Basal lobe of wings not produced upwards anteriorly into decurved lobule 118
- 118a. Base of leaves broadly amplexicaulous 7. *I. amplexicaulis*
- b. Base of leaves not broadly amplexicaulous 119
- 119a. Leaves wine-red below 23. *I. bracteolata*
- b. Leaves greenish or whitish below 120
- 120a. Distal lobe of wings coiled 121
- b. Distal lobe of wings not coiled 122
- 121a. Lateral sepals linear-oblong with bulbous base 28. *I. cirrhipetala*
- b. Lateral sepals ovate or ovate-lanceolate without a bulbous base 105. *I. longipes*
- 122a. Branchlets and spur of lip brown-furfuraceous hairy; hairs longer near apex of spur 35. *I. cothurnoides*
- b. Branchlets and spur of lip not brown-furfuraceous hairy 123
- 123a. Leaves velvety on dorsal side 62. *I. gamblei*
- b. Leaves not velvety on dorsal side 124
- 124a. Lateral sepals transparent 187. *I. tropaeoliflora*
- b. Lateral sepals not transparent 125
- 125a. Lateral sepals glandular on one or both margins 126
- b. Lateral sepals eglandular on margins 130
- 126a. Distal lobe of wings dolabriform 127

- b. Distal lobe of wings oblong or ovate, not dolabriform 128
- 127a. Flowers yellow; lateral sepals lanceolate; basal lobe of wings oblong 131. *I. odontosepala*
 b. Flowers pink; lateral sepals ovate; basal lobes of wings ovate 193. *I. urticifolia*
- 128a. Leaves petioled 129
 b. Leaves sessile 74. *I. hobsonii*
- 129a. Flowers yellowish-white; spur of lip 0.4 - 0.5 cm 201. *I. wallichii*
 b. Flowers purple or white; spur of lip 0.5 - 2.5 cm 57. *I. flemingii*
- 130a. Flowers rose and yellow with red nerves 131
 b. Flowers not as above 132
- 131a. Racemes interrupted by whorls of pedicels; bracts linear, 2 - 3 mm long; lateral sepals obliquely ovate to orbicular-obovate; leaves not membranous 18. *I. bicolor*
 b. Racemes not interrupted by whorls of pedicels; bracts ovate-lanceolate, larger; lateral sepals orbicular, aristate; leaves membranous 51. *I. duthiei*
- 132a. Racemes in fascicles or whorls on peduncle 133
 b. Racemes not in fascicles or whorls on peduncle 135
- 133a. Lip with an appendage at mouth 19. *I. bicornuta*
 b. Lip without an appendage at mouth 134
- 134a. Spur of lip 2.5 - 3.8 cm long 69. *I. graciliflora*
 b. Spur of lip 6 - 12 mm long 155. *I. radiata*
- 135a. Lip with an appendage at mouth 136
 b. Lip without an appendage at mouth 140
- 136a. Flowers yellow 137
 b. Flowers white, pale pink, rose, crimson or purplish 138
- 137a. Lateral sepals subacute, obliquely ovate 29. *I. citrina*
 b. Lateral sepals long-awned, uncinat 50. *I. drepanophora*
- 138a. Leaves opposite, ternate or whorled 139
 b. Leaves alternate 97. *I. laxiflora*
- 139a. Petioles glandular 66. *I. glandulifera*
 b. Petioles eglandular 188. *I. tuberculata*
- 140a. Distal lobe of wings toothed (2 - 4 teeth) along inner margin 14. *I. balfourii*
 b. Distal lobe of wings not toothed along inner margin 141
- 141a. Lateral sepals lobulate at base 20. *I. bivittata*
 b. Lateral sepals not lobulate at base 142
- 142a. Plants prostrate 148. *I. prostrata*
 b. Plants erect 143
- 143a. Lateral sepals pubescent 144
 b. Lateral sepals glabrous 147
- 144a. Lateral sepals linear 12. *I. asymmetrica*
 b. Lateral sepals lanceolate, ovate, ovate-oblong or orbicular 145
- 145a. Basal lobe of wings triangular; standard mucronate 91. *I. langeana*
 b. Basal lobe of wings rounded or obovate; standard not mucronate 146
- 146a. Flowers white; standard not spurred 157. *I. reidii*
 b. Flowers yellow; standard spurred on dorsal side 162. *I. scabrada*
- 147a. Wing-lobes subequal 148

- b. Wing-lobes unequal 149
- 148a. Leaves spirally arranged; flowers 3 - 10 on peduncle 25. *I. cathartii*
- b. Leaves alternate; flowers binate on peduncle 109. *I. mackeyana*
- 149a. Lateral sepals falcate 150
- b. Lateral sepals not falcate 152
- 150a. Flowers yellowish-white 153. *I. racemosa*
- b. Flowers pink or purple 151
- 151a. Flowers pink; leaves oblong; lip short-spurred 80. *I. jaeschkei*
- b. Flowers purple; leaves elliptic-lanceolate; lip long-spurred 100. *I. leptocarpa*
- 152a. Standard dorsally spurred or crested 153
- b. Standard not dorsally spurred or crested 155
- 153a. Leaves linear-lanceolate to narrowly elliptic 147. *I. prainii*
- b. Leaves ovate, ovate-lanceolate or ovate-elliptic 154
- 154a. Leaves alternate; bracts lanceolate, long-acuminate, gland-tipped 47. *I. discolor*
- b. Leaves spiral; bracts linear, not gland-tipped 189. *I. tubifer*
- 155a. Standard bilobed 174. *I. sulcata*
- b. Standard emarginate, entire or apiculate, not bilobed 156
- 156a. Petioles with scutellate gland at base 67. *I. glauca*
- b. Petioles without scutellate gland at base 157
- 157a. Leaves sessile or subsessile 158
- b. Leaves not sessile or subsessile 159
- 158a. Flowers in racemes; lateral sepals ovate 79. *I. insignis*
- b. Flowers binate; lateral sepals lanceolate 55. *I. falcifer*
- 159a. Wings emarginate opposite sinus of upper and lower lobes 178. *I. teneriflora*
- b. Wings not emarginate opposite sinus of upper and lower lobes 160
- 160a. Basal lobe of wings triangular 161
- b. Basal lobe of wings ovate, orbicular or elliptic-oblong 163
- 161a. Bracts linear-lanceolate 179. *I. thomsonii*
- b. Bracts ovate-lanceolate 162
- 162a. Bracts 3 - 4 mm long; lateral sepals obtuse, not apiculate; wings not with spots on sinus of upper and lower lobes 99. *I. lemanningii*
- b. Bracts ca 9 mm long; lateral sepals apiculate; wings with spots on sinus of basal and distal lobes 76. *I. inayatii*
- 163a. Spur less than 1 cm long 164
- b. Spur more than 1 cm long 165
- 164a. Petioles and leaves finely pubescent; lateral sepals with an appendage at apex; distal lobe of wings linear 138. *I. pantlingii*
- b. Petioles and leaves glabrous; lateral sepals without appendage at apex; distal lobe of wings oblanceolate 86. *I. kingii*
- 165a. Distal lobe of wings triangular 184. *I. trigonopteris*
- b. Distal lobe of wings suborbicular or transversely semiovate 136. *I. paludosa*
- 166a. Stipules large tufts of soft cilia 185. *I. trilobata*
- b. Stipules when present not as above 167
- 167a. Spur of lip inflated at middle and hooked at apex 191. *I. uncinata*

- b. Spur of lip not inflated at middle, hooked or not at apex 168
- 168a. Lip not spurred 169
- b. Lip spurred 173
- 169a. Lateral sepals linear 46. *I. depauperata*
- b. Lateral sepals ovate or lanceolate 170
- 170a. Bracts very large, 1 cm or more 24. *I. campanulata*
- b. Bracts not very large, much less than 1 cm long 171
- 171a. Flowers pink or pinkish-white; bracts ovate-lanceolate, whorled, not spreading 172
- b. Flowers white with red or pink patches at throat; bracts lanceolate, not whorled, spreading 181. *I. travancorica*
- 172a. Standard ovate-lanceolate; distal lobe of wings obovate or semicircular, seeds tubercled and glabrous 88. *I. konalarensis*
- b. Standard broadly ovate; distal lobe of wings not obovate or semicircular, seeds hairy 53. *I. elegans*
- 173a. Lip appendaged at mouth 174
- b. Lip not appendaged at mouth 175
- 174a. Racemes terminal; bracts persistent, linear, recurved with pinkish cilia on margins 22. *I. bracteata*
- b. Racemes axillary; bracts deciduous, lanceolate, not recurved, margins without pinkish cilia 32. *I. coelotropis*
- 175a. Wing-lobes equal or subequal 176
- b. Wing-lobes not equal, dorsal distinctly smaller than distal 177
- 176a. Standard spurred on dorsal side; spur of lip less than 1 cm; lateral sepals linear-lanceolate 186. *I. tripetala*
- b. Standard not spurred on dorsal side; spur of lip up to 2.5 cm long; lateral sepals broadly ovate 190. *I. umbellata*
- 177a. Spur of lip annular 10. *I. annulifer*
- b. Spur of lip straight, curved or hooked, not annular 178
- 178a. Stipules digitate or fimbriate 179
- b. Stipules not digitate or fimbriate 180
- 179a. Lateral sepals linear; lip bucciniform, spur 1.5 - 1.9 cm 78. *I. infundibularis*
- b. Lateral sepals ovate-lanceolate; lip navicular, spur 2.5 - 3 cm 112. *I. majumdarii*
- 180a. Basal and distal lobes of wings truncate 176. *I. tangachee*
- b. Basal and distal lobes of wings not truncate 181
- 181a. Plants prostrate 182
- b. Plants erect 184
- 182a. Flowers dull brick-red or orange 114. *I. manii*
- b. Flowers white, lilac or pale pink 183
- 183a. Leaves ovate, cordate, petiolate; petioles 1.5 - 1.7 cm long; distal lobe of wings orbicular 34. *I. cordata*
- b. Leaves ovate-elliptic, not cordate, sessile or when petiolate petioles not more than 7 mm long; dorsal lobe of wings triangular 140. *I. parvifolia*
- 184a. Leaves variegated 115. *I. marianae*
- b. Leaves not variegated 185
- 185a. Undershrubs or large branching perennial herbs 186
- b. Annual herbs 194

- 186a. Spur of lip trumpet-shaped, incurved with swollen tip, blood-crimson coloured
 b. Spur of lip not as above
- 187a. Spur of lip tubular, upcurved into a semicircle, cream coloured
 b. Spur of lip not as above
- 188a. Spur much shorter than limb of lip
 b. Spur not much shorter than limb of lip
- 189a. Bracts and lateral sepals very large
 b. Bracts and lateral sepals not very large
- 190a. Bracts ovate; spur of lip very short, hooked
 b. Bracts oblong; spur of lip 6 - 12 mm long, not hooked
- 191a. Stems with very prominent leaf-scars
 b. Stems without very prominent leaf-scars
- 192a. Lateral sepals linear-lanceolate; flowers scarlet-red
 b. Lateral sepals ovate or ovate-lanceolate; flowers white, rose, pinkish or purple
- 193a. Basal lobe of wings minute, concealed
 b. Basal lobe of wings not minute and concealed
- 194a. Standard larger than wings, bilobed
 b. Standard smaller than wings, not bilobed
- 195a. Basal lobe of wings triangular or ovate-triangular
 b. Basal lobe of wings not triangular or ovate triangular
- 196a. Wings with a narrow emargination opposite sinus of basal and distal lobes
 b. Wings without such emargination
- 197a. Stipular glands pubescent; dorsal auricle short, hooked
 b. Stipular glands when present not pubescent; dorsal auricle when present not hooked
- 198a. Leaves whitish on lower surface
 b. Leaves pale green on lower surface
- 199a. Flowers golden yellow or orange-red
 b. Flowers white with pale lilac lip
- 200a. Stems glabrous; leaves alternate
 b. Stems crisply hairy; leaves opposite or whorled
- 201a. Capsules beaked
 b. Capsules subacute, not beaked
- 202a. Spur of lip much shorter than its limb
 b. Spur of lip not shorter than its limb
- 203a. Leaves elliptic
 b. Leaves ovate to suborbicular
- 204a. Standard apiculate
 b. Standard not apiculate
- 205a. Bracts minute; sharp-pointed
 b. Bracts 3 - 5 mm long, lanceolate
- 206a. Leaves turning black on drying
 b. Leaves not turning black on drying
- 207a. Flowers yellowish-white or white with lip lilac
 b. Flowers of various shades of red, not yellowish-white or white
142. *I. phoenicea* 187
143. *I. platyadena* 188
24. *I. campanulata* 189
203. *I. wightiana* 191
48. *I. disotis* 190
70. *I. grandis* 192
195. *I. verticillata* 193
111. *I. maculata* 194
94. *I. latifolia* 199
101. *I. leptoceras* 200
173. *I. striolata* 202
54. *I. exilis* 201
146. *I. porrecta* 203
59. *I. florigera* 204
17. *I. benthamii* 205
102. *I. leptura* 206
3. *I. acuminata* 207
181. *I. travancorica* 208
8. *I. anaimudica* 209
171. *I. stoliczkaei* 209
194. *I. verecunda* 209
127. *I. nigrescens* 209

208a. Leaves opposite; lateral sepals ovate	169. <i>I. spissiflora</i>
b. Leaves alternate; lateral sepals linear-lanceolate	59. <i>I. florigera</i>
209a. Basal lobe of wings ovate or rounded	210
b. Basal lobe of wings elliptic	212
210a. Lateral sepals linear-lanceolate	60. <i>I. formosa</i>
b. Lateral sepals ovate	211
211a. Leaves pubescent on both surfaces	85. <i>I. khasiana</i>
b. Leaves glabrous but with short stiff hairs on nerves	102. <i>I. leptura</i>
212a. Bracts ovate; standard without a dorsal crest	154. <i>I. racemulosa</i>
b. Bracts linear or lanceolate; standard with a dorsal crest	213
213a. Stems pubescent; bracts ovate	93. <i>I. latiflora</i>
b. Stems glabrous; bracts lanceolate	152. <i>I. pulchra</i>

1. *Impatiens acaulis* Arn. in Companion Bot. Mag. 1: 325. 1835; Hook. f., Fl. Brit. India 1: 443. 1874.

KEY TO THE VARIETIES

1a. Pollen 4-colpate, triangular, exine simple, reticulate, murisimplibaculate	1.1. var. <i>acaulis</i>
b. Pollen 3-porate, radial, exine completely granulate	1.2. var. <i>granulata</i>

1.1. var. *acaulis*

Fig. 34.

Herbs, acaulescent, perennial; rhizomes horizontal, globose, tuber-like. Leaves radical, suborbicular to ovate or rarely elliptical or elliptic-lanceolate, cordate or rounded or truncate-attenuate at base, rounded to apiculate or subacute at apex, entire or crenate or serrate along margins, 1.5 - 10 x 1 - 10 cm, glabrous on both surfaces or pubescent above, lateral nerves 3 - 5 pairs; petiole 2 - 16 cm long. Inflorescence scapose, up to 35 cm long, 3- to many-flowered, rarely subumbellate, glabrous or rarely slightly pubescent. Flowers 3 cm across, deep-pink or mauve with white centre; pedicel 1 - 4.5 cm long, ascending in flower; bracts persistent, ovate-oblong to lanceolate, 2-4 mm long. Lateral sepals ovate, apiculate, 2-4 mm long, glabrous. Lip 5 - 8 mm long, abruptly constricted into a 2-5 cm long incurved filiform white spur, glabrous. Standard cucullate, 5-7 mm long. Wings 1.2 - 2.6 cm long, 2-lobed. Capsules narrowly fusiform or cylindrical-fusiform, 8-10 x 2.5 x 5 mm, glabrous.

Fl. & Fr. July - Nov.

Distrib. S. India. Wet rocks on damp banks near streams and rivers or in the spray-zone of waterfalls mostly on perennially dripping rocks at 1000 - 2250 m in W. Ghats and Shevaroy hills (Yercaud). Maharashtra, Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

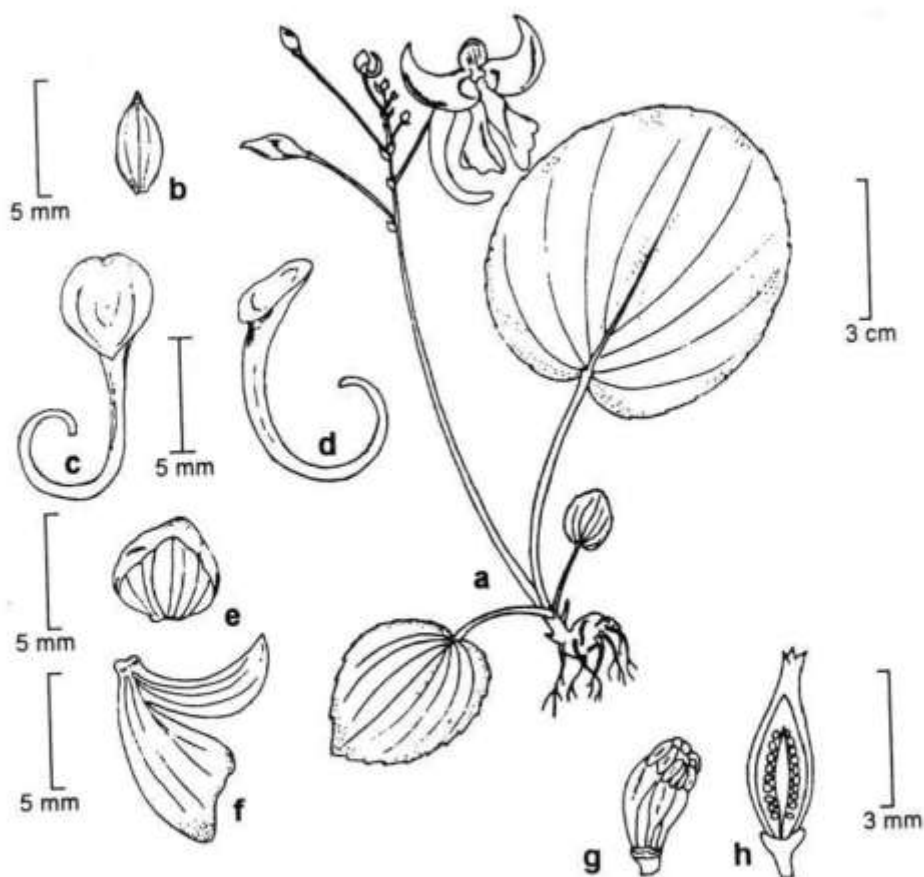


Fig. 34. *Impatiens acaulis* Arn. var. *acaulis* : a. habit; b. lateral sepal; c & d. lip - front & side view; e. standard; f. wing petal; g. stamens; h. l.s. of ovary.

Notes. This species is often confused with *Impatiens scapiflora* Heyne ex Roxb. but differs in having larger pale pink flowers with wing petals 2-lobed. This species is rather rare in South India (except Maharashtra) and appears to be more common in Sri Lanka.

Chromosome no. $n = 10$ (Bhaskar in Taxon 25 (1): 155. 1976).

1.2. var. *granulata* Bhaskar, Razi & Yogan. in Curr. Sci. 44(17): 622-623. 1973.

Herbs, erect, scapigerous; roots tuberous. Leaves radical, ovate, cordate at base, margins crenate, 60 - 90 mm long, pilose above, glabrous beneath, 5 - 7-nerved. Inflorescence racemose, 20 - 25 cm long; flowers pedicellate; pedicels ca 2.5 cm in length, glabrous; bracts ovate-lanceolate. Lateral sepals ovate, apex rounded, 3 - 5-nerved, pigmented at apex; spur 2 - 5 cm long. Wings distinctly 2-lobed; larger distal lobes fin-shaped, ca 2 cm long, smaller basal lobes bent to a side, ca 1.3 cm long, nervation dichotomous, nerves connected to each other at margin of lobes. Capsules many-seeded; seeds minute, brown, with spiral bands all over surface.

Fl. & Fr. Aug.

Distrib. India: Abundant on rocky slopes especially near waterfalls and on old bridges and on rocks during monsoon. Associated with other *Impatiens* spp. and species of *Begonia*, *Sonerila*, *Utricularia* and some blue green algae. Karnataka (W. Ghats - Chickmagalur Dist., Charmadi Ghat, Kotigehr Agumbe, Karwar).

Endemic.

Chromosome no. $n = 9, 10$ (Bhaskar et al. l.c.).

2. *Impatiens acmanthera* Hook. f. in Rec. Bot. Surv. India 4: 17. 1905.

Herbs, annual, glabrous. Leaves petiolate, oblong-elliptic to narrowly elliptic, cuneate at base, long-acuminate at apex, subentire or serrulate along margins with scarce filiform appendages, 3 - 5.4 x 0.8 - 1.5 cm, finely pubescent above and beneath; lateral nerves 5 - 8 pairs. Flowers solitary, borne on upper part of stem, blue; pedicels slender, 1.5 - 2 cm long, pubescent; bracts linear, ca 3 mm long. Lateral sepals ovate, 4 - 6 x 2.5 - 4 mm. Lip shallowly navicular, ca 8 mm long, constricted into a curved spur; spur 1 - 1.2 cm long. Standard obcordate to suborbicular, shallowly emarginate, ca 6 mm long. Wings: distal and basal lobes separated by a depression; basal lobes ovate; distal lobes semielliptic, entire; dorsal auricle present, 1 - 2 mm long. Capsules linear.

Fl. & Fr. Sept. - Nov.

Distrib. India: E. Himalayas, ca 800 m. Sikkim.

Endemic.

Chromosome no. $2n = 18, 20$ (Chatterjee, A. & A.K. Sharma in *Nucleus* 13: 179-200, 1970).

3. *Impatiens acuminata* Benth. ex Hook. f. & Thomson in *J. Linn. Soc., Bot.* 4: 145, 1860; Hook. f., *Fl. Brit. India* 1: 462, 1874 & in *Rec. Bot. Surv. India* 4: 25, 1902.

Herbs, annual, up to 60 cm high; stems simple, stout, marked below, rather fleshy, glabrous. Leaves alternate, crowded at apex, ovate-elliptic to elliptic-oblong, acuminate at apex, crenate or crenate-serrate along margins, crenations with appendages, 7.5 - 17.5 x 2 - 3 cm, glabrous, green, paler beneath; lateral nerves 4 - 8 pairs; petioles naked, 1.2 - 2.5 cm, with a red spot. Inflorescence axillary; peduncles stout, 2.5 - 3.5 cm, with red markings. Flowers 1.2 - 2.5 cm, scarlet or brick-red; pedicels erect, 1.5 - 2 cm long; bracts orbicular, obtuse or acute at apex, concave, 4 - 6 mm long, green. Lateral sepals 2, ovate-cordate, oblique, acuminate, red. Lip shallowly navicular; spur incurved, 1.5 - 2 cm long. Standard ovate, 1 - 1.5 cm long. Wings 1.5 - 2 cm long. Wings with basal lobes ovate-triangular, 5 - 8 mm; distal lobes suborbicular, 8 - 10 mm; dorsal auricle rounded. Stamens 5; anthers cohering. Ovules many; stigma sessile. Capsules erect, turgid, oblong, subacute, ca 1.3 cm long, glabrous; seeds many, arillate with spiral hairs.

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

Distrib. India: E. Himalayas, 1200 - 1500 m. Arunachal Pradesh, Assam and Meghalaya.

Endemic.

4. *Impatiens aganantha* Hook. f. in *Rec. Bot. Surv. India* 5: 61, 1905; Ghara & C. Ghara in *Bull. Bot. Surv. India* 27(1-4): 239, 1985(1987). Fig. 35.

Herbs, erect, annual, ca 20 cm high; branches slender, glabrous. Leaves ovate to ovate-lanceolate, cuneate at base, acuminate at apex, crenate along margins with bristles in notches, 2 - 3.5 x 0.8 - 1 cm, pale beneath; lateral nerves 4 - 5 pairs; petiole slender, 1 - 2 mm long; stipules absent. Inflorescence a raceme, usually terminal, slender, ca 5 cm long. Flowers 6 - 8 mm long, reddish-white, bracteate; bracts 1 or 2, lanceolate, ca 2 x 1 mm, glabrous; pedicels filiform, 8 mm long. Lateral sepals oblong, ca 2 x 1 mm, glabrous. Lip obliquely navicular, 3 - 4 mm long, spurred; spur narrow, curved, 3 - 4 mm long. Standard obovate, ca 3 x 2.5 mm. Wings 6 - 7 mm long, reddish-white; basal lobes ovate; distal lobes oblong; dorsal auricle present. Capsules clavate, 0.8 - 1 cm long, glabrous.

Fl. & Fr. July - Sept.

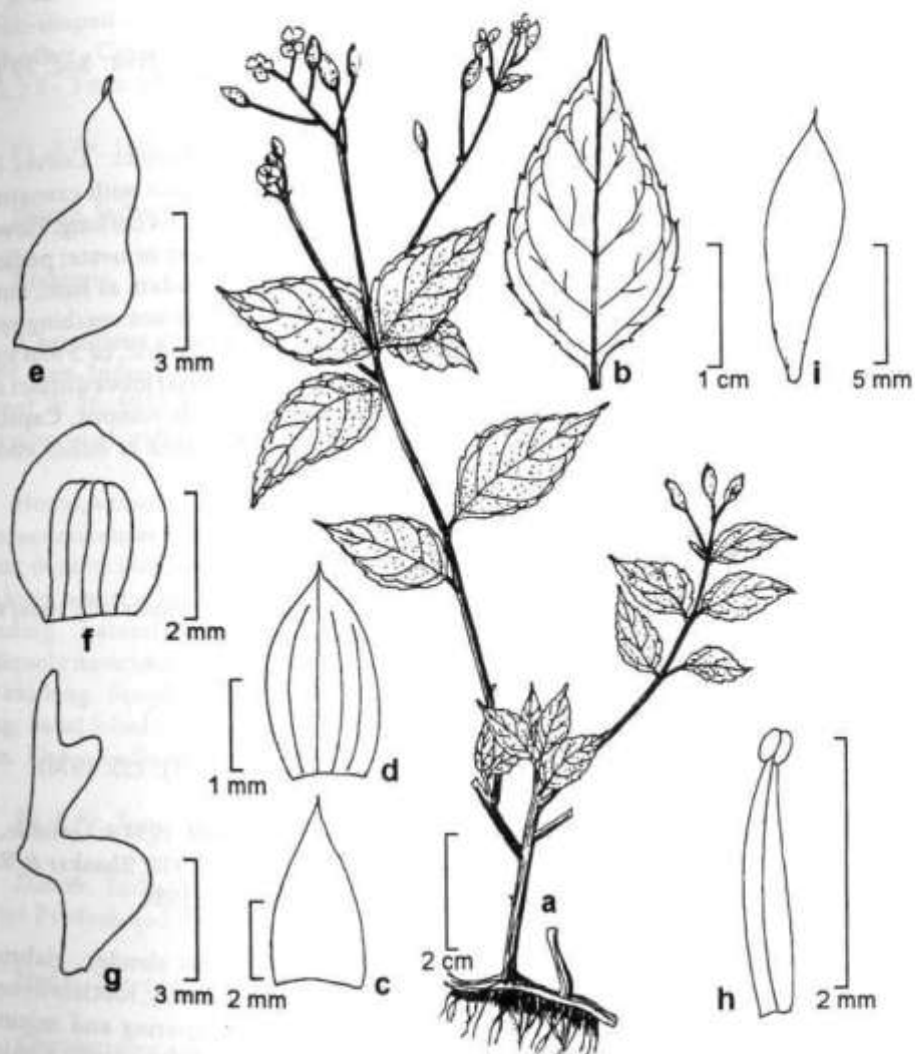


Fig. 35. *Impatiens aganantha* Hook. f. : a. habit; b. leaf; c. bract; d. lateral sepal; e. lip; f. standard; g. wing petal; h. stamen; i. fruit.

Distrib. India: E. Himalayas. Sikkim.

Tibet.

5. *Impatiens agumbeana* Bhaskar & Razi in *J. Bombay Nat. Hist. Soc.* 79 (2): 382-383. f. 1-4. 1982.

Herbs, epiphytic, scapigerous, perennial, ca 10 cm high, tuberous. Leaves 2-5, radical, ovate, obtuse, acute at base, faintly crenate along margins with crenatures minutely apiculate, 1-1.5 cm long, pubescent above; petiole filiform, 3-4 cm long. Flowers in erect scapes, pinkish; scape ca 10 cm long, slender; bracts linear or ovate; pedicels filiform, ca 20 cm long, glabrous. Sepals ovate, acute, slightly cordate at base, entire along margins, 3-nerved; lateral nerves with a short upcurved nerve not reaching apex. Lip flat, spatulate, ca 4 mm long; spur slightly curved, obtuse, cylindric, ca 5 mm long. Wings 3-lobed, ca 1 cm long; distal lobes more or less confluent; basal lobes distinct and smaller, dorsal auricle prominent, ca 4 mm long, venation open, dichotomous. Capsules ovoid, many-seeded; seeds oblong, hairy, hairs dense and elongated at either end of seeds, spirally banded, brownish.

Fl. & Fr. July - Sept.

Distrib. India: Rare epiphytic species occurring on huge tree-trunks with moss and hygrosopic ferns, in sholas, W. Ghats. Karnataka.

Endemic.

Chromosome no. $n = 8$ (Bhaskar & Razi. *l.c.* & in *Taxon* 25 (1): 155. 1976).

6. *Impatiens aliciae* C. Fischer in *Bull. Misc. Inform.* 1934: 389. 1934 & Gamble, *Fl. Pres. Madras* 11: 1870. 1935; Barnes in *J. Indian Bot. Soc.* 18: 100. 1939; Bhaskar & Razi in *Indian J. For.* 1: 72. 1978; B.D. Sharma et al., *Fl. Karnataka* 37. 1984.

Herbs, annual, often procumbent, 20 - 35 cm high; stems slender, glabrous, branched; internodes 5 - 7 cm long; rootstock short, horizontal, woody, rootlets fibrous. Leaves opposite, subsessile, linear or narrowly elliptic, base tapering and minutely toothed, basal 1 - 3 on either side sometimes elongated and glandular or with a pair of short linear stipular glands, 2.5- 10 x 0.25 - 0.9 cm, glabrous or minutely papillose-hispidulous, dark green above, glabrous or glaucous beneath; midnerve subprominent below, lateral nerves indistinct. Flowers axillary, solitary or binate, pink or white with purple streaks; bracts minute; pedicels capillary, 1.5 - 2 cm long, erect in flower, deflexed and up to 2.5 cm in fruit. Lateral sepals linear-oblong, acute, ca 4 mm long. Lip cymbiform, subacute, ca 7 mm long, pink; spur tubular, saccate, obtuse, ca 3 mm long. Standard oblate, more or less plicate and keeled, apex slightly emarginate, sometimes minutely apiculate, 4 - 5 mm long, pink, darker at centre. Wings ca 1 cm long; distal lobes larger,

obovate, deep-pink with a splash of purple-crimson streaks on inner side; dorsal auricle about half as long as wing, strap-shaped, its edge folded into form a tube near the green, spoon-shaped apex, two auricles descending into spur with their concave sides facing each other. Capsules ellipsoid, acuminate, ca 1 cm long, glabrous; seeds subglobose, 10 - 20, 2.5 - 3 mm long, black, glabrous, shining.

Fl. & Fr. July - Sept.

Distrib. India: On grassy slopes between 600 - 800 m. Karnataka and Kerala.

Endemic.

7. *Impatiens amplexicaulis* Edgew. in Trans. Linn. Soc. London 20: 37. 1846; Hook. f., Fl. Brit. India 1: 469. 1875 & in Rec. Bot. Surv. India 4: 5. 1904; H. Hara in Fl. E. Himal. 3: 78. 1975; H. Hara in H. Hara & Williams, Enum. Fl. Pl. Nepal 2: 78. 1979; Akiyama et al. in Bull. Natn. Sci. Mus. ser. B. 21(4): 151-168. 1995. **Fig. 36.**

Herbs, annual; stems branched. Leaves sessile, opposite or alternate, ovate-lanceolate, acuminate at apex, base more or less rounded and amplexicaulous or attenuate into stem; dentate along margins, 4 - 5 x 1 - 2 cm; lateral nerves 7 - 17 pairs. Flowers 1.6 - 2.3 cm long; bracts at base of pedicels, lanceolate, 2 mm long; pedicel thickened at top, often bending. Lateral sepals ovate, acuminate, 3 - 5 mm long. Lip shallowly and rather obliquely navicular, 0.9 - 1.1 cm long, spurred; spur abruptly constricted, filiform, 0.5 - 0.9 cm long. Standard cucullate, bilobed, 0.6 - 0.8 cm long. Wings bilobed, 1.2 - 1.8 cm long; basal lobes ovate, entire, 5 - 8 x 3 - 5 mm; distal lobes oblanceolate, 7 - 11 x 3 - 5 mm. Capsules linear to clavate, acute, 0.5 - 1.8 cm.

Fl. & Fr. June - Aug.

Distrib. India: W. & E. Himalayas, ca 2120 - 2430 m. Himachal Pradesh, Punjab, Uttar Pradesh and Arunachal Pradesh.

Nepal, Tibet and China (Yunnan).

Chromosome no. $2n = 20$ (Khoshoo, T.N. in Curr. Sci. 24: 423-424. 1955).

8. *Impatiens anaimudica* C. Fischer in Bull. Misc. Inform. 1935: 92-93. 1935 & in Gamble, Fl. Pres. Madras 11: 1871. 1936.

Herbs, slightly branched or unbranched; stems erect, 15 - 25 cm high, reddish, lenticelled, younger parts crispately hairy, rooting and branching at nodes. Leaves alternate, membranous, broadly ovate to suborbicular, subtruncate, rounded or shortly cuneate at base, acute at apex, margins evenly crenate, nearly entire at base, teeth apiculate or ciliate, 2 - 6.3 x 1.4 - 4.2 cm, upper surface glabrous or with scattered hairs

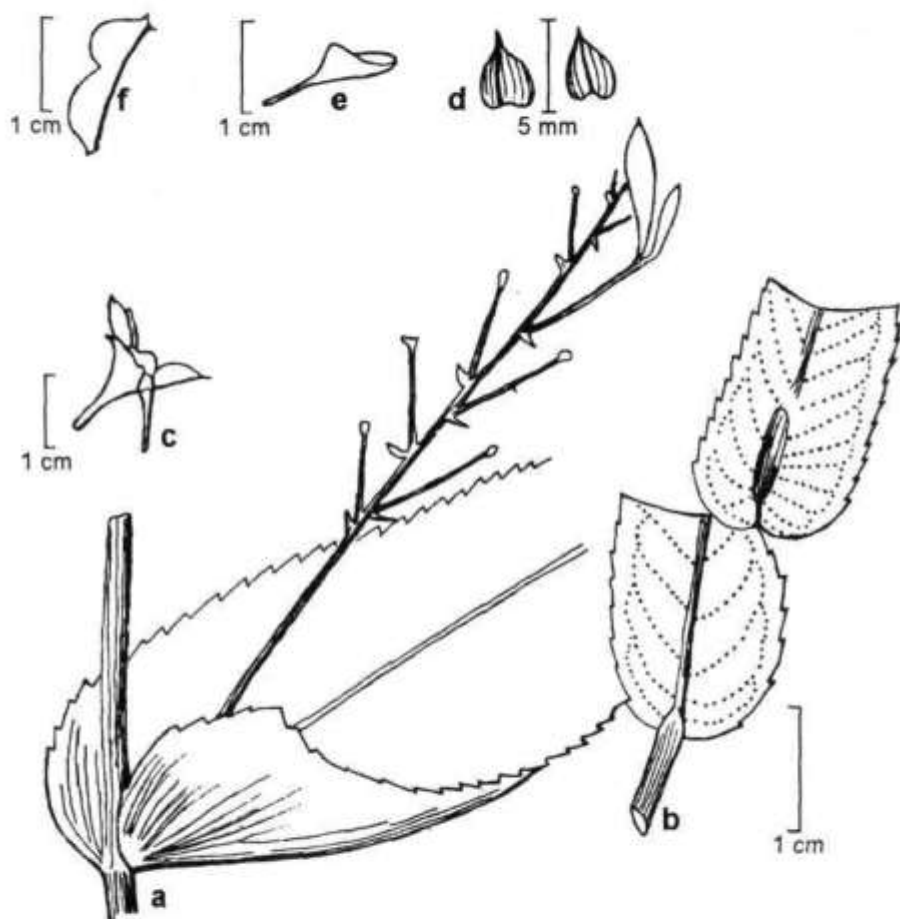


Fig. 36. *Impatiens amplexicaulis* Edgew. : a. habit; b. part of leaf; c. flower; d. lateral sepals; e. lip; f. wing petal.

on nerves, pale and with scattered often crisped hairs on nerves below; primary nerves 5 - 7 pairs, evenly arched, copiously set with short, linear nearly horizontal cystoliths; petiole 1-4 cm long, glabrous or sparsely hairy. Inflorescence axillary, shorter than leaves; peduncles capillary, 2.2 - 4.5 cm long, sparsely hairy near base; bracts lanceolate, acuminate, 2 - 3 mm long. Flowers 3 - 4, subumbellate; pedicels capillary, 7 - 10 mm long, glabrous. Lateral sepals ovate, slightly unsymmetric, cuspidate, ca 6 mm long, 5- 7-nerved, finely streaked with crimson. Lip oblong-ovate, deeply concave, cuspidate, 1 - 1.2 cm long with a small rounded spur at base, light-brownish crimson; spur and cup darker. Standard ovate-oblong, cuspidate, ca 8 mm long, coloured like lateral sepals. Wings ca 1.4 cm long, dull-crimson, drying with a bluish tinge; distal lobes semi-obovate, rounded; basal lobe oblong-lanceolate, rounded, ca 3 mm long. Capsules ellipsoid, cuspidate-acuminate, 6 - 7 mm long, glabrous; seeds few, often solitary, subglobose, 3 - 4 mm long, dotted with tufts of white or brownish papilla.

Fl. & Fr. Sept. - Dec.

Distrib. India: High Range in dense undergrowth in sholas at 2,400 m. Kerala.

Endemic.

Notes. So far recorded only from type locality by the type collection.

9. *Impatiens angustiflora* Hook. f., Fl. Brit. India 1: 480. 1875 & in Rec. Bot. Surv. India 4: 31. 1905.

Herbs, annual, erect, up to 2 m high; stems stout, simple or branched, glabrous or finely pubescent. Leaves alternate, narrowly elliptic to elliptic-oblong or lanceolate, long-acuminate at apex, shallowly crenate along margins, 3 - 7.5 x 1.2 - 3 cm, green, paler beneath; lateral nerves 4 - 9 pairs; petioles erect, 0.5 - 1.7 mm. Flowers horizontal to axis, 1.5 - 4 cm with spur, yellow or violet; bracts persistent, obliquely ovate, ca 5 x 2 mm; pedicels many, glabrous. Lateral sepals 4, 2 large, 2 minute, obliquely ovate, 2 - 4 mm. Lip obliquely navicular, spurred; spur long, slender, 1 - 3 mm long, greenish-yellow. Standard orbicular or oblong. Wings 0.5 - 2.3 cm long; basal lobes triangular, yellowish; distal lobes narrowly-ovate, pink. Capsules elongate, 0.5 - 2 cm, glabrous; seeds compressed, granular, black.

Fl. & Fr. March - Nov.

Distrib. India: E. Himalayas, 1500 - 3000 m, W. Bengal, Sikkim, Arunachal Pradesh, Assam and Meghalaya.

Bhutan.

10. *Impatiens annulifer* Hook. f. in Rec. Bot. Surv. India 4: 27. 1905.

Herbs, annual, erect, ca 30 cm high; stems much branched. Leaves alternate, crowded together at top of stem, elliptic to elliptic-oblongate, rarely ovate, attenuate or cuneate at base, acute to acuminate at apex, shallowly crenate or crenate-serrate along margins, crenations with appendages, 3.5 - 10.5 x 1.8 - 4.7 cm, deep green above, pale green beneath; petiole 0.9 - 2.7 cm long; stipular glands absent. Inflorescence a raceme, subterminal, 1 - 2-flowered; peduncles slender, 2.5 - 3.5 cm long. Flowers yellow; bracts ovate. Lateral sepals orbicular or broadly ovate, acute, 6 - 8 mm long, glabrous. Lip bucciniform, 1.7 - 2.3 cm long, 1.5 - 2 cm deep, abruptly constricted into spur; spur annular, 1.8 - 2 cm long. Standard cucullate, 1.5 cm long, with an appendage. Wings 2.7 cm long; basal lobes ovate or more or less triangular; distal lobes orbicular; dorsal auricle present. Capsules acute, 1 cm long, turgid, glabrous.

Fl. & Fr. Aug. - Dec.

Distrib. India: E. Himalayas, 900 - 1700 m. Sikkim, Arunachal Pradesh, Nagaland and Manipur.

Endemic.

11. *Impatiens arguta* Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 137. 1860; Hook. f., Fl. Brit. India 1: 470. 1875 & in Rec. Bot. Surv. India 4: 17. 1905; Biswas, Pl. Darj. Sikkim Himal. 1: 207. 1966; H. Hara in Fl. Pl. E. Himal. 1: 194. 1966, 2: 74. 1971 & 3: 78. 1975; H. Hara in H. Hara & Williams, Enum. Fl. Pl. Nepal 2: 78. 1979; Akiyama et al. in Bull. Natn. Sci. Mus. ser. B. 21(4): 151-168. 1995. *I. gagei* Hook. f. in Hooker's, Icon. Pl. ser. 4. 10: t. 2951. 1913.

Asm.: Dhumdhakuva.

Herbs, annual, at times much branched, erect, more or less glabrous. Leaves alternate, ovate or lanceolate, cuneate at base, acuminate at apex, sharply serrate along margins, often ciliate at base, 6 - 12 x 3 - 5 cm; petiole ca 3 cm long, usually glandular; stipules absent. Flowers axillary, 1-2-flowered, pedicellate, 2 - 4 cm long, pale lilac; bracts setaceous, twisted; bracteoles subulate, twisted; pedicels up to 4 cm long. Lateral sepals 4, outer dimidiate-ovate, oblique, cuspidate-acuminate, 5 - 9 x 2 - 5 mm. Lip elongate, bucciniform; spur short, stout, yellowish. Standard obovate with a red spot, spurred dorsally. Wings bilobed, long, pendulous, ca 2.5 cm long. Stamens 5, petaloid, glabrous. Capsules narrow, stout, linear, 1 - 4 x 0.2 - 0.5 cm; seeds glabrous.

Fl. & Fr. July - Oct.

Distrib. India: E. Himalayas, ca 910 - 2130 m. W. Bengal, Sikkim, Assam, Arunachal Pradesh, Nagaland, Manipur and Meghalaya.

Nepal, Bhutan, Tibet, Myanmar and China.

Chromosome no. $2n = 12, 18$ (Chatterjee, A. & A.K. Sharma in *Nucleus* 13: 179-200, 1970).

12. *Impatiens asymmetrica* Hook. f. in J. & Proc. Asiat. Soc. Bengal n. ser. 4: 189, 1908.

Herbs, annual; stems stout, nodes with a gland each. Leaves elliptic-lanceolate to lanceolate, attenuate towards base, deeply crenate along margins; long-acuminate at apex, 5.5 - 12 x 1.9 - 4.5 cm, pubescent above and beneath; lateral nerves 8 - 11 pairs. Flowers 2.5 - 4 cm long, yellow; bracts linear, 1 - 2 mm long; peduncle slender, 3.5 - 6 cm long, glabrous; pedicels many at top of peduncle, 1.5 - 1.8 cm long. Lateral sepals linear, acute, 4 - 5 mm long, pubescent. Lip shallowly and obliquely navicular, 2 - 3 cm long with an appendage, spurred; spur filiform, 1.3 - 1.5 cm long, usually with dark spots. Standard cucullate, acute, 7 - 10 mm. Wings ca 1.8 cm long; basal lobes triangular; distal lobes linear, ca 1.2 cm long. Capsules linear, acuminate, 1.7 - 2.8 cm long.

Fl. & Fr. Oct.

Distrib. India: E. Himalayas. W. Bengal.

Endemic.

13. *Impatiens auriculata* Wight in Madras J. Lit. Sci. ser. 1. 5: 8. t. 3. 1837; Hook. f., *Fl. Brit. India* 1: 460. 1874. Fig. 37.

Herbs, perennial, succulent, glabrous, epiphytic on tree trunks; stems fleshy, swollen, with leaf-scars, rarely branched, rooting at lower ends of stem, alternate, broadly ovate-lanceolate or elliptic, obtuse or acute at apex, obscurely crenulate with few glandular setae at base, 2 - 17 x 1 - 6 cm; petiole 1 - 4 cm long. Flowers in axillary, few-flowered peduncles, ca 2.5 cm across. Lateral sepals very large, pendulous, obliquely ovate or oblong, acute, scarlet. Lip bright green, saccate, wrinkled; spur short, hooked, thick. Standard small, dark-green, hooded. Wings 2-lobed, hooded, purple. Capsules ovate; seeds many.

Fl. & Fr. Aug. - Oct.

Distrib. India: On tree trunks in hills above 1300 m. Southern W. Ghats south of High way mountains in the hills of Tirunelveli, Kanyakumari and Thiruvananthapuram Districts. Tamil Nadu and Kerala.

Endemic and endangered species.

Notes. Colour of flower is quite interesting as noted by Wight l.c. Lip is bright green, lateral sepals and spur are deep scarlet-white, upper projecting portion of petal is dark

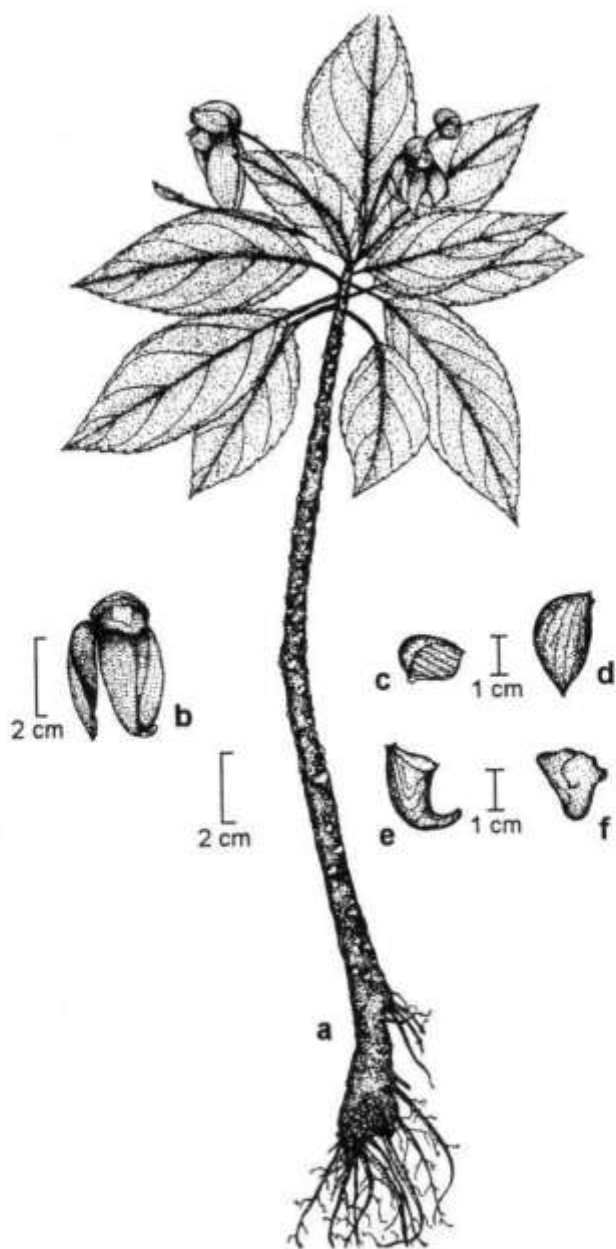


Fig. 37. *Impatiens auriculata* Wight : a. habit; b. flower; c. upper sepal; d. lateral sepals; e. lip; f. standard.

purple. In the protologue it is mentioned that peduncle bears two flowers but the type specimen (Courtallum, *Wight* 349 (CAL) in different stages of fruiting show solitary capsule (Nair and Nayar Fl. Courtallum 2: 207. 1987).

14. *Impatiens balfourii* Hook. f. in Bot. Mag. 59: 698. t. 7878. 1903 & in Rec. Bot. Surv. India 4: 5. 1904.

Herbs, annual, 60 - 90 cm high; stems branched, glabrous. Leaves alternate, ovate-lanceolate, acute to long-acuminate at apex, abruptly cuneate at base, serrate along margins, 7.5 - 12.5 cm long, green above, paler beneath, finely pubescent on both sides; lateral nerves 6 - 12 pairs; petiole with two glands at base, up to 5 cm long. Flowers in subterminal racemes, white, pink or yellow; bracts ovate, acuminate, ca 4 mm long; peduncles 7.5 - 10 cm long, slender, 6 - 8-flowered. Lateral sepals 2, orbicular, mucronate, ca 4 mm across. Lip bucciniform, 2.5 - 2.9 cm long, gradually constricted into spur; spur swollen at tip, 1 - 1.5 cm long. Standard nearly rounded, emarginate, fleshy, white suffused with rose, keeled; keel red. Wings 2 - 2.8 cm long, 2-lobed; basal lobes rounded or more or less triangular, much smaller than the distal; distal lobes obovate, toothed (with 2 or 3 teeth) along inner margin. Capsules linear, erect, 2.5 - 3.5 cm long; seeds ovoid, ca 3 mm long.

Fl. June - Oct.

Distrib. India: W. Himalayas. Jammu & Kashmir and Uttar Pradesh.

Pakistan.

Chromosome no. $2n = 14$ (Khoshoo in Curr. Sci. 24: 423-424. 1953).

15. *Impatiens balsamina* L., Sp. Pl. 938. 1753; Hook.f., Fl. Brit. India 1: 453. 1874
l. dahlii Warb. in K. Schum. & Lauterb. Nachtr. Fl. Deutsch. Sudsee 313. 1905.

Beng.: *Dupati*; Guj. & Hindi: *Gulmendi*; Mal.: *Mechingam*; Or.: *Haragaura*; Punj.: *Bentil*; Sans.: *Dushpatriyati*; Tam.: *Kasithumbai*.

Erect annuals up to 80 cm high; stems simple or branched, glabrous or pubescent when young. Leaves alternate, lanceolate-elliptic, serrate along margins, 3-15 x 1-3 cm; petioles 3-10 cm long, glandular. Flowers solitary or in fascicles of 2-3, purple or white; pedicels 1-2 cm long, glabrous or pubescent. Lateral sepals ovate-lanceolate, 2-3 mm long. Lip cymbiform, 1.2 - 1.8 cm long, petaloid with yellowish blotch; spur filiform, incurved, 1.5 - 3.5 cm long. Standard 1.2 cm long, with a crest terminating into a mucro. Wings obovate, 2 - 2.5 cm long, deeply notched; auricles ovate-rounded. Capsules ellipsoid, 1.5 - 2 cm long, tomentose; seeds globose, reticulate.

Fl. & Fr. March - Oct.

Distrib. India: Cultivated throughout.

Central, S. & S.E. Asia, Europe, New Guinea; introduced into many countries.

Notes. It is an extremely variable species particularly with regard to size of leaves and flowers. Moore (in Tutin et al. *Fl. Europaea* 2: 241. 1968) states that in European specimens spur is often absent. Three sepals developing into spurs has been reported by Bhaskar (*Indian J. For.* 9: 276-278. 1986) in cultivated specimens.

Chromosome no. $2n = 10, 12, 14$. (Virendra Kumar & Subramaniam, *Chr. Atlas Fl. Pl. Ind. Subc.* 1: 84. 1986).

16. *Impatiens barberi* Hook. f. in Rec. Bot. Surv. India 4: 39 & 45. 1906.

Herbs, acaulescent; roots tuberous. Leaves radical, orbicular, ca 1.5 cm. Flowers 1-3, on an elongate scape, mauve. Lateral sepals ovate. Lip cuneate, spurred; spur elongate, flat, incurved, inflated towards tip. Standard rounded, notched. Wings 3-lobed with a long filamentous dorsal auricle produced into the spur, papillose on dorsal side at base.

Fl. & Fr. Aug. - Sept.

Distrib. India: Common on wet, dripping rocks and tree trunks in semi-evergreen forests. Karnataka (W. Ghats, Cardamany, lower ghats of Hassan Dist.).

Endemic.

Chromosome no. $n = 8$ (Bhaskar in *Taxon* 25(1) : 155. 1976).

17. *Impatiens benthamii* Steenis in Bull. Jard. Bot. Buitenzorg, ser. 1. 3. 17: 385. 1948. *I. radicans* Benth. ex Hook. f. & Thomson in *J. Linn. Soc.*, Bot. 4: 126. 1860, non Zoll. & Morr. 1854; Hook. f., *Fl. Brit. India* 1: 451. 1874 & in *Rec. Bot. Surv. India* 4: 28. 1905. *I. salicifolia* Hook. f. & Thomson in *J. Linn. Soc.*, Bot. 4: 124. 1860, non Turcz. 1859; Hook. f., l.c. 45. 1874.

Herbs, annual, 25 - 65 cm tall; stems square, sparsely branched, more or less crispy hairy. Leaves subsessile, opposite, upper at times whorled; lanceolate to oblong-elliptic or narrowly elliptic, acuminate to long-acuminate at apex, shallowly crenate along margins, filiform appendages scarcely developed, 3 - 11 x 0.9 - 1.8 cm, pubescent above and beneath; lateral nerves 6 - 14 pairs; petiole almost absent; stipules two soft fascicles of gland-tipped setae. Flowers 2.5 - 3.5 cm, dark-purple; bracts persistent, linear, ca 3 mm long; pedicels 1.5 - 2 cm long. Lateral sepals ovate-lanceolate to linear-lanceolate, ca 5 mm long. Lip bucciniform, 1 - 1.5 cm long, abruptly constricted into spur; spur short, curved, 3 - 7 mm. Standard obovate, keeled, with a dorsal conical obtuse horn-like

structure. Wings 2-lobed; basal lobes ovate to triangular; distal lobes elliptic-oblong; dorsal auricle small. Capsules elliptic-lanceolate, 0.7 - 1.5 cm.

Fl. & Fr. April - Oct.

Distrib. India: E. Himalayas. Assam, Arunachal Pradesh, Meghalaya and Manipur.

Bangladesh and Myanmar.

18. *Impatiens bicolor* Royle, Ill. Bot. Himal. Mts. 151. t. 28. 1834; Hook. f. in Rec. Bot. Surv. India 4: 5. 1904. *I. amphorata* Edgew. var. *umbrosa* (Edgew.) Hook. f., Fl. Brit. India 1: 476. 1875. *I. amphorata* Edgew. & *I. umbrosa* Edgew. in Trans. Linn. Soc. London 20: 39. 1846.

Herbs, glabrous, 30 - 90 cm high; stems branched. Leaves alternate, ovate-elliptic to elliptic-oblong, acuminate at apex, attenuate towards base, crenate along margins, crenations with poorly developed filiform appendages, 15 - 25 x 8 - 15 cm, green above, paler beneath, finely pubescent on both surfaces; lateral nerves 6 - 10 pairs; petioles long, stipular glands present. Flowers aggregated on top of peduncles, rose and yellow with red nerves; bracts at base of pedicels, linear, 2 - 3 mm long. Peduncles long, glabrous; pedicels slender, small, glabrous. Lateral sepals obliquely ovate, to orbicular-obovate, with a short appendage, 3 - 7 x 2 - 5 mm. Lip bucciniform, 1.1 - 1.5 x 1.2 - 1.3 cm long, abruptly constricted into spur; spur filiform, slightly curved, 0.9 - 2 cm long. Standard orbicular, dorsally keeled, ca 0.9 x 1 cm. Wings 1.3 - 2 cm long; basal lobes ovate to triangular ovate, 5 - 7 x 4 - 5 mm; distal lobes oblong with a lobulate tip, 0 - 8 x 3 - 4 mm; basal auricle small. Capsules linear, subtorulose, acute, 1.1 - 2.2 cm long; seeds rugose.

Fl. & Fr. Aug. - Sept.

Distrib. India: W. Himalayas. On shady slopes between 1600 - 2500 m. Jammu & Kashmir, Himachal Pradesh, Punjab and Uttar Pradesh (Kumaon).

Nepal and Pakistan.

Notes. Two varieties of *I. amphorata* Edgew., viz. *umbrosa* and *pallens* treated by Hook.f. (Fl. Brit. India 1: 476. 1875) have been merged by himself (Rec. Bot. Surv. India 4: 8. 1904) under *I. bicolor*.

Chromosome no. $2n = 14$ (Virendra Kumar & Subramaniam, Chr. Atlas Fl. Pl. Ind. Subc. 1: 84. 1986).

19. *Impatiens bicornuta* Wallich in Roxb., Fl. Ind. 2: 460. 1824; Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 147. 1860; Hook. f., Fl. Brit. India 1: 475. 1875 & in Rec. Bot. Surv. India 4: 8. 1904; Biswas, Pl. Darj. Sikkim Himal. 1: 204. 1966; H. Hara in Fl. E.

Himal. 1: 195. 1966, 2: 75. 1971 & 3: 78. 1975. *I. pradhanii* H. Hara in J. Jap. Bot. 40: 99. 1965 & in Fl. E. Himal. 1: 196. 1966; Akiyama in J. Jap. Bot. 62(12): 368. 1987.

Herbs, annual, tall; stems stout, succulent, broadly winged or not. Leaves alternate, elliptic to lanceolate, oblong, abruptly cuneate to gradually attenuate at base, long-acuminate at apex, crenate along margins, crenations 3 - 7 mm apart, ca 1 mm long filiform appendages present between crenations, 4.5 - 23 x 1.8 - 8 cm, at times purple below, pubescent on both sides; lateral nerves 5 - 14 pairs; petiole slender, 2.5 - 7.5 cm long, glabrous; stipular glands present. Flowers in subterminal racemes, 2 - 3 cm long, rose to pink or yellow with red or purplish or brown spots on petals; bracts lanceolate, ca 3 mm long with a glandular appendage at apex; peduncles stout, erect, 4.5 - 17 cm long; pedicels slender, whorled, 1.8 - 2.5 cm long. Lateral sepals ovate, 2 - 5 x 1.5 - 2 mm, awned; awn with a curved, gland-tipped, 1 - 2 mm long appendage. Lip bucciniform, 1.5 - 2.5 cm long; spur abruptly constricted, incurved, short, 2 - 5 mm long; mouth with a long projecting appendage. Standard cucullate, 6 - 8 mm long. Wings with emarginations on both sides of sinus of basal and distal lobes; lobes small, basal lobes ovate; distal lobes more or less ovoid with long appendages. Capsules oblong, acute, ca 3.5 cm long.

Fl. & Fr. July - Oct.

Distrib. India: Temperate forests of W. & E. Himalayas. 2700 - 3000 m. Himachal Pradesh, Uttar Pradesh (Garhwal), W. Bengal, Sikkim and Arunachal Pradesh.

Nepal.

Notes. The small flowered variety var. *micrantha* H. Hara (Fl. E. Himal. 3: 78. 1975) discovered from Nepal has not been reported so far from contiguous areas, but may well occur.

Hara (l.c. 1965) described a new species *I. pradhanii* based on his collections from Sikkim. Detailed studies of Akiyama (l.c.) based on additional collections from Nepal reveal that the characters used for separating these species namely winged stem and longer appendage at the mouth of lip are highly variable and unreliable. The only clear-cut difference he could notice was the flower colour - yellow with reddish purple or brown dots in *I. pradhanii* and pale red purple with dark red purple dots in the other species. Flower colour alone cannot be taken as a suitable character to recognize a species.

Chromosome no. $2n = 16$ (Virendra Kumar & Subramaniam. Chr. Atlas Fl. Pl. Ind. Subc. 1: 84. 1986).

20. *Impatiens bivittata* Hook. f. in Rec. Bot. Surv. India 4: 16. 1905.

Herbs, glabrous; stems unbranched above; nodes and internodes prominent. Leaves mostly on upper part of stem, ovate to ovate-lanceolate or ovate-oblong, rounded or somewhat attenuate towards base, obtuse to long-acuminate at apex, deeply crenate along margins, 3.5 - 7 x ca 3 cm, midgreen above, pale green below; sparsely hairy above, particularly on midnerve and lateral nerves; lateral nerves 5 - 8 pairs; petiole 1.5 - 2.5 cm long. Flowers ca 1.2 cm with spur, yellow. Lateral sepals ovate, obtuse, lobulate at base, 2 - 2.5 mm long. Lip bucciniform; spur gradually tapering, filiform, incurved, 5 - 7 mm long. Standard semi-cucullate, crested dorsally. Wings bilobed; basal lobes ovoid-triangular; distal lobes linear. Capsules linear, acute, 0.6 - 1.8 cm long.

Fl. & Fr. Sept.

Distrib. India: E. Himalayas, ca 3000 m. Sikkim.

Endemic.

21. *Impatiens brachycentra* Kar. & Kir. in Bijull. Moskovsk. Obsc. Isp. Prir. Otd. Biol. 1: 179. 1842; Hook. f., Fl. Brit. India 1: 481. 1875 & in Rec. Bot. Surv. India 4: 6. 1904.

Herbs, slender, annual, 15 - 60 cm high, glabrous; stems usually branched. Leaves alternate, oblong-elliptic, occasionally lanceolate, cuneate or shortly attenuate towards base, long-acuminate at apex, shallowly crenate to occasionally serrate along margins, lower serrations with ca 1 mm long filiform appendages, 5.5 - 13 x 1.8 - 5.5 cm, green, pale beneath, membranous, glabrous; lateral nerves 6 - 10 pairs; petiole slender, 0.5 - 4 cm long, often with 2 sessile or stipitate glands. Racemes axillary or subterminal; peduncles 2.5 - 7.5 cm long, slender. Flowers small, 3 - 5 mm long, white; pedicels capillary, up to 2 cm long; bracts persistent, minute, setaceous. Lateral sepals ovate to ovate-lanceolate, acute, 1.5 - 2.5 x 1 - 1.5 mm. Lip navicular, 2.5 - 3.5 mm long; spur straight, filiform, 1 - 2.5 mm long, or absent. Standard orbicular-obovate, ca 2 x 2.5 mm. Wings 3 - 6 mm long, bilobed; basal lobes ovate; distal lobes semi-ovoid, obtuse. Capsules fusiform or clavate, acute to obtuse, 1 - 1.8 cm long; seeds few, pyriform, compressed, rugose.

Fl. & Fr. May - Oct.

Distrib. India: W. Himalayas, on moist slopes. 2500 - 4200 m. Jammu & Kashmir (Srinagar), Himachal Pradesh (Simla), Punjab and Uttar Pradesh (Garhwal and Kumaon).

C. Asia, China, Pakistan and Afghanistan.

Notes. Flowers are minute and mostly cleistogamous.

Chromosome no. $2n = 14$ (Khoshoo, T.N. in Curr. Sci. 24: 223-224. 1955).

22. *Impatiens bracteata* Colebr. in Roxb., Fl. Ind. 2: 458. 1824; Hook. f. in Rec. Bot. Surv. India 4: 12. 1905. *I. fimbriata* Hook., Exot. Fl. 2. t. 146. 1825; Hook. f., Fl. Brit. India 1: 461. 1874. **Fig. 38.**

Herbs, up to 75 cm high; stems simple or branched. Leaves opposite or alternate, rarely elliptic to elliptic-oblong or occasionally ovate-lanceolate, abruptly cuneate at base, acuminate at apex, serrulate along margins with lower teeth filiform and each upper teeth terminating in a short apiculum, 3.5 - 15 x 1.5 - 5 cm, young leaves reddish; petiole 2 - 7.5 cm long. Inflorescence a terminal, subcapitate, crowded raceme; peduncles up to 9 cm long. Flowers ca 3 cm across, violet or pink; pedicels capillary, 0.8 - 2 cm long, often concealed by bracts; bracts persistent, recurved, linear, 0.5 - 1.2 cm long, prominently pink-ciliate on margins, pale green, recurved. Lateral sepals small, lanceolate. Lip boat-shaped, mouth 5 - 7 mm with an appendage, yellow with red streaks; spur gradually constricted and tapering, filiform, incurved, up to 3 cm long, with pink striations. Standard ovate, ca 4 x 5 mm long, dark-pink. Wings ca 1.5 x 0.75 cm; basal lobes triangular, ca 3 mm long, reddish streaks present; distal lobes broadly elliptic to kidney-shaped, with a slight emargination distally along inner margin, entire, 10 - 12 x 7 - 8 mm; dorsal auricle small, rounded. Capsules turgid in middle, narrowed at both ends, ca 1 cm long; seeds few, obovate, white hairy.

Fl. & Fr. May - Nov.

Distrib. India: W. Bengal, Sikkim, Assam and Meghalaya.

Bhutan.

23. *Impatiens bracteolata* Hook. f. in Rec. Bot. Surv. India 4: 31. 1905.

Herbs, annual; stems branched, glabrous below petioles, winged on either side, wings hyaline and wavy. Leaves alternate, ovate, acuminate at apex, finely serrate-dentate along margins with lowermost teeth filiform, wine-red below, 5 - 10 x 3 - 5 cm; petiole 1.2 - 3 cm long, glabrous. Flowers 3 - 3.5 cm; bracts persistent, lanceolate, 3 mm long; peduncles 1.5 - 4.2 cm long, glabrous, with few pedicels. Lateral sepals obliquely ovate. Lip trumpet-shaped, spurred; spur 3.5 cm long. Standard orbicular, 0.9 - 1 cm. Wings 2.5 - 3.5 cm long; basal lobes ovate-triangular, 1 - 1.5 cm; distal lobes narrowly ovate but narrowed just above middle, 1.5 - 2 cm. Capsules narrow, 3 mm long, glabrous.

Fl. & Fr. June - Dec.

Distrib. India: E. Himalayas, ca 1500 - 2200 m. Arunachal Pradesh, Assam and Meghalaya.



Fig. 38. *Impatiens bracteata* Colebr.: a. habit; b. bract; c. lateral sepals; d. lip.

Endemic.

24. *Impatiens campanulata* Wight in Madras J. Lit. Sci. ser. 1. 5: 11. t. 7. 1837 & Icon. 3(1): 2. t. 744. 1844; Hook. f., Fl. Brit. India 1: 463. 1874.

Herbs, glabrous, robust, erect, ca 1.5 m high, sparingly branched. Leaves alternate, elliptic or broadly ovate-lanceolate, shortly and abruptly acuminate, incurved, bristly serrate, 7 - 15 cm long, membranous, glaucous beneath, nerves prominent; petiole eglandular, 2.5 - 5 cm long. Peduncle axillary, erect, 3-flowered; bracts very large, deciduous. Flowers creamy-white and yellow, speckled with purple. Lateral sepals broadly ovate, aristately acuminate, very large. Lip smooth, boat-shaped; spur very short, up to 2 mm long or absent. Standard orbicular, keeled on back. Wing-lobes small, incurved. Capsules ovoid to ellipsoid, attenuate at both ends; seeds globose, echinate.

Fl. & Fr. June - Sept.

Distrib. India: Southern W. Ghats from the Nilgiris, Anamalai and Pulney hills at an altitude of 1,800 - 2,200 m in moist woods. Tamil Nadu and Kerala.

Endemic.

Chromosome no. $2n = 20$ (Rao, R.V.S. in Proc. Indian Sci. Congr. sect. Bot. 60 (3): 137. 1973).

25. *Impatiens cathcartii* Hook. f., Fl. Brit. India 1: 473. 1875 & in Rec. Bot. Surv. India 4: 14. 1905; Biswas, Pl. Darj. Sikkim Himal. 1: 209. 1966.

Herbs, perennial, up to 60 cm high; stems simple or sparingly branched, glabrous. Leaves spirally arranged, ovate to ovate-lanceolate or ovate-elliptic, broader at middle, acute to acuminate at apex, shallowly crenate along margins, 8 - 25 x 2.5 - 12 cm, deep-green above, pale below; lateral nerves 5 - 11 pairs; petiole slender, 0.8 - 9 cm long, sometimes with a few stipitate glands towards apex. Flowers 3 - 10, pedunculate, pale yellow; bracts small, ovate-lanceolate, 2.5 - 6 mm long, herbaceous; peduncles 1.5 - 10 cm long, glabrous; pedicels slender, 1.8 - 5 cm long. Lateral sepals orbicular, ca 1.6 cm long, rather thin. Lip broadly navicular, thinner; spur abruptly constricted, 1 - 1.8 cm, reddish. Standard cucullate, dorsally keeled, 1.6 - 1.8 x 2 - 2.2 cm. Wings 2.5 - 3.7 cm long, bilobed; basal and distal lobes almost equal in size; basal lobes broadly elliptic to kidney-shaped, entire; distal lobes broadly ovate, emarginate. Capsules cylindrical to clavate, linear, ca 2.2 cm long.

Fl. & Fr. June - Dec.

Distrib. India: E. Himalayas, 600 - 1550 m. W. Bengal (Darjeeling), Sikkim, Arunachal Pradesh and Meghalaya.

Bhutan.

26. *Impatiens chandrasekharanii* Chandrab. in J. Bombay Nat. Hist. Soc. 75: 901. 1978 (1979).

Scapigerous herbs; rootstock tuberous with fibrous roots. Leaves radical; lamina suborbicular in outline, palmately 3 - 9-lobed; lobes oblong-obovate or obovate, 1.5 - 5 x 0.3 - 1.5 cm, membranous, divided into lobules; lobules emarginate, palmately 3 - 5-nerved; petioles 1 - 6 cm long. Scape 3 - 20 cm long, erect. Flowers in racemes, 0.8 - 1.2 cm across, white with pink tinge; pedicels 0.7 - 2 cm long; bracts ovate-oblong. Lateral sepals ovate-oblong, subacute, ca 2 x 1.2 mm. Lip broadly ovate, concave, ca 3 mm long; spur cylindric, ca 3 mm long. Standard suborbicular, 2 - 3 x 4 - 5 mm, membranous, keeled at centre. Wings 3-lobed; lobes oblong-obovate, subequal, ca 4 x 2 mm. Capsules ellipsoid.

Fl. & Fr. July.

Distrib. India: Southern W. Ghats on tree-trunks and wet rocks in evergreen forests. Tamil Nadu (Anamalais).

Endemic.

Notes. This is the only Indian *Impatiens* with palmately-lobed leaves.

27. *Impatiens chinensis* L., Sp. Pl. 2: 937. 1753; Hook. f., Fl. Brit. India 1: 444. 1874 & in Rec. Bot. Surv. India 4: 28. 1905; Biswas, Pl. Darj. Sikkim Himal. 1: 203. 1966; Akiyama et al. in Bull. Natn. Sci. Mus. ser. B. 21(4): 151-168. 1995.

KEY TO THE VARIETIES

- | | |
|--|-------------------------------|
| 1a. Spur much shorter than wings, often coiled into a complete ring | 27.1. var. brevicornis |
| b. Spur as long as wing, curved, but not coiled into a complete ring | 27.2. var. chinensis |

27.1. var. brevicornis Barnes in J. Indian Bot. Soc. 18(3): 99. 1939.

Erect, slender marshy herbs, 15 - 30 cm high, glabrous or sparsely hairy. Leaves elliptic, oblong-lanceolate or linear-oblong, acute or acuminate at apex, cuneate or rounded at base, ca 4 x 1 cm. Flowers up to 1.8 cm across, red. Lip boat-shaped; spur much curved, shorter than wing, often coiled into a complete circle and sometimes shorter than lip. Stipe of wings slender; basal lobes very small, narrow and curved.

Fl. & Fr. Aug. - Sept.

Distrib. India: Karnataka and Kerala.

27.2. var. chinensis

Herbs, stems succulent, erect, angled. Leaves sessile, or upper leaves subsessile, opposite, linear to linear-elliptic, rounded or cordate at base, acute to acuminate at apex; finely serrate along margins, teeth very prominent, 3 - 7 x 0.3 - 0.5 cm; stipular glands persistent. Flowers large, white or reddish-white; pedicels axillary, highly variable, up to 4 cm long, glabrous. Lateral sepals linear, acute, ca 7 mm long. Lip bucciniform, with some markings on one side; abruptly constricted into spur; spur curved, 1.5 - 2 cm long, violet-red. Standard suborbicular, shortly acute, 5 - 7 x 4 - 8 mm, white. Wings 1.4 - 2 cm long; basal lobes ovate-triangular to ovate-elliptic, 3 - 6 x 2 - 4 mm; distal lobes broadly elliptic, with slight emargination, 1 - 1.6 x 0.6 - 1.2 cm, elliptic portion white with reddish tinge and also deep-violet. Capsules elliptic, turgid in middle, 0.7 - 1.5 x 0.2 - 0.7 cm; seeds many, glabrous, shining black.

Fl. & Fr. June - Nov.

Distrib. India: Orissa, W. Bengal, Sikkim, Assam and Meghalaya.

Nepal, Bhutan, Tibet, China, Bangladesh, Malaysia and Vietnam.

28. *Impatiens cirrhipetala* Hook. f. in Hooker's Icon. Pl. ser. 4. 10: t. 2962. 1913.

Herbs, erect, glabrous. Leaves alternate, acuminate at apex, crenate along margins, 0.5 - 1.5 cm long; lateral nerves 6 - 7; petioles 1 - 3 mm long. Flowers 1 cm across; bracts minute, linear-lanceolate, 2 mm long; peduncles axillary, erect, 5 - 7 cm long. Lateral sepals 2, linear-oblong, acuminate, base bulbous, 6 - 7 mm long. Lip bucciniform, notched, with an appendage, spurred; spur long, incurved, apex bifurcate. Standard orbicular, with an appendage at apex, ca 8 mm across. Wings ca 1.8 cm long; basal lobes rounded, 5 - 6 mm across; distal lobes strap-shaped, coiled. Capsules acuminate.

Fl. & Fr. Not known.

Distrib. India: E. Himalayas. Locality? *Griffith 1239 (CAL)*.

Endemic.

29. *Impatiens citrina* Hook. f. in Rec. Bot. Surv. India 4: 17. 1905.

Stems branched. Leaves alternate, lanceolate to ovate-lanceolate, slightly attenuate towards base, acuminate at apex, crenate along margins, 3 - 12 x 1.5 - 3.7 cm, green above, paler beneath. Flowers yellow; bracts persistent, ovate. Lateral sepals obliquely ovate, 2.5 - 3 mm long. Lip obliquely navicular with an appendage, spurred; spur gradually constricted, filiform, ca 2 cm long. Standard cucullate. Wings bilobed; basal lobes obliquely ovate; distal lobes orbicular. Capsules clavate, acute, 0.5 - 1 cm long.

Fl. & Fr. Sept. - Nov.

Distrib. India: E. Himalayas. Arunachal Pradesh.

Endemic.

30. *Impatiens clavicornu* Turcz. in Bull. Soc. Imp. Naturalistes Moscou 32 (1): 271. 1859. *I. beddomei* Hook. f., Fl. Brit. India 1: 442. 1874.

Herbs, 10 - 30 cm high, scapigerous; rootstock tuberous. Leaves radical, orbicular or reniform, entire or obscurely crenate-serrate, cordate at base, 2.5 - 10 cm across, fleshy, glabrous; nerves flabellate; petioles 2.5 - 8 cm long. Scape longer than leaves, up to 15 cm long. Flowers in racemes, ca 1.2 cm across, white with yellow patches on the wings or pink; bracts broadly ovate, obtuse or subacute; pedicels slender. Lateral sepals broadly and obliquely ovate. Spur ca 1 cm long, incurved, tip inflated. Standard broader than long. Wings with 3 subequal, truncate, retuse lobes, dorsal auricle of wing obscure. Capsules ellipsoid, ca 0.8 cm long; seeds minute, granulate.

Fl. & Fr. June - Oct.

Distrib. On rocky crevices in high altitude grasslands of W. Ghats. Karnataka, Tamil Nadu and Kerala.

Endemic.

Chromosome no. $n = 8$ (Bhaskar, V. & B.A. Razi in J. Mysore Univ. sec. B. 25: 116. 1972-73); $2n = 16$ (Rao, R.V.S. in Proc. Indian Sci. Congr. sect. Bot. 60(3): 137. 1973).

31. *Impatiens cochinica* Hook.f. in Bull. Misc. Inform. 1911: 355. 1911.

Shrubs, 40 - 50 cm high, glabrous or puberulous; branches stout. Leaves alternate at base, whorled above and on branches, ovate or ovate-lanceolate, acute or acuminate at apex, crenate, 6 - 10 cm long; petioles 2 - 4 cm long, slender. Flowers solitary or in fascicles; pedicels shorter than leaves. Lateral sepals triangular-ovate. Lip ca 6 mm long, cymbiform, pubescent; spur slender, incurved, ca 1.8 cm long. Standard orbicular, bilobed, with a mucro in sinus. Wings ca 8 x 8 mm, bilobed; lobes broadly obcordate; basal lobes smaller than distal ones; dorsal auricle rotundate. Capsules ovoid, gibbous, ca 1.5 cm long, beaked, few-seeded; seeds obovoid, ca 2 mm long, pubescent.

Fl. & Fr. Not known.

Distrib. India: Southern W. Ghats at about 600 m. Kerala. Endemic.

32. *Impatiens coelotropis* C. Fischer in Bull. Misc. Inform. 1934: 390-391. 1934 & in Gamble, Fl. Pres. Madras 1871. 1936.

Undershrubs, weak, erect or prostrate, glabrous, up to 1 m or little more high; stems terete, green with red patches at insertion of leaves, succulent, eventually becoming woody, brown, erect, stems unbranched, prostrate ones emitting long slender furred roots from nodes. Leaves alternate, ovate to narrowly lanceolate, base cuneate, often unequal-sided and decurrent on one side, acute or rounded at apex, regularly and closely or rather distantly serrate along margins, serratures subappressedly apiculate, 5 - 13 x 2.5 - 6 cm, succulent, bright green with a velvety lustre above, paler below, eventually becoming yellow or scarlet, drying dark-brown; midnerve and 3 - 6 pairs of primary nerves slightly prominent and pale green below; petiole terete, channelled above, 1.5 - 7 cm long, red, usually bearing 1 - 4, solitary or paired capitate glands above middle. Racemes axillary, 3 - 4-flowered; peduncles solitary, 1.3 - 8 cm long; pedicels 1 - 4 cm long; bracts lanceolate, acuminate, 6 - 7 x ca 2.8 mm, midnerve stout, margins entire, early deciduous, leaving an elongated scar. Flowers up to 2.7 cm long. Lateral sepals thick, ovate-lanceolate, concave, acuminate, bluntly keeled, 1.4 - 1.6 cm long, scarlet. Lip deeply cylindric-saccate, slightly compressed laterally, ca 1.8 cm long, 1 cm across, anterior part of mouth with a curved acuminate beak, 4 mm long; spur 6-10 mm long, tubular, blunt, upcurved with apex appressed to front of sac, bright glossy-green, becoming scarlet at mouth with a crimson patch on beak, nerves deeply looped in the shape of sac. Standard suborbicular, cucullate, acute, ca 1.5 cm long, scarlet, keel ca 2.5 mm wide, hollow. Wings sessile, ca 1.5 cm long, 2-lobed; lobes slightly overlapping; distal oblong-falcate, obtuse, nerved, basal lobes semi-obovate, rounded, scarlet with bullate crimson patches. Capsules ellipsoid-fusiform, ca 1.5 cm long, green, glossy; seeds up to 15, more or less kidney-shaped, compressed, ca 1.4 x 2 mm, pale brown, minutely papillose.

Fl. & Fr. Aug. - Nov.

Distrib. India: Growing among rocks under trees that border streams on open grasslands and also amongst undergrowth in moist shola forests between 2,100 m to 2,500 m. Kerala (Southern W. Ghats in Nemakad gap and Anaimudi slopes).

Endemic.

33. *Impatiens concinna* Hook. f., Fl. Brit. India 1: 449. 1874.

Erect annuals, 15 - 25 cm high; stems stout, branched; branches ascending. Leaves opposite, subsessile, ovate-cordate, acute at apex, serrate, 1.2 - 1.8 cm long, glandular; 3 lower serratures almost setaceous, nerves prominent beneath; stipules setaceous or absent. Flowers ca 1 cm across, axillary, solitary, binate or in fascicles, rose-purple; pedicels shorter than the leaves. Lateral sepals ovate or ovate-lanceolate. Lip subequal to lateral sepals, cymbiform; spur very short, incurved. Standard orbicular, spurred.

Wings 2-lobed; distal lobes dimidiate-ovate, clawed. Capsules ca 8 mm long, turgid in middle; seeds few, broader than long, subcompressed, black, shining.

Fl. & Fr. Not known.

Distrib. India: Kerala. "Mountains of Malabar, Wight" - Hook. f. 1874.

Endemic. So far not recollected after type.

Notes. Hook. f. (1874) reported this species based on Wight's collection. But Wight did not mention this species in any of his works.

34. *Impatiens cordata* Wight in Madras J. Lit. Sci. ser. 1. 5: 10. 1837; Hook. f., *Fl. Brit. India* 1: 462. 1874.

Herbs, flaccid, erect; 15 - 30 cm high; stems prostrate and rooting below, glabrous. Leaves alternate, ovate-cordate, acuminate, obscurely crenate, crenatures with minute cilia, 4 - 7.5 x 3 - 4.5 cm, membranous, nerves slender with scattered hairs on both surfaces; petiole 2.5 to 7.5 cm long. Peduncles 5-10 cm long, subterminal and axillary, 3 - 4-flowered; bracts broadly ovate, green. Flowers in umbels, lilac with purple centre or white with crimson near centre. Lateral sepals almost equalling standard, large, ovate, acuminate. Lip cymbiform; spur slender, incurved, ca 2 cm long. Wings with basal lobes small, incurved, fleshy; distal lobes almost orbicular, spreading. Capsules ellipsoid, beaked, glabrous; seeds almond-shaped, 11, 12 or 18 in capsule, ca 2.5 mm long, brown with a tuft of white hairs around the margin.

Fl. & Fr. March - Dec.

Distrib. India: In Southern W. Ghats south of Palakkad gap at an altitude of 1,200 to 2000 m along streams, sometimes on trees. Kerala and Tamil Nadu.

Notes. Closely related to *I. leptura* Hook. f. but differs mainly in leaf shape and seed character.

Chromosome no. $2n = 20$ (Bhaskar & Razi in J. Mysore Univ. sec. B. 25 (1 - 2): 118. 1972 & 1973; Rao, R.V.S. in Proc. Indian Sci. Congr. sect. Bot. 60 (3): 137. 1973; Bhaskar, V. in Taxon 25 (1): 155. 1976).

35. *Impatiens cothurnoides* C. Fischer in Bull. Misc. Inform. 1931: 281. 1931.

Herbs, ca 60 cm high; stems stout, almost woody, branched, glabrous below, brown-furfuraceous at ends of branchlets, as are peduncles, pedicels and bracts. Leaves opposite and ternate, linear-elliptic, decurrent at base, subacute at apex, denticulate along margins, membranous, sparsely hairy on midnerve and lateral nerves on both

surfaces; midnerve prominent below, primary nerves 9 - 10 pairs ascending at a narrow angle. Flowers 2 - 4 together in an umbel, primrose-yellow; peduncles axillary, solitary, slender, 0.2 - 1.5 cm long; bracts at base of pedicels, lanceolate, acute, ca 3 mm long; pedicels slender, 0.5 - 1 cm long. Lateral sepals falcate-lanceolate, acute, ca 5 mm long, green. Lip ca 1.2 cm long excluding spur, mouth oblique, acute, shortly saccate at posterior base, spurred at anterior extremity; spur upwardly recurved, blunt, ca 1 cm long, shortly furfuraceous-hairy, hairs longer near apex of spur. Standard suborbicular, concave, ca 8 mm across, dorsally shortly hairy. Wings ca 2 cm long, 2-lobed; distal lobes oblong, orbicular, ca 1.2 x 0.45 cm, auricle well-developed, orbicular, cuneate, 3 - 4 mm long; basal lobes orbicular, 8 - 9 mm long; dorsal auricle cuneate, 3 - 4 mm long. Capsules linear-fusiform or slightly clavate, acute, ca 1 cm long, glabrous; seeds pyriform, strongly curved, ca 1 mm long, rugulose, papillose.

Fl. & Fr. Nov.-Jan.

Distrib. India: W. & E. Himalayas, on river banks, ca 3000 m. Uttar Pradesh, W. Bengal and Sikkim.

Endemic.

36. *Impatiens craddockii* Hook. f. in Rec. Bot. Surv. India 4: 29. 1905.

Herbs, annual. Leaves opposite, lower sessile and upper subsessile, linear to linear-elliptic, acute at apex, finely serrate along margins with lower teeth terminating in 1 - 2 mm long filiform appendage, ca 8 x 0.5 cm; stipular glands present; petioles 0 - 10 mm. Flowers axillary, 2 or more; pedicels slender, up to 4 cm. Lateral sepals lanceolate, ca 1 cm long. Lip shallowly navicular, spurred; spur gradually constricted, long, filiform. Standard cucullate. Wings with basal lobes ovate-triangular; distal lobes narrowly elliptic; dorsal auricles present. Capsules turgid in middle.

Fl. & Fr. July.

Distrib. India: E. Himalayas, ca 1150 m. Assam.

Myanmar.

37. *Impatiens crenata* Beddome in Madras J. Lit. Sci. ser. 2. 20: 69. t. 7. f. 10. 1859 & Icon. t. 31. 1868 - 1874; Hook. f., Fl. Brit. India 1: 442. 1876.

Herbs, scapigerous; rootstock bulbous. Leaves radical, orbicular-reniform or cordate, rounded at base, crenate with a bristle on each crenature and shaggy hairs on nerves above, glabrous. Scape slender, 2-3-flowered at apex; pedicels short; bracts ovate-oblong. Flowers white with a tuft of blue hairs. Lateral sepals small, ovate. Lip with a short,

obtuse spur. Wings deeply 2-lobed; inner surface with a dense tuft of hairs. Standard broader than long. Capsules tapering at both ends, glabrous.

Distrib. India: Anamalai mountain in Southern W. Ghats from 1350 to 2300 m altitude. Tamil Nadu and Kerala.

Endemic.

Notes. Beddome l.c. 69. f. 11. 1859 described another species *I. akka* from Akka mountains of Anamalai high altitudes and subsequently treated it as synonymous with *I. crenata*.

38. *Impatiens cuspidata* Wight & Arn. in Companion Bot. Mag. 1: 321. 1836; Wight, Icon. t. 741. 1844. *I. latifolia* sensu Hook.f., Fl. Brit. India 1: 450. 1874, p.p. non L. 1753.

Shrubs 50 - 100 cm high; stems and branches glaucous. Leaves opposite, alternate or whorled, elliptic-lanceolate, serrate, 5 - 11 x 2 - 4.5 cm, glandular at lower margins; nerves hairy beneath; petioles 1.5 - 5 cm long, glandular. Flowers axillary, solitary or in fascicles, pale pink or white; pedicels up to 8 cm long. Lateral sepals minute. Lip with 1.5 - 2 cm long spur. Standard ca 1.6 x 0.8 cm, larger than wings. Wings bilobed; basal lobes larger than distal ones. Capsules ellipsoid, cuspidate, ca 2.2 x 1.2 cm; seeds 7 - 11.

Fl. & Fr. Aug. - Dec.

Distrib. India: W. Ghats between 1500 - 2000 m. Karnataka, Tamil Nadu and Kerala.

Chromosome no. $2n = 14$. (Virendra Kumar and Subramaniam, Chr. Atlas Fl. Pl. Ind. Subc. 1: 84. 1986).

39. *Impatiens cuspidifera* Hook. f. in Rec. Bot. Surv. India 4: 27. 1905.

Herbs, annual, prostrate, glabrous. Leaves alternate, ovate to ovate-lanceolate, somewhat attenuate towards base, acute to long-acuminate at apex, serrate to serrulate along margins, 6.3 - 9.5 x 3 - 3.5 cm, dull green when dry; stipular glands absent. Flowers axillary, 2.5 - 3 cm with spur; bracts linear, ca 3 mm long; pedicels very slender, 0.6 - 1.1 cm long. Lateral sepals ovate, acuminate, ca 8 mm. Lip obliquely navicular, ca 1.3 cm deep, spurred; spur slightly curved, ca 1.6 cm long. Standard somewhat semicucullate with a small appendage. Wings with basal lobes ovate, smaller than distal lobes; distal lobes elliptic-ovate; dorsal auricle short, filiform. Capsules glabrous, turgid, ca 4 mm long.

Fl. & Fr. Sept.

Distrib. India: E. Himalayas, ca 1800 m. Nagaland.

Endemic.

40. *Impatiens cymbifera* Hook. f., Fl. Brit. India 1: 474. 1875 & in Rec. Bot. Surv. India 4: 14. 1905; Biswas, Pl. Darj. Sikkim Himal. 1: 212. 1966.

Herbs, glabrous; stems 60 - 90 cm high, branched, slender, green with pale red-purple blotches. Leaves elliptic-ovate or lanceolate, slightly or prominently attenuate towards base, acuminate or long-acuminate at apex, finely serrate along margins, serrations with filiform bristles, 10 - 20 x 3 - 7 cm, membranous; lateral nerves 8 - 14 pairs; petioles winged, 1 - 2.8 cm long. Flowers 1.8 - 3 cm long, pale lilac spotted with red; bracts navicular, long-pointed; peduncles terminal and subterminal, much shorter than leaves, 3.5 - 6.2 cm long. Lateral sepals ovate or broadly oblong, acuminate, green. Lip navicular, ovoid in outline, ca 1.6 cm long, not spurred. Standard cucullate (when flattened), broad with a shallow crest. Wings with rounded base; basal lobes somewhat ovoid; distal lobes slightly elongate with rounded apex. Capsules linear, 5 - 9 mm long, glabrous.

Fl. & Fr. Nov.

Distrib. India: E. Himalayas, 2100 - 3040 m. W. Bengal, Darjeeling and Sikkim.

Endemic.

41. *Impatiens dalzellii* Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 123. 1860; Hook. f., Fl. Brit. India 1: 449. 1874.

Erect, branched, succulent herbs, up to 30 cm high. Leaves lanceolate or oblong, the upper often linear, cordate, acute or acuminate at apex, spinous-serrate, 5 - 14 x 2 - 4 cm, glabrous or with short hairs above, pale beneath; lower leaves with short petioles, upper sessile; stipules absent. Flowers axillary, solitary or fascicled, yellow; pedicels shorter than leaves. Lateral sepals linear-lanceolate, somewhat falcate, acuminate, exceeding the tip in length in bud. Lip boat-shaped, acuminate, streaked inside with red nerves; spur very short. Standard orbicular, hooded, winged on back and horned. Wings with an obovate basal lobe, slightly incumbent on a clawed obovate distal one. Capsules ellipsoid, turgid in the middle, tapering at both ends, smooth, ca 2 cm long; seeds few, rarely 5, large, black.

Fl. & Fr. Aug. - Oct.

Distrib. India: Maharashtra and Karnataka.

Endemic to W. Ghats.

42. *Impatiens dasysperma* Wight in Madras J. Lit. Sci. 1, 5: 7, t. 2. 1837 & Icon. t. 742. 1844; Hook.f., Fl. Brit. India 1: 457. 1874.

Erect flaccid herbs, 30 - 60 cm high, branching sometimes. Leaves alternate, elliptic or ovate, acuminate, crenate, 4 - 8 x 1.5 - 4 cm, sparsely hairy above, glabrous below; petioles 0.8 - 2 cm long, often with stipitate glands. Flowers axillary, usually solitary or binate, pink; pedicels slender, decurved, 1 - 2.2 cm long. Lateral sepals minute, ovate. Lip cymbiform; spur up to 1.5 cm long, incurved, hairy. Standard obcordate, cuspidate. Wings divergently bilobed; lobes subequal, obovate, retuse. Capsules obliquely ovoid, ca 8 mm long, turgid in the middle, glabrous; seeds subglobose, papillose.

Fl. & Fr. Aug. - Nov.

Distrib. India: W. Ghats at lower elevations up to 900 m. Karnataka, Tamil Nadu and Kerala.

43. *Impatiens decipiens* Hook. f. in Rec. Bot. Surv. India 4: 17. 1905.

Herbs, glabrous. Leaves alternate, elliptic-oblancheolate, long-attenuate or cuneate at base, acuminate at apex; crenate along margins, 4.5 - 11 x 2.5 - 5 cm, midgreen above, pale green below; lateral nerves 7 - 9 pairs. Flowers solitary. Lateral sepals ovate, 3 - 7 x 2 - 4 mm, appendage 1 - 2 mm long. Lip shallowly navicular, 6 - 9 mm long, spurred; spur abruptly constricted from lip, filiform, curved, 2 - 2.7 cm long. Standard caudate, emarginate, ca 1 x 1.2 cm. Wings ca 1.4 cm long; basal lobes ovate; distal lobes ovate-elliptic. Capsules linear, 0.5 - 1.5 cm long.

Fl. & Fr. June - Oct.

Distrib. India: E. Himalayas, 1500 - 2750 m. W. Bengal and Sikkim.

Tibet.

44. *Impatiens dendricola* C. Fischer in Bull. Misc. Inform. 1935: 157. 1935.

Herbs, epiphytic, stemless. Leaves pendulous, membranous, elliptic to ovate-lanceolate, obtuse, minutely apiculate, rounded or more often attenuate at base, margins rather distinctly crenate, apiculate in sinuses, 1.8 - 8.2 x 1 - 3.7 cm, more or less scattered hairy on upper surface, glabrous below; midnerve and 4 - 5 pairs of nerves slender, latter ascending at a very acute angle; petiole slender, terete, 1.5 - 6.5 cm long, glabrous. Scapes 2-3, semi-pendulous; peduncles slender, terete, 7-13 cm long, glabrous. Racemes 1.5 - 4 cm long, up to 8-flowered; pedicels 1 - 2 cm long; bracts broadly ovate, obtuse, 2.5 - 3.5 mm long, glabrous. Flowers white. Lateral sepals falcate-ovate, obtuse, base deeply lobed on anterior side, ca 2.5 mm long. Lip ovate, base saccate, 5 - 5.5 x 7 - 7.5 mm, white. Wings 3-lobed, 1.6 - 1.8 cm long, white with a tuft of orange hairs a little

above base; distal lobes straight, strap-shaped, rounded, ca 8 mm long; median lobes sub-circular, ca 6 mm across; basal lobe strap-shaped, slightly widened at the apex, strongly recurved, about as long as lower, spurred; spur strongly curved, clavate, 1 - 1.5 cm long, white. Capsules semi-ellipsoid, one side straight, acute 8-9 mm long; seeds sausage-shaped, ca 1.2 mm long, dark brown, muriculate, with a dense tuft of wrinkled hairs up to 2.5 mm long, at each end.

Fl. & Fr. Sept.

Distrib. India: On tree trunks in evergreen forests. Karnataka.

Notes. The species was described based on two specimens collected by E. Barnes and so far not recollected.

45. *Impatiens denisonii* Beddome in Madras J. Lit. Sci. ser. 3.1: 41. 1864 & Icon. t. 151. 1868 - 1874; Hook. f., Fl. Brit. India 1: 444. 1874.

Herbs, scapigerous. Leaves radical, ovate - cordate, base deeply 2-lobed, sinus broad, obtuse or acute at apex, bristly crenate, 7-15 x 7.5 - 10 cm, hairy above, glabrous below; petioles shorter than leaves. Scapes twice to four times as long as leaves. Flowers numerous, ca 2.5 cm long, pink, racemed towards apex; pedicels 2.5 - 3.5 cm long. Lateral sepals ovate. Lip broadly ovate with three broad spreading lobes with dense tuft of petaloid hairs above conjunction of lobes; spurred. Wings with a filiform auricle enclosed in long recurved spur. Capsules glabrous; seeds numerous with spiral hairs.

Fl. & Fr. July - Nov.

Distrib. India: Common on moist rocks and tree trunks between 1000 to 1600 m altitude. Tamil Nadu and Kerala.

Endemic to the western slopes of Nilgiris.

46. *Impatiens depauperata* Hook. f., Fl. Brit. India 1: 481. 1875; Hook. f. in Rec. Bot. Surv. India 4: 31. 1905.

Herbs, annual; glabrous; stems much branched. Leaves alternate, ovate to ovate-lanceolate, abruptly narrowed to attenuate towards base, crenate along margins and ciliate on basal margin, 2 - 5 x 1.3 - 2 cm, sparsely hairy on upper surface; stipules linear. Flowers white, 4 - 5, pedunculate, buds globose; bracts linear. Lateral sepals linear, 2 - 3 mm long. Standard more or less orbicular, 4 - 5 mm long. Wings 8 - 10 mm long; basal lobes ovate-triangular, 2 - 4 x 1.5 - 3 mm; distal lobes suborbicular or transversely semiovate, 4 - 7 x 3 - 4 mm. Capsules swollen at middle, 5 - 6 x 2 - 3 mm; seeds elliptic, 1 - 2, black.

Fl. & Fr. Oct.

Distrib. India: E. Himalayas, 1500 - 1850 m. Meghalaya.

Endemic.

47. *Impatiens discolor* DC., Prodr. 1: 687. 1824; H. Hara in Fl. E. Himal. 1: 195. 1966.

Herbs, slender, decumbent and rooting at lower nodes, up to 2 m. Leaves alternate, ovate to lanceolate, cuneate at base, acuminate at apex, coarsely crenate and with bristles in sinus, 2.5 - 12 x 1 - 5.5 cm, sparsely hairy above; petioles up to 3.5 cm long. Peduncles short, axillary, up to 4 cm long, 1 - 3-flowered. Flowers axillary, ca 3 cm long, pale lilac to violet; bracts lanceolate, long-acuminate, gland-tipped; pedicels ca 2 cm long. Lateral sepals broadly ovate, acuminate, big. Lip bucciniform, pink-purple nerved, spurred; spur short, stout incurved, obtuse. Standard small, orbicular, spurred on back. Wings with basal lobes elliptic-oblong; distal lobes elliptic-obovate, large, pendulous. Capsules clavate, up to 4 cm, acuminate beyond the middle.

Fl. & Fr. July - Oct.

Distrib. India: E. Himalayas. W. Bengal, Sikkim and Meghalaya.

Nepal.

48. *Impatiens disotis* Hook. f. in Rec. Bot. Surv. India 4: 48. 1906; Gamble, Fl. Pres. Madras 144. 1915.

Erect herbs. Leaves alternate. Flowers in umbels of short racemes, white. Lateral sepals oblong, acute. Spur shorter than limb of lip, 0.6 - 1.2 cm long.

Fl. & Fr. Not known.

Distrib. India: "S. Western Ghats of Travancore and Tinneveli Hills, alt. 400 ft." - Hook. f. (1906). Tamil Nadu and Kerala.

Endemic.

Notes. Gamble (1915) reported this species apparently based on Hook. f. (1906). It has not been recollected or reported afterwards.

49. *Impatiens diversifolia* Wallich ex Wight & Arn., Prodr. 139. 1834; Hook. f., Fl. Brit. India 1: 446. 1874; Gamble, Fl. Pres. Madras 140. 1915.

Herbs, flaccid, diffuse, 15 - 40 cm high; stems rooting at lower nodes. Leaves opposite, sessile or shortly petiolate, 1 - 8 x 0.8 - 1.2 cm; lower ones shortly petiolate, elliptic or oblong; upper linear-oblong or ligulate, cordate at base, sessile; stipules obscure, glandular. Flowers axillary, solitary or binate, ca 2 cm across; pedicels 1 - 2 cm long, pubescent, deflexed in fruits. Lateral sepals linear, acuminate. Spur filiform, 1 - 1.5 cm long. Standard small. Wings semiobovate, ca 1.2 x 0.8 cm. Capsules ellipsoid, ca 8 mm long; seeds globose, dark-brownish, smooth, shining.

Fl. & Fr. July - Nov.

Distrib. India: In marshy places. W. Ghats of Karnataka, Tamil Nadu and Kerala.

Endemic.

50. *Impatiens drepanophora* Hook. f. in Rec. Bot. Surv. India 4: 17. 1905; Toppin in Bull. Misc. Inform. 1920: 364. 1920; H. Hara in Fl. E. Himal. 1: 195. 1966. Fig. 39.

Herbs, annual, slender, 25 - 50 cm high; stems often creeping at base, branched, glabrous; nodes swollen. Leaves erect, alternate or opposite, ovate-lanceolate to ovate or ovate-elliptic, slightly attenuate towards base, acuminate at apex, margins finely serrate-dentate with lowermost teeth filiform, 2.5 - 11 x 1.7 - 5.5 cm, glabrous; lateral nerves 7 - 12 pairs; petioles 2 - 5 mm, glabrous. Flowers pedicellate, more or less horizontal, 2 - 2.7 cm long, yellow; bracts ovate-lanceolate, up to 4 mm long; pedicels deciduous, slender, 1.5 - 2.3 cm long, glabrous. Lateral sepals uncinately incurved, 2 - 3 mm long, long awned. Lip bucciniform with 1 mm long appendage, 1.7 - 2 cm long, spurred; spur abruptly constricted, filiform, 1.2 - 1.7 cm long. Standard orbicular, with long narrow curved ends. Wings oblong, ca 2 cm long; distal lobes oblong; dorsal auricle small. Capsules fusiform, ca 1.5 cm long; seeds oblong, ca 1 mm long, glabrous or tuberculate.

Fl. & Fr. May - July.

Distrib. India: E. Himalayas, ca 1800 m. Sikkim, Arunachal Pradesh, Nagaland, Manipur and Meghalaya.

Nepal.

Chromosome no. $2n = 20$ (Sarkar, A.K. et al. in Taxon 24: 367-372. 1975).

51. *Impatiens duthiei* Hook. f. in Rec. Bot. Surv. India 4: 11. 1905.

Herbs. Leaves membranous. Pedicels not fascicled or umbelled. Lateral sepals orbicular or broadly ovate with appendage. Lip bucciniform. Capsules erect.

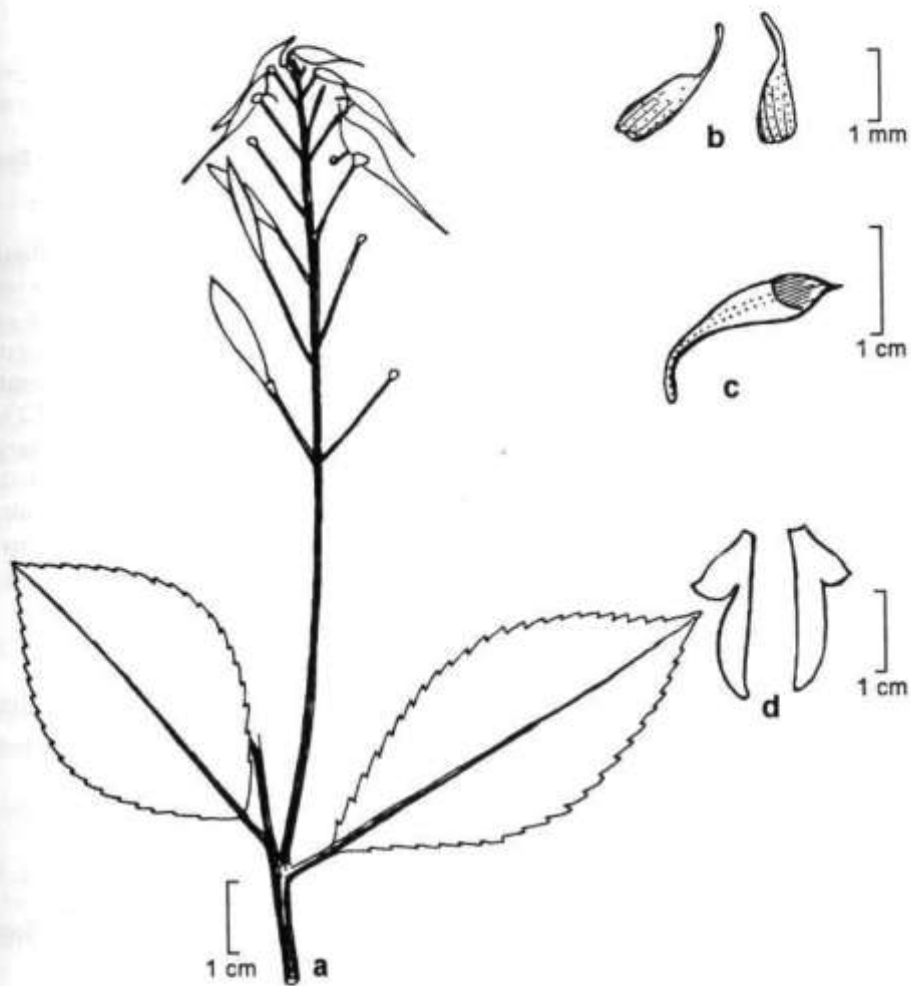


Fig. 39. *Impatiens drepanophora* Hook. f. : a. habit; b. lateral sepals; c. lip; d. wing petals.

Fl. & Fr. Unknown.

Distrib. India: W. Himalayas, ca 2700 m. Uttar Pradesh (Kumaon).

Endemic.

Notes. Included on the basis of literature.

52. *Impatiens edgeworthii* Hook. f., Fl. Brit. India 1: 476. 1875 & in Rec. Bot. Surv. India 4: 5. 1904; H. Hara in H. Hara & Williams, Enum. Fl. Pl. Nepal 2: 78. 1979.

Herbs, annual, robust, glabrous. Leaves ovate-lanceolate, to ovate or ovate-elliptic, base attenuate towards base, acuminate at apex, serrate to crenate along margins with lowermost teeth (1 - 2 mm) filiform, 5 - 15 x 1.5 - 7.5 cm, glabrous; lateral nerves 6 - 14 pairs; petiole 0.5 - 7 cm long. Flowers 2.5 cm, yellow; bracts at times whorled, lanceolate, 2 mm long; peduncles 2.5 - 7 cm long; pedicels sometimes whorled. Lateral sepals ovate, acute, ca 3 x 2 mm, midnerve prominent. Lip bucciniform, 1.2 - 1.5 cm long, 1 - 1.2 cm deep, spurred; spur gradually constricted, 0.8 - 1 cm long. Standard cucullate, emarginate, ca 1 x 1.4 cm (when flattened). Wings with a globular dorsal auricle and a lobular structure towards sinus; basal lobes obovate, 6 x 5 mm; distal lobes oblong with ligulate apex, lobular structure oblong, ca 6 x 2 mm. Stamens 5, filaments short and broad. Carpels 5. Capsules erect, linear, 2.5 - 2.9 cm long.

Fl. & Fr. Aug. - Oct.

Distrib. India: W. Himalayas. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Nepal.

Chromosome no. $2n = 12$ (Khoshoo, T.N. in Curr. Sci. 24: 423-424. 1955).

53. *Impatiens elegans* Beddome in Madras J. Lit. Sci. ser. 2. 78: 67. 1859 & Icon. 29. t. 145. 1868 - 1874; Hook. f., Fl. Brit. India 1: 465. 1875.

Herbs, erect, up to 40 cm high; stems glabrous, simple or branched, often rooting at lower nodes. Leaves alternate, ovate or ovate-cordate, rounded or cordate at base, acuminate, crenate with incurved bristles, 4 - 12 x 1 - 4 cm, hairy on nerves above, pale glabrous beneath; petioles up to 5 cm long. Peduncle slender, axillary and terminal. Flowers 3 - 5, umbelled or shortly racemed, ca 2.5 cm across, pale rosy-white with dark purple eye; bracts ovate-lanceolate, acuminate, recurved. Lateral sepals ovate with green ridge ending in an acumen. Lip cymbiform, very small, spur absent. Standard broad, ovate, flat with a green ridge on its back. Capsules ellipsoid, beaked, turgid in middle, ca. 1.2 cm long, glabrous; seeds subglobose, hairy.

Fl. & Fr. Jan. - May; July - Dec.

Distrib. India: Tamil Nadu (Anamallay hills - Poonachi & Kadamparai 700 m to 1500 m) and Kerala (Travancore hills). Endemic.

Notes. This species is closely allied to *Impatiens cordata* Wight but differs from it in absence of spur.

54. *Impatiens exilis* Hook. f. in Rec. Bot. Surv. India 4: 13. 1905; H. Hara in Fl. E. Himal. 1: 195. 1966 & 3: 79. 1975.

Herbs. Leaves ovate-elliptic, elliptic or oblong, attenuate towards base, acuminate at apex, shallowly serrate along margins, serrations with poorly developed filiform appendages, lowermost appendages less than 1 mm long, 4.5 - 22.5 x 2.3 - 4.5 cm, finely pubescent beneath, green, paler beneath; lateral nerves 7 - 10 pairs; petiolate, stipular glands pubescent. Flowers pedunculate, 3.5 - 4 cm long. Lateral sepals lanceolate, acuminate, 2 - 4 mm. Lip shallowly navicular, 4 - 8 mm long, 3 - 4 mm deep, spurred; spur filiform, slender, 2.5 - 3 cm long. Standard broadly obovate, slightly emarginate, ca 3 x 2 cm with a small appendage. Wings 1 - 1.5 cm long; basal lobes ovate-triangular, 6 - 7 x 3 - 4 mm; distal lobes elliptic-obovate, acutely pointed at apex, 7 - 10 x 5 - 7 mm; dorsal auricle short, hooked. Capsules turgid, tapering towards both ends, 2 - 6 mm long, glabrous.

Fl. & Fr. June - Oct.

Distrib. India: E. Himalayas, 600 - 1550 m. W. Bengal (Darjeeling) and Sikkim (Gangtok).

Endemic.

55. *Impatiens falcifer* Hook. f. in Bot. Mag. t. 7923. 1903 & in Rec. Bot. Surv. India 4: 18. 1905; H. Hara in Fl. E. Himal. 1: 195. 1966 & 3: 79. 1975. *L. serrata* sensu Hook. f., Fl. Brit. India 1: 473. 1875, p.p., non Benth. ex Hook. f. & Thomson 1860.

Herbs. Leaves sessile or subsessile, elliptic to elliptic-lanceolate, rarely lanceolate, cuneate or abruptly attenuate into stem, long-acuminate at apex, serrate along margins with each tooth terminating in a short apiculum, 2.4 - 6.8 x 0.9 - 2.3 cm; lateral nerves 4 - 7 pairs. Flowers 2.3 - 3 cm; usually pedunculate; pedicels 1.5 - 2.5 cm long, with a 1 - 3 mm long lanceolate appendage nearabout middle. Lateral sepals lanceolate, acuminate, 4 - 5 x 1.5 - 2 mm. Lip 5 - 7 mm long, spurred; spur filiform, 2 - 2.3 cm long. Standard elliptic to elliptic-obovate, shortly pointed-acute at apex, 1 - 1.3 x 0.6 - 0.7 cm. Wings ca 1 x 1 cm; basal lobes broadly triangular, ca 3 x 4 mm, with a dorsal auricle; distal lobes oblong-reniform, 1.7 - 2 x 0.3 - 0.7 cm. Capsules acute, 1.2 - 3.5 cm long.

Fl. & Fr. Sept. - Nov.

Distrib. W. Bengal and Sikkim.

Nepal and Bhutan.

56. *Impatiens flaccida* Arn. in Companion Bot. Mag. 1: 322. 1836; Hook. in Bot. Mag. 87: t. 5276. 1861; Hook.f., Fl. Brit. India 1: 457. 1874, excl. syn. *I. bipartita* Arn. & *I. floribunda* Wight.

Erect or decumbent herbs up to 50 cm high; stems slender, sparingly branched in lower half, green or flushed with pink, rooting at lower nodes. Leaves alternate, ovate-lanceolate or lanceolate-elliptic, crenate, 3 - 8 x 1.2 - 3.5 cm, sparsely pubescent; petioles 1.2 - 3.5 cm long with stipitate glands. Flowers solitary or in fascicles of 2 - 3, pale to deep pink; pedicels 2 - 3 cm long; bracts inconspicuous. Lateral sepals ovate. Lip 8 - 10 mm long; spur 1.5 - 2.5 cm long, filiform or slender, incurved. Standard obcordate with a keel on dorsal side terminating into an acute point. Wings 2-lobed. Capsules ca 1.5 cm long, ellipsoid, glabrous; seeds globose, glabrous or papillose.

Fl. & Fr. July - Dec.

Distrib. India: W. Ghats, Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

Notes. This species is closely related to *I. floribunda* Wight in having 3-lobed radical pollen, crescent-shaped epidermal flangs and minutely puberulous capsules (Bhaskar & Razi 1978).

Chromosome no. $2n = 14$. (Jones and Smith in Kew Bull. 20: 64. 1966).

57. *Impatiens flemingii* Hook. f. in Rec. Bot. Surv. India 4: 5. 1904. *I. parviflora* auct. non DC.: Hook. f., Rec. Bot. Surv. India 4: 10. 1904.

Herbs, annual, glabrous. Leaves alternate or opposite, elliptic ovate to lanceolate, gradually attenuate towards base, acute to long-acuminate at apex, shallowly crenate to dentate along margins with lower teeth filiform, gland-tipped and 1 - 1.5 mm long, finely pubescent on both surfaces; lateral nerves 4 - 10 pairs; petioles 0.8 - 3.2 cm, glabrous. Flowers pedunculate, 1.2 - 3.2 cm long with spur, white or pink; peduncle slender, 0.5 - 12 cm long, glabrous; pedicels 0.9 - 1.8 cm, glabrous. Lateral sepals ovate, slightly curved on one side, with few appendages along margins, ca 3 x 2 mm. Lip shallowly navicular, 0.6 - 1.5 cm long, spurred; spur abruptly constricted, filiform, curved, 0.5 - 2.5 cm. Standard obcordate to suborbicular, obtuse, ca 6 x 4 mm. Wings bilobed; basal lobes

ovate, ca 1.1 x 0.3 cm; distal lobes broadly oblong. Carpels 5; stigma sessile. Capsules linear, acute, 0.3 - 1.2 cm.

Fl. & Fr. June-Aug.

Distrib. India: W. Himalayas, ca 1550 - 3200 m. Jammu & Kashmir.

Pakistan.

Notes. True *I. parviflora* DC. occurs only in Siberia (Y. Nasir in E. Nasir & Ali. *Fl. Pakistan* 113: 10, 11. 1980).

58. *Impatiens floribunda* Wight in *Madras J. Lit. Sci. ser. 1. 5: 7. 1837. I. flaccida* sensu Hook.f., *Fl. Brit. India* 1: 457. 1874, p.p. non Arn. 1836. **Fig. 40.**

Erect or decumbent herbs up to 70 cm high; stems branched, green. Leaves alternate or opposite, rarely whorled, elliptic-lanceolate, caudate-acuminate at apex, 2 - 10 x 1.2 - 1.4 cm, serrate or crenate-serrate along margins, apiculate from apex of teeth, glaucous beneath; petioles 1.5 - 3.5 cm long with stipitate glands. Flowers solitary or in fascicles, purple; pedicels up to 2.5 cm long. Lateral sepals small, ovate. Lip cymbiform; spur slender, straight. Wings bilobed; seeds globose.

Fl. & Fr. July - Nov.

Distrib. India: Southern W. Ghats, 1800 - 2100 m. Tamil Nadu and Kerala.

Endemic.

59. *Impatiens florigera* C.B. Clarke ex Hook. f. in *Rec. Bot. Surv. India* 4: 13. 1905.

Herbs, erect. Leaves alternate, ovate, lanceolate to narrowly elliptic, cuneate at base, long-acuminate at apex, shallowly serrate along margins with filiform appendage scarcely developed, 2.2 - 9.5 x 1.4 - 3 cm, whitish beneath; lateral nerves 4 - 11 pairs; stipular glands 1.5 mm long; petiole 1.5 - 3.5 cm long. Flowers pedunculate, white, with lip pale lilac. Lateral sepals linear-lanceolate, 2 - 3 mm long. Lip bucciniform, 5 - 8 mm long, 9 - 12 mm deep, spurred; spur gradually constricted, filiform upwards, 4 - 5 mm. Standard suborbicular, ca 4 x 3 mm, many-nerved. Wings bilobed, ca 8 mm long; basal lobes more or less globose or triangular-ovate; distal lobes narrowly ovate, but narrowed just above middle. Capsules turgid in middle, 0.5 - 1.2 cm long, glabrous.

Fl. & Fr. May - Oct.

Distrib. India: E. Himalayas, ca 300 - 1500 m. W. Bengal and Sikkim.

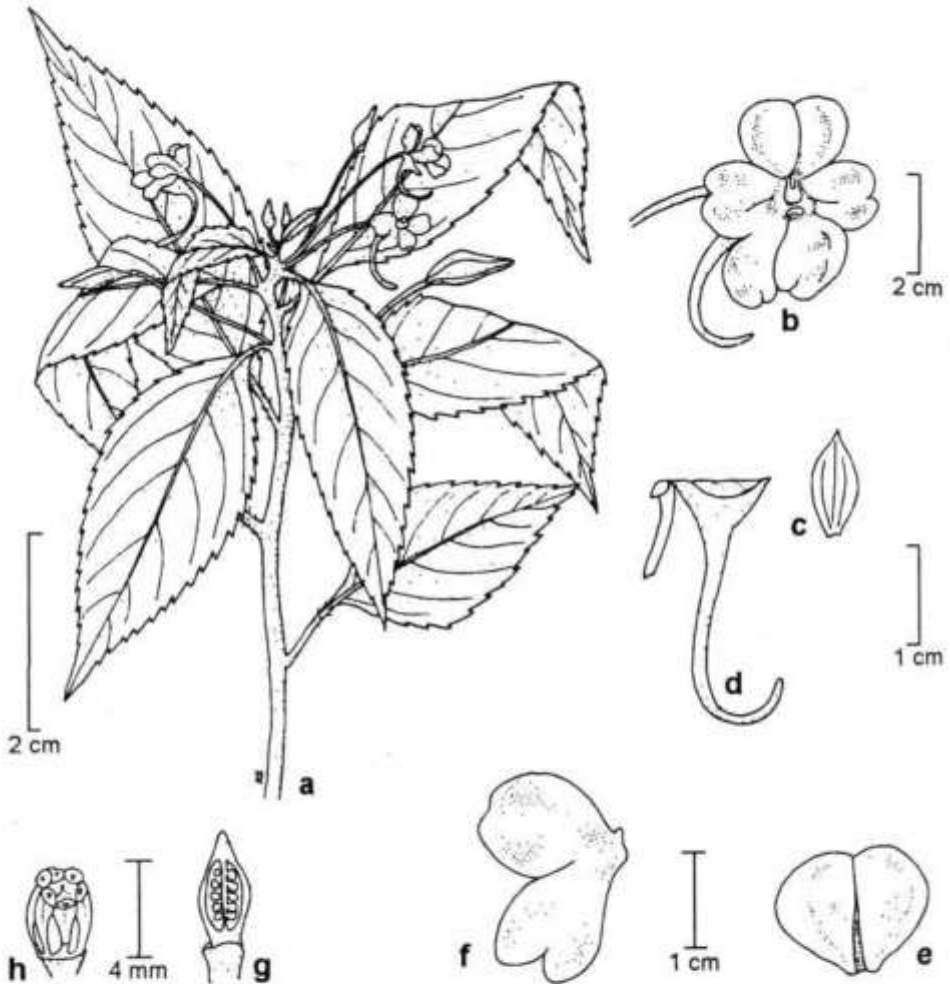


Fig. 40. *Impatiens floribunda* Wight : a. habit; b. flower; c. lateral sepal; d. lip; e. standard; f. wing petal; g. stamens; h. l.s. of ovary.

Bhutan.

60. *Impatiens formosa* Hook. f. in Rec. Bot. Surv. India 4: 28. 1905.

Herbs, annual; stems branched. Leaves all alternate or upper sessile and whorled, lanceolate to lanceolate-elliptic, attenuate into petiole, acute to acuminate at apex, coarsely serrate along margins with lower teeth terminating in filiform appendages, 4.2 - 12 x 1.5 - 4 cm, slightly pubescent above, glabrous below; stipular glands 2 - 2.5 mm long. Flowers pedunculate, ca 3 cm long, pinkish; peduncle axillary, 2 - 5 cm long; bracts linear; pedicels very slender, 1.5 - 2 cm long. Lateral sepals linear-lanceolate, ca 3 mm long. Lip obliquely navicular, 2 - 3 cm long, spurred; spur narrow, curved. Standard semicucullate, ca 7 x 11 mm (when flattened), with appendage. Wings ca 2.6 cm long; basal lobes ovate, ca 1.2 cm; distal lobes semiovate to ovate-elliptic, ca 1.4 cm. Capsules turgid at middle, narrowed at both ends, 1.7 - 2.5 cm long.

Fl. & Fr. July - Oct.

Distrib. India: E. Himalayas, 910 - 1650 m. Meghalaya.

Endemic.

61. *Impatiens fruticosa* Leschen. ex DC., Prodr. 1: 687. 1824; Hook. f., Fl. Brit. India 1: 459. 1874.

Shrubs, perennial, erect, ca 2.5 m high, much branched; branches glabrous, glaucous, nodose at scars. Leaves alternate, ovate or elliptic, attenuate at base, acuminate at apex, crenate along margins, ciliate and glandular towards base, 7 - 13 x 3.5 - 5.5 cm, pubescent on both surfaces, sometimes silky beneath, many nerved, nerves stout; petiole 2 - 7 cm long, stout, often villous, naked or glandular. Flowers axillary, paired or solitary, ca 4 cm broad, pink; bracts linear-subulate; pedicels often much larger and exceeding leaves. Lateral sepals ovate, acuminate, 1.5 x 0.6 cm, tomentose. Lip trumpet-shaped, acuminate, ca 1 cm long, spurred; spur curved, ca 2.5 cm long. Wings 2-lobed; lobes oblong, subequal, divaricate. Filaments united at apex. Capsules erect, ellipsoid, narrowed at both ends, beaked, ca 2.5 cm long, glabrous; seeds numerous.

Fl. Oct. - Jan. *Fr.* Nov. onwards.

Distrib. India: Southern W. Ghats, margins of sholas at an altitude of 1000 m. Tamil Nadu and Kerala.

Endemic.

Chromosome no. $n = 10$ (Krishnaswamy et al. in South Indian Hort. 17 (1 & 2): 28 - 33. 1969); $n = 8$ (Rao, R.V.S. in Proc. Indian Sci. Congr. 59 (3): 356. 1972).

62. *Impatiens gamblei* Hook. f. in Rec. Bot. Surv. India 4: 15. 1905; H. Hara in Fl. E. Himal. 3: 79. 1975.

Herbs; stems simple or branched. Leaves alternate, ovate-lanceolate, ovate or ovate-elliptic, slightly attenuate into petiole, acuminate at apex, shallowly crenate along margins, 4-9 x 1.5-3 cm, velvety on dorsal side; lateral nerves 4-6 pairs; petioles present. Inflorescence axillary pedunculate few-flowered racemes. Flowers ca 3 cm including spur, rose-purple. Lateral sepals ovate-lanceolate, acuminate, 4-5 x 2-3 mm, margins with small appendages. Lip bucciniform, 1-1.4 x 0.8-1.7 cm, spurred; spur 0.5-1.7 cm. Standard cucullate, 0.8-1 cm long. Wings bilobed; basal lobes more or less ovate with one side extended; distal lobes ligulate. Stamens 5; anthers united. Capsules linear, acute, 0.4-2.2 cm; seeds glabrous.

Fl. & Fr. July - Sept.

Distrib. India: E. Himalayas, ca 2500-3700 m. W. Bengal (Darjeeling) and Sikkim.

China and Nepal.

63. *Impatiens gammiei* Hook. f. in Rec. Bot. Surv. India 4: 16. 1905.

Herbs. Leaves mostly on upper half of stems, alternate, ovate to ovate-lanceolate or ovate-elliptic, somewhat attenuate into petiole, acuminate at apex, deeply crenate along margins, 4.2-9 x 2.5-3 cm; midnerve strong, lateral nerves 4-10 pairs. Flowers small, 4-6 mm, flesh-coloured; peduncles 5-16 cm long, with large number of pedicels; bracts lanceolate, 2-4 mm, with 1-2 mm long appendage. Lateral sepals ovate, ca 2 mm long, long-acuminate. Lip navicular, sometimes spurred or spurless. Standard suborbicular, shallowly emarginate. Wings 2-lobed, joined by a narrow sinus; basal lobes ovate; distal lobes fusiform. Capsules linear, acute, 0.3-2.3 cm long.

Fl. & Fr. July - Oct.

Distrib. India: E. Himalayas, ca 3000 m. W. Bengal, Sikkim and Arunachal Pradesh.

Endemic.

64. *Impatiens gardneriana* Wight, Icon. t. 1050. 1846; Hook. f., Fl. Brit. India 1: 445. 1874 & in Rec. Bot. Surv. India 4: 46. 1906. *I. setosa* Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 123. 1860; Hook. f., Fl. Brit. India 1: 445. 1874.

Annuals, 30-60 cm high; stems procumbent or creeping at base, simple or branched with cilia at upper nodes. Leaves opposite and whorled, upper sessile, ovate-oblong or elliptic-lanceolate, cuneate or rounded at base, acuminate at apex, serrate, ciliate towards base of margins, 3-12 x 1-4 cm, sparsely pubescent; petioles 1.2-2.5 cm long,

sparsely pubescent. Flowers axillary, solitary, binate or in fascicles, ca 2.5 cm across, bright red or pink; pedicels filiform, 2 - 3.5 cm long, glabrous. Lateral sepals ovate, acuminate, apiculate, ciliate on margins. Lip cymbiform; spur slender, curved upwards, 1.5 - 1.8 cm long. Standard suborbicular-obovate, apiculate, keeled on dorsal side. Wings 2-lobed; lobes obovate, subequal; distal lobes comparatively larger.

Fl. & Fr. July - Dec.

Distrib. India: Evergreen forests and slopes of southern W. Ghats, 500 - 1400 m. Tamil Nadu and Kerala.

Endemic.

65. *Impatiens gibbisepala* Hook. f. in Bull. Misc. Inform. 1910: 298. 1910.

Herbs, erect; stems branched, glabrous. Leaves alternate, ovate or ovate-lanceolate, caudate-acuminate at apex, crenate along margins with setae in sinuses, 6 - 10 cm long; lateral nerves 8 - 10 pairs; petiole slender, 3 - 5 cm long, stipular glands absent. Flowers golden yellow; bracts ovate-lanceolate, 2 - 3 mm long; peduncle few-flowered, erect, glabrous, shorter than leaves; pedicels 2 - 3 cm long. Lateral sepals 4, outer 2 oblong, acute or cuspidate, 6 - 7 mm long, inner 2 with a hyaline sharp point. Lip bucciniform; spur slender, gradually constricted, ascending, mucronate, ca 3 cm long. Standard ovate to oblong, acute, ca 7 mm long. Wings sessile; basal lobes oblong or rounded at apex, ca 1.5 cm long; distal lobes three times longer, strap-shaped, ca 1.5 cm long; dorsal auricle absent. Capsules linear, slender; seeds many.

Fl. & Fr. July - Oct.

Distrib. India: E. Himalayas, ca 2500 m; very rare. Manipur.

Endemic.

66. *Impatiens glandulifera* Royle, Ill. Bot. Himal. Mts. 151. 28, t. 2. 1853; Hook. f. in Bot. Mag. 4020. 1843; H. Hara in H. Hara & Williams, Enum. Fl. Pl. Nepal 2: 78. 1979. *I. roylei* Walpers, Rep. Bot. Syst. 1: 475. 1842; Hook. f., Fl. Brit. India 1: 468. 1875 & in Rec. Bot. Surv. India 4: 5. 1904.

Herbs, perennial, 1 - 2 m high; stems erect, simple or branched, glabrous, succulent. Leaves opposite or ternate, elliptic, lanceolate or oblong, rounded to gradually attenuate towards base, acute to long-acuminate at apex, crenate-serrate along margins, teeth with filiform appendages, 6.2 - 15 x 2.5 - 7 cm, finely pubescent or glabrous; lateral nerves 7 - 9 pairs; petiole glabrous, 1.5 - 5 cm, glandular; stipules stout, gland-tipped. Flowers 3.3 - 3.8 cm, in subterminal umbels or racemes, pale-pink or dark-crimson; peduncles stout, up to 9 cm long; bracts ovate-lanceolate, long-acuminate, 4 - 8 mm long; pedicels

slender, 0.5 - 3 cm long, glabrous. Lateral sepals ovate, 5 - 8 x 3 - 5 mm, with ca 1 mm long appendage. Lip bucciniform, 1.2 - 2 x 1 - 1.7 cm, mouth with an appendage; spur suddenly constricted, filiform, incurved, 3 - 5 mm long. Standard suborbicular, 1 x 1.6 cm. Wings bilobed, ca 2.5 cm long; basal lobes about one-third the size of distal, rounded; distal lobes elliptic-oblong, obtuse, 1.3 - 1.6 x 0.6 - 0.8 cm. Capsules obovate, 0.4 - 1.3 x 0.2 - 0.8 cm, beaked; beak ca 1 cm long.

Fl. & Fr. July-Sept.

Distrib. India: W. Himalayas in damp places and along streams 2000 - 3000 m. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh (Kumaon) and Mizoram.

Nepal and Pakistan.

Chromosome no. $2n = 18$ (Javur Kuva, V. in Taxon 28: 703-730. 1979).

Notes. All three varieties of this species erected by J.D. Hooker (Fl. Brit. India 1: 469. 1875) namely var. *moschata*, var. *candida* and var. *macrochila* have been subsequently clubbed by himself (Rec. Bot. Surv. India 4: 7. 1904).

67. *Impatiens glauca* Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 155. 1860; Hook. f., Fl. Brit. India 1: 482. 1875 & in Rec. Bot. Surv. India 4: 6. 1904; H. Hara in H. Hara & Williams, Enum. Fl. Pl. Nepal 2: 79. 1979.

Herbs, glabrous; stems ca 70 cm high, much branched, glaucous. Leaves alternate, ovate-lanceolate, more or less rounded or cordate at base, acute at apex, deeply crenate along margins, 5 - 16 x 2.5 - 8.5 cm, membranous, glaucous; lateral nerves 6 - 20 pairs, linked by a loose network of secondary nerves; petiole 2.5 - 9.5 cm with a scutellate gland at base. Flowers in axillary or terminal 6 - 8-flowered racemes, ca 2 cm, orange or pale red; bracts elliptic to elliptic-oblong or ovate, ca 4 mm long; peduncles ca 12 cm long; pedicels stout, ca 1.5 cm long. Lateral sepals ovate, curved at base, ca 5 x 4 mm. Lip navicular; spur bent upwards. Standard cucullate, acutely pointed at apex. Capsules linear or clavate, ca 3.5 cm, glabrous.

Fl. & Fr. Aug. - Oct.

Distrib. India: W. Himalayas, 2100 - 3000 m. Himachal Pradesh and Uttar Pradesh (Kumaon).

Nepal.

68. *Impatiens goughii* Wight, Ill. Ind. Bot. 1: 160. 1840 & Icon. t. 1603. 1850; Hook. f., Fl. Brit. India 1: 452. 1874. *I. microtheca* Hook. f. in Hooker's Icon. Pl. 30: t. 2910. 1910.

Annual herbs, 5 - 30 cm high; stems simple or branched. Leaves opposite, ovate, subacute at apex, crenate-serrulate along margins, 1.5 - 3.5 x 0.8 - 1.5 cm, glabrous, rarely hairy below; petioles up to 2 cm long. Flowers in terminal subumbels, pale pink; peduncles 2 - 5 cm long; pedicels up to 1.5 cm long; bracts persistent, minute, lanceolate. Lateral sepals falcate, ca 2 mm long. Lip cymbiform; spur shorter than wings, straight. Standard obovate, mucronate at the retuse apex. Wings bilobed; basal lobes oblong, rounded at apex; distal lobes longer than basal ones; dorsal auricle produced into the spur. Capsules ellipsoid, 3 - 5 mm long, 6 - 12-seeded; seeds almond-shaped, chestnut-coloured, granular with hairs.

Fl. & Fr. July - Dec.

Distrib. India: Southern W. Ghats, 1500 - 2400 m. Karnataka, Tamil Nadu and Kerala.

Endemic.

Chromosome no. $2n = 16, 20$. (Virendra Kumar & Subramaniam, *Chr. Atlas Fl. Pl. Ind. Subc. 1*: 85. 1986).

69. *Impatiens graciliflora* Hook. f. in *Rec. Bot. Surv. India* 4: 15. 1905; H. Hara in *Fl. E. Himal.* 1: 195. 1966. **Fig. 41.**

Herbs. Leaves elliptic-lanceolate, 6 - 12 x 1.6 - 5 cm, attenuate towards base into petiole and with seriate glands at lower margins of leaf and downwards into stem, acuminate at apex, crenate along margins, pubescent on both surfaces; lateral nerves 5 - 12 pairs. Flowers small, reddish; pedicels whorled on peduncle; bracts obovate, ca 3 mm long. Lateral sepals obliquely obovate, 3 - 4 mm long, with 1.5 - 2 mm long appendage. Lip shallowly navicular, 4 - 5 mm, spurred; spur abruptly constricted, 2.5 - 3.8 cm long. Standard cucullate, 4 - 5 mm long, with a ca 1 mm long appendage. Wings 7 - 10 mm long; basal lobes 3 - 4 mm; distal lobes transversely semioval, 4 - 6 mm long. Capsules linear, acute, 1.7 - 2 cm long.

Fl. & Fr. Aug.

Distrib. India: E. Himalayas, ca 1800 - 2000 m. W. Bengal (Darjeeling) and Sikkim.

Endemic.

70. *Impatiens grandis* Heyne ex Wallich in *Roxb., Fl. Ind.* 2: 464. 1824; Hook. f., *Fl. Brit. India* 1: 463. 1874. *I. hookeriana* Arn. in *Hook. Companion Bot. Mag.* 1: 324. 1834; Hook. f. *Fl. Brit. India* 1: 463. 1874.

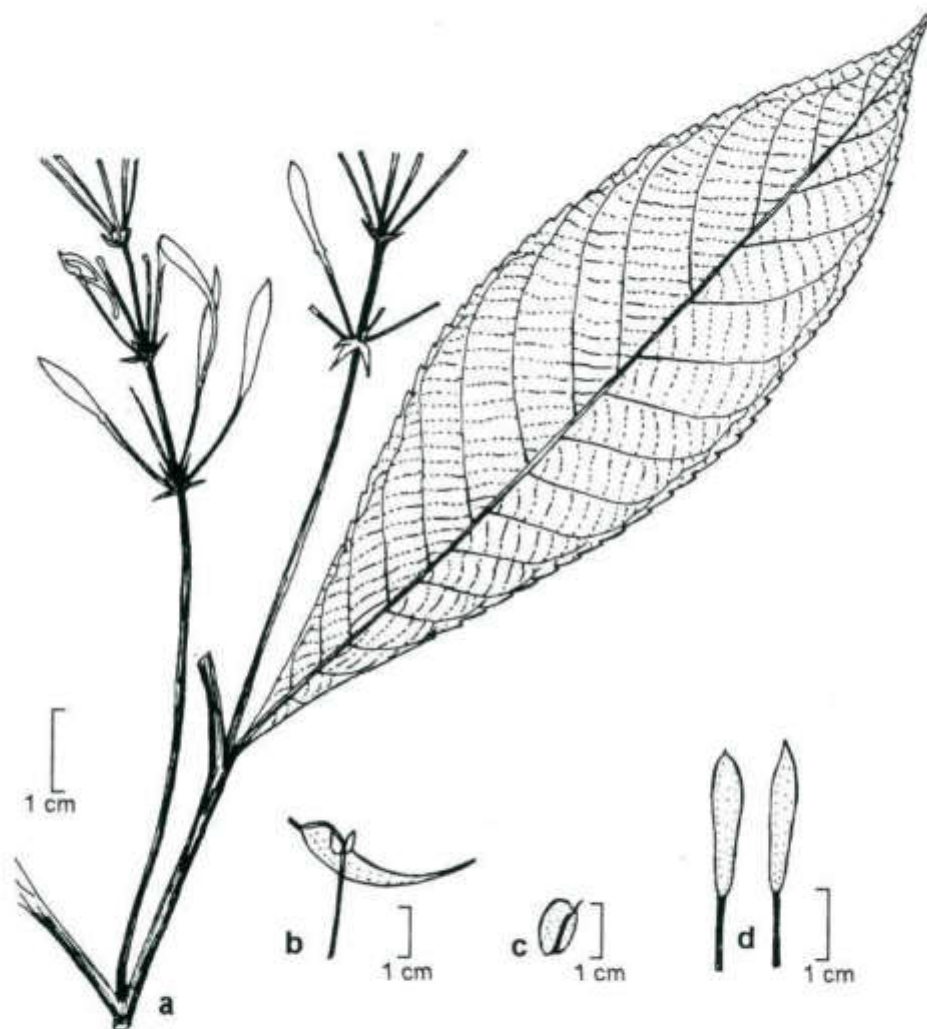


Fig. 41. *Impatiens graciliflora* Hook.f. : a. habit; b. flower; c. standard; d. capsule.

Herbs, robust, often shrubby, erect, 1 - 2.75 m high; branches terete, glabrous with prominent leaf-scars. Leaves confined to apex of branches, alternate, ovate-lanceolate or elliptic, acute or rounded at base, acuminate at apex, incurved, bristly serrate, 8 - 21 x 3 - 8 cm, thick, prominently nerved; petiole 2 - 9.5 cm long with 2 pedicelled glands near apex. Flowers large in subumbellate clusters of 3 - 4 on long peduncles, pale rose or white. Lateral sepals obovate. Lip saccate, obtuse or prolonged into very stout ca 4 cm long, conical straight spur. Standard orbicular, cuneate, notched. Wings 2-lobed, spreading; basal lobes oblong-obovate; distal lobes larger than the basal ones, rounded, notched. Capsules ellipsoid, obscurely 4 - 5-angled, glabrous, 1.5 - 2 cm long; seeds glabrous.

Fl. & Fr. Sept. - Nov. & March.

Distrib. India: Southern W. Ghats South of High Wavy Mountains, High Ranges and South Tirunelveli hills at an altitude of 950 m to 1700 m in densely forested ravines. Tamil Nadu and Kerala.

Sri Lanka.

Notes. J.D. Hooker (1906) combined *Impatiens hookeriana* with this species. Bhaskar and Razi (Indian J. For. 1(1): 76. 1978), however, has not accepted this merger.

Chromosome no. $2n = 20$ (Rao, R.V.S. in Proc. Indian Sci. Congr. sect. Bot. 60(3): 137. 1973.

71. *Impatiens helferi* Hook. f. in Rec. Bot. Surv. India 4: 28. 1905.

Herbs, annual, succulent; internodes long. Leaves opposite, sessile or subsessile, linear, truncate or caudate at base, acute to acuminate at apex, entire along margins, 5 - 7 x 0.3 - 0.5 cm, pubescent on both sides; midnerve prominent, lateral nerves not visible to naked eyes. Flowers axillary, 2 - 4, ca 1 cm long, spurred; spur gradually constricted, long, curved. Standard obcordate to suborbicular, shallowly emarginate with small appendage. Wings with basal lobes triangular; distal lobes transversely semiovate; dorsal auricle globular. Capsules fusiform, ca 6 mm long.

Fl. & Fr. July.

Distrib. India: E. Himalayas. Assam.

Myanmar.

72. *Impatiens henslowiana* Arn. in Companion Bot. Mag. 1: 322. 1836; Hook.f., Fl. Brit. India 1: 458. 1874. *I. albida* Wight in Madras J. Lit. Sci. ser. 1. 5: 7, t. 1. 1837 & Icon. t. 743. 1844.

Suffruticose shrubs up to 1.5 m high; stems simple or branched, succulent when young, covered with scars of fallen leaves. Leaves alternate or spiral, elliptic-lanceolate, serrate, 3.5 - 14 x 1.2 - 5 cm, subglabrous to pilose; glandular along margins; petioles 0.8 - 5 cm long, glabrescent to pilose. Flowers axillary, solitary or in fascicles, white; pedicels slender, 3 - 10 cm long, glabrous or pilose. Lateral sepals ovate, acuminate. Lip navicular; spur 4.5 - 6 cm long, slender, incurved, pubescent up to middle. Standard suborbicular, emarginate with an erect spur on back. Wings 2-lobed. Capsules fusiform, 2 - 2.5 cm long, glabrous or pilose; seeds almond-shaped, ca 3 mm long, rusty-brown, furrowed.

Fl. & Fr. April - Oct.

Distrib. India: Southern W. Ghats in ravines and clefts of rocks, 600 - 2000 m. Tamil Nadu and Kerala.

Sri Lanka.

Chromosome no. $2n = 16$. (Bhaskar, V. in *Taxon* 25: 155. 1976).

73. *Impatiens herbicola* Hook. f. in *Bull. Misc. Inform.* 1911: 354. 1911; Gamble, *Fl. Pres. Madras* 141. 1915.

Succulent herbs, 20 - 40 cm high. Leaves opposite, sessile or shortly petioled, linear-lanceolate, rounded or cordate at base, acuminate at apex, serrate, 3 - 6 x 0.4 - 0.6 cm. Flowers white or pink, ca 5 mm across, axillary, solitary or in fascicles; pedicels 5 - 15 mm long, 2 - 3 cm long in fruit, erect or deflexed. Lateral sepals linear, acuminate, 4 - 5 mm long. Lip cymbiform, 4 - 5 mm long; spur absent or provided with a punch-like structure at base. Standard orbicular, ca 4 mm across, keeled at dorsal side, apiculate. Wings 7 - 8 mm long, clawed, 2-lobed; basal lobes somewhat oblong; distal lobes rotundate or semilunate; dorsal auricle prominent. Capsules ovoid, gibbous, 7 - 10 mm long, beaked, few-seeded; seeds globose, compressed, 2 - 5 mm, black, shining.

Fl. & Fr. Sept. - Nov.

Distrib. India: Southern W. Ghats on grassy slopes and in marshy places. Tamil Nadu and Kerala.

74. *Impatiens hobsonii* Hook. f. in *Rec. Bot. Surv. India* 4: 15. 1905; H. Hara in H. Hara & Williams, *Enum. Fl. Pl. Nepal* 2: 79. 1979.

Herbs. Leaves alternate, subsessile, thick, lanceolate, attenuate towards base into small petiole, long-acuminate at apex, shallowly crenate along margins. Peduncle long, glabrous; pedicels bracteate at base. Lateral sepals obliquely ovate-lanceolate, margins glandular, ca 1.5 cm long. Lip obliquely bucciniform, spurred; spur suddenly con-

stricted, ca 5 mm long. Standard orbicular. Wings with basal lobes triangular ovate; distal lobes ovate, narrowed just above middle, shortly apiculate. Capsules clavate, acute.

Fl. & Fr. Aug. - Nov.

Distrib. India: E. Himalayas. Sikkim.

Nepal.

75. *Impatiens humilis* Hook. f. in Hooker's Icon. Pl. ser. 4. 10: t. 2964. 1913.

Herbs, pubescent. Leaves ovate-lanceolate, crenate along margins, 3 - 5 cm long, lateral nerves 5 - 6; petiole 0.5 - 1.5 cm. Flowers ca 2.5 cm across; bracts ovate-lanceolate, 2 - 3 mm long; pedicels 2 - 3 cm long, pubescent. Lateral sepals 2, ovate-oblong, with appendages. Lip bucciniform, spurred; spur long. Standard inflated, funnel-shaped. Wings with basal lobes notched; distal lobes more or less oblong.

Fl. & Fr. Not known.

Distrib. India: E. Himalayas, ca 2280 m. Sikkim.

Endemic.

76. *Impatiens inayatii* Hook. f. in Rec. Bot. Surv. India 4: 6. 1904.

Herbs glabrous. Leaves ovate-elliptic to ovate-lanceolate or elliptic-oblong, cuneate or attenuate towards base into petiole, acuminate at apex, crenate to deeply crenate along margins, crenations with filiform appendages, 9 - 15.5 x 4 - 7 cm, glabrous; lateral nerves 6 - 8 pairs; petioles 0.7 - 6 cm long. Flowers pedunculate, large, ca 2.5 x 2 cm; bracts persistent, ovate-lanceolate, ca 9 x 3 mm; peduncle slender, 5 - 7 cm long, glabrous; pedicels opposite. Lateral sepals 2, ovate, ca 5 x 4 mm, with ca 2 mm long appendage. Lip bucciniform, ca 2 x 2.5 cm, spurred; spur gradually constricted, curved, ca 5 mm long. Standard suborbicular-obcordate. Wings with few spots on sinus of basal and distal lobes; basal lobes broadly triangular; distal lobes narrowly ovate but narrowed just above middle, shortly apiculate. Capsules linear, acute, ca 4 mm.

Fl. & Fr. May - Sept.

Distrib. India: W. Himalayas. Uttar Pradesh.

Endemic.

77. *Impatiens inconspicua* Benth. ex Wight & Arn., Prodr. Fl. Pen. Ind. Or. 139. 1834; Wight, Icon. t. 970. 1845; Hook. f., Fl. Brit. India 1: 447. 1874. *I. inconspicua* Benth. ex Wight & Arn. var. *filiformis* (Wight & Arn.) Hook. f., Fl. Brit. India 1: 448. 1874. *I. inconspicua* Benth. ex Wight & Arn. var. *ramosissima* (Dalz.) Hook. f., Fl. Brit. India 1: 448. 1874. *I. pusilla* var. *nematostachys* Hook. f. in Bull. Misc. Inform. 1910: 294. 1910.

Small annuals, 10-32 cm high, much branched from base; stems erect, rigid, filiform. Leaves variable, ovate or ovate-lanceolate, rounded or acute at base, serrate, 2-5 x 0.5-1.5 cm, coriaceous, glabrous above, glaucous beneath; upper usually petioled, lower subsessile; stipules setaceous or absent. Flowers small, usually 2-3, fascicled, pink; pedicels with a line of pubescence, axillary, shorter than leaves. Lateral sepals linear-subulate. Lip saccate, acuminate; spur absent or very minute. Wings with distal lobes broadly rhomboid, obovate, clawed; basal lobes small. Capsules ca 1 cm long, turgid in middle, acute at both ends; seeds few, globose, little compressed, black, shining.

Fl. & Fr. Aug. - Oct.

Distrib. India: In ghats of Western Peninsula in grasslands and rock crevices. Karnataka and Maharashtra.

Endemic.

Chromosome no. $2n = 16$ (Bhaskar, V. in Taxon 25: 155-164. 1976).

78. *Impatiens infundibularis* Hook. f. in Rec. Bot. Surv. India 4: 13. 1905.

Herbs. Leaves ovate-lanceolate to narrowly oblanceolate, long-attenuate or cuneate at base, acuminate at apex, serrate or shallowly crenate along margins; 7.5-9 x 1.5-5 cm, green above, whitish beneath, lateral nerves 5-10 pairs; petiole 3-4.5 cm; stipula glands digitate, ca 2 mm long. Flowers 3.2-3.5 cm; peduncle small, 2-4 mm long. Lateral sepals linear, 2-3 mm long. Lip bucciniform, 7-9 mm long, spurred; spur abruptly constricted, filiform, 1.5-1.9 cm. Standard obovate, with a hood on back, 6-7 mm. Wings bilobed, ca 1 cm long, reddish. Capsules fusiform, 0.4-0.9 cm long.

Fl. & Fr. Sept. - Oct.

Distrib. India: E. Himalayas, ca 300-1500 m. W. Bengal and Sikkim.

Endemic.

79. *Impatiens insignis* DC., Prodr. 1: 688. 1824; Hook. f., Fl. Brit. India 1: 477. 1875 & in Rec. Bot. Surv. India 4: 14. 1905; H. Hara in Fl. E. Himal. 1: 195. 1966.

Herbs; stems angled, stout; nodes swollen, lower nodes rooting. Leaves sessile or subsessile, elliptic-lanceolate to oblanceolate, gradually attenuate towards base, acute to shortly acuminate at apex, shallowly crenate to serrate along margins with lower teeth filiform and upper ones shortly apiculate, 4.2 - 9.3 x 1.4 - 2.2 cm, finely pubescent on both sides, paler beneath, lateral nerves 5 - 11 pairs. Inflorescence racemose, subterminal, overtopping leaves. Bracts persistent, lanceolate. Lateral sepals ovate, acuminate, ca 6 x 3 mm. Lip bucciniform, 0.8 - 1 cm long, 0.9 - 1.1 cm deep, spurred; spur abruptly constricted, 1.2 - 2.5 cm long. Standard ovate or broadly oblong, slightly recurved at apex, 0.7 - 1.2 cm; midnerve prominent. Wings bilobed; basal lobes ovate, ca 1 x 0.5 cm; distal lobes oblong, ca 1 cm long. Capsules clavate, acute, 0.6 - 1 cm long.

Fl. & Fr. Unknown.

Distrib. India: E. Himalayas.

Endemic.

80. *Impatiens jaeschkei* Hook. f. in Hooker's Icon. Pl. ser. 4, 10: t. 2902. 1913.

Herbs, tall, glabrous. Leaves alternate, oblong, acuminate at apex, 10 - 20 cm long, crenate along margins, lateral nerves 6 - 12; petioles 2 - 5 cm long. Flowers in 3 - 5-flowered racemes, ca 2.5 cm across, pinkish; peduncles slender, 5 - 10 cm long; pedicels filiform, 1 - 2 cm long; bracts lanceolate, acuminate, 4 - 6 mm long. Lateral sepals 2, ovate-rounded, falcate, long-acuminate, 6 - 7 mm long, membranous. Lip shorter than wings, bucciniform, beaked; spur short, incurved. Standard orbicular, emarginate at apex, 1.8 - 2 cm across. Wings sessile, bilobed, 2.5 - 3 cm long; basal lobes more or less ovate, cuneate at base; distal lobes more or less oblong with rounded apex. Capsules erect.

Fl. & Fr. Unknown.

Distrib. India: W. Himalayas, ca 2700 - 3100 m. Uttar Pradesh (Kumaon).

Endemic.

81. *Impatiens jerdoniae* Wight in Madras J. Lit. Sci. ser. 1, 5: 8. 1837 & Icon. 4 (4): 15, t. 1602. 1850; Hook. f., Fl. Brit. India 1: 460. 1874. excl. var. *parasitica* (Beddome) Hook. f.

Fig. 42.

Herbs, succulent, epiphytic on tree trunks or rocks; stems tumid, glabrous, green or purple. Leaves few, alternate, elliptic, acute, serrate, 5 - 8 cm long, deep green; nerves few with glandular cilia at base and on top of stout petiole. Flowers solitary or binate, 3.5 - 5 cm long; peduncles 2.5 - 8 cm long, green, stout. Lateral sepals lanceolate, acuminate, green. Lip rounded, overlapping, laterally compressed, scarlet, spur ventri-

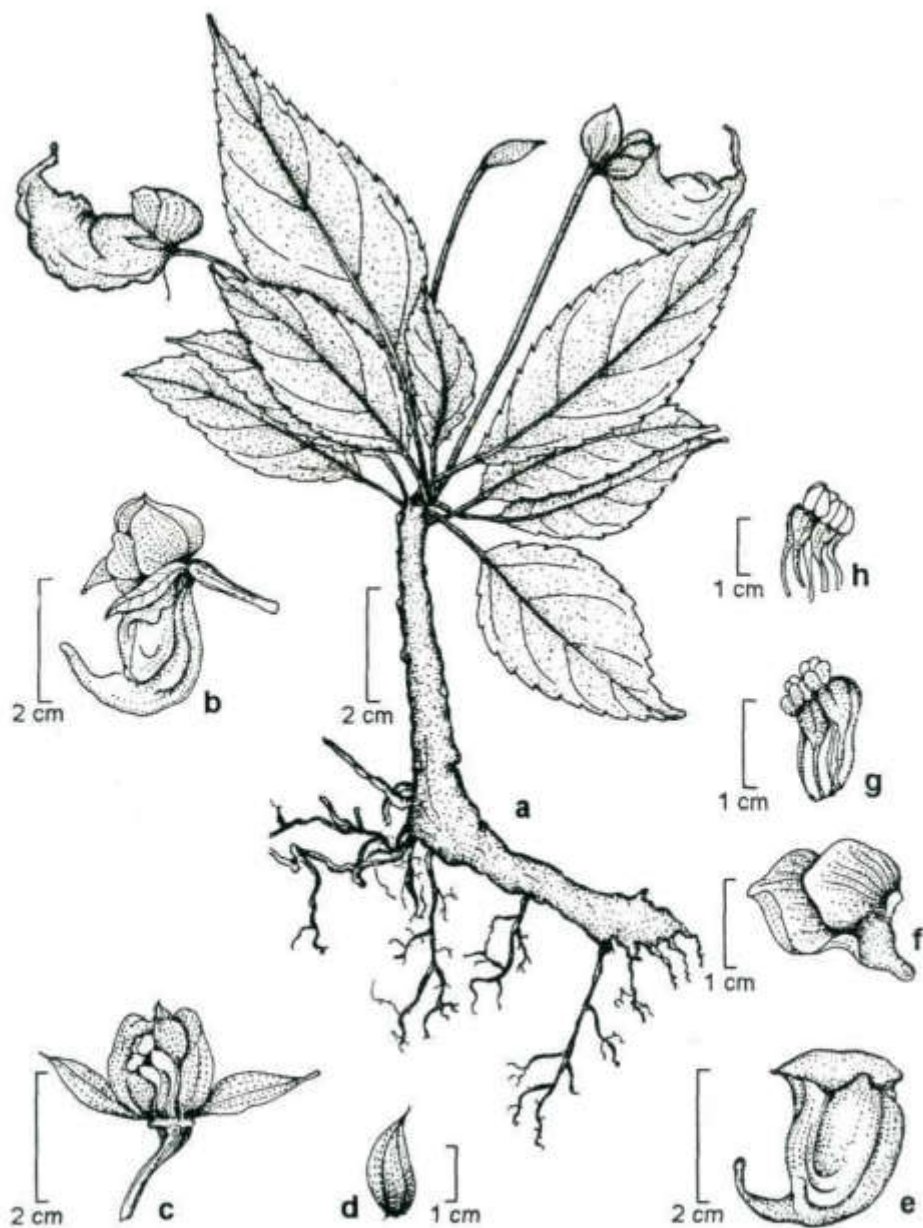


Fig. 42. *Impatiens jerdoniae* Wight : a. habit; b. flower; c. flower-with lip removed; d. lateral sepal; e. lip; f. wing petals; g & h. stamens.

cose, wrinkled, saccate, very large. Standard yellow, orbicular, apiculate, narrowly keeled at back. Wings 2-lobed; lobes rounded, overlapping, concealed under lip. Capsules ellipsoid.

Fl. & Fr. Aug. - Dec.

Distrib. India: W. Ghats. 800 - 1500 m. Karnataka (Kodagu and Brahmagiri); Tamil Nadu (Nilgiris, Anamalais & Pulneys) and Kerala (Palakkad).

Endemic.

82. *Impatiens johnii* Barnes in J. Indian Bot. Soc. 18: 102. 1939.

Shrubs, erect, up to 1 m high; stems branching at base, dilated at nodes. Leaves opposite, alternate or whorled, ovate-elliptic, acuminate, crenate-serrate, ca 13.5 x 5 cm, hairy above and on midnerve and nerves beneath; petioles up to 8 cm long, hairy. Flowers solitary, axillary, ca 4 cm long; pedicels up to 6.5 cm long, hairy; bracts lanceolate, ca 3 mm long. Lateral sepals ovate, ca 1.3 cm long, ciliate along margins. Lip cymbiform, mucronate; spur slender, up to 4 cm long, curved, crimson at lower end. Standard cymbiform, keeled on dorsal side, pink, glabrous. Wings bipartite, deep pink; distal lobes longer than basal ones. Capsules ca 2.8 cm long, beaked; seeds 5, pear-shaped, tuberculed.

Fl. & Fr. June - Sept.

Distrib. India: Southern W. Ghats, on stream beds at about 1400 m. Kerala (Kallar Valley, Idukki Dt.).

Endemic; so far known only from type locality.

83. *Impatiens jurpia* Buch.-Ham. ex Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 140. 1860; Hook. f., Fl. Brit. India 1: 471. 1875 & in Rec. Bot. Surv. India 4: 14. 1905; Biswas, Pl. Darj. Sikkim Himal. 1: 207. 1966; H. Hara in Fl. E. Himal. 1: 196. 1966 & 2: 75. 1971.

Shrubs; stems 1.5 - 2.5 m high; stems branched, stout, woody below, finely pubescent. Leaves alternate, ovate-elliptic to elliptic-oblong or oblanceolate, attenuate towards base into petiole, caudate-acuminate at apex, shallowly crenate to crenate-serrate with filiform glandular appendages on crenations thin and starting almost from middle of petiole, 5 - 25 x 2.5 - 8 cm, pubescent on both sides; lateral nerves 6 - 12 pairs; petioles red, up to 7 cm long, very narrowly winged with a pair of stalked glands on either side. Inflorescence axillary large pedunculate racemes. Flowers 2 - 4, large, 3 - 5 cm long, yellow or light-orange to white with wings yellowish and with red line on back; bracts subulate, ca 4 mm long, red. Lateral sepals 2, ovate-lanceolate, acuminate, reddish. Lip

navicular, 2-3 cm long, spurred; spur abruptly constricted, coiled, obtuse, ca 1 cm long, reddish with brownish spots or deep red. Standard suborbicular, 1.3-1.5 x 1.8-2 cm, dorsally spurred; spur red, ca 5 mm long. Wings 2-lobed, 3-5.3 cm long; basal lobes ovate, entire, ca 1.3 x 1.5 cm; distal lobes elliptic-oblanccolate, entire, ca 2 x 1.3 cm; dorsal auricle present. Capsules linear, acute, 1-3 cm long, glabrous.

Fl. & Fr. June - Dec.

Distrib. E. Himalayas, ca 1000-1700 m. W. Bengal (Darjeeling), Sikkim, Arunachal Pradesh and Meghalaya.

Nepal and Bhutan.

Notes. Dorsal spur on the standard that protrudes in front of the flower is a characteristic feature.

84. *Impatiens kaliensis* Grey-Wilson in Kew Bull. 44: 65. 1989.

Annual herbs, 20-60 cm high; stems with scattered glands, particularly towards apex. Leaves spiral, elliptic-lanceolate, attenuate into petiole, acuminate-caudate at apex, incised-crenate along margins, 7-27 x 3.2-8.2 cm, scattered hairy above, glabrous below; petiole 1.6-6.2 cm long. Flowers in racemes, pink or lilac-spotted; peduncle 1.9-9 cm long; bracts ovate, caudate, 3-4 mm long, gland-tipped; pedicels slender, 12-27 mm long. Lateral sepals ovate, caudate at apex, 3-4 mm long. Lip bucciniform, 1-1.3 cm long, 0.8-1 cm with a pointed 1-1.5 mm long apex; spur S-shaped, 3-4 mm long. Standard cucullate, apiculate, 6-7 mm long. Wings 2-2.8 cm long; basal lobes subovate, distal lobes ovate, tapering into a 1-1.5 cm long dorsal auricle. Capsules cylindrical, 2.3-2.9 x ca 0.2 cm.

Fl. Aug. - Sept.

Distrib. India: in moist places of W. Himalayas, 2850-3250 m. Uttar Pradesh.

Endemic.

Notes. It is similar to *I. bicornuta* Wallich in habit and leaves. But flowers are smaller and floral parts quite different in shape.

85. *Impatiens khasiana* Hook. f. in Rec. Bot. Surv. India 4: 27. 1905. *I. bella* Hook. f. & Thomson var. *major* Hook. f., Fl. Brit. India 1: 459. 1874. **Fig. 43.**

Herbs, annuals, 60-80 cm high; stems erect, sparsely hispidulous to pubescent. Leaves alternate, broadly ovate or oblanceolate, abruptly cuneate or gradually attenuate at base, acute to acuminate at apex, shallowly crenate along margins with lower teeth

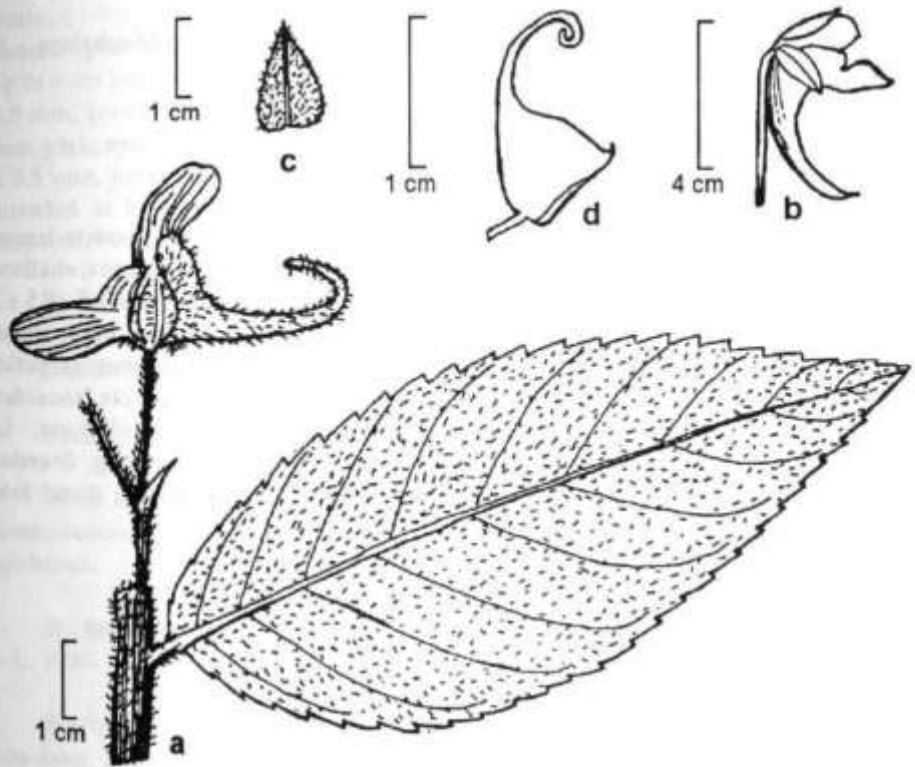


Fig. 43. *Impatiens khasiana* Hook. f. : a. habit; b. flower; c. lateral sepal; d. lip.

filiform, 8 - 11.5 x 3 - 4 cm, pubescent on both sides, green above, pale beneath; lateral nerves 8 - 13 pairs; petioles slender, 0.5 - 3.6 cm long, glandular pubescent. Flowers 2.5 - 4 cm long, pubescent, red with purple streaks; pedicels slender, 1 - 2 cm long, pubescent. Lateral sepals obliquely ovate, acuminate, 0.5 - 1.1 cm long, pubescent. Lip shallowly navicular, 0.8 - 1.3 cm long, spurred; spur abruptly constricted, filiform, curved, 1 - 1.8 cm long. Standard cucullate, crested; crest shallow, entire, along full length of petal. Wings with distal lobes larger than basal; dorsal auricle glandular. Capsules elliptic, acute, 0.5 - 1.3 cm long, glabrous.

Fl. & Fr. May - Nov.

Distrib. E. Himalayas, ca 1500 - 1850 m. Arunachal Pradesh and Meghalaya.

Endemic.

86. *Impatiens kingii* Hook. f. in Rec. Bot. Surv. India 4: 14. 1905.

Herbs, annual, glabrous; stems stout, nodes distant. Leaves ovate to ovate-lanceolate, rounded or somewhat attenuate into petiole at base, acuminate at apex, shallowly crenate along margins, crenations with ca 1 mm long appendages in sinus, 3.5 - 8.5 x 2 - 4.5 cm, differently coloured on upper and lower surfaces, upper glabrous, lower slightly rough; lateral nerves 4 - 6 pairs, linked together by a network of secondary nerves; petiole 0.2 - 2.2 cm long, glabrous. Flowers 1.5 - 2.3 cm long, rose-purple; bracts lanceolate, acuminate, 3 - 6 mm. Lateral sepals ovate, acuminate, 0.8 - 1 x 0.2 - 0.3 cm. Lip bucciniform, 1.3 - 2 cm long; spur abruptly constricted, short, 6 - 8 mm long. Standard semiovoid, ca 12 mm long. Wings ca 1.5 cm long; basal lobes ovoid; distal lobes oblanceolate, entire. Capsules linear, ca 5 mm long, glabrous.

Fl. & Fr. July - Aug.

Distrib. India: E. Himalayas. Sikkim.

Endemic.

87. *Impatiens kleiniformis* Sedgwick in Rec. Bot. Surv. India 6: 351. 1919.

Erect herbs, 20 - 35 cm high; branches flaccid. Leaves opposite, elliptic or oblong, gradually attenuate at apex, base of lower leaves narrowed into a short petiole, base of upper leaves increasingly rounded to cordate, crenate, subulate, ca 9 x 2.5 cm, glabrous, inconspicuously hirsute on nerves. Peduncles axillary, solitary or 2 - 3 together; pedicels with two distinct line of pubescence. Flowers about 6 mm broad, rose-coloured, corolla pink with a conspicuous darker line down the inner edge of lip. Spur about 9 mm long, filiform, subarcuate. Capsules fusiform; seeds black, glabrous, polished.

Fl. & Fr. Aug. - Sept.

Distrib. India: In ghats at about 550 m, Karnataka.

Rare; endemic.

88. *Impatiens konalarensis* Chandrab., Chandras. & Nair in J. Bombay Nat. Hist. Soc. 81: 676. 1984.

Herbs, 20 - 75 cm high, rooting at lower nodes. Leaves alternate, ovate or elliptic-ovate, 1 - 9 x 0.7 - 4.5 cm, crenate, glabrous except nerves; petioles up to 6.5 cm long, slender, glabrous. Flowers 1.2 - 1.5 cm across in contracted racemes, pink; peduncles up to 4 cm long, axillary; pedicels ca 7 mm long. Lateral sepals obliquely ovate, ca 4.5 x 2.5 mm, green with pinkish tinge. Lip ovate-elliptic, concave, acuminate, ca 8.5 x 5.5 mm, pink; spur absent. Standard ovate-lanceolate with a pointed acumen, concave, 6.5 x 3.5 mm, pink. Wings bilobed, ca 12 x 5 mm; basal lobes obovate or semicircular, auricled at base; distal lobes shorter than basal ones, oblong. Capsules obliquely ellipsoid, beaked, ca 9 x 4 mm; seeds ovoid, ca 4.5 x 3 mm, tubercled.

Fl. & Fr. Nov.

Distrib. India: W. Ghats in sholas at about 1950 m. Tamil Nadu (Anamalais).

Endemic.

Notes. Allied to *Impatiens elegans* Beddome but differs in having standard petal ovate-lanceolate; distal lobes of wings obovate or semi-circular and seeds tubercled and glabrous.

89. *Impatiens kulamavuensis* Pandurangan & V.J. Nair in Novon 5: 57 - 58. f. 1. A - L. 1995.

Fig. 44.

Herbs, stoloniferous, epiphytic on tree trunks; stems short, stout, fleshy, less than 1 cm long. Leaves alternate, ovate-lanceolate, cuneate at base, acuminate at apex, entire to obscurely crenate-serrate along margins, crenules 2 - 4 mm apart, 2 - 5.5 x 1.5 - 2.5 cm, membranous, gland-dotted above, glabrous below, lateral nerves 4 - 6 pairs, indistinct; petioles gland-dotted, 2 - 7 cm long, with 2 stipitate glands near base of blade. Inflorescence a 1 - 3-flowered raceme; peduncles 2.5 - 5 cm long; pedicels 3.5 - 5 cm long. Flowers greenish-yellow. Lateral sepals linear, 8 - 10 x 2 - 3 mm, hairy outside, glabrous inside. Lip saccate, compressed, 12 - 15 x 5 - 7 mm, glabrous; spur strongly curved, tip obtuse, 7 - 8 x 3 - 5 mm. Standard erect, orbicular to ovate, 6 - 7 x 8 - 9 mm, hairy at base. Wings united close to base, 3-lobed; basal lobes smaller in size,

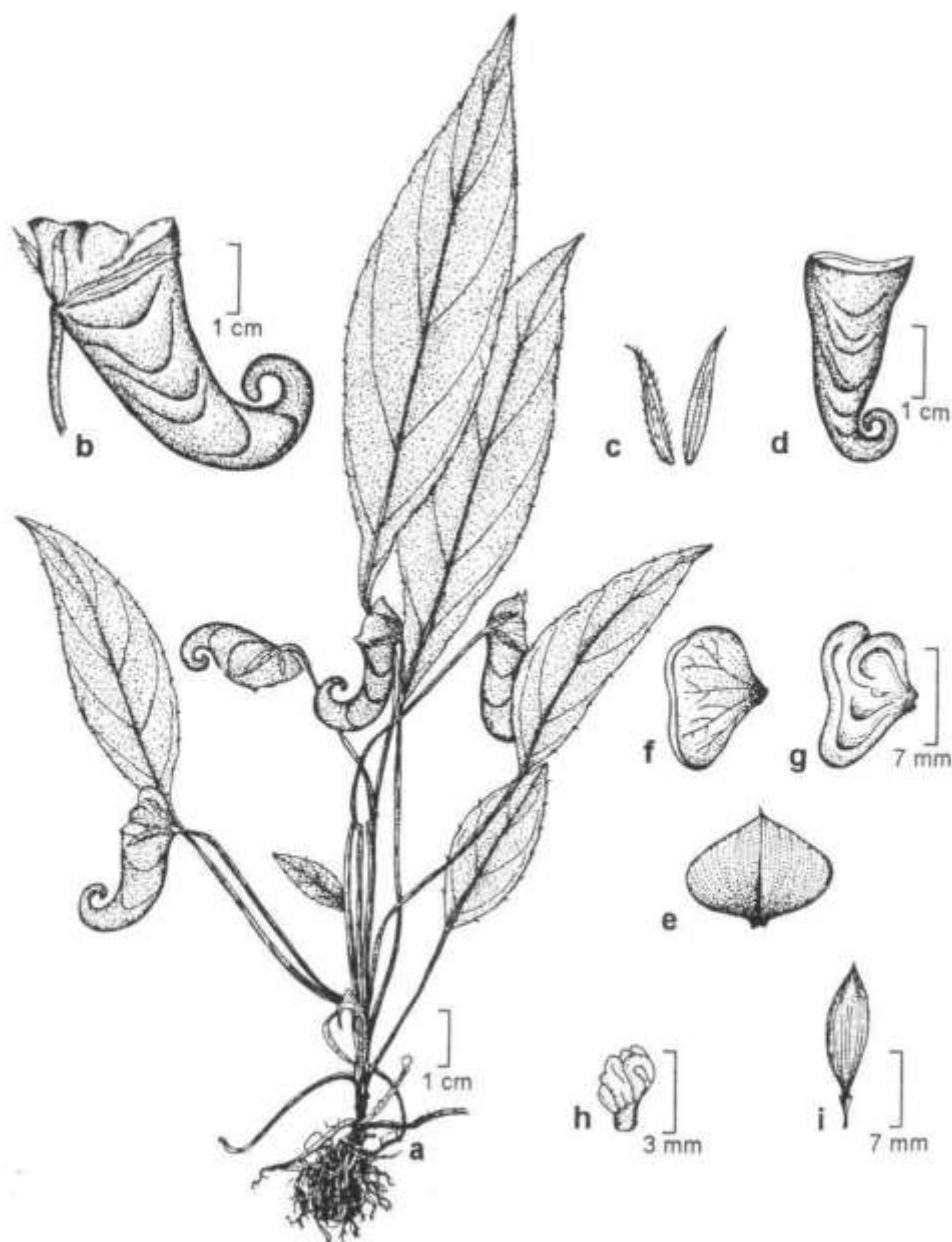


Fig. 44. *Impatiens kulamavuensis* Pandurangan & V.J. Nair : a. habit; b. flower; c. lateral sepals; d. lip; e. standard; f & g. wing petal - dorsal and ventral views; h. stamens; i. fruit.

7-8 x 9-10 mm. Capsules ellipsoid, 10-12 x 4-5 mm, glabrous; seeds pear-shaped, smooth.

Fl. & Fr. Oct. - Dec.

Distrib. India: On moss-clad tree trunks at an altitude of 600 - 850 m. Kerala.

Endemic to Meenmutty - Kulamavu, Idukki Dt., Kerala, in W. Ghats.

90. *Impatiens laevigata* Wallich ex Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 146. 1860; Hook. f., Fl. Brit. India 1: 473. 1875 & in Rec. Bot. Surv. India 4: 30. 1905; H. Hara in H. Hara & Williams, Enum. Fl. Pl. Nepal 2: 79. 1979.

Undershrubs; stems branched, erect, woody below, glabrous. Leaves alternate, crowded together at top of stem, elliptic-oblong to narrowly oblong, attenuate or cuneate at base, acute to caudate-acuminate at apex, shallowly serrate along margins with teeth shortly appendaged, 5 - 12 x 2.5 - 5 cm, midgreen above, pale green beneath; lateral nerves 5 - 12 pairs; petiole 1 - 6 cm long, often glandular. Flowers 1 - 4, clustered at top of stem, yellow; bracts two types, outer bracts larger, ovate-cordate, long, inner ones 6 mm long, yellow; peduncles slender, 1.2 - 2.5 cm long. Lateral sepals ovate, acuminate, 1.6 - 1.8 x 1.4 - 1.6 cm, greenish with brownish nerves. Lip navicular, 2.5 - 3 cm long, red inside, spurred; spur abruptly constricted, curved, 1.6 - 2.2 cm long, yellow. Standard semicucullate, 1.8 - 2 x 1.5 - 1.7 cm, yellow. Wings 2 - 3 cm long, yellowish or with brownish streaks, basal and distal lobes about equal in size; basal lobes broadly elliptic to kidney-shaped, 1.2 - 1.5 x 1 - 1.3 cm, entire; distal lobes broadly ovate with a slight emargination distally along margin, 1 - 1.5 x 0.8 - 1.2 cm, yellow with red spots. Capsules narrowly fusiform, ca 1.5 cm long, glabrous.

Fl. & Fr. July - Dec.

Distrib. India: E. Himalayas, ca 600 - 1500 m. Sikkim, Assam, Nagaland, Manipur and Meghalaya.

Nepal and Myanmar.

91. *Impatiens langeana* Hook. f. in Hooker's Icon. Pl. ser. 4. 10: t. 2907. 1913.

Herbs, tall, robust, glabrous. Leaves alternate, upper sessile, lower shortly petioled, elliptic to ovate-oblong, acute at apex, serrulate to crenate along margins, 5 - 15 cm long; lateral nerves 10 - 12 pairs; glands at base of petioles prominent. Flowers in axillary corymbs, ca 1.5 cm across; peduncles axillary, 2 - 3 cm long; pedicels slender, 8 - 1.2 cm long; bracts caducous, linear-lanceolate, 3 - 5 mm long. Lateral sepals 2, ovate to ovate-oblong or orbicular, cuspidate, membranous, glabrous or pubescent. Lip bucciform, ca 7 mm long; spur slender, incurved, ca 1.5 cm. Standard orbicular, rounded at

apex, 0.8 - 1.1 cm across, keeled on dorsal side ending in a mucro. Wings sessile, ca 1.2 cm long; basal lobes rounded triangular; distal lobes oblong. Capsules linear, acute, 2 - 2.5 cm long.

Fl. & Fr. Unknown.

Distrib. India: W. Himalayas. Uttar Pradesh (Kumaon).

Endemic.

92. *Impatiens laticornis* C. Fischer in Bull. Misc. Inform. 1930: 154. 1930.

Herbs, erect, acaulescent, stoloniferous; rhizome globose. Leaves 1 - 2, erect, thick, suborbicular or ovate, cordate at base, obtuse at apex, crenate along margins, 1.5 - 4 cm x 1.2 - 2.5 cm; pilose above, glabrous below; primary nerves 1-2, ascending; petiole glabrous. Scapes solitary, 6 - 17 cm long, glabrous, purple, 2 - 10-flowered; bracts semi-amplexicaulous, concave, oblong, obtuse, 0.3 - 0.6 cm long; pedicels 1 - 1.7 cm long. Flowers ca 2 cm long, white with yellow or orange hairs or pink with magenta hairs. Lateral sepals ovate or subcordate, obtuse, ca 5 mm long, green. Standard suborbicular, concave, obtuse, 6 - 8 mm long. Spur of lip curved, bullose, ca 2 mm across. Wing 3-lobed, pilose; distal lobes ovate-oblong, rotundate, 4 - 5 mm long; middle lobes suborbicular, 8 - 9 mm across; basal lobes oblong, obtuse, 9 - 13 mm long. Capsules ellipsoid.

Fl. & Fr. Sept.

Distrib. India: Common on wet rocks or tree trunks and in other shady places exposed to rain and mist at about 2500 m in Kundah, Nilgiri Dist., Tamil Nadu.

Endemic and endangered species of Nilgiris.

93. *Impatiens latiflora* Hook. f. & Thomson in J. Linn. Soc. Bot. 4: 139. 1860; Hook. f., Fl. Brit. India 1: 459. 1874 & in Rec. Bot. Surv. India 4: 12. 1905.

Herbs, glabrous, or pubescent; stems branched. Leaves elliptic-lanceolate to narrowly lanceolate, usually cuneate at base, caudate-acuminate at apex, shallowly crenate along margins, with filiform appendages scarce, 7.5 - 17.5 x 3 - 5 cm, greenish above, greyish beneath, pubescent; lateral nerves 6 - 14 pairs; petiole up to 4 cm, puberulous, stipular glands absent. Flowers 2 - 3, ca 6 cm across, pale rose or violet or bright red; bracts linear or lanceolate, 1 - 2 mm long; pedicels stout, 1 - 2.5 cm long. Lateral sepals ovate, acute, ca 8 mm long. Lip shallowly and obliquely navicular, 2.5 - 5 cm long, yellowish, spurred; spur abruptly constricted, filiform, straight, 2 - 4.5 cm long. Standard suborbicular-obcordate, acutely pointed at apex, dorsally crested, ca 1.5 x 1.3 cm long.

Wings red-violet; basal lobes elliptic-oblong; distal lobes elliptic-obovate, emarginate. Capsules turgid in middle, constricted at both ends, glabrous.

Fl. & Fr. Aug. - Nov.

Distrib. India: E. Himalayas, 600 - 1250 m. Sikkim, Assam, Arunachal Pradesh, Nagaland and Meghalaya.

Bhutan.

94. *Impatiens latifolia* L., Sp. Pl. 937. 1753; Hook.f., Fl. Brit. India 1: 450. 1874, excl. syn. *I. cuspidata* Wight & Arn. *I. bababudanensis* Hook.f. in Bull. Misc. Inform. 1910: 295. 1910.

Erect shrubs, 1 - 2 m high; stems branched. Leaves alternate, subopposite or whorled, often crowded at ends of branches, ovate-lanceolate, acuminate or caudate-acuminate at apex, crenate-serrate along margins, 5 - 12 x 2 x 2.5 cm, membranous, glandular on lower half and petiole; nerves 7 - 10 pairs; petioles 2 - 10 cm long. Flowers solitary, binate or in fascicles, white or purple; pedicels slender, often recurved in fruits, 2 - 6 cm long. Lateral sepals small or minute, ovate, cuspidate. Lip cymbiform, concave, acuminate; spur 1.2 - 2 cm long, slender, straight or incurved. Standard larger than wings, bilobed. Wings bilobed; basal lobes shorter than distal ones. Capsules ellipsoid, 1.8 - 2.5 cm long; seeds obovoid, rugose or papillose.

Fl. & Fr. May - Dec.

Distrib. India: Southern W. Ghats up to 2400 m. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

Notes. Hook.f. (Fl. Brit. India 1: 450. 1874) treated *I. cuspidata* Wight & Arn. as a synonym under this species but in Rec. Bot. Surv. India 4: 47. 1906 reinstated it as a distinct species.

Chromosome no. $2n = 6$. (Rao, R.V.S. in Proc. Indian Sci. Cong. Assoc. 61: 120. 1975).

95. *Impatiens lawii* Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 122. 1860; Hook. f., Fl. Brit. India 1: 448. 1874.

Erect herbs, up to 30 cm high with many stout branches, glabrous. Leaves oblong to ovate, acute or obtuse at apex, rounded or cuneate at base, rarely cordate in upper leaves, distantly spinous toothed or subsessile, 1.5 - 3 x 1 - 2.5 cm, scabrid above, glabrous

and paler below; stipules absent. Flowers ca 2 cm across; pedicels equalling leaves, pubescent, deflexed in fruit. Lateral sepals linear-lanceolate. Lip boat-shaped; spur absent or rudimentary. Standard orbicular, cuspidate. Wings with very broad, obovate, subsessile, distal and small basal lobes. Capsules ellipsoid, acute at both ends, ca 1 cm.

Fl. & Fr. Oct. - Nov.

Distrib. India: Karnataka.

Endemic.

Chromosome no. $2n = 16$ (Bhaskar, V. and B.A. Razi in Proc. 61st Indian Sci. Congr. part 3. 35. 1974).

96. *Impatiens lawsonii* Hook. f. in Rec. Bot. Surv. India 4: 45. 1906.

Epiphytes, scapigerous, tuberous herbs, up to 15 cm high. Leaves radical, ovate, cuneate, obtuse or rounded, sparsely hairy above, petiolate, 2 x 1.2 cm; petioles up to 2 cm long. Flowers white, ca 1 cm across, in 4 - 6-flowered, straight scapes, bracteate; bracts ca 1.5 mm long, persistent; pedicels filiform, in fruit ca 2 mm long, glabrous. Lateral sepals ovate, acuminate, 3 - 4-nerved. Lip funnel-shaped; spur conical. Standard hood-like, enclosing stamens. Wings 3-lobed, ca 1.5 cm long; dorsal auricle short, spiniferous, pale pink with yellow tinge at centre, whitish outside. Capsules ovate, raised in centre, glabrous; seeds powdery, minute, hairy.

Fl. & Fr. Aug. - Sept.

Distrib. India: On moist tree trunks in ghats at about 1200 m. Karnataka and Tamil Nadu.

Endemic.

97. *Impatiens laxiflora* Edgew. in Trans. Linn. Soc. London 20: 40. 1846; Hook. f., Fl. Brit. India 1: 479. 1875 & in Rec. Bot. Surv. India 4: 9. 1904; Biswas, Pl. Darj. Sikkim Himal. 1: 212. 1966. *I. micranthema* Edgew., l.c.; Hook. f., l.c. 481. 1875, incl. var. *sikkimensis* Hook.f.

Herbs, glabrous; stems branched. Leaves lanceolate-elliptic to elliptic-oblong, shortly attenuate at base, acuminate at apex, crenate along margins with filiform appendages on basal crenations, 7.5 - 12.5 x 2 - 4.5 cm, membranous, green above, paler beneath; lateral nerves 6 - 12 pairs; petioles 2.5 - 7.5 cm; stipular glands present. Flowers white or rose; bracts persistent, narrow; peduncles axillary, slender, 4 - 8 cm long; pedicels regularly seriate, slender. Lateral sepals narrowly ovate, usually long-acuminate, ca 4 mm long, 3-nerved. Lip shallowly navicular, appendage present, 5 - 8 mm long, spurred;

spur gradually constricted, filiform, straight or curved, 0.9 - 1.2 cm. Standard orbicular, ca 4 mm across. Wings bilobed; basal lobes elliptic, entire; distal lobes narrowly elliptic. Stamens 5. Ovary 5-carpellary; stigma sessile. Capsules clavate, 0.5 - 2.5 cm, glabrous.

Fl. & Fr. July - Oct.

Distrib. India: W. & E. Himalayas. Jammu & Kashmir, Uttar Pradesh, W. Bengal, Sikkim and Meghalaya.

Endemic.

98. *Impatiens lemunnii* Hook. f. & Thomson in J. Linn. Soc. Bot. 4: 154. 1860; Nasir in Nasir & Ali, Fl. W. Pakistan 133: 16. 1980. *Impatiens harrisii* Hook. f. in Bull. Misc. Inform. 1911: 211. 1911.

Herbs, erect; stems simple, glabrous. Leaves alternate, ovate, more or less rounded or somewhat attenuate towards base, acute at apex, crenate along margins, 4 - 5 cm, membranous; lateral nerves 5 - 6 pairs; petioles slender, 1 - 2 cm long; stipular glands absent. Flowers ca 2.5 cm long; peduncles 1 - 2-flowered; bracts persistent, ovate-lanceolate, acuminate, 3 - 4 mm long; pedicels 1 - 2 cm long. Lateral sepals 2, ovate, obtuse, 3 - 4.5 mm long, membranous. Lip navicular. Standard orbicular, ca 1.2 cm across with an appendage. Wings ca 2.2 cm long; basal lobes narrowly triangular, acute to subacute; distal lobes transversely ovate to ovate-elliptic. Capsules fusiform, acute, ca 1.3 cm long, glabrous.

Fl. & Fr. Not known.

Distrib. India: E. & W. Himalayas. Kashmir and Sikkim.

Endemic.

99. *Impatiens lenta* Hook. f. in Hooker's Icon. Pl. ser. 4. 10: t. 2933. 1913, '*leita*'; Gamble, Fl. Pres. Madras 140. 1915.

Herbs, ca 20 cm high, glabrous; stems flaccid, simple, erect; internodes elongate. Leaves opposite, entire or remotely denticulate, 2 - 3 cm long; lower ones smaller, ovate, shortly petiolate; upper sessile or subsessile, oblong or ovate-oblong, truncate or cordate at base, acute at apex; midnerve strong below, lateral nerves obscure; glands at base of petiole minute, setaceous, deflexed. Flowers up to 2 cm across, pale violet; pedicels solitary, longer than leaves in fruits. Lateral sepals 2, narrowly linear, capillary at apex, 3-nerved. Lip cymbiform, acuminate, 0.3 - 1 cm long; spur thin, up to 1.6 cm long. Standard small, orbicular, 4 - 5 mm broad, cuspidate at apex, dorsally keeled. Wings 2-lobed, long-stipitate, ca 1.2 cm long; basal lobes small, placed on stipe, narrowly lanceolate, erect, ca 3 mm long; distal lobes large, obovate or broadly axe-shaped, erect,

narrow at base, rounded at apex; dorsal auricle small, opposite basal lobes. Filaments subulate; anthers minute, narrow, acuminate. Capsules shortly stipitate narrowly ellipsoid, 1 - 1.2 cm, compressed, acutely long-beaked, 1 - 1.2 cm long, many-seeded; seeds minute, subglobose, ca 2 mm across, shining black.

Fl. & Fr. Not known.

Distrib. India: W. Ghats in Nilgiri mountains. Tamil Nadu.

Endemic.

Notes. Closely allied to *I. tenella*, but leaves are almost entire or remotely denticulate, pedicels much longer and glabrous and flowers larger with stipes of wings much longer.

100. *Impatiens leptocarpa* Hook. f. in Rec. Bot. Surv. India 4: 17. 1905.

Herbs. Leaves sessile above, petiolate elsewhere, elliptic-lanceolate, acuminate at apex, crenate along margins with crenations ca 4 mm apart. Flowers axillary; bracts ca 2 mm; peduncle long; pedicels alternate on peduncles. Lateral sepals falcate, ca 7 x 5 mm, appendage ca 2 mm long. Lip bucciniform, long spurred. Standard very broadly obovate, slightly emarginate, appendage present, purple. Wings with basal lobes ovoid; distal lobes linear-oblong. Capsules clavate, obtuse.

Fl. & Fr. Sept.

Distrib. India: E. Himalayas. W. Bengal and Sikkim.

Endemic.

101. *Impatiens leptoceras* DC., Prodr. 1: 688. 1824; Hook. f., Fl. Brit. India 1: 477. 1875 & in Rec. Bot. Surv. India 4: 16. 1905. *I. longicomu* Wallich in Roxb., Fl. Ind. 2: 462. 1824.

Herbs; stems branched. Leaves linear-lanceolate, to ovate-elliptic, attenuate at base, acuminate at apex, finely serrate to crenate along margins, 7.5 - 12.5 x 2 - 4.5 cm, finely pubescent above and beneath; lateral nerves 6 - 12 pairs; petiole 2.5 - 7.5 cm long, glabrous. Flowers pedunculate, 2 - 3 cm; bracts deciduous. Lateral sepals ovate-lanceolate, acute, 2 - 3 mm long. Lip shallowly and obliquely navicular, 5 - 6 mm long, spurred; spur abruptly constricted, filiform, 1.5 - 2.2 cm. Standard suborbicular. Wings 1.2 - 1.4 cm long; basal lobes somewhat triangular; distal lobes elliptic-obovate, auricle long, obtuse.

Fl. & Fr. Sept. - Oct.

Distrib. India: E. Himalayas. Arunachal Pradesh, Manipur and Meghalaya.

China.

102. *Impatiens leptura* Hook. f. *Fl. Brit. India* 1: 467. 1875; C. Fischer in *Bull. Misc. Inform.* 1934: 391 - 393. 1934.

Herbs, erect, about 60 cm high, unbranched; stems somewhat angled, greenish. Leaves alternate, ovate to elliptic-lanceolate, acute or acuminate at apex, cuneate at base, crenate along margins with short cilia in sinuses, 4.5 - 10 x 2.5 cm, midnerve slightly prominent below, lateral nerves in 5 pairs, rising almost at right angles to midnerve, glabrous with short and stiff hairs on nerves above, pale and subglaucous below; petioles 1 - 7 cm long. Peduncles axillary, 4 - 6.5 cm long, glabrous, 2 - 3-flowered; bracts ovate, ca 4 mm long, glabrous, green, deciduous; pedicels 1.5 - 2.5 cm long, fascicled. Flowers ca 2.5 cm across, pinkish. Lateral sepals broadly ovate, acute, 4.5 - 5.5 mm long, green. Lip bowl-shaped, acute, 1 - 1.3 cm long; spur slender, tapering, incurved. Standard broadly oblong, obtuse. Distal lobes of wings 6 - 7 mm long, green becoming pinkish at edges. Stamens yellow. Capsules ellipsoid, beaked, ca 1.5 cm long; seeds orbicular, pilose when young and glabrous when mature.

Fl. & Fr. May - Sept.

Distrib. India: Southern W. Ghats in Anamallais and High Ranges (Idukki dt.) in evergreen forest margins at an altitude of 1300 - 1650 m. Tamil Nadu and Kerala.

Notes. Closely related to *Impatiens cordata* Wight.

103. *Impatiens leschenaultii* (DC.) Wallich ex Wight & Arn., *Prodr. Fl. Pen. Ind.* Or. 131. 1834; Wight, *Icon.* t. 970. 1845; Hook.f., *Fl. Brit. India* 1: 450. 1874. *Balsamina leschenaultii* DC., *Prodr.* 1: 586. 1824.

Suffruticose shrubs up to 1.5 m high. Leaves opposite, alternate or whorled, ovate-lanceolate, acute or acuminate, 2.5 - 10.5 x 1.2 - 4 cm, crenate, sometimes ciliate on sinus; nerves 4 or 5 pairs; petioles up to 5 cm long, glandular on upper half. Flowers solitary, binate or in fascicles, pink or white; pedicels up to 8 cm long. Lateral sepals ovate-lanceolate, ca 3 mm long, yellow with brownish tinge. Lip cymbiform, 5 - 7 mm long, yellow; spur slender, incurved, 1 - 1.2 cm long. Standard suborbicular, spurred on dorsal side. Wings bilobed; basal lobes smaller than distal ones. Capsules ellipsoid, beaked, ca 1.8 cm long, glabrous; seeds 3 - 5, obovoid, ca 3 mm long, dark purplish-brown, rugose or papillose.

Fl. & Fr. April - Dec.

Distrib. India: W. Ghats, 900 - 2400 m. Maharashtra, Tamil Nadu and Kerala.

Endemic.

Notes. Wight & Arnott (l.c.) attributed this species as a connecting link between *I. latifolia* L. and *I. balsamina* L. The type is from Kerala collected by Leschenault and not from Sri Lanka as stated by De Candolle 1824.

Chromosome no. $2n = 6$. (Virendra Kumar & Subramaniam, Chr. Atlas Fl. Pl. Ind. Subc. 1: 85. 1986).

104. *Impatiens ligulata* Beddome in Madras J. Lit. Sci. ser. 2. 4: 67, t. 7, f. 6. 1859 & Icon. t. 149. 1868-74; Hook. f., Fl. Brit. India 1: 446. 1874.

Erect herbs, 30 - 60 cm high; branches slender, spreading. Leaves opposite, subsessile, linear-lanceolate, mucronate, serrate, 7.5 - 10 cm long, hispid above; stipules setaceous or absent. Flowers solitary or in fascicles, pink or white; pedicels slender, ca 3.5 cm long. Lateral sepals linear-lanceolate. Lip saccate; spur stout, ca 2 cm long, undulate. Standard small, with a pubescent line on dorsal side. Wings 2-lobed; distal lobes slender; dorsal auricle filiform, descending into spur. Capsules ellipsoid; seeds ca 12, shining.

Fl. & Fr. July - Oct.

Distrib. India: Southern W. Ghats. Tamil Nadu and Kerala.

Endemic.

Notes. According to J.D. Hooker (l.c. 1874) this plant has "broad almost hatchet shaped" basal lobes of wings. However, he contradicted it by stating, "the basal lobes of wings absent" in Rec. Bot. Surv. India 4: 46. 1906.

105. *Impatiens longipes* Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 151. 1860; Hook. f., Fl. Brit. India 1: 473. 1879 & in Rec. Bot. Surv. India 4: 16. 1905; Biswas, Pl. Darj. Sikkim Himal. 1: 209. 1966.

Herbs, up to 2 m high; stems branched, glabrous. Leaves alternate, broadly lanceolate to obovate, attenuate into petiole at base, long-acuminate at apex, crenate along margins, 3.3 - 13 x 1.2 - 3.5 cm, membranous, black on drying; lateral nerves 5 - 10 pairs; stipules absent. Inflorescence axillary, a raceme, 3 - 6-flowered; peduncles slender, solitary, up to 1.3 cm long. Flowers twisted in various ways, yellow, sometimes spur curls over; pedicels seriate on peduncle; bracts subulate, caducous. Lateral sepals 2 - 4, ovate, or ovate-lanceolate, long-acuminate, ca 3 mm long. Lip bucciniform, spurred; spur gradually tapering, hooked, ca 1.8 cm long. Standard orbicular. Wings with basal lobes ovate-triangular; distal lobes long, narrow twisted. Capsules linear, 0.7 - 2.5 cm long.

Fl. & Fr. July - Oct.

Distrib. India: E. Himalayas, ca 2400 - 3100 m. W. Bengal, Assam, Sikkim and Arunachal Pradesh.

Nepal and Myanmar.

106. *Impatiens longirama* Hook. f. in Bull. Misc. Inform. 1910: 292. 1910.

Herbs; stems branched here and there, branches divaricate, 4 - 6 cm long. Leaves opposite, topmost ones ternately verticillate and crowded, ovate-lanceolate, elliptic-lanceolate, somewhat attenuate into petiole at base, acuminate at apex, 8 - 12 cm long, crenulate to dentate along margins with lowermost teeth generally filiform and 1 mm long, pubescent above; petiole 2 - 3 cm long. Flowers ca 2 cm long, rose coloured; pedicels 1 - 2 cm long. Lateral sepals 2, ovate to ovate-lanceolate, ca 2 mm long, uninerved. Lip with limb pouched, ca 2 cm long, basal and front round; spur short, erect, half the size of limb, acute. Standard obliquely orbicular, with scale-like appendage, bluntly beaked at apex, ca 1.5 cm across. Wings ca 2.3 cm long; basal lobes rounded; distal lobes dolabriform. Capsules fusiform, acute, 1 - 1.5 cm long, glabrous, ca 1.5 cm; seeds few, obovoid, ca 3.5 mm long, rugulose.

Fl. & Fr. July - Nov.

Distrib. India: E. Himalayas, ca 1200 m, very rare. Manipur.

Endemic.

107. *Impatiens lucida* Heyne ex Hook. f., Fl. Brit. India 1: 451. 1874, excl. syn. *I.atifolia* Wight & Arn.; Barnes in J. Indian Bot. Soc. 18: 101. 1939.

Slender annuals, 10 - 20 cm high. Leaves subopposite or whorled, ovate or ovate-lanceolate, cuneate at base, acuminate at apex, crenate-serrate, 3.5 - 10 x 1.5 - 5 cm, glabrous or sparsely hairy above; petioles 0.8 - 3.5 cm long. Flowers solitary or in fascicles, ca 8 mm across, pink. Lateral sepals small, ovate, acute. Lip cymbiform; spur much longer than flower, incurved, slender. Standard suborbicular, keeled on dorsal side. Wings bilobed; distal lobes orbicular, larger than basal ones. Capsules ellipsoid, ca 1.2 cm long, glabrous; seeds smooth, black.

Fl. & Fr. April - Nov.

Distrib. India: On marshy slopes of W. Ghats. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

108. *Impatiens lutea* Hook. f. in Rec. Bot. Surv. India 4: 18. 1905.

Herbs, pubescent, particularly in upper portion. Leaves alternate, ovate-lanceolate, lanceolate, abruptly cuneate to gradually attenuate at base, acuminate at apex, shallowly crenate along margins with lower teeth filiform, 3.2 - 7.4 x 1.5 - 2.9 cm, finely pubescent above and beneath; green above and whitish beneath; lateral nerves 5 - 8 pairs; petiole slender, 0.8 - 3.2 cm long, pubescent. Flowers ca 1.5 cm, yellow; bracts ovate, acuminate, 3 - 4 mm. Lateral sepals navicular, 5 - 7 mm long, ca 2 mm deep, pubescent. Lip obliquely navicular, 6 - 8 mm long, spurred; spur abruptly constricted, filiform with coiled apex, 0.8 - 1.2 cm long. Standard suborbicular, ca 8 x 7 mm, strongly nerved. Wings bilobed; basal lobes ovate-triangular, ca 9 x 8 mm; distal lobes suborbicular, ca 1.2 x 1 cm long. Capsules linear.

Fl. & Fr. June - July.

Distrib. India: E. Himalayas, ca 1500 m. Sikkim and Arunachal Pradesh.

Endemic.

109. *Impatiens mackeyana* Hook. f. in J. Proc. Linn. Soc. Bot. 7: 188. 1864.

Herbs, glabrous. Leaves alternate, ovate-lanceolate, to ovate, slightly attenuate into petiole, acuminate at apex, finely serrate along margins with lowermost teeth filiform, 3.2 - 8.5 x 1.8 - 3.5 cm, membranous, glabrous; lateral nerves 5 - 9 pairs; petioles 0.5 - 1.8 cm long. Flowers axillary, in pairs, pedunculate; bracts linear, ca 3 mm long; peduncles 1.5 - 2 cm long, glabrous; pedicels slender, 0.6 - 1 cm long, glabrous. Lateral sepals ovate, small, ca 4 x 1.5 mm long. Lip bucciniform, pointed at apex, spurred; spur more or less abruptly constricted, incurved, 1.5 - 1.8 cm long. Wings 1.7 - 2.8 cm long; basal lobes broadly ovate, 1.2 - 1.4 x 0.8 - 1.1 cm; distal lobes broadly oblong, 0.8 - 1.5 x 0.8 - 1 cm; dorsal auricle globular. Capsules linear, acute, 5 - 9 mm long.

Fl. & Fr. Aug.

Distrib. India: Meghalaya.

Endemic.

110. *Impatiens macrocarpa* Hook. f. in Bull. Misc. Inform. 1911: 355. 1911; Gamble, Fl. Pres. Madras 142. 1915.

Undershrubs with spreading branches. Leaves opposite at base and in whorls of 3 - 5 above, obovate-oblongate, serrulate, 8 - 10 cm long; petioles 3 - 5 cm long. Flowers solitary or binate, white; pedicels stout, decurved, 3.5 - 5 cm long, 5 - 8 cm long in fruit. Lateral sepals ovate, cuspidate-acuminate, 4 - 6 mm long. Lip cymbiform, ca 6 mm long;

spur stout, incurved, ca 1.2 cm long. Standard obcordate-reniform, cuspidate, 1.5 - 2 cm across. Wings sessile, stout, bilobed; basal lobes oblong-obovate, spreading or recurved; distal lobes oblong, smaller than basal ones, erect. Capsules obliquely ovoid, beaked, 1.5 - 2 cm long, many-seeded; seeds ca 5 mm long, chestnut-coloured, granulate.

Fl. & Fr. Not known.

Distrib. India: Southern W. Ghats, 1800 m. Kerala (Devicolam).

Endemic; so far recorded only from type locality.

111. *Impatiens maculata* Wight in *Madras J. Lit. Sci. ser. 1. 5: 12. 1837*; Hook. f., *Fl. Brit. India 1: 465. 1875.*

Tall herbs or shrubs, up to 2 m high, slender, erect; stems and branches angled or ribbed, laxly hairy or glabrate, speckled with pinkish blotches. Leaves alternate, ovate-lanceolate, acuminate, serrate, 7.5 - 12.5 x 3 - 5 cm long, hairy on both surfaces; petiole 2.5 - 5 cm long, glanduliferous, often with 2 or more long-stipitate glands. Flowers in racemes, laxly many-flowered, pink or white, ca 2.5 cm long; bracts ovate, persistent. Lateral sepals ovate, acute. Lip conoid; spur slender, curved upwards, longer than petals. Standard obtuse, shorter than lateral sepals. Wings 2-lobed; distal lobes suborbicular, very large; basal ones minute, concealed. Capsules ellipsoid, 5-angled, beaked, ca 8 mm long, glabrous; seeds suborbicular, shortly hairy.

Fl. & Fr. June - Feb.

Distrib. India: Southern W. Ghats, on banks of mountain streams and marshy places between 850 m to 1800 m. Tamil Nadu and Kerala.

Endemic.

Chromosome no. $n = 10$ (Bhaskar & Razi in *J. Mysore Univ. sec. B. 25 (1 & 2): 118. 1972-73* & Bhaskar, V. in *Taxon 25 (1): 155. 1976*).

112. *Impatiens majumdarii* Ghara & C. Ghara in *J. Econ. Tax. Bot. 17(1): 139-140. 1993.* **Fig. 45.**

Herbs or shrubs up to 1.2 m high; stems branched, green, often tinged red; nodes swollen. Leaves usually alternate, opposite towards apex, elliptic to lanceolate, cuneate at base, acuminate at apex, crenate to serrulate and glandular along margins, lower glandular bristles 1 - 1.5 mm long, 4 - 11 x 1.4 - 3.5 cm, deep green and slightly puberulous above, whitish and glabrous or rarely puberulous below; lateral nerves 6 - 8 pairs; petioles 0.2 - 1.9 cm long, glabrous, smooth; stipules 1 - 1.5 mm long, fimbriate. Flowers usually axillary, in fascicles of 2 - 3 flowers, bluish violet; peduncles slender, 3.5 - 4 cm, glabrous;

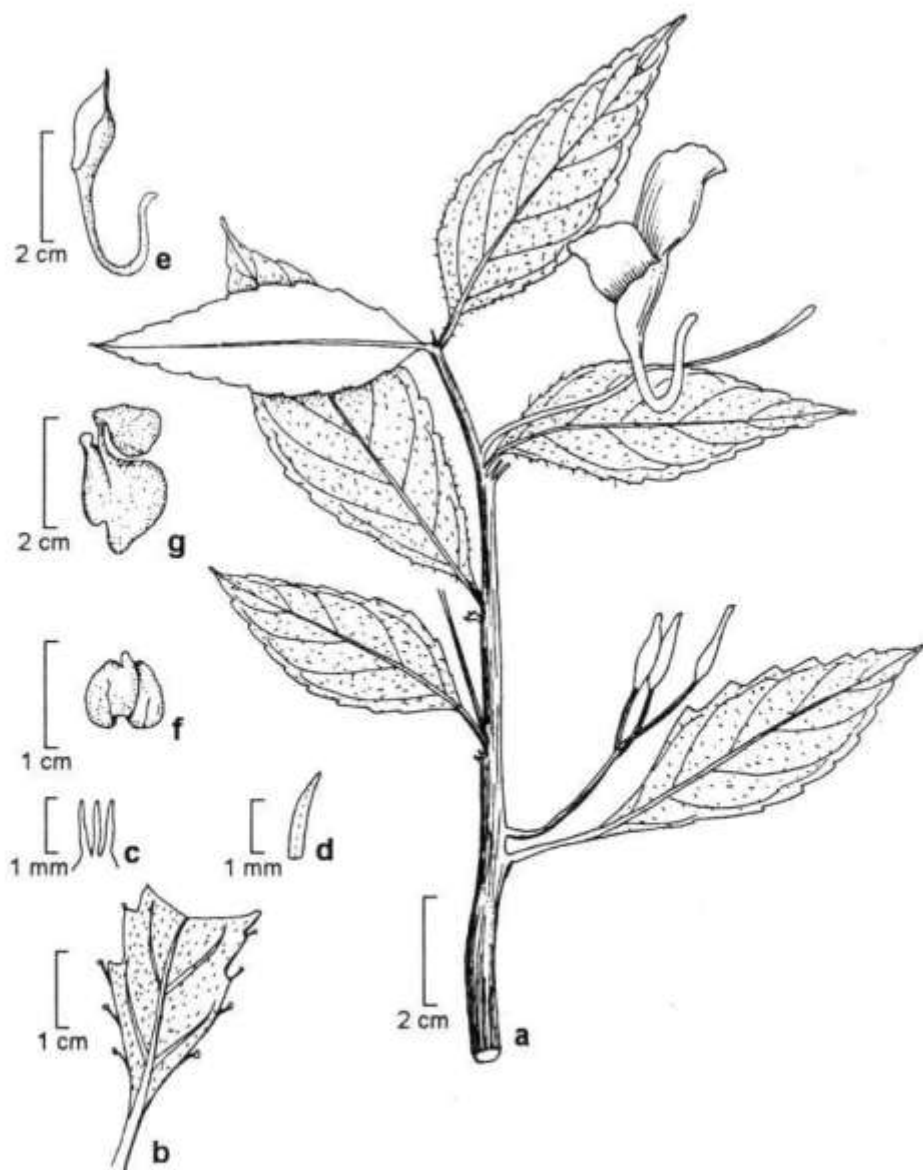


Fig. 45. *Impatiens majumdarii* Ghara & C. Ghara : a. habit; b. leaf-basal part; c. stipule; d. bract; e. lip; f. standard; g. wing petal.

pedicels 1.7 - 2 cm long; bracts ovate, glandular at apex, 1 - 1.5 mm long. Lateral sepals 2, ovate-lanceolate, ca 2.5 x 1 mm, glabrous, green. Lip navicular, 1 - 1.8 cm long, spurred; spur filiform, curved, 2.5 - 3 cm long. Standard obcordate to suborbicular, 0.8 - 1 x 1 - 1.2 cm, crested; crest shallow, acutely pointed at apex. Wings 2 - 2.7 cm long; basal lobes ovoid, 0.8 - 1 x 0.8 - 1.1 cm; distal lobes elliptic or obovate, slightly emarginate distally along inner margin, 1.2 - 1.7 x 1.1 - 1.4 cm; dorsal auricle short. Capsules fusiform, ca 1.4 x 0.2 cm.

Fl. & Fr. July - Oct.

Distrib. India: In moist shaded places along streams and on damp hill slopes. Meghalaya (Shillong).

Endemic.

113. *Impatiens manipurensis* Hook. f. in Rec. Bot. Surv. India 4: 31. 1905.

Herbs, annuals, glabrous. Leaves alternate, ovate or lanceolate-elliptic, long-attenuate into petiole at base, acuminate at apex, finely serrate along margins with lowermost teeth filiform, 5 - 7 x 2 - 3 cm, green above, paler below, lower pale, finely pubescent above and beneath; lateral nerves 10 - 12 pairs; petiole rather leafy with two glands, glabrous. Flowers axillary; bracts on pedicels, linear-lanceolate, 3 - 8 mm long. Lateral sepals 4, outer sepals orbicular, ca 8 mm long with an appendage; inner broadly lanceolate. Lip bucciniform, suddenly constricted into small spur. Standard cucullate. Wings with basal lobes broadly triangular-ovate; distal lobes orbicular; dorsal auricle more or less globular. Capsules linear.

Fl. & Fr. June - Sept.

Distrib. India: E. Himalayas, 900 - 1500 m. Nagaland, Manipur and Meghalaya.

Bhutan.

114. *Impatiens mannii* C.B. Clarke ex Hook. f. in Rec. Bot. Surv. India 4: 27. 1905.

Herbs; stems procumbent, thickly hairy all over, reddish-green. Leaves ovate to ovate-oblong, obtuse at apex, crenate at margins, 1.5 - 2.4 x 1.1 - 1.7 cm, green, pubescent throughout; lateral nerves 5 - 7 pairs; petiole thickly hairy. Flowers dull brick-red or orange. Lateral sepals ovate-cuspidate, 5 - 7 x 4 - 5 mm, white, hairy, with ca 1 mm long appendage. Lip bucciniform, 2.5 - 3 cm, red-striped, spurred; spur gradually constricted, short, curved. Standard cucullate, 1 - 1.2 cm long, with ca 2 mm long appendage just at middle of outer side, reddish tinged at middle. Wings 1.5 - 2.2 cm; basal lobes obovate with reddish base, 8 - 10 x 5 - 6 mm; distal lobes suborbicular or transversely semiovate, 0.9 - 1.3 x 0.6 - 0.2 cm, pale orange. Capsules acute, 6 - 9 mm long.

Fl. & Fr. March - April.

Distrib. India: Assam, Arunachal Pradesh and Nagaland.

Endemic.

115. *Impatiens marianae* Reichb. f. ex Hook. f. in Rec. Bot. Surv. India 4: 27. 1905.

Herbs, erect, annual; stems erect, pubescent; nodes swollen. Leaves alternate, ovate to elliptic-lanceolate, long-attenuate or cuneate at base, acuminate at apex, shallowly serrate along margins, 5 - 10 x 2 - 5 cm, papillose hairy, variegated above, pubescent on middle; lateral nerves 6 - 8 pairs; petiole 1 - 1.5 cm long. Flowers solitary, 0.9 - 2.5 cm long, yellowish; bracts setaceous, ca 3 mm long; peduncles slender, 2.5 - 4 cm long, pubescent. Lateral sepals ovate, usually long-acuminate and appendaged at apex, 8 - 9 x 3 - 4 mm. Lip bucciniform, 2 - 2.3 cm long, spurred; spur gradually constricted, filiform, 0.6 - 2 cm long. Standard cucullate. Wings with basal lobes broadly triangular; distal lobes suborbicular with a triangular apex. Capsules turgid in middle, ca 0.5 cm long.

Fl. & Fr. June - July.

Distrib. Assam and Meghalaya.

Endemic.

116. *Impatiens masonii* Hook. f. in Rec. Bot. Surv. India 4: 29. 1905.

Herbs, annual, glabrous, erect, internodes long. Leaves opposite, sessile or subsessile; linear, attenuate into petiole at base, acuminate at apex, finely serrate along margins with 1 - 2 mm long filiform appendage on each tooth, 5.5 - 14.5 x 0.3 - 0.5 cm, finely pubescent above, glabrous below; lateral nerves rather distinct; stipular glands pubescent. Flowers axillary, epedunculate, red; pedicels slender, 3.5 - 6 cm long, glabrous. Lateral sepals ovate, 5 - 7 mm long, glabrous. Lip navicular, 6 - 10 mm long, spurred; spur gradually constricted, filiform, 1.5 - 2.5 cm long, glabrous. Standard elliptic-oblong, one side irregularly toothed, ca 1 x 0.6 cm. Wings 2.2 - 2.5 cm long; basal lobes triangular, ca 6 x 4 mm; distal lobes transversely semiovate or ovate-elliptic, shortly round lobed or emarginate on inner margin about two-third distance from base, 1.5 - 1.8 x 1-1.2 cm. Capsules turgid in middle, 0.5 - 1.4 cm.

Fl. & Fr. July.

Distrib. India: E. Himalayas, Assam.

Myanmar.

117. *Impatiens meeboldii* Hook. f. in Bull. Misc. Inform. 1910: 291. 1910.

Herbs, erect, 20 - 30 cm high, glabrous. Leaves opposite or upper ones clustered and sessile, lower ones petioled, ovate to ovate-lanceolate, acuminate at apex, serrulate along margins, 3 - 5 cm long; lateral nerves 3 - 5 pairs; stipular glands minute, globose. Peduncles erect in axils of uppermost leaves, 3 - 6-flowered. Flowers 6 - 8 mm, white, lip and tip of wings purple; bracts persistent, ovate-lanceolate, minute, subverticillate; pedicels umbellate. Lateral sepals 2, ovate, obtuse, ca 2 mm long. Lip bucciniform, cuspidate, limb ca 6 mm; spur straight, as long as or slightly longer than limb. Standard orbicular, ca 5 mm across. Wings sessile, 1 - 1.2 cm long; basal lobes small; distal lobes 2 - 3 times larger; dorsal auricle obscure. Capsules clavate to oblong, acute, 1.2 - 1.3 cm long; seeds oblong-ovoid, ca 3.5 mm long, smooth, chestnut coloured.

Fl. & Fr. Aug.

Distrib. India: W. Himalayas, ca 2400 m. Jammu & Kashmir.

Endemic.

118. *Impatiens minimiflora* Hook. f. in Rec. Bot. Surv. India 4: 16. 1905.

Herbs, up to 8 - 15 cm high, glabrous. Leaves ovate to ovate-lanceolate, more or less rounded or somewhat attenuate into petiole at base, acuminate or often shortly apiculate at apex, crenate along margins, 2.5 - 3.5 x 1.7 - 2 cm; petiole 2 - 3 mm long. Flowers spurless, pedicellate; pedicels slender, 0.9 - 1 cm long. Lateral sepals ovate, ca 1.5 mm long, with an appendage. Standard suborbicular, shortly and acutely pointed at apex. Wings bilobed, ca 5 mm long; basal lobes broadly ovate; distal lobes oblong. Capsules linear.

Fl. & Fr. July - Sept.

Distrib. India: E. Himalayas, ca 3000 m. Sikkim.

Endemic.

119. *Impatiens minor* (DC.) Bennet in Indian J. For. 2: 283. 1979. *Balsamina minor* DC., Prodr. 1: 140. 1874. *Impatiens kleinii* Wight & Arn., Prodr. Fl. Pen. Ind. Or. 140. 1834; Wight, Icon. t. 884. 1884-85; Hook. f., Fl. Brit. India 1: 445. 1874 & in Bull. Misc. Inform. 1910: 293. 1910.

Annuals, 15 - 60 cm high; stems slender, branched, flaccid. Leaves opposite, elliptic-lanceolate, oblong or obovate, acute or acuminate at apex, 2 - 7 x 1 - 2.5 cm, serrulate, glabrous or pilose above, glaucous beneath; stipules sometimes with 2 glands; petioles up to 1 cm long or rarely sessile. Flowers ca 8 mm across, axillary, solitary or

binate, pink; pedicels ca 1.2 cm long, filiform, deflexed in fruits. Lateral sepals linear, subulate, 2 - 3 mm long, 1 - 3-nerved. Spur slender, longer than wings, greenish. Standard orbicular, keeled on dorsal side, ca 8 mm across. Wings obovate, entire, clawed. Capsules ellipsoid, beaked, ca 1.2 cm long; seeds globose, black, shining.

Fl. & Fr. June - Nov.

Distrib. India: In damp situations and crevices of rocks of West Coast and W. Ghats, 100 - 1800 m. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

120. *Impatiens mishmiensis* Hook. f., Fl. Brit. India 1: 476. 1875 & in Rec. Bot. Surv. India 4: 12. 1905.

Herbs, ca 1.5 m high; stems stout, branched. Leaves crowded together at top of stem, generally 10 or more, elliptic to elliptic-oblong, rarely narrowly obovate, cuneate into petiole at base, acuminate at apex, crenate-dentate along margins with ca 1 mm long filiform appendages on basal crenations, ca 17.5 x 5 cm, pubescent beneath on midnerve, deep green above, pale green beneath; lateral nerves 9 - 16 pairs; petiole 2.8 - 6 cm long; stipular glands absent. Peduncles less than 15 cm, stout. Flowers few, in broken whorls, on short axillary umbels, 2 - 3.5 cm across, white; bracts large, ca 8 mm long, whorled, persistent. Lateral sepals broadly ovate, acuminate, ca 8 x 7 mm, flesh-coloured. Lip bucciniform, 1.5 - 1.8 x 1.3 - 1.5 cm; spur abruptly constricted, filiform, curved, 1.4 - 2.5 cm long. Standard obcordate to suborbicular, obtusely spurred on back, flesh coloured. Wings clawed and bilobed; basal lobes elliptic-oblong; distal lobes semielliptic, entire, tinged yellow and with two yellow spots; dorsal auricle short, curved. Capsules linear, acute, 1.9 - 2.2 cm long.

Fl. & Fr. Aug.

Distrib. India. E. Himalayas. Assam and Arunachal Pradesh.

Endemic.

121. *Impatiens modesta* Wight in Madras J. Lit. Sci. ser. 1. 5: 13. 1837 & Icon. 3 (3): 6. t. 968. 1845; Hook. f., Fl. Brit. India 1: 442. 1874.

Herbs, perennial, 8 - 30 cm high, epiphytic; rootstock tuberous. Leaves radical, ovate-cordate or suborbicular, acute, crenate-serrate, 2.5 - 14 x 2 - 9 cm, sparsely hairy above, glabrous and pale shining-glaucous beneath. Scape slender, erect, 10 - 20 cm long; bracts subulate, lanceolate, thickened at tips. Flowers pinkish or white ca 1 cm across in 2 - 5 cm long racemes; pedicels filiform. Upper sepals broad, obovate or suborbicular, lateral ones narrowly lanceolate or subulate, incumbent on upper. Lip

shorter than petals. Standard short, broader than long, entire. Wings 3-lobed; lobes subequal, obtuse; spur short, obtuse, straight. Capsules ellipsoid, 4 - 6 mm long, acute at both ends, glabrous; seeds minute with spiral hairs.

Fl. & Fr. April - Sept.

Distrib. India: Succulent epiphytes on moss cushions or lithophytes in damp shady woods at an altitude of 800 - 2000 m in Southern W. Ghats. Tamil Nadu and Kerala.

Endemic.

Chromosome no. $n = 8, 9, 16$ (Bhaskar, V. in *Taxon* 25 (1): 155. 1976).

122. *Impatiens munnarensis* Barnes in Bull. Misc. Inform. 1938: 32. 1938.

Herbs, weak, erect or semi-erect, up to 1 m high; stems slender, sparingly branched, often procumbent below, rooting at lower nodes. Leaves variable, usually lanceolate, base broadest, shallowly cordate tapering to an acute apex or narrowly ovate, subacute at base, distinctly serrate along margins with apiculate teeth, setose at base, up to 5.5 cm x 1.7 cm, pubescent above, glabrous and pale, sometimes glaucous below; petioles flattened, red above, decurrent on stem; stipules filiform, pointed, red, tips darker, bent towards right angles pointing downwards. Pedicels solitary or up to 4, fascicled in axils, very short in bud, in flower 1 - 2.5 cm long, partially reflexed in fruit. Flowers 1 - 1.3 cm long. Lateral sepals filiform, curved, ca 6 mm long. Lip boat-shaped, cuspidate in front, white with purple nerves, bottom somewhat flattened with a small pit instead of spur, inside convex continued forward as a ridge with a small yellow or orange crest about middle. Standard ovate, keeled, tip mucronate. Wings white with lilac or violet markings; distal lobes obovate-triangular; basal lobes triangular; dorsal auricle bluntly conical or rounded, placed at right angles, dark-purple. Capsules fusiform, later swollen, acuminate, 1.3 - 1.5 cm long, few seeded; seeds black, glossy, ca 1.5 mm long.

Fl. & Fr. Sept. - Dec.

Distrib. India: Southern W. Ghats, common on edges of streams and marshy places in High Range near Munnar. Kerala.

Endemic.

Notes. The depression on innerside of lip appears to be a unique feature but it is not easily seen in dried specimens. Closely related to *Impatiens inconspicua* Benth. ex Wight & Arn. Not located since type collection.

123. *Impatiens munronii* Wight, Ill. Ind. Bot. 1: 160. 1840 & Icon. t. 1049. 1846; Hook.f., Fl. Brit. India 1: 456. 1876.

Undershrubs, up to 60 cm high, softly hairy; stems branched, woody, nodose, almost woolly. Leaves alternate, towards ends of branches, elliptic, acuminate, serrulate, 3 - 8 x 1.5 - 3 cm, membranous, hairy on both sides, glandular along margins; petioles 1.5 - 5 cm long, hairy. Flowers axillary, solitary, white or red; pedicels 1.5 - 3 cm long, slender, hairy. Lateral sepals ovate, as large as wings, hirsute. Lip with spur trumpet-shaped, ca 1.5 cm long, incurved, hirsute. Standard orbicular, keeled on dorsal side, hirsute. Wings short, bipartite to middle. Capsules hairy; seeds glabrous.

Fl. & Fr. Nov. - Jan.

Distrib. India: Southern W. Ghats, 1500 - 2000 m. Tamil Nadu.

Endemic.

124. *Impatiens mysorensis* Roth, Nov. Pl. Sp. 164. 1821; Hook.f., Fl. Brit. India 1: 456. 1874.

Erect slender herbs, 15-25 cm high. Leaves alternate, lanceolate, serrulate along margins, ca 8 cm long. Flowers axillary, binate, ca 8 cm across, red; pedicels shorter than leaves, filiform, ca 2 cm long. Lateral sepals minute. Lip boat-shaped; spur shorter than lip, straight. Standard suborbicular, gibbous. Wings bilobed; distal lobes larger than basal ones. Capsules ellipsoid, pubescent, ca 1 cm long; seeds few.

Fl. & Fr. Not known.

Distrib. India: Karnataka (Mysore).

Endemic.

Chromosome no. $2n = 14$ (Bhaskar, V. in Taxon 25: 155. 1976).

125. *Impatiens nataliae* Hook. f. in Bull. Misc. Inform. 1910: 294. 1910.

Herbs, ca 20 cm high; stems glabrous; branches slender, ascending. Leaves opposite, oblong or linear-oblong, firm, lower ones obovate, acute or obtuse, spinulose serrate or entire, 2 - 3 cm long; glands below petiole 2, setaceous, deflexed or absent. Inflorescence simple, pedicellate; pedicels solitary, thread-like; fruiting pedicels little longer, deflexed. Flowers scarcely 1 cm when opened, white in dried specimens. Lateral sepals 2, linear, acuminate, 4 - 5 mm long, single nerved. Lip infundibular, elongate; spur short, hooked, attenuate. Standard large, orbicular or elliptic, little arched, mucronate at apex. Wings narrowly stalked, 9 - 10 mm long; basal lobes very small, trigonous, truncate; distal ones much bigger, obovate or dolabriform; dorsal auricle big, exerted or decurved. Capsules small, almost globose, about 1 cm long, shortly stalked, acute, rostrate, few-seeded; seeds globose, smooth, black, shining, about 2 mm across.

Fl. Oct.

Distrib. India: Karnataka.

Endemic.

126. *Impatiens neo-barnesii* C. Fischer in Bull. Misc. Inform. 1930: 330. 1930 & Gamble, *Fl. Pres. Madras* 1869. 1935. *I. barnesii* C. Fischer in Bull. Misc. Inform. 1930: 153-154. 1930 non Hook. f. 1909.

Herbs, epiphytic, acaulescent, delicate, pendulous; bulbs small, globose. Leaves 1 - 2, ovate or elliptic-ovate, rounded at base, more or less unequal-sided, acute or subacute at apex, remotely denticulate along margins, 2 - 8 x 1.3 - 3.6 cm, sparsely pilose above, glabrous. Scapes delicate, glabrous, 4 - 5 cm long, few-flowered; bracts lanceolate or ovate, subacute; pedicels ca 1.5 cm long. Flowers cream-coloured or almost white, 2 - 2.5 cm long. Lateral sepals ovate-falcate, 5 mm long. Lip ovate-oblong or suborbicular, rotund, base shortly saccate at base, 1 - 1.2 cm long. Petals delicate. Wings 2-lobed, 1.75 - 2.3 cm long; upper lobes oblong, obtuse, ca 7 mm long; distal lobes oblong-lanceolate, obtuse or shortly emarginate, ca 1.5 cm long. Capsules ellipsoid, acute, ca 8 mm long.

Fl. & Fr. July - Sept.

Distrib. India: W. Ghats; on moss-covered tree trunks in wet shola forests at about 2,200 m. Tamil Nadu.

Endemic to Nilgiri hills (Kundah Range - Nilgiri Peak, Makurti).

127. *Impatiens nigrescens* Hook. f. in Rec. Bot. Surv. India 4: 28. 1905.

Herbs; stems pubescent towards apex. Leaves alternate, ovate-lanceolate to elliptic-lanceolate, slightly attenuate into petiole, acute at apex, serrate-dentate along margins, 1.5 - 9 x 1.2 - 3.5 cm, black when dry. Flowers 2.2 - 3.8 cm. Lateral sepals ovate, acuminate. Lip bucciniform, 1.4 - 1.7 cm long, 9 - 12 mm deep, spurred; spur filiform, 0.7 - 1.6 cm long. Standard more or less ovate, acutely pointed at apex, ca 6 x 5 mm. Wings bilobed, emarginate; basal lobes more or less elliptic with an appendage; distal lobes elliptic-ovoid. Capsules fusiform, acute, ca 1.7 cm.

Fl. & Fr. Aug.

Distrib. India: Assam.

Endemic.

128. *Impatiens nilgirica* C. Fischer in Bull. Misc. Inform. 1931: 41 - 42. f. A-C. 1931 & in Gamble, Fl. Pres. Madras 1869. 1935.

Herbs, erect, acaulescent; bulbs small, globose. Leaves 1-2, radical, suborbicular, prominently cordate at base, lobes rounded, often imbricate, distantly apiculate - crenate along margins, 2.5 - 4 cm broad, fleshy; primary nerves 7 - 9, fan-shaped, obscure above, distinct below; petiole 3 - 9 cm long, purplish. Scapes 1 - 2, ca 20 cm long, 4 - 10-flowered, purplish; bracts broadly ovate or suborbicular, concave, ca 6 mm long; pedicels ca 1 cm long, longer in fruits, reflexed apex slightly cordate, ca 4 mm long. Lip ca 1 cm long, navicular, subacute; spur short, broadly obtuse. Wings 3-lobed, ca 2 cm long, base of lower two-lobed, pilose within; distal lobes broadly obovate, oblique, retuse, 5 - 6 mm long; middle lobe narrower, obovate - oblong, apex rounded, ca 8 mm long; basal lobes further narrower, often smaller, oblong, obtuse. Capsules ellipsoid, 1-2 cm long; seeds minute, ovate-oblong, compressed, glabrous.

Fl. & Fr. Sept.

Distrib. India: Rare, among grasses or on rocks at 2800 m altitude. Tamil Nadu.

Endemic to Nilgiris (Kundah Range) of W. Ghats.

129. *Impatiens nummularifolia* Hook. f. in Rec. Bot. Surv. India 4: 14. 1905.

Herbs. Leaves ovate-lanceolate to ovate, slightly attenuate into petiole at base, acuminate or often shortly apiculate at apex, crenate along margins, 1.2 - 2.5 x 0.9 - 1.2 cm, grey-coloured beneath; lateral nerves 4 - 6 pairs; petiole 3 - 9 mm long, finely pubescent. Flowers axillary, pedunculate; bracts ovate, acuminate, ca 3 mm long; pedicels slender, 1 - 1.3 cm long, pubescent. Lateral sepals 4, ovate or outer sepals oblong, acuminate, with wing on one side, 5 mm long. Lip shallowly navicular, 6 - 8 mm long, spurred; spur filiform, 1.1 - 1.7 cm long. Standard suborbicular-obcordate, with a shallow dorsal acutely pointed crest. Wings ca 2.5 cm long; basal lobes obliquely ovate; distal lobes linear-oblong, entire; dorsal auricle small, blunt, crest-like. Capsules linear, acute, 0.3 - 1.6 cm long.

Fl. & Fr. July - Sept.

Distrib. India: E. Himalayas, ca 3000 - 3600 m.

Endemic.

130. *Impatiens occultans* Hook. f. in Rec. Bot. Surv. India 4: 17. 1905; H. Hara in Fl. E. Himal. 3: 79. 1975.

Herbs; stems prostrate, up to 9 cm long. Leaves alternate, ovate, obtuse at apex, shallowly crenate along margins, 1.8-2.9 x 1.4-1.7 cm, whitish beneath, pubescent above; lateral nerves 4-6 pairs. Flowers minute. Lip spurless.

Fl. & Fr. Unknown.

Distrib. India: E. Himalayas, ca 3650-4200 m.

Endemic.

131. *Impatiens odontosepala* Hook. f. in Bull. Misc. Inform. 1910: 299. 1910.

Herbs. Leaves alternate, elliptic-oblong or oblanceolate to oblong-lanceolate, attenuate into petiole at base, long-acuminate at apex, crenulate along margins, 1-1.5 cm long, drying blackish-brown; nerves 6-10 pairs; petiole 3-5 cm long; glands below petiole absent. Flowers 1-4, fleshy, yellow, streaked with red; peduncles ca 4 cm long; pedicels 1-2 cm long; bracts lanceolate, acuminate, 1-1.5 cm long. Lateral sepals lanceolate, acuminate, appendaged at margins, ca 1.5 cm long. Lip navicular, mouth ca 2 cm long; spur obtuse, robust, incurved. Standard orbicular, acutely pointed at apex. Wings sessile, ca 2-2.5 cm long; basal lobes oblong, decurved, slightly emarginate; distal lobes little longer, erect, dolabriform; dorsal auricle rounded. Capsules linear, clavate, ca 1.5 cm long.

Fl. & Fr. Nov.

Distrib. India: E. Himalayas, ca 2200 m, rare. Manipur.

Endemic.

132. *Impatiens oppositifolia* L., Sp. Pl. 937. 1753; Wight, Icon. t. 883. 1844; Hook. f., Fl. Brit. India 1: 448. 1874.

Erect annuals, up to 60 cm high; branches slender, glabrous. Leaves opposite, subsessile, linear-oblong, serrate, 2.5-7 cm long, glabrous or sparsely hairy above; stipules subulate. Flowers ca 1.2 cm across, axillary, solitary or in fascicles, pinkish; pedicels slender, elongate, glabrous. Lateral sepals lanceolate-linear, apiculate. Lip saccate; spur stout, short, incurved. Standard orbicular. Wings 3-lobed; basal lobes falcate; distal lobes obovate, larger than basal ones, clawed. Capsules ellipsoid, 1-1.25 cm long; seeds subglobose, blackish.

Fl. & Fr. July - Oct.

Distrib. India: In open grasslands and pastures of W. Ghats, up to 600 m. Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

133. *Impatiens orchioides* Beddome in Madras J. Lit. Sci. ser. 3. 1: 44. 1864 & Icon. t. 152. 186. 1874; Hook. f., Fl. Brit. India 1: 443. 1874.

Herbs, epiphytic, scapigerous; roots tuberous. Leaves radical, ovate-orbicular, deeply cordate at base, obtuse or acuminate at apex, bristly crenate along margins, 1.5 - 5.5 x 1 - 6 cm, hairy above, with numerous weak hairs, almost glabrous beneath; petioles 2 - 16 cm long. Scapes 5 - 19 cm long, 6 - 10- flowered at apex; bracts ovate; pedicels very slender, 1 - 1.5 cm long. Flowers ca 8 mm across, reddish-brown or pale brown. Lateral sepals ovate, acute. Lip ovate, acute, saccate, spurless. Standard ovate, obtuse, not vaulted; wings with a dimidiate oblong blade produced into two linear, pendulous lobes. Capsules constricted at both ends, glabrous; seeds numerous, minute, scrobiculate, brown.

Fl. & Fr. July - Dec.

Distrib. India: Rare epiphytic species occurring at high altitudes from 1800 - 2250 m in moist woods, Nilgiris in W. Ghats. Tamil Nadu.

Endemic.

134. *Impatiens pahalgamensis* Hook. f. in Bull. Misc. Inform. 1910: 291. 1910.

Herbs, glabrous, erect, 30 - 40 cm high; stems unbranched; internodes long. Leaves alternate, ovate to ovate-lanceolate, rounded or somewhat attenuate into petiole at base, acute at apex, coarsely crenate along margins, 4 - 5 cm long; lateral nerves 6 - 8 pairs; petiole 1 - 2 cm; stipular glands cushion-shaped or absent. Flowers small, 3 - 4 mm, rose-coloured; bracts linear or linear-lanceolate, 2 - 4 mm; peduncles erect, 3 - 6-flowered; pedicels not whorled, 1 - 2 cm long. Lateral sepals 2, ovate to ovate-orbicular, obtuse cuspidate, 4 mm long. Lip funnel-shaped or boat-shaped; spur gradually constricted, short, attenuate, incurved. Standard orbicular, ca 4 mm long, beaked at apex. Wings in bud short, broad, sessile. Capsules ellipsoid or linear-oblong, rounded at apex, 1.5 - 2 cm long; seeds few, obovoid-oblong, 3 - 6 mm long, pale, tuberculate.

Fl. & Fr. June.

Distrib. India: W. Himalayas, ca 3000 m, very rare. Jammu & Kashmir.

Endemic.

135. *Impatiens pallidiflora* Hook. f. in Bull. Misc. Inform. 1911: 354. 1911; Gamble, Fl. Pres. Madras 141. 1915; Bhaskar & Razi in Indian J. For. 1: 73. 1978.

Herbs, slender, 30 - 50 cm high; stems branched, often pubescent. Leaves opposite, shortly petiolate, oblong or linear-oblong, truncate or rounded at base, acute or acuminate at apex, entire or minutely spinulose-serrulate, 3 - 5 cm long, glabrous or pubescent above, turning almost glaucous beneath. Flowers in fascicles, ca 2 cm across, rose or pink turning yellow when dry. Lateral sepals linear, 6 - 7 mm long. Lip cymbiform, acute; spur subequal to limb of lip or longer. Standard orbicular with an obscure dorsal keel, short. Wings ca 1.5 cm long, clawed; basal lobes almost absent; distal lobes dolabriform; dorsal auricle present.

Fl. Not known.

Distrib. India: ca 2100 m "Almost grassy slopes, Iduki (Devicolam)" - Hook. f. l.c. Kerala.

Endemic.

136. *Impatiens paludosa* Hook. f., *Fl. Brit. India* 1: 480. 1875 & in *Rec. Bot. Surv. India* 4: 31. 1905.

Herbs up to 60 cm. Leaves alternate, distant, narrowly elliptic-ovate to lanceolate, attenuate into petiole at base, acuminate, acute or obtuse at apex, finely crenate-serrate, with filiform appendages along margins, 5.5 - 7 x 1.5 - 3.2 cm, coriaceous; lateral nerves 6 - 10 pairs; petioles ca 1 cm long. Flowers 2 - 3.2 cm, yellow; bracts deciduous, broadly ovate, acute, ca 4 mm long; peduncles 2 - 4-flowered, ca 5 cm long. Lateral sepals broadly ovate to almost orbicular, long-acuminate, ca 3 mm long. Lip shallowly navicular, 1.8 - 2.9 cm long, apiculate; spur abruptly constricted, filiform, curved, club-shaped at tip, 1.6 - 2 cm, glabrous. Standard obcordate to suborbicular. Wings with basal lobes ovate, obtuse; distal lobes suborbicular or transversely semiovate, shortly apiculate at apex, ca 1.5 cm. Capsules cylindrical, acute, 0.5 - 1.5 cm long, glabrous; seeds minute, obovate, pointed at the hilum, rough, opaque.

Fl. & Fr. Aug. - Oct.

Distrib. India: E. Himalayas, ca 1500 - 1550 m. Arunachal Pradesh and Meghalaya.

Endemic.

137. *Impatiens pandata* Barnes in *Bull. Misc. Inform.* 1938: 33 - 34. 1938 & in *J. Indian Bot. Soc.* 18: 98. 1939.

Herbs, scapigerous, succulent. Leaves radical, solitary or few, orbicular-reniform, cordate at base, shallowly crenate along margins, thick and fleshy, glabrous, green above, dark-purple below; basal nerves 3 - 4 pairs, curved, not reaching margin, one pair of nerves arising from a little higher up; petioles ca 2 cm long. Scape solitary, up to 20 cm

long or much shorter, thick, succulent, pale-green with numerous red streaks, bent abruptly at right-angles at first pedicel. Racemes 9 or fewer-flowered; lower bracteoles broad and short, upper narrowly ovate, up to 5 mm long; pedicels slender up to 2.7 cm long, in fruits hanging down. Lateral sepals ca 5 mm long, streaked brownish-red. Lip spoon-shaped, spurless, posteriorly light brownish-purple shading to white anteriorly. Standard broadly elliptic with long axis sideways, concave, entire along margins, ca 1 cm wide. Wings 3-lobed, up to 2.9 cm long; lobes oblong, rounded, two upper curved outwards, white, slightly tinted with a dark shade of blue within, hairy at base within. Capsules turgid, ca 1.2 cm long, glabrous; seeds very numerous, narrowly ovoid, ca 1 mm long, reddish-brown, covered with scattered white granules which swell to hairs when wet.

Fl. & Fr. Aug. - Sept.

Distrib. India: On wet rocks in cushions of moss and on cliffs in shrub-savannah at high elevations above 1,800 m. Kerala (Anaimudi slopes and Karunkulam, Idukki Dist.)

Endemic.

Notes. Its counterparts are *I. akka* Beddome and *I. nilgirica* C. Fischer occurring in similar situations in Anamalais and Nilgiris. Barnes (1938) considers this to be related to *I. crenata* and *I. nilgirica* but in pollen it is quite distinct at least from *I. nilgirica*.

138. *Impatiens pantlingii* Hook. f. in Rec. Bot. Surv. India 4: 16. 1905.

Herbs, erect, 40 - 70 cm high; stems erect, branched or generally unbranched above, glabrous. Leaves spirally arranged, ovate-lanceolate to ovate-elliptic, attenuate into petiole at base, long-acuminate at apex, crenate along margins, 3.5 - 6.5 x 1.8 - 2.6 cm, finely pubescent above and beneath; lateral nerves 5 - 8 pairs; petiole 0.5 - 2.5 cm long, finely pubescent. Flowers in axils of uppermost leaves, pedunculate; bracts lanceolate, 2 - 4 mm long; peduncles glabrous, 2 - 4.5 cm long; pedicels slender, glabrous. Lateral sepals ovate with an appendage, incurved at base, 4 - 5 mm long. Lip navicular, 8 - 10 mm long, spurred; spur gradually constricted, filiform, 4 - 6 mm long, glabrous. Standard suborbicular, 7 - 6 mm; midnerve prominent. Wings 1.5 - 1.8 cm long; basal lobes elliptic-oblong, 5 - 7 x 3 - 5 mm; distal lobes linear, 1 - 1.1 cm. Capsules linear, acute, 0.7 - 1.2 cm long.

Fl. & Fr. Oct.

Distrib. India: E. Himalayas, ca 3000 m. Sikkim.

Endemic.

139. *Impatiens parasitica* Beddome in Madras J. Lit. Sci. ser. 2. 20: 66. t. 7. f. 2. 1859 & Icon. t. 140. 1868 - 74. *I. jerdoniae* Wight var. *parasitica* (Beddome) Hook. f., Fl. Brit. India 1: 460. 1874. **Fig. 46.**

Herbs, succulent, perennial; stems moniliform, 10 - 25 cm long, green or purple, internodes swollen. Leaves crowded at ends of branches, elliptic, acute, serrate, with glandular cilia at base, 3 - 7 x 2 - 3 cm; petioles 2 - 6 cm long. Peduncles axillary, up to 3.5 cm long, bearing 1 - 3 flowers; pedicels ca 5 cm long. Lateral sepals linear, green with a foliaceous crest. Lip saccate; spur ca 5 mm across the mouth, recurved at tip. Standard dorsally winged, green. Wings yellow, 2-lobed, concealed under lip. Capsules gibbous, glabrous; seeds numerous, small.

Fl. & Fr. June - Nov.

Distrib. India: Epiphytic on tree trunks in hills, 1000 - 2000 m. Tamil Nadu (Anamalai and High Wavy Mountains) and Kerala (Idukki and Palakkad hills).

Endemic in Southern W. Ghats.

140. *Impatiens parvifolia* Beddome in Madras J. Lit. Sci. ser. 2. 20: 66. t. 7. f. 1. 1859; & Icon. 29, t. 142. 1868-74; Hook. f., Fl. Brit. India 1: 453. 1874. *I. omissa* Hook.f. in Rec. Bot. Surv. India 4: 48. 1906.

Herbs 12 - 25 cm long; stems simple or branched. Leaves opposite and alternate, sessile or petioled, ovate-elliptic, crenate-serrate, 0.8 - 2 x 0.5 - 1.3 cm; petioles up to 7 mm long. Flowers axillary, solitary or in racemes, white or pale pink with crimson blotches; peduncles up to 5 cm long. Lateral sepals small, falcate. Lip cymbiform; spur green, short, blunt. Standard suborbicular, keeled. Wings up to 1.2 cm long, bilobed; basal lobes small; distal lobes triangular, thrice larger than basal ones; dorsal auricle minute. Capsules ellipsoid; seeds ovoid, villous.

Fl. & Fr. Sept. - Dec.

Distrib. India: Southern W. Ghats, 1800 - 2500 m. Tamil Nadu and Kerala.

Endemic.

Notes. J.D. Hooker (Rec. Bot. Surv. India 4: 48. 1906) separated *I. omissa* from *I. parvifolia* based on presence of "filiform dorsal auricle of wing" in the former which is reduced to a minute appendage in the latter. But there is no consistency in that character. However, there is difference in chromosome numbers, $2n = 28$ in the former and 20 in the latter (Virendra Kumar & Subramanian, Chr. Atlas Fl. Pl. Ind. Subc. 1: 86. 1986).



Fig. 46. *Impatiens parasitica* Beddome : a. habit; b. flowers; c. another view of flower; d & e. lateral sepals; f. lip; g. standard; h. wing petals.

141. *Impatiens pendula* Heyne ex Wight & Arn., Prodr. Fl. Pen. Ind. Or. 136. 1834; Hook. f., Fl. Brit. India 1: 455. 1874.

Erect flaccid herbs, 10 - 15 cm high; branches with a line of pubescence. Leaves alternate, ovate, elliptic-ovate or subcordate at base, acute at apex, serrate, 6 - 12 mm long, sparsely hairy above, glabrous below; petioles short. Flowers axillary, solitary, ca 6 mm across; pedicels longer than petioles, puberulous, deflexed in fruits. Lip concave; spur absent. Standard spurred on dorsal side. Capsules ellipsoid, 3 mm long, beaked, glabrous; few-seeded.

Fl. & Fr. July - Oct.

Distrib. India: W. Ghats. Karnataka and Kerala.

Endemic.

142. *Impatiens phoenicea* Beddome in Madras J. Lit. Sci. ser. 2. 19: 175. 1858 & Icon. 30. t. 148. 1868 - 1874; Hook. f., Fl. Brit. India 1: 466. 1875.

Herbs, suffruticose, erect, 0.3 to 1 m high, branched or not, glabrous. Leaves alternate, lanceolate or ovate, attenuate at both ends, bristly crenate-serrate, incurved, 5 - 15 x 2.5 - 3.5 cm, dark-green, shining; petioles 1.5 - 2.5 cm long. Peduncles axillary as long as leaves, slender, erect; bracts at base of pedicels, ovate, cordate, persistent. Flowers ca 2.5 cm long, brilliant scarlet, yellow in centre. Lateral sepals obliquely ovate. Lip with spur blood-crimson, trumpet-shaped, incurved with swollen tip. Standard scarlet, broad, ovate. Wings scarlet, yellow at base, small; basal lobes cordate, overlapping the larger oblong, distal lobes. Capsules 4 - 5-seeded; seeds compressed-furrowed, ca 3 mm long, light brown.

Fl. & Fr. May - Nov. but mostly Sept. - Oct.

Distrib. India: Southern Western Ghats south of Pulneys and High Ranges of Kerala, sholas above 1,500 m. Tamil Nadu and Kerala.

Endemic.

Notes. This beautiful and striking species with its bright scarlet flowers against dark green foliage is closely allied to *Impatiens walkeri* Hook. of Sri Lanka. This plant can be cultivated using cuttings and deserves a place in gardens.

Chromosome no. $n = 10$ (Bhaskar, V. in Taxon 25(1): 155. 1976).

143. *Impatiens platyadena* C. Fischer in Bull. Misc. Inform. 1934: 393. 1934.

Undershrubs, up to 1 m high; stems angled. Leaves alternate, elliptic-lanceolate, acuminate, crenate-serrate with apiculate crenations, 8 - 17 x 3.5 - 7 cm, decurrent on petiole; nerves impressed above, slightly prominent beneath; decurrent part of blade with 4 - 8 marginal, flattened, white glands. Racemes axillary; peduncles patent or slightly drooping, slender, 2.5 - 4.5 cm long. Flowers ca 1.5 cm long; bracts ovate, 8 - 15 mm long, persistent. Lateral sepals suborbicular, ca 6 mm across, cream-coloured. Lip funnel-shaped, ca 1.2 cm long, pinkish; spur tubular, upcurved into a semicircle, cream-coloured. Standard ovate, 7 - 8 mm long. Wings 1.5 - 1.6 cm long, 2-lobed; basal lobes triangular-ovate, acute or obtuse; distal lobes semioval, subacute, 1 - 1.2 cm long, scarlet. Capsules ovoid, acute, ca 6 mm long, accrescent; seeds pyriform, 1.5 - 2 mm long, mottled brown, minutely papillose.

Fl. & Fr. Sept.

Distrib. India: In grasslands at an altitude of 2000 m in southern W. Ghats. Kerala (Idukki Dist. - Nema Kad Gap).

Endemic and probably extinct species. Not located since type collection.

144. *Impatiens podocarpa* Hook. f. in Hooker's Icon. Pl. ser. 4. 10: t. 2963. 1913.

Herbs, glabrous, up to 50 cm high; branches slender. Leaves alternate, uppermost sessile, others petiolate, ovate to ovate-lanceolate, caudate-acuminate at apex, crenate along margins, 10 - 20 cm long; lateral nerves 10 - 12. Flowers small, in 6 - 8-flowered racemes; peduncles 6 - 8 cm long; bracts ovate, ca 2 mm long. Lateral sepals 2, rounded or deltoid-ovate or rotund, ca 2 mm long, with a straight appendage without glandular point, uninerved. Lip without appendage at mouth; spur ca 1 cm long, yellow. Standard simple, without appendage. Capsules clavate, 2 - 2.2 cm long; seeds 2 - 3, oblong, 3 - 5 mm long, tuberculate. *Fl. & Fr.* Not known.

Distrib. India: W. Himalayas, ca 2100 - 2500 m. Uttar Pradesh (Garhwal).

Endemic.

Notes. The protologue is based on a single specimen collected by Duthie.

145. *Impatiens polysciadia* Hook. f. in Hooker's Icon. Pl. ser. 4. 10: t. 2906. 1913.

Herbs, erect, glabrous; stems robust. Leaves alternate, sessile to subsessile, ovate to oblong, rounded or cordate at base, acuminate at apex, serrate to serrulate along margins, 5 - 15 cm long. Flowers in umbels or rarely racemes, ca 1 cm across, rose-coloured; peduncle 4 - 6 cm long, 3 - 8-flowered; bracts ovate to ovate-lanceolate, acuminate; pedicels umbellate, not whorled. Lateral sepals 2, concave, ovate to oblong, obtuse, ca 4 mm long. Lip bucciniform; spur ca 6 mm long. Standard ovate-orbicular,

beaked, ca 6 mm wide, keeled on dorsal side. Wings sessile, 8 - 9 mm long; basal lobes rounded; distal lobes little longer than basal ones, dolabriform; dorsal auricle slender.

Fl. & Fr. Not known.

Distrib. India: W. Himalayas. Uttar Pradesh (Kumaon).

Endemic.

Notes. This is one of the minute-flowered *Impatiens* of India.

146. *Impatiens porrecta* Wallich ex Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 138. 1860; Hook. f., Fl. Brit. India 1: 472. 1875 & in Rec. Bot. Surv. India 4: 26. 1905; H. Hara in H. Hara & Williams, Enum. Fl. Pl. Nepal 2: 79. 1979. **Fig. 47.**

Herbs, annual, 20 - 45 cm high; stems decumbent, rooting at lower nodes, branched at basal part but generally unbranched above, succulent, pubescent; lower nodes rooting. Leaves broadly ovate to orbicular, sometimes lanceolate, slightly attenuate into petiole at base, acuminate at apex, finely crenate-serrate along margins with lowermost teeth filiform, lower surface whitish, pubescent; lateral nerves 6 - 12 pairs; petiole 1 - 2 cm long, pubescent. Flowers axillary, 1 - 3, orange-red or golden-yellow with dark-purplish red nerves at throat, ca 2.5 cm across, pubescent; peduncles from axils of subterminal leaves or extra-axillary; bracts linear, 1 - 3 mm long; pedicels slender, 1.5 - 3 cm long, pubescent. Lateral sepals ovate to ovate-lanceolate, 3 - 7 mm long, pubescent, white with red dots. Lip obliquely navicular, 3 - 5 mm long; spur abruptly constricted, filiform, 0.5 - 1.5 cm long, yellowish with red markings on back and rosy apex. Standard orbicular-ovate, shortly and acutely pointed at apex, 0.8 - 1.5 cm, reddish-yellow. Wings 1.2 - 1.7 cm long; basal lobes ovate-triangular, 5 - 7 x 3 - 4 mm, with an orange spot in middle; distal lobes suborbicular or elongate-ovate; dorsal auricle short. Capsules fusiform, 0.8 - 1.1 cm long, slightly pubescent.

Fl. & Fr. April - Nov.

Distrib. India: E. Himalayas, 1500 - 1800 m. Assam, Arunachal Pradesh, Nagaland, Manipur and Meghalaya.

Myanmar.

147. *Impatiens prainii* Hook. f. in Rec. Bot. Surv. India 4: 14. 1905.

Herbs; stems erect, mostly on upper part of stem; linear-lanceolate to narrowly elliptic, cuneate or attenuate into petiole at base, acuminate at apex, serrate-dentate along margins, 1.8 - 6.5 x 0.3 - 1.2 cm, green above, pale beneath, finely pubescent above and beneath; petiole 2 - 4 mm long. Flowers 3 - 3.8 cm; bracts ovate, ca 3 mm with ca 1

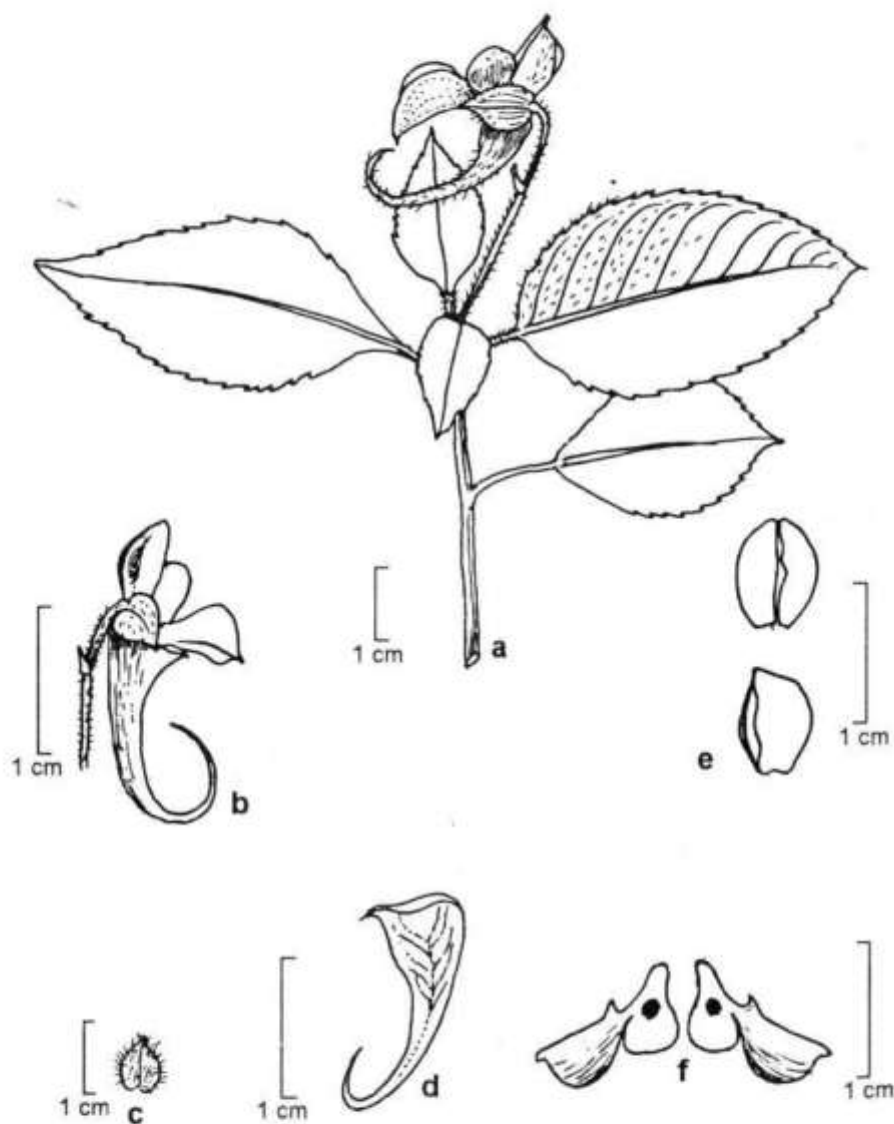


Fig. 47. *Impatiens porrecta* Wallich ex Hook. f. & Thomson : a. habit; b. flower; c. lateral sepal; d. lip; e. standard; f. wing petals.

mm long appendage. Lateral sepals ovate, acuminate, later becoming cuspidate, 4 - 4.5 x 2 - 4 mm. Lip obliquely and shallowly navicular, 1 - 1.4 cm long, spurred; spur gradually constricted, 1.3 - 1.5 cm long. Standard suborbicular-obcordate, ca 8 x 6 mm, crested; crest dorsal, acutely pointed, ca 1 mm long. Wings bilobed; basal lobes ovate-triangular; distal lobes linear-oblong. Capsules linear, acute, 0.4 - 1.5 cm long.

Fl. & Fr. July - Sept.

Distrib. India: E. Himalayas, ca 3000 m. Sikkim.

Nepal.

148. *Impatiens prostrata* Hook. f. in Rec. Bot. Surv. India 4: 31. 1905.

Herbs; stems prostrate, creeping. Leaves ovate to ovate-lanceolate, rounded or somewhat attenuate into petiole at base, obtuse or slightly acuminate at apex, serrate along margins, 2.8 - 3 x 1.3 - 1.5 cm, pale beneath. Flowers small, ca 1.5 cm across. Lateral sepals ovate, acuminate. Lip bucciniform, 1 - 2.2 cm long, spurred; spur filiform. Capsules linear, acute, 0.8 - 1.9 cm long.

Fl. & Fr. Oct.

Distrib. India: E. Himalayas, ca 1600 m. Manipur.

Endemic.

149. *Impatiens psittacina* Hook. f. in Bot. Mag. t. 7809. 1901.

Erect, much-branched herbs; stems and branches stout, coloured. Leaves alternate, ovate, acuminate at apex, serrulate along margins, 5 - 7.5 cm long, midnerve with clavate glands on either side. Flowers axillary, solitary, ca 5 cm long; pedicels ca 2.5 cm long; bracts setaceous. Lateral sepals greenish, orbicular. Lip conico-campanulate; spur short, hooked. Standard orbicular, concave, ca 1.6 cm across, pale-rose. Wings ca 3.5 cm long, bilobed; basal lobes orbicular, erect; distal lobes longer than basal ones, obliquely oblong, recurved, streaked with red.

Fl. & Fr. Not known.

Distrib. India: On hills. Manipur.

Myanmar.

150. *Impatiens puberula* DC., Prodr. 1: 687. 1824; Hook. f., Fl. Brit. India 1: 470. 1875 & in Rec. Bot. Surv. India 4: 17. 1905; Biswas, Pl. Darj. Sikkim Himal. 1: 206. 1966; H. Hara in Fl. E. Himal. 1: 196. 1966 & 2: 75. 1975.

Herbs, up to 1 m high; stems slender, occasionally branched, finely pubescent to glabrous. Leaves alternate, oblong to elliptic or lanceolate-elliptic, shortly attenuate into petiole at base, acuminate at apex, shallowly crenate to crenate-dentate along margins, 6 - 13 x 2.3 - 4.7 cm, pubescent above, lower surface white; lateral nerves 6 - 10 pairs; petiole 0.5 - 4.5 cm long; stipules absent. Flowers in axils towards apex, solitary, 2.5 - 3.5 cm long, reddish-violet; bracts subulate, basal or absent, ca 2 mm long; pedicels up to 4 cm long. Lateral sepals ovate to lanceolate, acuminate, 6 - 10 x 2.5 - 3 mm. Lip conoidal, rather small, pinkish-white; spur abruptly constricted, filiform, incurved, 1.5 - 2.2 cm long. Standard suborbicular to obcordate, notched, dorsally crested, 1 - 1.8 x 1.2 - 2 cm. Wings 1.5 - 2.5 cm long, dark-purple; basal lobes elliptic-reniform; distal lobes transversely elliptic or obovate. Capsules linear, 4 - 5 mm long, glabrous.

Fl. & Fr. June - Oct.

Distrib. India: W. Bengal, Sikkim, Arunachal Pradesh and Meghalaya.

Nepal and Bhutan.

Chromosome no. $2n = 28$ (Malla, S.B. et al. in Taxon 26: 443-452. 1977).

151. *Impatiens pulcherrima* Dalz. in Hooker's J. Bot. Kew Gard. Misc. 2: 37. 1850; Hook. in Bot. Mag. t. 4615. 1851; Hook. f., Fl. Brit. India 1: 458. 1874.

Erect succulent herbs, up to 60 cm high; stems simple or branched. Leaves alternate, ovate-lanceolate or elliptic-oblong, acuminate, crenate-serrate, crenature setose, 7.5 - 12.5 x 2.5 - 5 cm, membranous, glabrous or sparsely hairy above, glabrous and glaucous beneath; petiole 1.5 - 3 cm long, often with stipitate glands towards apex. Flowers axillary, solitary or in fascicles, ca 4 cm across, rose or violet-purple; pedicels 2 - 3 together, 5 - 7.5 cm long, erect in fruits. Lateral sepals small, lanceolate. Lip subcymbiform, mucronate; spur filiform, incurved, 3 - 5 cm long. Standard orbicular, notched, spurred or keeled on dorsal side. Wings broad, bifid, spreading; lobes obovate; distal lobes larger than basal ones. Capsules ovoid-oblong, beaked, ca 1 cm long, glabrous or pilose; seeds 2 - 8, rugose, glabrous.

Fl. & Fr. Aug. - Nov.

Distrib. India: W. Ghats. Maharashtra, Goa, Karnataka and Kerala.

Endemic.

Chromosome no. $2n = 12$ (Stahevitch & Grant in Can. J. Bot. 62: 2631. 1984).

152. *Impatiens pulchra* Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 139. 1860; Hook. f., Fl. Brit. India 1: 459. 1874 & in Rec. Bot. Surv. India 4: 12. 1905; Biswas, Pl. Darj. Sikkim Himal. 1: 205. 1966.

Herbs, erect, 10 - 30 cm high; stems sparsely branched. Leaves alternate, oblong to elliptic or lanceolate-elliptic, shortly attenuate into petiole at base, acuminate at apex, shallowly crenate to crenate-dentate along margins, 2 - 15 x 1.7 - 4 cm, dark-green above, paler beneath; petiole 1 - 3 cm long; lateral nerves 8 - 12 pairs; petiole 5 - 15 mm, stout, glabrous. Flowers rose-straw coloured or purplish-pink with dark-red streaks; peduncles 1 - 2-flowered; bracts on top of peduncle, lanceolate, 2 - 5 mm long; pedicels ca 2 cm long. Lateral sepals 2, ovate, acute to acuminate, 6 - 10 x 4 - 7 mm, green. Lip funnel-shaped, 1 - 1.5 x 0.8 - 1.2 cm; spur abruptly constricted, filiform, curved, 1.3 - 2.5 cm long. Standard suborbicular, acutely crested on back, ca 1.6 x 1 cm. Wings broad, 2 - 2.8 cm long; basal lobes elliptic-oblong, ca 1.3 x 1 cm; distal lobes narrowly elliptic to semioval, obtuse, ca 1.9 x 1.1 cm. Capsules turgid in middle, narrowed at both ends, 1 - 1.3 cm, glabrous.

Fl. & Fr. Sept. - Nov.

Distrib. India: E. Himalayas, ca 1200 - 1500 m. W. Bengal, Sikkim, Assam, Arunachal Pradesh, Nagaland and Meghalaya.

Nepal and Myanmar.

153. *Impatiens racemosa* DC., Prodr. 1: 688. 1824; Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 147. 1860; Hook. f., Fl. Brit. India 1: 479. 1875 & in Rec. Bot. Surv. India 4: 6. 1904; Biswas, Pl. Darj. Sikkim Himal. 1: 210. 1966; H. Hara, Fl. E. Himal. 1: 196. 1966. *I. microsciadia* Hook. f. in Rec. Bot. Surv. India 4: 16. 1905. Fig. 48.

Herbs, up to 1 m high; stems slender, branched, sometimes glandular above, glabrous. Leaves ovate-elliptic to elliptic-oblong or oblanceolate, sometimes smaller, attenuate into petiole at base, acuminate at apex, shallowly crenate or crenate-serrate along margins with poorly developed filiform appendages on crenations, 3.5 - 12 x 0.8 - 3 cm, green, paler beneath; petiole 0.8 - 3.5 cm long; stipular glands 2, large, rarely absent. Inflorescence a raceme, axillary, exceeding leaves, 6 - 10-flowered. Flowers 1.6 - 2.5 cm long, yellowish-white with reddish blotches; peduncles 3 - 8 cm long; bracts ovate, ca 3 mm long, with ca 2 mm long glandular filiform appendages; pedicels alternate on peduncles, 1 - 4 cm long, hairy. Lateral sepals falcate, ca 3 x 1 mm, usually with ca 3 mm long appendage, yellow. Lip shallowly navicular, shortly pointed, ca 2 x 5 mm, spurred; spur constricted, curved, 1.1 - 1.8 cm long. Standard orbicular, with an appendage, not spurred or crested, 4 - 5 mm long. Wings narrow, pendulous, 0.7 - 1 cm long; basal lobes orbicular, 3 - 4 x 4 - 5 mm; distal lobes transversely semioval to elliptic-ovate,

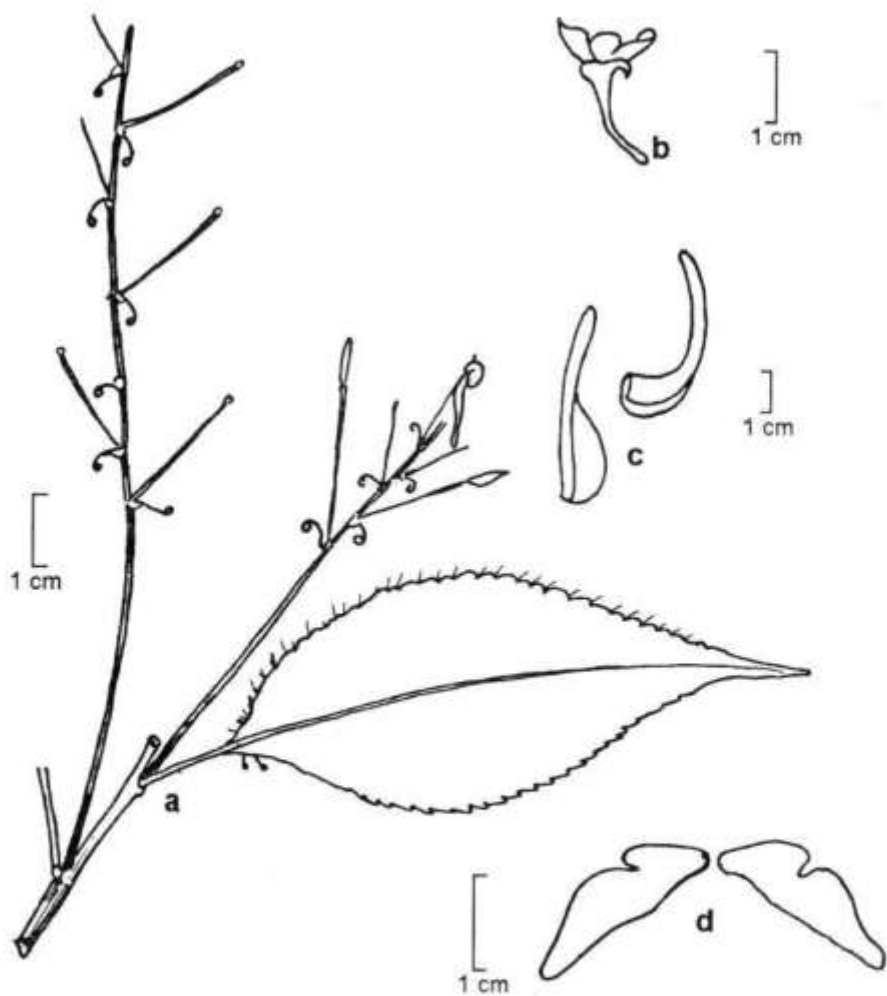


Fig. 48. *Impatiens racemosa* DC. : a. habit; b. flower; c. lateral sepals; d. wing petals.

broadly strap-shaped, shortly apiculate, 5 - 7 x 2 - 3 mm. Capsules linear or clavate, 0.5 - 1.8 cm, glabrous; seeds large, oblong, compressed, rugose.

Fl. & Fr. June - Oct.

Distrib. India: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, W. Bengal, Sikkim and Meghalaya.

Nepal, Tibet and Malay Peninsula.

Chromosome no. $2n = 18$ (Chatterjee, A. & A.R.K. Sastry in *Nucleus* 13: 177-200. 1970); $2n = 20$ (Malla, S.B. et al. in *Taxon* 27: 53-61. 1977).

154. *Impatiens racemulosa* Wallich ex Hook. f. & Thomson in *J. Linn. Soc., Bot.* 4: 138. 1860; Hook. f. in *Fl. Brit. India* 1: 486. 1875 & in *Rec. Bot. Surv. India* 4: 25. 1905.

Fig. 49.

Herbs, annual, 15 - 25 cm high; stems simple, erect. Leaves alternate, ovate or broadly elliptic, shortly attenuate at base, subacute to acute or shortly acuminate at apex, finely serrate along margins with filiform appendages on serrations, 2.5 - 9 x 1.3 - 2.5 cm; lateral nerves 4 - 6 pairs, shortly hairy on both sides of nerves; petiole up to 7 cm long, eglandular; stipules absent. Inflorescence a raceme, axillary, 3 - 8-flowered. Flowers reddish-violet, ca 2.5 cm across; bracts persistent, ovate, ca 3 mm long. Lateral sepals obliquely ovate, usually long-acuminate, 3 - 4 mm long. Lip shallowly navicular, 2 - 4 mm; spur abruptly constricted, filiform, curved, 0.4 - 2 cm long. Standard small, obovate, shallowly emarginate, ca 4 mm long, not spurred on back. Wings bilobed; basal lobes small, more or less elliptic; distal lobes large, orbicular, violet; dorsal auricle absent. Capsules globose, 5 - 6 mm long, glabrous; seeds few, small, globose.

Fl. & Fr. June - Oct.

Distrib.: India: E. Himalayas, 1200 - 1550 m. Assam, Arunachal Pradesh and Meghalaya.

Bhutan and Bangladesh.

155. *Impatiens radiata* Hook. f., *Fl. Brit. India* 1: 476. 1875 & in *Rec. Bot. Surv. India* 4: 15. 1905; Biswas, *Pl. Darj. Sikkim Himal.* 1: 210. 1966; H. Hara in *Fl. E. Himal.* 1: 196. 1966 & 2: 75. 1971 et H. Hara in H. Hara & Williams, *Enum. Fl. Pl. Nepal* 2: 80. 1979; Akiyama et al. in *Bull. Natn. Sci. Mus. ser. B.* 21(4): 151-168. 1995. **Fig. 50.**

Herbs, glabrous, up to 1 m high, leaf-bases deep red with stalked glands, ca 1.5 mm long. Leaves ovate-elliptic to elliptic-oblong, attenuate into petiole at base, long-acuminate at apex, crenate along margins, with red filiform appendages on crenations;

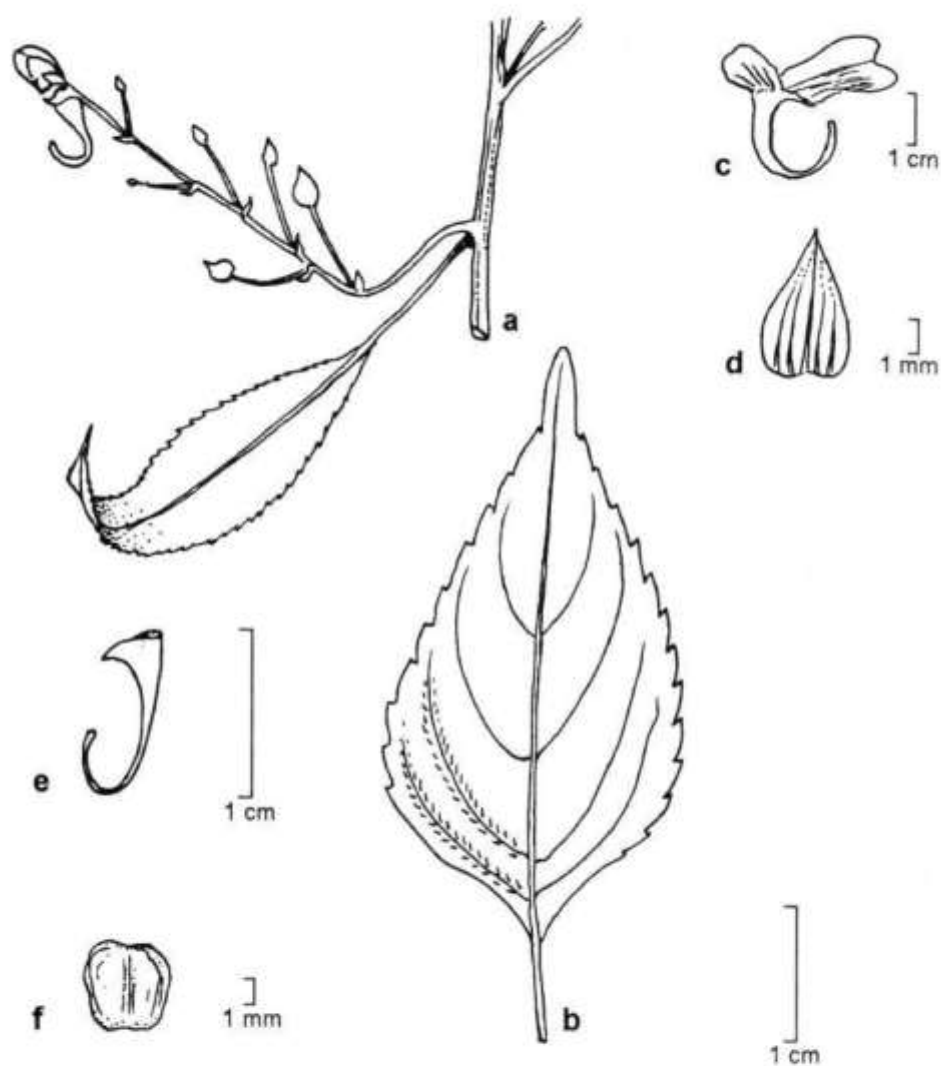


Fig. 49. *Impatiens racemulosa* Wallich ex Hook. f. & Thomson: a. part of the plant; b. lower leaf; c. flower; d. lateral sepal; e. lip; f. standard.

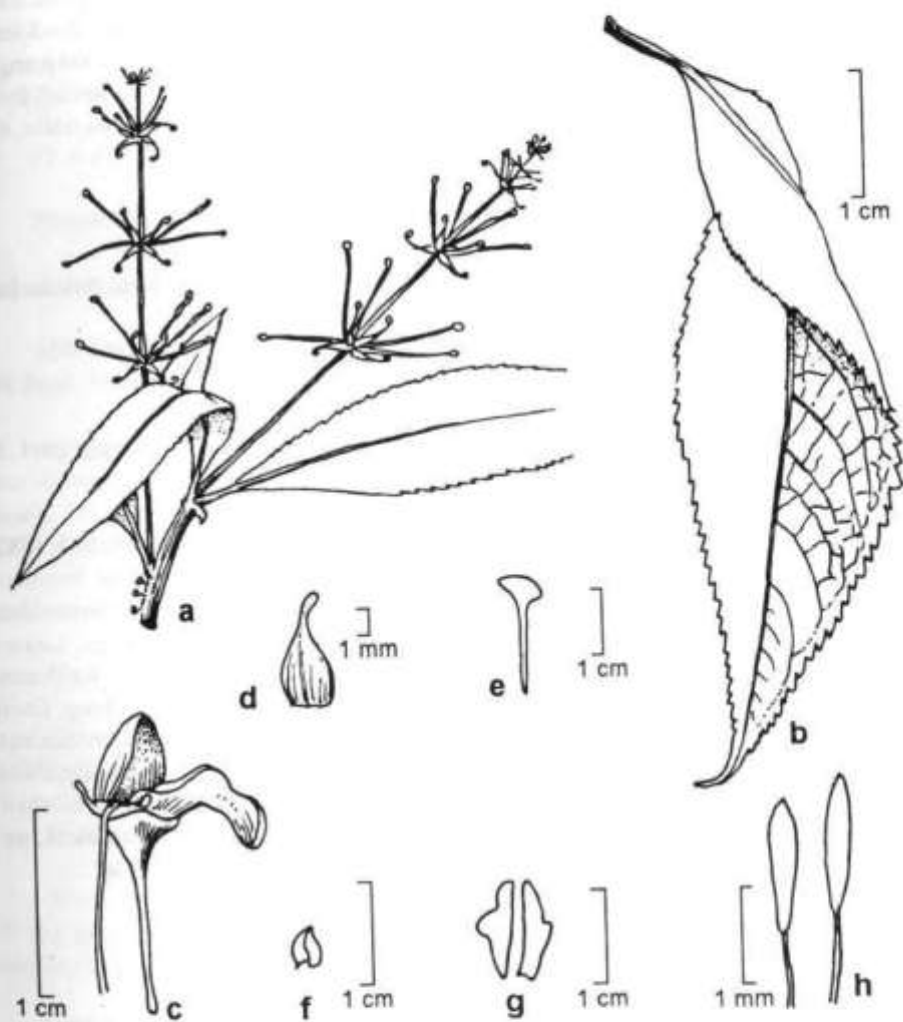


Fig. 50. *Impatiens radiata* Hook.f. : a. habit; b. leaf; c. flower; d. bract; e. lip; f. standard; g. wing petals; h. capsule.

lateral nerves 9 - 12 pairs; petiole 2 - 10 cm long; stipular glands 2, large. Flowers ca 2.5 cm across, yellow or purplish; peduncles 8.5 - 11 cm long with 2 - 5 whorls of pedicels; bracts persistent, ovate with glandular tip, ca 1.5 cm long. Lateral sepals ovate, ca 3 x 1 mm long, with stout ca 1 mm long glandular points. Lip shallowly navicular, 3 - 5 mm long; spur abruptly constricted, filiform, straight with a swollen tip, 6 - 12 mm long, rosy. Standard ovate, ca 4 x 3 mm. Wings 9 - 12 mm long; basal lobes ovate-triangular, 2 - 3 x 1.5 - 2 mm; distal lobes narrowly ovate but narrowed just above middle, apiculate, 6 - 9 x 3 - 4 mm. Capsules 1.5 cm, glabrous.

Fl. & Fr. Sept. - Nov.

Distrib. India: E. Himalayas, ca 1500 - 3650 m. W. Bengal, Sikkim, Arunachal Pradesh and Meghalaya.

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

Chromosome no. $2n = 20$ (Sarkar, A.K. et al. in Proc. Indian Sci. Cong. part. 3. 32-33. 1974).

156. *Impatiens raziana* Bhaskar & Razi in J. Bombay Nat. Hist. Soc. 79: 383. 1982.

Herbs, prostrate or procumbent, annual, rooting at nodes; roots fibrous; branchlets opposite, arising from basal nodes, 7 - 8 cm long; stems quadrangular, glabrous. Leaves opposite, ovate or spatulate, obtuse at apex, attenuate at base, glabrous, 4 x 7 mm, exstipulate, petiolate. Flowers solitary, axillary, scarlet; pedicels ca 7 mm long, finely pubescent. Lateral sepals linear, elliptic, faintly serrulate, nerves 3, median distinct, furunculate, furuncles parallel. Lip minute, yellow-tinged; spur arising slightly above base of lip. Standard ovate, more or less mucronate, glabrous. Wings ovate, bilobed; basal lobes fin-shaped, transparent, honey guides prominent. Filaments subulate, unequal. Capsules 3 - 5 mm long, glabrous; seeds shiny, black, smooth, globose.

Fl. & Fr. Aug. - Sept.

Distrib. India: Karnataka.

Endemic.

157. *Impatiens reidii* Hook. f. in Hooker's Icon. Pl. ser. 4. 10: t. 2901. 1913.

Herbs, erect, glabrous; bulbs pubescent. Leaves alternate, elliptic-lanceolate to oblanceolate, gradually attenuate into petiole at base, acuminate at apex, crenate along margins with filiform appendages on crenations, membranous, finely pubescent or glabrous; lateral nerves 8 - 12 pairs; petiole 1 - 4 cm with glands at base. Flowers medium-sized, pedunculate, white; bracts linear, 3 - 5 mm long; peduncles 3 - 4-flowered,

slender, 3 - 5 cm long, glabrous or slightly puberulous; pedicels unibracteate, 6 - 8 mm long. Lateral sepals 2, obliquely ovate, acute to acuminate, 6 - 8 mm, puberulous, 6 - 7-nerved. Lip shallowly navicular, 2 - 2.5 cm long, spurred; spur gradually constricted, filiform, curved, ca 1.4 cm long. Standard suborbicular, 1 - 1.3 cm, midnerve thickened. Wings 1.5 - 1.9 cm long; basal lobes more or less rounded; distal lobes elliptic-obovate, distally shortly and obtusely apiculate. Capsules linear, acuminate, 3 - 4 cm long.

Fl. & Fr. July - Aug.

Distrib. India: W. Himalayas, ca 1800 - 2400 m. Uttar Pradesh.

Endemic.

158. *Impatiens rheedii* Wight & Arn., Prodr. Fl. Pen. Ind. Or. 138. 1834; Gamble, Fl. Pres. Madras 140. 1915.

Annuals, erect; stems slender, flaccid. Leaves opposite, oblong-lanceolate, attenuate at base, acute at apex, crenate-serrate along margins, 7.5 - 12.5 cm long, sparsely hairy. Flowers axillary, solitary or in fascicles, pink or mauve with dark streaks; pedicels 2.5 - 4 cm long, deflexed in fruits. Lateral sepals oblong or linear, caducous. Lip concave, subequal to petals; spurs longer than flowers, subulate. Wings oblong, clawed, entire or with minute basal lobes. Capsules oblong, ca 1.8 cm long.

Fl. & Fr. Not known.

Distrib. India: "W. Ghats in Malabar at low elevations (Barber, Bourne)" - Gamble (1915). Kerala.

Endemic.

Notes. It was included by Gamble (l.c.) based on collections of Barber and Bourne. It has not been recollected since then. J.D. Hooker has not mentioned this species neither in Fl. Brit. India Vol. 1: 1874 nor in Rec. Bot. Surv. India Vol. 4: 1904.

159. *Impatiens rubro-lineata* Hook. f. in Bull. Misc. Inform. 1910: 300. 1910.

Herbs, 50 - 60 cm high, glabrous. Leaves alternate, ovate-oblong, acuminate at apex, serrulate along margins, 6 - 10 cm long; petiole 2 - 3 cm long. Flowers ca 4 cm across, yellow, red-striated; bracts ovate to ovate-lanceolate, 1 - 1.5 cm long; peduncles 2 - 4-flowered. Lateral sepals 4, 2 ovate-oblong, acuminate, 0.3 - 2 cm long. Lip bucciniform, 2.5 - 3 cm long, horizontal and ascending; spur much smaller, robust. Standard orbicular with terminal appendage, ca 3 cm across. Wings 3 - 3.5 cm long; basal lobes large, broadly oblong or rotundate; distal lobes long and narrow, obovate or oblong, apex expanded or emarginate; dorsal auricle rotundate.

Fl. Nov.

Distrib. India: E. Himalayas, ca 1500 m. Manipur.

Endemic.

160. *Impatiens rufescens* Benth. ex Wight & Arn., Prodr. Fl. Pen. Ind. Or. 138. 1834; Wight, Icon. t. 963. 1845; C. Fischer in Gamble, Fl. Pres. Madras 1871. 1935. *I. tomentosa* Heyne ex Wight & Arn. var. *rufescens* (Benth. ex Wight & Arn.) Hook. f., Fl. Brit. India 1: 449. 1874.

Herbs, 10 - 25 cm high; stems erect, glabrous. Leaves opposite, shortly petioled, elliptic or cordate-obovate, acute or acuminate at apex, serrate, hispid above, hairy on nerves beneath. Flowers axillary, solitary or in pairs, ca 1.8 cm across, rose-pink or purplish; pedicels about the length of leaves, villous. Lateral sepals linear, smaller than wings. Lip saccate, without spur. Standard orbicular, apiculate. Wings 2-lobed; basal lobes rounded, distal lobes larger than basal ones. Capsules ovoid.

Fl. & Fr. Not known.

Distrib. India: In swampy and marshy places, 1400 - 1500 m. Tamil Nadu and Kerala.

Endemic.

161. *Impatiens rupicola* Hook. f. in Bull. Misc. Inform. 1910: 292. 1910; Gamble, Fl. Pres. Madras 140. 1915. *I. rivulicola* Hook. f. in Bull. Misc. Inform. 1911: 354. 1911; Gamble, l.c. *I. chinensis* L. var. *rupicola* (Hook. f.) Bhaskar in Indian J. For. 1: 172. 1978.

Herbs, 20 - 30 cm high; stems tetragonous. Leaves opposite, shortly petiolate, linear, acute or acuminate, entire or rarely very minutely serrulate, 3 - 4 cm long, coriaceous; petioles with stipitate glands at base. Flowers solitary or in 2 - 3-flowered fascicles, 0.5 - 2 cm long, rose to bluish-purple; pedicels 1 - 1.5 cm long, 2 - 2.5 cm long in fruiting, deflexed. Lateral sepals linear, acuminate, ca 1 cm long. Lip cymbiform; spur incurved, short. Standard orbicular, dorsally keeled. Wings up to 2 cm long, clawed, 2-lobed; basal lobes oblong, erect or decurved, small; distal lobes semilunate, fleshy; dorsal auricle short. Capsules ovoid, 0.8 - 1 cm long, pendulous; seeds globose, hardly 2 mm, black, shining.

Fl. & Fr. Not known.

Distrib. India: Maharashtra, Karnataka, Kerala.

Endemic.

162. *Impatiens scabrida* DC., Prodr. 1: 687. 1824; Hook. f., Fl. Brit. India 1: 472. 1875 & in Rec. Bot. Surv. India 4: 7. 1904; Biswas, Pl. Darj. Sikkim Himal. 1: 208. 1966; H. Hara in Fl. E. Himal. 1: 196. 1966 & 2: 75. 1971. *I. practemissa* Hook. f. in J. Linn. Soc., Bot. 37: 29. 1904 & in Rec. Bot. Surv. India 4: 18. 1905; *I. cristata* Roxb., Fl. Ind. 2: 456. 1824; Hook. f. in Rec. Bot. Surv. India 4: 10. 1904.

Hindi: *Tilura, Rindliya.*

Herbs, annuals, 60 - 120 cm high; stems branched. Leaves alternate, ovate-lanceolate to ovate-oblong, attenuate into petiole at base, subacute to acuminate at apex, serrate to dentate along margins with filiform appendage, 5 - 17 x 2 - 8.5 cm, green above, pale-green beneath, pubescent on both sides; petioles with two sessile glands at base. Flowers ca 3 cm long, yellow, speckled with brown; peduncles 1 - 4-flowered, pubescent; bracts lanceolate, acuminate; pedicels slender. Lateral sepals ovate, acuminate, ca 7 x 4 mm, pubescent. Lip navicular, 0.8 - 1 x 0.8 - 1.4 cm; spur abruptly constricted, curved, 1.3 - 3.5 cm long. Standard suborbicular, crested; crest dorsal, horn-like, acutely short-pointed at apex. Wings bilobed, ca 2.2 cm long; basal lobes broadly obovate, ca 1.2 x 0.8 cm; distal lobes narrowly oblong, 1 - 1.2 cm long. Capsules erect, oblong, acute, 3.5 - 5 cm long, puberulous; seeds ovoid, rugose.

Fl. & Fr. Sept. - Oct.

Distrib. India: E. & W. Himalayas, 2200 - 3300 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, W. Bengal, Sikkim and Arunachal Pradesh.

Nepal, Bhutan and Pakistan.

Chromosome no. $2n = 14, 20$ (Khoshoo, T.N. in Curr. Sci. 24: 223-224. 1955); $2n = 18$ (Chatterjee, A. & A.K. Sharma in Nucleus 13: 179-200. 1970).

163. *Impatiens scabriuscula* Heyne ex Roxb., Fl. Ind. 2: 464. 1824; Beddome, Icon. t. 144. 1868-74; Hook.f., Fl. Brit. India 1: 454. 1878.

Erect herbs, 10 - 25 cm high; stems branching at base, hairy. Leaves alternate, elliptic-lanceolate, serrate along margins, 1.8 - 6 x 0.6 - 1.2 cm, sparsely hairy above; petioles ca 3 mm long, sometimes glandular. Flowers in axillary fascicles, pink or rose; pedicels up to 6 mm long, scabrid. Lateral sepals minute, linear-lanceolate, hairy. Lip cymbiform, hairy; spur absent. Standard orbicular, beaked, hairy. Wings bilobed; basal lobes small; distal lobes oblong-obovate. Capsules ellipsoid, mucronate, ca 8 mm long, villous; seeds globose, brown, tubercled.

Fl. & Fr. Aug. - Jan.

Distrib. India: W. Ghats up to 1800 m. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

164. *Impatiens scapiflora* Heyne ex Roxb., Fl. Ind. 2: 464. 1824; Hook. f., Fl. Brit. India 1: 444. 1874.

Herbs, scapigerous, 15-45 cm high; rootstock tuberous. Leaves radical, orbicular, ovate or reniform with deep sinus, rounded base or oblique at base, rounded or acute at apex, crenate or serrate along margins, 5 - 15 x 3 - 12 cm, fleshy, hairy above, glabrous, pale, shining and green below; palmately nerved; petioles up to 15 cm long. Scapes racemose, many-flowered, 7 - 30 cm long. Flowers ca 2.5 cm across, pink; pedicels 1.5 - 2.5 cm long; bracts ovate, ca 3 mm long, fleshy. Lip saccate, ca 2.5 cm long, vaulted. Wings 3-lobed; lobes linear, falcate. Capsules fusiform, erect ca 1.2 cm long, glabrous; seeds hispid.

Fl. & Fr. July - Dec.

Distrib. India: W. Ghats. In the crevices of wet rocks and moist places of evergreen forests. Karnataka, Tamil Nadu and Kerala.

Chromosome no. $n = 6, 8, 10$ (Bhaskar, V. in Taxon 25(1): 155. 1976); $n = 10$ (S. Krishnaswamy et al. in South Indian Hort. 17 (1 & 2): 28 - 33. 1969).

165. *Impatiens scitula* Hook. f. in Rec. Bot. Surv. India 4: 14. 1905; Ghara, Maity & Sikdar in Bull. Bot. Surv. India 22(1-4): 191. 1980. Fig. 51.

Herbs, succulent, glabrous; nodes swollen. Leaves elliptic to ovate-lanceolate, acute at apex, crenate along margins with bristles in notches, 2 - 3 x 1 - 1.5 cm, green above, whitish beneath; lateral nerves 3 - 4 pairs with faint reticulations; petiole 2 - 9 mm long, slender. Inflorescence a raceme, axillary or subterminal. Flowers 3 - 3.5 cm long; bracts 1 or 2, ca 2 x 1.6 mm; peduncles both axillary and subterminal, 1 - 1.7 cm long, simple or 2-pedicelled; pedicels filiform, bracteate, 0.8 - 1.5 cm long. Lateral sepals 4; outer sepals ovate to ovate-lanceolate, 4 - 5 x 2 - 3 mm. Lip bucciniform; spur somewhat constricted, incurved. Standard ovate, acute, caudate at base, 5 - 8 x ca 5 mm. Wings 2.5 - 3 cm long; basal lobes elliptic-ovate; distal lobes unevenly bilobed, lower portion ligulate. Capsules linear, 1 - 1.7 cm long; seeds many.

Fl. & Fr. July - Sept.

Distrib. India: W. Bengal.

Tibet.

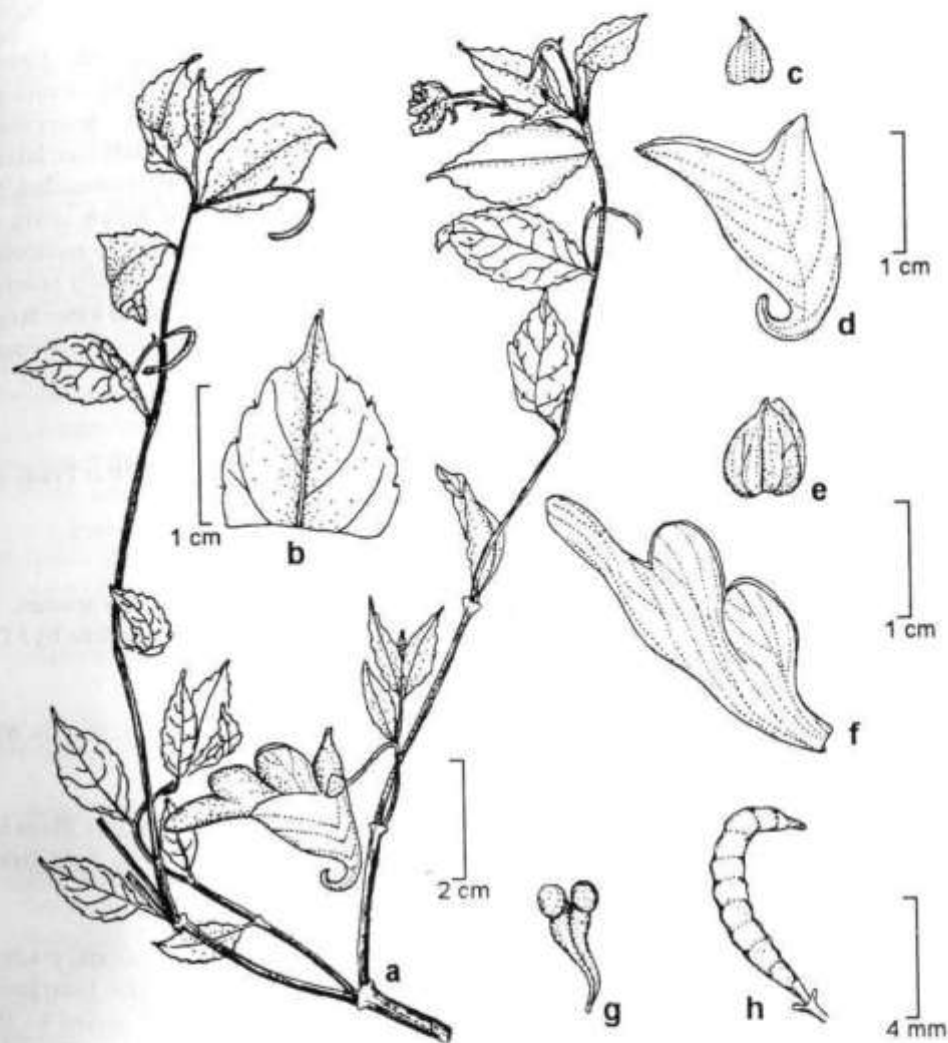


Fig. 51. *Impatiens scitula* Hook.f.: a. habit; b. leaf-upper portion; c. lateral sepal; d. lip; e. standard; f. wing petal; g. stamen; h. capsule.

166. *Impatiens serrata* Benth. ex Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 136. 1860; H. Hara in Fl. E. Himal. 3: 79. 1975. *I. serrulata* Hook. f. in Rec. Bot. Surv. India 4: 7. 1904.

Herbs, 30 - 90 cm high, glabrous; stems simple or sparingly branched. Leaves alternate, ovate to ovate-lanceolate, gradually attenuate at base, acute to long-acuminate at apex, serrate to serrulate along margins, serration with fine appendages, lower teeth become filiform appendages, 2 - 11.2 x 2 - 3.5 cm, finely pubescent or glabrous; lateral nerves 4 - 9 pairs; petiole 0.3 - 3 cm long, glabrous. Flowers one or two, peduncled, 1.5 - 3.2 cm, yellow or white with red spots; bracts setaceous. Lateral sepals ovate or elliptic-lanceolate, acuminate, ca 4 x 2.5 mm, red-spotted, puberulous. Lip navicular, 9.5 x 0.3 cm, red-spotted, not spurred. Standard suborbicular, shortly acutely pointed at apex, red-spotted. Wings bilobed, narrow, acutely pointed at apex; basal lobes large, rounded; distal lobes oblong. Capsules linear, acute, 0.7 - 4.2 cm long; seeds glabrous.

Fl. Aug. - Oct.

Distrib. India: W. Himalayas, 2430 - 3040 m. Himachal Pradesh and Uttar Pradesh.

Nepal and Bhutan.

Notes. H. Hara (l.c.) treated *I. serrulata* Hook.f. as a synonym under this species. *I. serrata* sensu Hook.f. has been split into two species - *I. falcifer* and *I. serratifolia* by J.D. Hooker (Rec. Bot. Surv. India 4: 23. 1905).

Chromosome no. $2n = 14$ (Khoshoo, T.N. in Proc. Indian Acad. Sci. sect. B. 63: 35-48. 1966).

167. *Impatiens serratifolia* Hook. f. in Rec. Bot. Surv. India 4: 18. 1905; H. Hara in H. Hara & Williams, Enum. Fl. Pl. Nepal 2: 80. 1979. *I. serrata* sensu Hook.f., Fl. Brit. India 1: 473. 1875, p.p., non Benth. ex Hook. f. & Thomson, 1860.

Herbs, delicate, glabrous. Leaves alternate, ovate-lanceolate to lanceolate, gradually attenuate into petiole at base, acuminate at apex, serrate to serrulate along margins, 3.2 - 9.5 x 0.7 - 2.5 cm, green above, pale beneath, glands at base; lateral nerves 4 - 10 pairs. Flowers one or two, peduncled, 1.3 - 1.5 cm long, yellow or white. Lateral sepals obliquely elliptic or lanceolate, acutely pointed at apex, 5 - 5.5 x 2.5 - 3 mm, white. Lip navicular, 0.7 - 1.4 x 0.6 - 0.8 cm; spur gradually constricted, coiled from base, 0.5 - 1.6 cm long. Standard suborbicular-obcordate, acutely pointed at apex. Wings bilobed; basal lobes ovoid; distal lobes elliptic, obtuse; dorsal auricle present. Capsules linear, acute, 0.8 - 2.7 cm long.

Fl. & Fr. June - Oct.

Distrib. India: Sikkim.

Nepal.

168. *Impatiens spirifer* Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 135. 1860; Hook. f., Fl. Brit. India 1: 471. 1875 & in Rec. Bot. Surv. India 4: 17. 1905; Biswas, Pl. Darj. Sikkim Himal. 1: 208. 1966.

Herbs, erect, 20 - 30 cm high, glabrous or sparsely pubescent; stems slender, sparingly branched. Leaves alternate, upper sessile, subverticillate; lower petiolate, alternate, ovate to ovate-lanceolate or ovate-elliptic, more or less rounded or somewhat attenuate at base, acuminate to long-acuminate at apex, shallowly crenate along margins, 2.5 - 7.5 cm long, membranous; lateral nerves 4 - 8 pairs, linked together by a loose network of secondary nerves; stipules setose. Flowers one or two, peduncled, yellow; pedicels very slender, 2 - 3.2 cm long. Lateral sepals ovate, cordate, 7 - 8 x 6 - 7 mm, usually with 3 mm long appendages, slightly pubescent. Lip bucciniform, ca 2 x 2.5 cm, pale-rose coloured; spur abruptly constricted, spirally coiled at apex, ca 5 mm long, purple-spotted. Standard cucullate, deeply emarginate to almost bifid, ca 1.5 x 1.4 cm. Wings bilobed, 2.3 - 2.5 cm long, violet-purple; basal lobes slightly smaller than distal ones, ovate to narrowly obcordate, 1.5 - 1.7 x 0.8 - 0.9 cm; distal lobes widely oblong, 1.5 - 1.9 x 1 - 1.2 cm. Capsules elongate, ca 0.5 - 2.5 cm; seeds globose, puberulous.

Fl. & Fr. Sept. - Dec.

Distrib. India: E. Himalayas, ca 1200 - 3200 m. W. Bengal, Assam, Sikkim, Nagaland and Meghalaya.

Nepal, Tibet, Bhutan and China.

169. *Impatiens spissiflora* Hook. f. in Bull. Misc. Inform. 1910: 296. 1910.

Herbs, 60 - 80 cm high, glabrous. Leaves opposite, oblong-elliptic to narrowly elliptic, more or less cuneate at base, acute to acuminate at apex, minutely serrulate along margins with minute appendages at basal region, 8 - 12 cm, pubescent; lateral nerves 12 - 16 pairs. Flowers 2 - 6, 2 - 3 cm long, yellowish-white with pink margins; peduncles 4 - 7 cm long; pedicels 0.5 - 1.5 cm long; bracts ovate, minute. Lateral sepals ovate, acuminate, 4 - 6 mm long, with 5 parallel nerves. Lip bucciniform, 1.4 - 1.6 cm long; spur abruptly constricted, 1.2 - 1.5 cm long, curved. Standard suborbicular, ca 1 - 1.5 cm across with a shallow crest on posterior side. Wings bilobed, 2.5 - 3 cm long; basal lobes ovate; distal lobes elliptic-obovate; dorsal auricle large, reniform, inflexed. Capsules fusiform, 1.8 - 2 cm long; seeds globose, compressed, 2 - 2.5 cm across, glabrous.

Fl. & Fr. Nov.

Distrib. India: E. Himalayas, ca 910 - 1520 m, very rare. Manipur.

Endemic.

170. *Impatiens stenantha* Hook. f., Fl. Brit. India 1: 478. 1875 & in Rec. Bot. Surv. India 4: 17. 1905; Biswas, Pl. Darj. Sikkim Himal. 1: 213. 1966; H. Hara in Fl. E. Himal. 1: 197. 1966 & 2: 75. 1971.

Herbs, erect, up to 60 cm high; stems branched, glabrous. Leaves lanceolate or elliptic-ovate, shortly attenuate at base, acute to acuminate at apex, crenate along margins with filiform appendages on crenations, 2.5 - 15 x 1.5 - 4.7 cm, under-surface whitish, black or reddish on drying, pubescent; lateral nerves 6 - 12 pairs; petioles 1.5 - 3.5 cm long; stipular glands sessile or stipitate. Racemes axillary or terminal; peduncles shorter or longer than leaves. Flowers 1.5 - 2.5 cm, yellow, speckled with red. Lateral sepals 4, ovate, incurved at base, acuminate, 3 - 5 x 2 - 2.5 mm. Lip shallowly and rather obliquely navicular, 0.7 - 1 cm long; spur abruptly constricted, gradually tapering to apex, 1.5 - 1.8 cm long. Standard elliptic-oblongate, shallowly emarginate, 6 - 8 x 4 - 5 mm. Wings bilobed, 1.5 - 1.8 cm long; basal lobes triangular, 1.5 - 1.7 x 0.4 - 0.5 cm; distal lobes linear, acute, recurved or twisted, 0.8 - 1 cm. Capsules clavate, 1.2 - 2 cm long, glabrous; seeds obovoid, compressed.

Fl. & Fr. July - Nov.

Distrib. India: E. Himalayas, ca 1500 - 3000 m. W. Bengal, Assam, Sikkim, Arunachal Pradesh, Meghalaya and Manipur.

Nepal, Bhutan and China.

Notes. Two varieties of this species proposed by J.D. Hooker (Fl. Brit. India 1: 478. 1875) have been subsequently merged by himself (Rec. Bot. Surv. India 4: 22. 1905).

Chromosome no. $2n = 22$ (Chatterjee, A. & A.K. Sharma in Nucleus 13: 179-200. 1970).

171. *Impatiens stoliczkai* Hook. f. in Hooker's Icon. Pl. ser. 4. 10: t. 2904. 1913.

Herbs, glabrous. Leaves alternate, ovate to ovate-lanceolate, acuminate at apex, serrate to crenate-serrate along margins, 6 - 10 cm long; stipular glands present. Flowers ca 1 cm across; bracts very small, sharp-pointed; pedicels very slender on peduncles, 1 - 2 cm long. Lateral sepals 2, linear-oblong, 3 - 5 mm long. Lip shallowly navicular, ca 5 mm long, spurred; spur very small, broad. Standard suborbicular, ca 4 mm across. Wings ca 8 mm long; basal lobes elliptic; distal lobes semilunar, 2-lobed at apex. Capsules and seeds glabrous.

Fl. & Fr. Aug.

Distrib. India: W. Himalayas. Himachal Pradesh.

Endemic.

172. *Impatiens stricta* C.B. Clarke in Rec. Bot. Surv. India 4: 28. 1905.

Herbs. Leaves alternate, lanceolate-elliptic, rounded or somewhat attenuate at base, acuminate at apex, finely serrate along margins, 3 - 4.2 x 1 - 1.3 cm; lateral nerves 5 - 8 pairs; petiole 0.4 - 0.9 mm long; stipular glands ca 1 mm long. Flowers pedicellate. Lateral sepals ovate, slightly curved, acuminate, appendage present. Lip 0.8 - 1 cm long, ca 1 cm deep, spurred; spur abruptly constricted, filiform, curved, 0.9 - 1.2 cm long. Standard nearly orbicular, ca 3 mm across. Wings ca 0.8 cm long; basal lobes subovate; distal lobes suborbicular or elliptic, with short obtuse appendage; dorsal auricle short, more or less globular. Capsules narrow, fusiform, ca 1.1 cm long.

Fl. & Fr. July - Sept.

Distrib. India: E. Himalayas, ca 230 - 760 m. Manipur and Meghalaya.

Endemic.

173. *Impatiens striolata* Hook. f. in Rec. Bot. Surv. India 4: 28. 1905.

Herbs, annual, glabrous; stems erect or procumbent at base, simple or sparsely branched, rooting at lowermost nodes. Leaves ovate to ovate-lanceolate, rounded or somewhat attenuate and with glands at base, obtuse to subacute at apex, shallowly serrate along margins, 3.9 - 5 x 1.6 - 2.5 cm, mid-green above, pale green beneath, glabrous; lateral nerves 5 - 7 pairs; petiole 1 - 2.5 cm long. Flowers 3.4 - 4 cm. Lateral sepals ovate, with an appendage, ca 3 mm long. Lip navicular, 1.3 - 1.5 cm long, spurred; spur constricted, curved, 1.5 - 2 cm long. Standard cucullate, with a notch on back. Wings with slight emargination opposite sinus of basal and distal lobes; basal lobes ovate-triangular with an appendage; distal lobes ovate-elliptic. Capsules acute, 6 - 8 mm long.

Fl. & Fr. Aug. - Oct.

Distrib. India: E. Himalayas, ca 1200 - 1850 m. Meghalaya.

Endemic.

174. *Impatiens sulcata* Wallich in Roxb., Fl. Ind. 2: 458. 1824; Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 129. 1860; Hook. f., Fl. Brit. India 1: 469. 1875 incl. var. *minor* & in Rec. Bot. Surv. India 4: 5. 1904; Blatter, Beaut. Fl. Kashmir 1: 71. 1927; Biswas, Pl.

Darj. Sikkim Himal. 1: 206. 1966; H. Hara in Fl. E. Himal. 3: 179. 1975. *I. gigantea* Edgew. in Trans. Linn. Soc. London 20: 38. 1846; Hook.f., Fl. Brit. India 1c.

Herbs, annual, erect, 0.2 - 3 m high, glabrous; stems stout, fistular, grooved. Leaves usually opposite or whorled, ovate-elliptic to elliptic-oblong or oblanceolate, attenuate into petiole or cuneate at base, acuminate at apex, shallowly crenate-serrate along margins with the upper teeth gland-tipped, 7 - 18 x 2 - 2.5 cm, green, paler beneath, finely pubescent; lateral nerves 6 - 11 pairs; stipules pulvinate. Flowers axillary, 2.5 - 3.7 cm long, pink, purple or dark-crimson; bracts broad, with ca 1 mm long appendage, ca 6 x 3 mm; peduncles 4 - 15 cm long, glabrous; pedicels slender, umbelled. Lateral sepals obliquely ovate, 6 - 8 x 3 - 4 mm, with ca 2 mm long appendage. Lip bucciniform, 1.2 - 1.6 x 1 - 1.5 cm; spur abruptly constricted, short, 5 - 8 mm, inflexed, spotted. Standard bilobed, keeled on dorsal side. Wings ca 2.5 cm long, orange-streaked; basal lobes broad, ca 1 x 0.8 cm, with an appendage; distal lobes linear-oblong. Capsules elongate, narrowly clavate, 2.5 - 3 cm long; seeds ca 8 mm across, rugose.

Fl. & Fr. July - Oct.

Distrib. India: Temperate Himalayas, 2000 - 3900 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Punjab, W. Bengal and Sikkim.

Nepal, Tibet, Bhutan and Pakistan.

Notes. Specimens with smaller leaves and infundibular lip designated as var. *minor* by J.D. Hooker (Fl. Brit. India 1: 469. 1875) hardly differ from the typical species.

Chromosome no. $2n = 20$ (Khoshoo, T.N. in Curr. Sci. 24: 223-424. 1955).

175. *Impatiens talbotii* Hook.f. in Rec. Bot. Surv. India 4: 47. 1906.

Annual herbs 20 - 30 cm high, glabrous or stems and leaves pubescent. Leaves alternate, ovate-elliptic or ovate-oblong, acuminate at both ends, serrulate, 6 - 10 cm long, membranous; petioles up to 1.3 cm long, glandular. Flowers axillary, solitary, 2 - 2.5 cm across, pink; pedicels up to 1.2 cm long. Lateral sepals ovate or subulate, 3 - 6 mm long. Lip cymbiform, ca 1 cm long; spur slender, incurved when young, straight at length, 2 - 3 cm long. Standard orbicular, concave, 0.6 - 1 cm across, keeled on dorsal side. Wings sessile, bilobed, ca 1.2 cm long; basal lobes subquadrate, bilobulate; distal lobes inserted into spur. Capsules 0.8 - 1.2 cm long, few-seeded; seeds subglobose, compressed, 3 - 4 mm long, rugose, glabrous or papillose.

Distrib. India: W. Ghats in moist and shady places. Maharashtra and Karnataka (Shimoga Dt.).

Endemic.

Chromosome no. $2n = 12$ (Bhaskar, V. in Taxon 25: 156. 1976).

176. *Impatiens tangachee* Beddome in Madras J. Lit. Sci. ser. 2. 20: 66. 1859 & Icon. 30. t. 147. 1868 - 1874; Hook. f., Fl. Brit. India 1: 467. 1875.

Herbs up to 40 cm high; stems forked, sub-procumbent, rooting at lower nodes, glabrous. Leaves crowded towards tip, obscurely whorled, alternate, subsessile, elliptic-acuminate at apex, serrate along margins, 3 - 10 x ca 1.2 cm; nerves few, slender. Peduncles axillary, stout, 4 - 16 cm high, exceeding leaves; bracts ovate, coriaceous, persistent. Flowers 4 - 8, in racemes or subumbels, bright rose; pedicels erect, 1 - 2.5 cm long. Lateral sepals orbicular-oblong. Standard short, broad. Wings 2-lobed; basal lobes broadly truncate; distal lobes truncate with erose apex. Capsules gibbous, glabrous, ca 8 mm long; seeds many, small.

Fl. & Fr. May; Sept. - Feb.

Distrib. India: W. Ghats in Anamallai and Pulney hills, along streams and riverbeds at an altitude of 1700 - 2100 m. Most abundant on higher ranges of Anamallai; a very beautiful species. Tamil Nadu and Kerala.

Endemic.

177. *Impatiens tenella* Heyne ex Hook. f., Fl. Brit. India 1: 447. 1874, incl. var. *brachycarpa* Hook.f. *I. rosmarinifolia* Retz., Obs. Bot. 5: 29. 1789; Wight, Icon. t. 750. 1844. *I. debilis* Turcz. in Bull. Soc. Imp. Naturalistes Moscou 32(1): 279. 1859; Hook.f., Fl. Brit. India 1: 483. 1875.

Herbs; erect, slender, glabrous; stems sparingly branched. Leaves sessile or shortly petioled, opposite, oblong or lanceolate, remotely serrate, 2.5 - 11 cm long; stipules absent. Flowers solitary or fascicled, pink; pedicels capillary, erect, horizontal or deflexed in fruit. Lateral sepals linear, acuminate. Standard short. Wings sessile or shortly stipitate; distal lobes of wings clawed, elongate; basal ones small; dorsal auricle small, straight or decurved. Spur shorter than flowers. Capsules clavate, pointed, straight, long-beaked, about 1 cm long; seeds few, orbicular, compressed, shining black.

Fl. & Fr. Not known.

Distrib. India: Karnataka and Kerala.

178. *Impatiens teneriflora* Hook. f. in Bull. Misc. Inform. 1910: 296. 1910.

Herbs; stems tall, nearly glabrous. Leaves alternate, oblong-lanceolate to linear-oblong, attenuate into petiole at base, acuminate at apex, shallowly crenate along margins, filiform appendages present, those at base of lamina up to 2 mm long, 6 - 17.5

x 1.8 - 4.5 cm, usually green above, pale beneath, sparsely pubescent above, glabrous beneath; midnerve prominent and glabrous; lateral nerves 6 - 14 pairs; petiole 1 - 8.3 cm long, glabrous; stipular glands absent. Flowers 3 - 6 cm long; peduncles 3 - 5 cm long, 1 - 6-flowered; pedicels filiform 2 - 3 cm long; bracts caducous, lanceolate, long-acuminate, 3 - 6 mm long. Lateral sepals ovate-lanceolate, 6 - 9 x 4 - 4.5 mm, with ca 1 mm long appendage. Lip bucciniform, 1.2 - 1.7 x 0.7 - 1.1 cm; spur abruptly constricted, filiform, 1.3 - 3.3 cm long. Standard ovate-oblong, 1.8 cm long, with an appendage. Wings ca 2.5 cm, emarginate opposite sinus of basal and distal lobes; basal lobes ovate; distal lobes elliptic-obovate, obtuse; dorsal auricle reniform, big, inflexed. Capsules erect, acuminate, 2 cm long; seeds many, minute, oblong, ca 1.5 mm long, hairy, chestnut brown.

Fl. & Fr. Nov.

Distrib. India: E. Himalayas, ca 1500 - 2000 m. Manipur.

Endemic.

179. *Impatiens thomsonii* Hook. f. in J. Linn. Soc., Bot. 4. 128. 1860; Hook. f., Fl. Brit. India 1: 469. 1875, in Bot. Mag. t. 7795. 1901 & in Rec. Bot. Surv. India 4: 5. 1904; Collett, Fl. Siml. 73. 1902; Blatter, Beaut. Fl. Kashmir 1: 73. 1927.

Herbs, annual, 30 - 60 cm high, glabrous; stems branched. Leaves opposite below, whorled or alternate above, ovate or lanceolate-elliptic to elliptic-oblong, shortly attenuate at base, acuminate at apex, coarsely serrate along margins with small bristle-like glands on serrations, 6.5 - 17 x 1.5 - 3 cm, pubescent on midnerve; lateral nerves 6 - 8 pairs; stipules pulvinate, glandular. Flowers in umbels, 0.8 - 1.5 cm long, pale-pink or crimson; bracts linear-lanceolate, 2 - 5 mm long; peduncle axillary, erect, 2 - 9 cm long, glabrous; pedicels up to 1.8 cm long. Lateral sepals ovate to ovate-lanceolate, 3 - 5 x 2 - 4 mm, with an appendage. Lip navicular, 0.7 - 1.1 cm long; spotted with brown or yellow; spur abruptly constricted, filiform, up to 5 mm long. Standard suborbicular-obcordate, emarginate, 0.5 - 0.8 x 0.8 - 1 cm. Wings bilobed, 1.2 - 1.4 cm long; basal lobes triangular-ovate, 5 - 6 x 4 - 5 mm, with an appendage; distal lobes ligulate, oblanceolate, 7 - 8 x 3 - 4 mm. Capsules clavate, 0.5 - 2 cm long.

KEY TO THE VARIETIES

- | | |
|---------------------------------|-------------------------------|
| 1a. Spur of lip up to 6 mm long | 179.2. var. thomsonii |
| b. Spur of lip absent | 179.1. var. ecalcarata |

179.1. var. ecalcarata Hook. f. in Rec. Bot. Surv. India 4: 8. 1904.

Fl. & Fr. Not known.

Distrib. India: W. Himalayas, Jammu & Kashmir and Himachal Pradesh.

Endemic.

179.2. var. thomsonii

Fl. & Fr. July - Aug.

Distrib. India: E. & W. Himalayas, ca 2000 - 3600 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim.

Pakistan and Afghanistan.

Chromosome no. $2n = 14, 20$ (Khoshoo, T.N. in *Curr. Sci.* 24: 223-424. 1955 & in *Proc. Indian Acad. Sci. sect. B.* 63: 38-45. 1966).

180. *Impatiens tomentosa* Heyne ex Wight & Arn., *Prodr. Fl. Pen. Ind. Or.* 139. 1834; Wight, *Icon. t.* 749. 1844; Hook. f., *Fl. Brit. India* 1: 449. 1824.

Erect herbs, 30 - 45 cm high; stems rufescent-hairy above. Leaves opposite, elliptic to ovate-oblong, obtuse or acute at apex, serrulate, 1.2 - 3 x 0.6 - 1.2 cm, hispid above, scabrid and tomentose on nerves beneath; petioles ca 3 mm long. Flowers 0.8 - 1 cm across, axillary, solitary, pink; pedicels 2 - 2.5 cm long, deflexed in fruit, hairy. Lateral sepals linear-lanceolate, ciliate. Lip deeply saccate, hairy outside; spur short, hooked. Standard orbicular, apiculate, keeled on dorsal side. Wings bilobed; basal lobes oblong; distal lobes rotundate, larger than basal ones. Capsules ellipsoid, ca 1.2 cm long; seeds subglobose.

Fl. & Fr. June - Feb.

Distrib. India: In boggy places and swamps of W. Ghats, 1400 - 2300 m. Karnataka, Tamil Nadu and Kerala.

Endemic.

181. *Impatiens travancorica* Beddome, *Icon.* 29. t. 142. 1868 - 1874; Hook. f., *Fl. Brit. India* 1: 464. 1874.

Herbs, annual, succulent, up to 30 cm high; stems usually simple, rarely branched, glabrous. Leaves crowded and rosulate towards apex, elliptic, sub-acute, crenate, ciliate in crenatures; petiole as long or longer than lamina. Peduncles 1 - 3, subterminal, erect, 2.5 to 5 cm long, 2 - 4-flowered; bracts green, subulate, lanceolate, spreading. Flowers umbelled, white, streaked with red or with pink patches near base, membranous. Lateral sepals obliquely ovate, acuminate. Lip boat-shaped; spur short, stout, obtuse or absent. Standard small, concave. Distal lobes of wings large, sessile.

Fl. & Fr. Aug. - Sept.

Distrib. India: Tamil Nadu (Mahendragiri and Aghastayar hills at an altitude of 1,100 m to 1,500 m on wet rocks) Kerala.

Endemic to Southernmost hills of Southern W. Ghats.

182. *Impatiens trichocarpa* Hook. f. in Hooker's Icon. Pl. ser. 4. 10: t. 2914. 1913; Gamble, Fl. Pres. Madras 142. 1915.

Kan.: *Kaadu kama kundala*.

Annuals, 20 - 60 cm high, branching, appressed hairy. Leaves alternate, subsessile, elliptic-lanceolate, acute, serrulate along margins, 4 - 7 x 2.5 - 3.5 cm, coriaceous. Flowers solitary or binate; pedicels 1 - 1.5 cm long, glabrous or puberulous. Lateral sepals ovate, acute. Lip cymbiform, ca 8 mm long, pubescent; spur shorter than lip, robust, incurved. Standard orbicular, ca 7 mm across, cucullate, keeled on dorsal side ending into a mucro. Wings ca 1.2 cm long, bilobed; basal lobes rounded; distal lobes larger than basal ones, semilunate or dolabriform; dorsal auricle prominent, decurved. Capsules ellipsoid, 1 - 1.2 cm long, turgid, tomentose; seeds globose, ca 2 mm, papillose.

Fl. & Fr. Aug. - Dec.

Distrib. India: W. Ghats. Karnataka and Tamil Nadu.

Endemic.

183. *Impatiens trichocladon* Hook. f. in Rec. Bot. Surv. India 4: 16. 1905.

Stems more or less hirsute. Inflorescence racemose. Flowers small or minute. Lateral sepals 4, outer linear-oblong, inner very slender. Capsules clavate.

Fl. & Fr. Unknown.

Distrib. India: E. Himalayas, ca 3000 m. Sikkim.

Endemic.

184. *Impatiens trigonopteris* Hook. f. in J. & Proc. Asiat. Soc. Bengal n. ser. 4: 189. 1908.

Herbs; stems slender, erect or sometimes decumbent at base, lowermost nodes rooting. Leaves ovate to ovate-lanceolate, long-attenuate into petiole, long-acuminate at apex, crenate along margins, 7.5 - 9.5 x 2 - 3.5 cm, green above, pale beneath, sparsely

hairy above, glabrous beneath; lateral nerves 9 - 15 pairs; petiole 1 - 2.5 cm long. Flowers yellow; bracts lanceolate, 3 - 4 mm long; peduncles axillary, slender, 4 - 9 cm long; pedicels alternate on peduncle, slender, 1.1 - 1.8 cm long, glabrous. Lateral sepals ovate, ca 2.5 mm, with an appendage. Lip navicular, long-spurred. Standard cucullate, ca 3 mm long. Wings ca 9 mm long; basal lobes semiovate; distal lobes triangular, notched at apex. Capsules linear, acute, 1 - 1.5 cm long.

Fl & Fr. Oct.

Distrib. India: E. Himalayas, 1820 - 2500 m. W. Bengal.

Endemic.

185. *Impatiens trilobata* Colebr. in Hook., *Exot. Fl.* 2: t. 141. 1825; Hook. f., *Fl. Brit. India* 1: 451. 1874 & in *Rec. Bot. Surv. India* 4: 13. 1905; Biswas, *Pl. Darj. Sikkim Himal.* 1: 203. 1966. *I. flavida* Hook. f. & Thomson in *J. Linn. Soc., Bot.* 4: 127. 1860; Hook. f., *l.c.* 1: 452. 1874.

Fig. 52.

Herbs, annual, up to 75 cm high, alternately branched, glabrous; nodes swollen. Leaves opposite or whorled, elliptic, or ovate-lanceolate, shortly attenuate at base, acute or caudate-acuminate at apex, shallowly serrate along margins, each serration with a filiform appendage, appendage at base of lamina up to 2 mm long, 2.5 - 10 x 1.3 - 1.8 cm, pubescent; lateral nerves 4 - 8 pairs; petiole long below, almost absent above; stipules large tufts of soft cilia. Flowers purple-red or bright violet-purple; peduncles horizontal, 2 - 4.5 cm long, 3 - 5-flowered, shorter than leaves; pedicels 8 - 15 mm long; bracts lanceolate, minute, subsetaceous, ca 3 mm long. Lateral sepals ovate-lanceolate, 5 - 6 x 2 - 3 mm. Lip variable, saccate, obtuse or conical, 1.3 - 1.6 cm long, with network markings; spur abruptly constricted, curved, 0.8 - 1 cm long. Standard obcordate, emarginate, dorsally gibbous, 1 - 1.2 x 0.6 - 0.8 cm, deep-violet, spurred on back. Wings shallowly 2-lobed, 1.5 - 2 cm long, yellow; basal lobes ovate-triangular, entire, 7 - 8 x 4 - 6 mm, pale violet; distal lobes broadly elliptic to kidney-shaped, 0.8 - 1.1 x 0.6 - 1 cm, violet; dorsal auricle present. Capsules turgid in middle, 1.2 - 1.7 cm, glabrous.

Fl & Fr. July - Oct.

Distrib. India: W. Bengal, Assam, Sikkim, Arunachal Pradesh Meghalaya and Mizoram.

Bangladesh and Myanmar.

186. *Impatiens tripetala* Roxb. ex DC., *Prodr.* 1: 687. 1824; Roxb., *Fl. Ind.* 2: 453. 1832; Hook. f., *Fl. Brit. India* 1: 470. 1875 & in *Rec. Bot. Surv. India* 4: 13. 1905; Toppin in *Bull. Misc. Inform.* 1920: 358. 1920; Biswas, *Pl. Darj. Sikkim Himal.* 1: 206. 1966; H. Hara in *Fl. E. Himal.* 1: 197. 1966 & 2: 76. 1971. *I. tripetala* Roxb. ex DC. var. *microscypha*

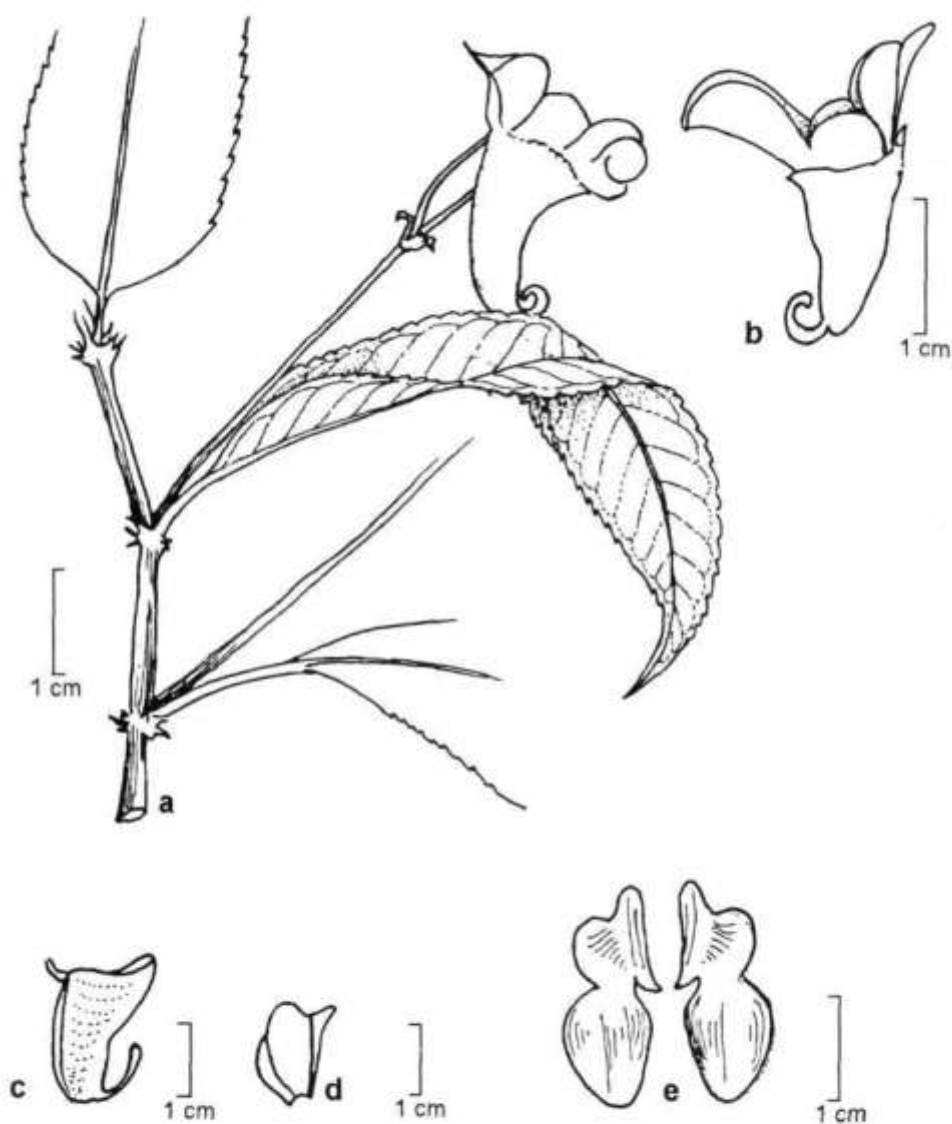


Fig. 52. *Impatiens trilobata* Colebr. : a. habit; b. flower; c. lip; d. standard; e. wing petals

Hook. f. in Bull. Misc. Inform. 1910: 298. 1910. *I. multiflora* Wallich ex Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 126. 1860.

Herbs, annual; nodes swollen. Leaves opposite or whorled, ovate-elliptic, shortly attenuate at base, acuminate at apex, shallowly serrate along margins, 3.5 - 20 x 2 - 7.5 cm long, green, paler beneath or whitish, finely pubescent above; lateral nerves 6 - 19 pairs; stipules filiform. Flowers 2 - 2.5 cm long; peduncle short, ca 2.5 mm; pedicels slender, 1.3 - 2.3 cm long, solitary or fascicled. Lateral sepals linear-lanceolate, acuminate, ca 3 x 1 mm. Lip beaked, 1.2 - 1.5 x 1 - 1.2 cm, spurred; spur curved, ca 8 mm long. Standard semicucullate. Wings ca 1.6 cm long; basal and distal lobes about equal in size; basal lobes broadly elliptic, 8 - 10 x 5 - 6 mm; distal lobes slightly emarginate on inner margin, 1.1 - 1.3 x 0.7 - 0.8 cm; dorsal auricle short, globular. Capsules turgid in middle, acute, 1.5 - 2 cm long.

Fl. & Fr. Nov. - Dec.

Distrib. W. Bengal, Assam, Arunachal Pradesh, Nagaland, Manipur and Meghalaya.

Bhutan and Bangladesh.

Chromosome no. $2n = 14$ (Khoshoo, T.N. in Proc. Indian Acad. Sci. sect. B. 63: 38-45. 1966); $2n = 16$ (Sarkar, A.K. et al. in Taxon 22: 647-654. 1973 & in Taxon 29: 347-367. 1980).

187. *Impatiens tropaeoliflora* Griffith ex Hook. f., Fl. Brit. India 1: 472. 1875 (*'tropaeolifolia'*).

Herbs, annuals, ca 30 cm high, nearly glabrous; stems stout, diaphanous, flexuous, succulent. Leaves alternate, oblong or occasionally oblanceolate, slightly attenuate into petiole at base, acute at apex, crenate-serrate along margins, crenations with bristles, 3.5 - 8 x 1.7 - 3.6 cm, glabrous or sparsely puberulous above, glaucous beneath; petioles 0.6 - 1.9 cm long. Flowers ca 2.5 cm long, yellow with dull-red tips; bracts ovate, acuminate, ca 4 mm; peduncle 0.9 - 1.5 cm long, apparently not stiff. Lateral sepals orbicular-ovate, acuminate, transparent. Lip bucciniform; spur abruptly constricted, filiform, incurved, ca 2.5 cm long. Standard fleshy, orbicular, with a dorsal spur. Wings unevenly bilobed, 2.5 cm long; basal lobes entire; distal lobes irregularly toothed; dorsal auricle semiglobular. Capsules linear, acute.

Fl. & Fr. July - Sept.

Distrib. India: E. Himalayas. Sikkim, Arunachal Pradesh, Meghalaya and Mizoram (Mishmi hills).

Endemic.

188. *Impatiens tuberculata* Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 155. 1860; Hook. f., Fl. Brit. India 1: 478. 1875 & in Rec. Bot. Surv. India 4: 16. 1905.

Herbs; stems succulent, 60 - 90 cm high. Leaves whorled at ends of branches, elliptic-lanceolate or occasionally oblanceolate, gradually attenuate into petiole at base, acuminate at apex; crenate to serrate along margins; lateral nerves 7 - 12 pairs; petiole 0.5 - 1.5 cm long. Flowers ca 1 cm long, purplish. Lateral sepals ovate, acuminate, curved, ca 6 mm. Lip navicular, with an appendage, spurred; spur short. Standard orbicular, crested on back. Wings with basal lobes ovate; distal lobes narrowly ovate, but narrowed just above middle; dorsal auricles short. Capsules dumbel-shaped, obtuse, 0.4 - 1 cm long.

Fl. & Fr. Aug. - Sept.

Distrib. India: E. Himalayas, 3000 - 4300 m. W. Bengal and Sikkim.

Endemic.

189. *Impatiens tubifer* Hook. f. in Rec. Bot. Surv. India 4: 14. 1905.

Herbs; stems erect, usually branched at base, generally unbranched above. Leaves spirally arranged, ovate-lanceolate to ovate or ovate-elliptic, slightly attenuate into petiole at base, acuminate at apex, crenate along margins, 2 - 3.5 x 1 - 1.6 cm; petiole 4 - 8 mm long. Flowers axillary, pedunculate; bracts linear; pedicels slender, 2 - 4 together on top of long peduncle. Lateral sepals ovate, ca 4 mm long. Lip bucciniform. Standard ovate, crested. Wings bilobed; basal lobes triangular ovate; distal lobes elliptic-obovate. Capsules clavate.

Fl. & Fr. July.

Distrib. India: E. Himalayas, ca 2750 m. Sikkim.

Endemic.

190. *Impatiens umbellata* Heyne ex Roxb., Fl. Ind. 2: 464. 1824; Hook. f., Fl. Brit. India 1: 461. 1874.

Herbs, annual; stems simple, rarely branched, 10 - 20 cm high, naked below. Leaves rosulate, ovate or elliptic, sometimes orbicular, obtuse or acute, broadly crenate, 2.5 - 5 cm, often dark-brownish to purplish beneath. Peduncles subterminal, erect, 1 - 6-flowered, shorter than leaves. Lateral sepals broad, ovate. Lip boat-shaped; spur ca 2.5 cm

long, slender, incurved. Standard orbicular, not spurred. Wings with subequal lobes, obtuse. Capsules ellipsoid, turgid, glabrous; seeds many, echinate.

Fl. & Fr. Aug. - Dec.

Distrib. India: Southern W. Ghats. Tamil Nadu and Kerala.

Endemic.

191. *Impatiens uncinata* Wight in Madras J. Lit. Sci. ser. 1. 5: 11. t. 6. 1837 & Icon. 3 (1): 2. t. 747. 1844; Hook.f., Fl. Brit. India 1: 465. 1875.

Herbs, slender, up to 30 cm high, erect; stems sparingly branched, leafy. Leaves alternate, ovate or suborbicular, acute or cordate at base, acute or acuminate at apex, crenate to bristly serrate along margins, 3 - 7 x 2 - 4 cm, membranous, often ciliate at base, glabrous or hairy on nerves above. Petioles 1.5 - 4 cm long, glanduliferous at apex. Flowers 4 - 8 on short racemes, ca 2 cm across, pink; peduncles axillary, solitary, up to 8 cm long; pedicels 1 - 2 cm long. Lateral sepals obliquely ovate, pointed. Lip subcampanulate; spur inflated in middle, hooked at tip, short, stout. Standard elliptic. Wings 2-lobed, divaricate; distal lobes obovate or falcate; basal lobes oblong, smaller than distal ones. Capsules ellipsoid, attenuate below, beaked above, glabrous, ca 8 mm long; seeds few, globose, glabrous.

Fl. & Fr. March - Jan.

Distrib. India: Endemic to Southern W. Ghats at an altitude of 900 to 1700 m altitude in shady rocky places in dense moist forests. Tamil Nadu (Kanyakumari and Tirunelveli Districts) and Kerala (Thiruvananthapuram District).

Chromosome no. $n = 8$ (Bhaskar, V. in Taxon 25(1) : 155. 1976).

192. *Impatiens uncipectala* C.B. Clarke ex Hook. f. in Rec. Bot. Surv. India 4: 18. 1905; H. Hara in H. Hara & Williams, Enum. Fl. Pl. Nepal 2: 80. 1979.

Herbs; stems thickened at nodes. Leaves ovate-lanceolate, slightly attenuate into petiole, acute to acuminate at apex, crenate along margins with filiform appendages on crenations, lower surface white; petiole up to 4 cm long. Flowers 3 - 3.3 cm long; peduncles subterminal. Lateral sepals ovate, acuminate, ca 1 x 0.5 cm. Lip navicular, 1 - 1.2 cm long; spur abruptly constricted, almost annular, 2 - 2.8 cm long. Standard acuminate, ca 1.5 x 0.9 cm, green. Wings rose-tinged; basal lobes triangular-ovate; distal lobes ligulate; dorsal auricle short. Capsules linear, acute, 1.7 - 5.4 cm long.

Fl. & Fr. Aug.

Distrib. India: E. Himalayas, ca 1950 - 2600 m. Assam and Sikkim.

Nepal.

193. *Impatiens urticifolia* Wallich in Roxb., Fl. Ind. 2: 457. 1832; Hook. f. & Thomson in J. Linn. Soc., Bot. 4: 152. 1860; Hook. f., Fl. Brit. India 1: 474. 1875 & in Rec. Bot. Surv. India 4: 15. 1905; H. Hara in Fl. E. Himal. 3: 79. 1975.

Herbs. Leaves alternate, mostly sessile, ovate-elliptic or lanceolate, attenuate into petiole at base, acute to long-acuminate at apex, crenate to deep-crenate along margins, 8 - 23 x 3.2 - 4.8 cm long; lateral nerves 6 - 12 pairs. Flowers pedunculate, pink; bracts persistent, lanceolate, ca 2 mm long. Lateral sepals ovate, acuminate, ca 4 mm long. Lip bucciniform, 1.3 - 1.5 cm long. Standard cucullate, acutely pointed at apex, 0.8 - 1 cm. Wings bilobed; basal lobes ovate with base extended on both sides; distal lobes dolabriform. Capsules linear, acute, 0.6 - 3 cm long.

Fl. & Fr. July - Nov.

Distrib. W. Bengal, Sikkim and Arunachal Pradesh.

Nepal.

194. *Impatiens verecunda* Hook. f. in Bull. Misc. Inform. 1911: 356. 1911

Herbs, small, 10 - 15 cm high, flaccid, glabrous; stems simple or branched. Leaves alternate, ovate or ovate-rotundate, acute or acuminate, base rounded, crenate, 4 - 6 cm long, membranous, nerves 3 - 4; petioles slender, 2 - 3 cm long. Flowers in 2 - 4-flowered subumbels, ca 2 cm across, rose; pedicels 1 - 2 cm long, deflexed in fruits; bracts lanceolate, 3 - 5 mm long. Lateral sepals ovate, truncate at base, 6 - 7 mm long, 5-nerved. Lip orbicular, 6 - 7 mm; spur obtuse, less than half the length of limb of lip. Standard orbicular or oblong, 6 - 9 mm across, with a blunt or pointed apiculum. Wings sessile, 1.3 - 1.5 cm long, 2-lobed; basal lobes orbicular, minute, more or less folding over distal lobes from base; distal lobes trigonous or dolabriform, larger than basal ones; dorsal auricle obscure. Capsules ellipsoid, beaked, many-seeded; seeds obovoid or globose, 2 - 2.5 mm, compressed, pubescent.

Fl. & Fr. Not known.

Distrib. India: Southern W. Ghats, on a steep marshy embankment under trees, ca 1372 m. Kerala (High Range at Periakanal and Devicolam)

Endemic. Not located since the type collection made by A. Meebold).

195. *Impatiens verticillata* Wight in Madras J. Lit. Sci. ser. 1. 5: 15. 1837; Hook.f., Fl. Brit. India 1: 452. 1874.

Herbs or undershrubs up to 60 cm high; stems branching in lower half, swollen at joints. Leaves opposite or in whorls of 3 - 6, elliptic or elliptic-lanceolate, acuminate, crenate-serrulate along margins, 6 - 12 x 1.2 - 2.2 cm; petioles 0.5 - 1.5 cm long. Flowers in 3- to many-flowered subumbels, scarlet-red; peduncles up to 4 cm long; pedicels 0.7 - 2 cm long. Lateral sepals linear-lanceolate, 0.8 - 1 cm long. Lip cymbiform; spur slender, curved, 2.5 - 3.5 cm long. Standard cucullate, ca 1 x 1.2 cm. Wings bilobed, clawed, up to 2.8 cm long; lobes oblong-obovate, with hairs on dorsal keels. Capsules fusiform, 0.8 - 1.2 cm long, many-seeded; seeds 2.5 mm long, brown, hairy at pointed end.

Fl. & Fr. Nov.

Distrib. India: Southern W. Ghats in gravelly beds near streams between 900 - 1500 m. Tamil Nadu and Kerala.

Endemic.

Chromosome no. $2n = 16$ (Virendra Kumar & Subramaniam, Chr. Atlas Fl. Pl. Ind. Subc. 1: 87. 1986).

196. *Impatiens vexillaria* Hook. f. in Hooker's Icon. Pl. ser. 4. 10: t. 2905. 1913.

Herbs, up to 15 cm high. Leaves alternate, ovate-lanceolate, acuminate at apex, serrate along margins, ca 2 cm long, upper side puberulous; lateral nerves 5. Flowers terminal, solitary, ca 2 cm across, white; pedicels slender, erect, ca 1 cm long, pubescent, with bracteole above middle. Lateral sepals 2, ovate-rotundate, acuminate at apex, cordate at base. Lip bucciniform, ca 1.5 cm long; spur slender, incurved, ca 1 cm long. Standard ovate to suborbicular, retuse at apex, ca 2.5 cm across. Wings ca 1.6 cm long; basal lobes more or less ovate; distal lobes oblong, obtuse.

Fl. & Fr. Unknown.

Distrib. India: W. Himalayas. Himachal Pradesh and Uttar Pradesh (Kumaon).

Endemic.

Notes. Standard petal is very large and disproportionate to other floral parts.

197. *Impatiens violoides* Edgew. ex Hook. f. in Rec. Bot. Surv. India 4: 5. 1904.

Herbs. Leaves whorled, ovate, crenate. Racemes short, few-flowered. Flowers large, pedunculate; pedicels umbellate; bracts ovate. Lip navicular; spur absent. Wings bilobed; basal lobes rounded. Capsules clavate, deflexed.

Fl. & Fr. Oct.

Distrib. India: W. Himalayas. Uttar Pradesh (Kumaon).

Endemic.

Notes: Included based on literature.

198. *Impatiens viridiflora* Wight in Madras J. Lit. Sci. ser. 1. 5: 9. 1837; Hook. f., Fl. Brit. India 1: 460. 1974. Fig. 53.

Herbs, erect, glabrous, epiphytic on tree-trunks; stems fleshy, thick, ca 2.5 cm across; branches few, short, nodose. Leaves congested at ends of branches, elliptic, sometimes ovate, obovate or lanceolate, acute at apex, crenate-serrate, crenatures large with a few glandular cilia at base, 3 - 5 cm long, fleshy; petiole stout. Peduncles axillary, two, rarely one. Flowers completely green, ca 2.5 cm along with lip. Lateral sepals reflexed or deflexed, linear-oblong, acuminate. Lip saccate, narrowed into a stout involute spur; spur wrinkled, green, laterally compressed. Standard orbicular, 2-lobed, strongly keeled on back. Wings fleshy, 2-lobed; basal lobes concealed under standard, distal lobes oblong, rounded. Capsules glabrous.

Fl. & Fr. Sept.

Distrib. India: On tree-trunks at an altitude of 1,350 m. Tamil Nadu (Sivagiri hills).

Endemic to Tirunelveli hills of Southern W. Ghats.

199. *Impatiens viscida* Wight in Madras J. Lit. Sci. ser. 1. 5: 12. 1837; Hook. f., Fl. Brit. India 1: 462. 1874.

Herbs, slender, 0.5 - 1 m high, branching, rooting at lower nodes; stems angled. Leaves alternate, elliptic-lanceolate, serrate, 5 - 8 cm long, pubescent beneath, nerves on both surfaces covered with stiff hairs. Peduncles axillary, viscid, 5 - 10 cm long. Flowers umbelled or in short racemes, deep-pink or light-purple; pedicels viscid. Lateral sepals suborbicular, equalling the small standard. Lip boat-shaped; spur long, strong, incurved. Distal lobes of wings large, suborbicular. Capsules glabrous, ellipsoid, beaked; seeds globose, hairy.

Fl. & Fr. April - Dec.

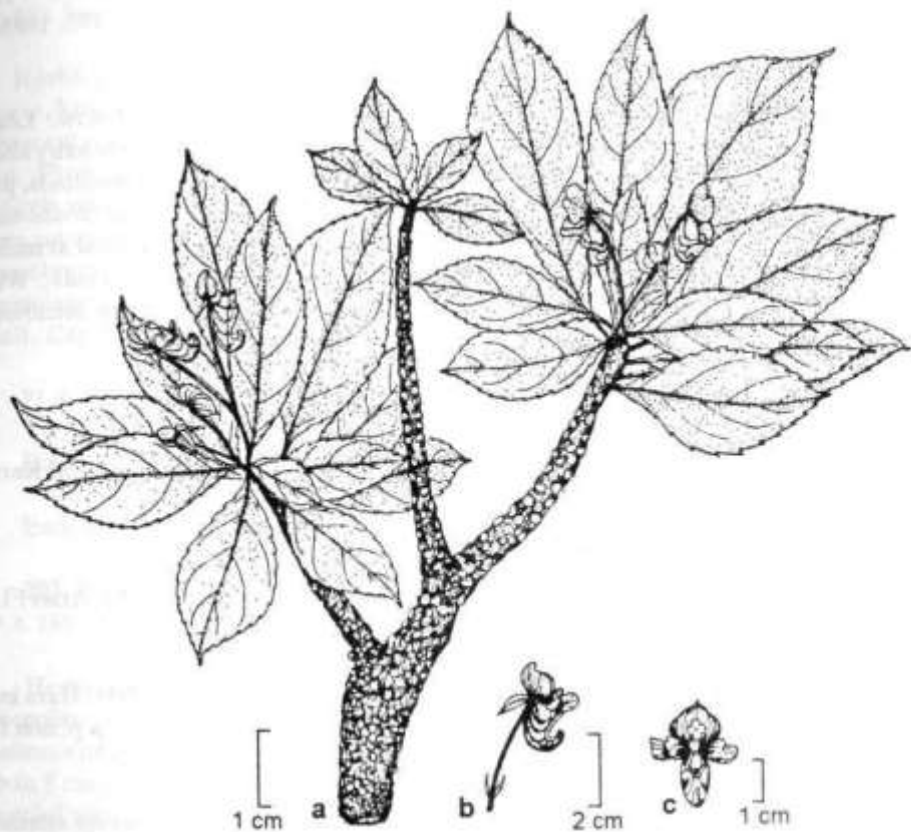


Fig. 53. *Impatiens viridiflora* Wight : a. habit; b & c. two views of flower.

Distrib. India: On beds of streams and swampy ground at an altitude of 1700 to 2000 m, Southern W. Ghats. Tamil Nadu.

Endemic to Pulney hills.

200. *Impatiens viscosa* Beddome in Madras J. Lit. Sci. ser. 2. 10: 68, t. 7, f. 7. 1859; Hook.f., Fl. Brit. India 1: 453. 1874. *I. ballardii* Beddome, Icon. 44, t. 192. 1868-74; Hook.f., Fl. Brit. India 1: 482. 1874.

Herbs, 12 - 30 cm high; stems succulent, often branched, rooting below. Leaves opposite, rarely alternate, elliptic-ovate, serrate, 2 - 6 x 0.8 - 3 cm, sparsely hairy above, glabrous below, glandular at base. Flowers in axillary and terminal subumbels, pink; peduncles 2.5 - 7 cm long; pedicels slender, 0.5 - 1.5 cm long. Lateral sepals ovate-subulate. Lip cymbiform; spur as long as or longer than wings, incurved, inflated at middle, subulate at tip. Standard orbicular, concave, obscurely keeled on dorsal side. Wings bilobed; distal lobes larger than basal ones, clawed, dorsal auricle filiform, enclosed in spur. Capsules ovoid, turgid, 7 - 10-seeded; seeds echinate.

Fl. & Fr. Aug. - Dec.

Distrib. India: Southern W. Ghats between 900 - 2000 m. Tamil Nadu and Kerala.

Endemic.

Chromosome no. $2n = 16, 20$ (Virendra Kumar & Subramaniam, Chr. Atlas Fl. Pl. Ind. Subc. 1: 87. 1986).

201. *Impatiens wallichii* Hook. f. in Rec. Bot. Surv. India 4: 20. 1905; H. Hara in Fl. E. Himal. 3: 79. 1975. *I. discolor* sensu Hook.f., Fl. Brit. India 1: 471. 1875, p.p. non DC. 1824.

Herbs, 1 - 1.5 m high; stems decumbent, rooting at lower nodes. Leaves alternate, ovate-lanceolate to ovate or ovate-elliptic, slightly attenuate into petiole at base, long-acuminate at apex, shallowly crenate along margins with filiform appendages on crenations, 3.2 - 8.7 x 1.8 - 2.8 cm, membranous, glabrous above and beneath but finely pubescent on midnerve and lateral nerves; lateral nerves 4 - 8 pairs; petiole 0.5 - 1.5 cm long, glabrous. Racemes 3-flowered. Flowers 3 - 4 cm, yellowish-white; bracts ovate-lanceolate, 3 - 4.5 mm long, gland-tipped; peduncles glabrous, 2 - 4 cm long, glabrous; pedicels 1 - 1.3 cm long, glabrous. Lateral sepals ovate-lanceolate, glandular on one margin, 3 - 5 x 2.5 - 3 mm. Lip bucciniform, pointed at apex, 1.5 - 1.7 x 2.3 - 2.5 cm, spurred; spur abruptly constricted, filiform, 4 - 5 mm long. Standard caudate-acuminate, many-nerved. Wings bilobed; distal lobes ovate-oblong. Capsules linear-oblong, acuminate, 0.5 - 1.5 cm long.

Fl. & Fr. July - Oct.

Distrib. India: E. Himalayas, 3000 - 3700 m. W. Bengal (Darjeeling), Sikkim.

Nepal.

202. *Impatiens wattii* Hook. f. in Rec. Bot. Surv. India 4: 30. 1905.

Herbs, glabrous. Leaves linear-lanceolate, abruptly cuneate to gradually attenuate at base, long-acuminate at apex, shallowly dentate along margins, 5 - 10 cm long, finely pubescent; lateral nerves 7 - 9 pairs; petiole glabrous, sometimes with glands, 1 - 2.2 cm long. Flowers usually solitary; peduncle 2 - 3 mm long; bracts linear, 4 - 4.5 mm long; pedicels very weak, 1.2 - 2.3 cm long, glabrous. Lateral sepals 4, one set 6 - 7 mm long, other set ovate, ca 1 cm long, long-acuminate, membranous. Lip bucciniform, spurred; spur abruptly constricted, short, incurved. Standard ovoid, ca 1.3 x 0.9 cm, with an appendage. Wings trilobed; basal lobes ovoid; distal lobes orbicular; dorsal auricle small. Capsules linear, acute, ca 6 mm.

Fl. & Fr. Aug.

Distrib. India: E. Himalayas, ca 900 - 1500 m. Manipur.

Endemic.

203. *Impatiens wightiana* Beddome in Madras J. Lit. Sci. ser. 2. 20: 67. 1858 & Icon. 30. t. 146. 1868 - 1874; Hook. f., Fl. Brit. India 1: 467. 1875.

Herbs, erect, suffruticose, branched, rooting at lower nodes. Leaves alternate, lanceolate, unequal at base, acuminate at apex, bristly serrate, 5 - 18 x 1.5 - 4.5 cm, glabrous or glabrescent, lineolate; petiole with numerous stalked glands towards apex, up to 8 cm long. Peduncles axillary, solitary, little longer than petioles. Flowers white, mottled with pink, ca 1 cm across, in axillary racemes, up to 11 cm long. Lateral sepals small. Lip funnel-shaped; spur short, hooked. Standard orbicular, ovate, apiculate with a green dorsal ridge. Capsules ovoid, trapezoid, acute with a pointed tip, glabrous; seeds 4 - 5, hairy.

Fl. & Fr. June - Sept.

Distrib. India: A rare species confined to Anamalai range and Anaimudi, Devicollam High Range in moist sholas and banks of streams in dense evergreen forests between 1000 m to 1500 m altitude in Southern W. Ghats. Kerala.

Endemic.

OXALIDACEAE

(M.K. Manna)

Herbaceous plants, sometimes with scaly rhizomes, bulbs, bulbils or stolons, or woody perennials, shrubs, lianas or trees. Leaves digitately or pinnately 3-foliolate, imparipinnate or paripinnate; basal ones alternate, pinnate or paripinnate, subopposite; petioles articulate at base; stipules sometimes present; petiolules articulate. Inflorescence basal, axillary, cymose, rarely racemose, 1- to many-flowered, bracteate and bracteolate. Flowers bisexual, actinomorphic, 5-merous; pedicels articulate. Sepals imbricate, free or connate at base, sometimes with apical calli (*Oxalis*), persistent. Petals contorted, free, usually cohesive above base, glabrous or sometimes minutely papillose or pilose inside. Stamens 10, obdiplostemonous, connate at base into an annulus, persistent, short ones sometimes with a basal gland near insertion of petals, long ones at times with a dorsal tooth (*Oxalis*); anthers dorsifixed or versatile, 2-locular, dehiscing extrorsely by longitudinal slits. Ovary superior, 5-locular; ovules 1 - several per locule in 1 - 2 rows; styles 5, terminal, persistent, free. Fruits capsular, 5-locular, dry, rarely fleshy and indehiscent; seeds usually arillate.

Temperate and tropical India, Malesia, S. America, S. Africa and Madagascar; 6 genera and ca 850 species, 2 genera and 20 species in India.

Literature. VELDKAMP, J.F. (1976). In: STEENIS, Fl. Males. ser. 1. 7(1): 151-178.

KEY TO THE GENERA

- 1a. Leaflets digitate; capsules with valves remaining attached to central axis 2. *Oxalis*
b. Leaflets pinnate; capsules dehiscing into a 5-rayed star without leaving a central axis 1. *Biophytum*

1. *Biophytum* DC.

Herbs, annual; stems unbranched or branched. Leaves pinnate, fascicled or almost whorled at top of stem, sometimes sensitive; petioles swollen at base; leaflets opposite, terminal pair mostly different from rest. Flowers terminal, in usually peduncled, bracteate, pseudo-umbels. Sepals 5, lanceolate, acuminate. Petals 5. Stamens 10; filaments free, 5 outer smaller. Styles 5; stigmas terminal, crenate to bifid; ovules 3 - 6 per locule alternating in 2 rows. Capsules ovoid or oblong, splitting loculicidally to base into 5 spreading valves; seeds with explosive aril.

Pantropical, ca 70 species, 12 in India.

KEY TO THE SPECIES

- | | |
|--|--------------------------------|
| 1a. Stems usually branched | 2 |
| b. Stems usually unbranched | 8 |
| 2a. Leaflets more than 30 pairs | 9. <i>B. polyphyllum</i> |
| b. Leaflets less than 30 pairs | 3 |
| 3a. Leaflets 4 - 15 pairs | 4 |
| b. Leaflets 15 - 30 pairs | 6 |
| 4a. Stems long and slender, prostrate, copiously dichotomously branched from a rootstock | 10. <i>B. proliferum</i> |
| b. Stems not as above | 5 |
| 5a. Bracts 5 - 8 mm long | 4. <i>B. longibracteatum</i> |
| b. Bracts much less than 5 mm | 2. <i>B. insignis</i> |
| 6a. Plants often umbellately branched; branches not arching from woody rootstock | 7 |
| b. Plants not umbellately branched; branches long and arching from woody rootstock | 3. <i>B. intermedium</i> |
| 7a. Leaf-scars prominent, persistent; leaflets densely strigose below; peduncles shorter than leaves | 1. <i>B. congestiflorum</i> |
| b. Leaf-scars not prominent; leaflets faintly hairy and glaucous below; peduncles longer than leaves | 7. <i>B. nudum</i> |
| 8a. Bracts very conspicuous, 5 - 8 mm long | 4. <i>B. longibracteatum</i> |
| b. Bracts not very conspicuous, much less than 5 mm long | 9 |
| 9a. Seeds with two longitudinal ridges with transverse rows of tubercles in between | 8. <i>B. petersianum</i> |
| b. Seeds spirally, obliquely or transversely ridged and or tuberculate | 10 |
| 10a. Leaflets conspicuously nerved beneath | 6. <i>B. nervifolium</i> |
| b. Leaflets not conspicuously nerved beneath | 11 |
| 11a. Sepals almost as long as petals | 12 |
| b. Sepals about half as long as petals | 11. <i>B. reinwardtii</i> |
| 12a. Sepals longer than pedicels | 12. <i>B. sensitivum</i> |
| b. Sepals shorter than pedicels | 5. <i>B. longipedunculatum</i> |

1. *Biophytum congestiflorum* Govind. in J. Econ. Tax. Bot. 20(2): 311. f. 1. 1996.

Herbs, large, perennial, up to 100 cm high; stems usually branched, appressedly hairy when young; branches 2 - 6 in pseudo-whorls; leaf-scars many, lunate. Leaves 6 - 10(-12) x 2 - 3 cm; stipules linear-lanceolate, up to 4 mm; leaflets 15 - 22 pairs, falcate, cuspidate, undulate, densely bulbous based hairy on lower surface, margins and mid-nerve above with a row of bulbous-based hairs, dirty-green above, glaucous beneath; terminal pair of leaflets obovate, asymmetric; intramarginal nerve thick. Inflorescence shorter than leaves; peduncle 4 - 8 cm long. Flowers 10 - 12 in a pseudo-umbel; pedicels shorter than bracts, 1.5 - 2 mm, glabrous; bracts closely whorled, linear-lanceolate, strigose at margins, 4.5 - 5 mm, membranous. Sepals ovate to lanceolate, 4 - 4.5 x 1 - 1.5 mm, sparsely strigose, 5 - 7-nerved. Petals obovate, rounded at apex, 5.2 - 5.5 x 0.5 - 0.7 mm, yellow, up to 5-nerved. Staminal filaments glabrous, 1 - 1.8 mm long; anthers ca 0.4 mm long. Ovary 5-lobed, ca 0.8 x 0.4 mm, glabrous, ovules (2-) 4 per locule; styles

puberulous, ca 2.6 mm long; stigma discoid. Fruits turbinate, ca 2.5 x 2 mm; seeds 2 - 4 per locule, broadly ovoid, acute, 0.6 - 0.8 x 0.6 - 0.7 mm, with undulate, oblique and muricate ridges, shining, reddish-brown.

Distrib. India: Sheltered places in W. Ghats, Kerala.

Endemic.

2. *Biophytum insignis* Gamble in Bull. Misc. Inform. 1921: 216. 1921; C. Fischer in Gamble, Fl. Pres. Madras 1868. 1935.

Undershrubs, low-growing; stems erect, wrinkled, almost black, divided into 2 - 4 branchlets towards apex. Leaves crowded towards apex of stem, paripinnate, ca 10 cm long; common rachis naked for 2 - 4 cm at base, moderately villous, canaliculate above; stipules many, linear-lanceolate, strigose-hirsute; leaflets 7-10 pairs; lower ones smaller, ovate; middle ones longer; farthest 1 or 2 oblong, unequal at base, subcordate, up to 3.5 x 1 - 1.5 cm, mucronate, sparingly villous beneath; midnerve with 10 - 12 straight primary nerves ending in thickened margin; secondary nerves 1 - 2. Scapes 2, arising between leaves, slender, up to 3 cm long; umbels terminal, 8 - 12-flowered; bracts small, many, lanceolate, villous; pedicels filiform, up to 5 mm long. Sepals 5, lanceolate, scarious along margins, pubescent, nerves 5-7. Petals 5, connate, 5 - 7 mm long, yellow. Filaments villous. Capsules ellipsoid, ca 4 mm long, villous; seeds minute, with spirally connected tubercles, red.

Fl. & Fr. Feb. - March.

Distrib. India: Tamil Nadu (Tirunelveli).

Endemic.

3. *Biophytum intermedium* Wight, Ill. 1: 162. 1840; Edgew. & Hook. f. in Fl. Brit. India 1: 438. 1874, incl. var. *pulneyensis*. Fig. 54.

Herbs, perennial, semiwoody at base, erect, 60 - 120 cm high; nodes hairy; hairs stiff, reflexed, arranged in a ring. Leaves 5 - 10 cm long; leaflets 15 - 25 pairs, lowest smallest, scarcely overlapping, oblong, somewhat falcate, truncate at base, very obliquely apiculate, glabrous; midnerve curved at apex; lateral nerves fine, numerous, oblique, anastomosing. Peduncles slender, shorter, strongly pubescent. Flowers 4-8 in an umbel, ca 12 mm across; pedicels thrice as long as sepals; bracts subulate. Capsules as long as sepals; seeds tuberculate.

Fl. & Fr. Feb. - June.

Distrib. India: Tamil Nadu.

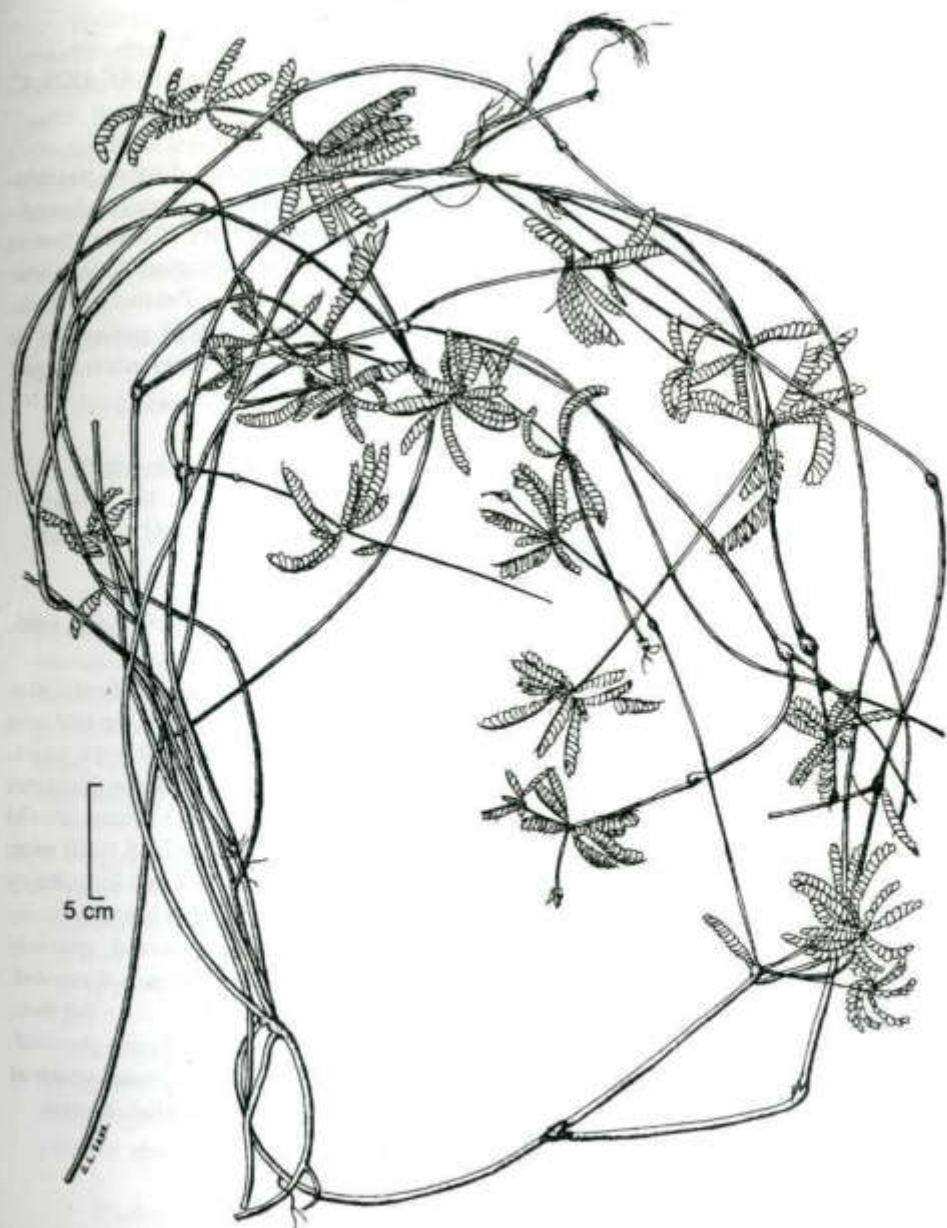


Fig. 54. *Biophytum intermedium* Wight : habit

Sri Lanka.

4. *Biophytum longibracteatum* Tad. & Jacob in J. Indian Bot. Soc. 4: 87. 1924; C. Fischer in Gamble, Fl. Pres. Madras 1868. 1935.

Herbs; stems simple or sometimes shortly branched, pubescent. Leaves paripinnate, 2 - 5 cm long; rachis hairy; petioles short-hairy; stipules linear, minute; leaflets 4 - 11 pairs, subsessile, 5 - 10 mm long. Peduncles slender, densely hairy. Flowers few to many, in umbels; pedicels short, slender, glabrous; bracts very conspicuous, lanceolate, acuminate, 5 - 8 mm long. Sepals lanceolate, acuminate, 5 - 6 mm long. Petals 5, connate, yellow. Stamens 10, 5 long alternating with 5 short; filaments shortly pubescent in middle. Capsules obovate, half the length of calyx; seeds minute with tuberculate ridges.

Fl. & Fr. Feb.

Distrib. India: Peninsular India, Tamil Nadu.

Endemic.

5. *Biophytum longipedunculatum* Govind. in J. Econ. Tax. Bot. 20(2): 312. f. 2. 1996.

Herbs, up to 40 cm high; stems unbranched, woody, densely retrorsely strigose towards apex. Leaves obovate, 7.5 - 12 x 2 - 3 cm; stipules linear-lanceolate, up to 3 mm long; rachis adaxially sulcate, strigose, lower portion barren; leaflets 9 - 18 pairs, asymmetric, cuspidate, margins thickened, densely appressedly strigose above, glabrous below and along margins; terminal leaflets obovate, oblique, (13-) 18 x (6-) 10 mm; lateral leaflets elliptic or oblong, oblique at base, slightly undulate, 15 - 20 x 7 - 8 (-10) mm. Peduncles 14 - 23 cm long, densely hairy; bracts ovate-lanceolate, 1 - 1.3 mm long, hairy along margins, 1-nerved. Flowers 6 - 8 in an umbel; pedicels 7 - 10 mm long, strigose. Sepals ovate-lanceolate, acuminate, 3 - 3.5 x 0.2 - 0.3 mm, usually 7-nerved, sparsely strigose on nerves. Petals obovate, rounded at apex, 3.5 - 4.5 x 0.5 - 0.6 mm, 4-nerved. Staminal filaments 2.5 mm long. Ovary 5-lobed, elliptic-ovate, 1 - 1.5 x 0.4 - 0.8 mm, pubescent, 3 - 4-ovuled per locule; styles ca 0.5 mm long; stigma discoid. Fruits obovoid, ca 3 x 2.8 mm, hairy; seeds 3 - 4 per locule, arillate, bipyramidal, tetragonous acute at both ends, ca 1 x 0.8 mm, obliquely ridged and unevenly tubercled, reddish-brown.

Distrib. India: Kerala.

Endemic.

6. *Biophytum nervifolium* Thwaites, Enum. Pl. Zeyl. 64. 1858. *B. sensitivum* (L.) DC. var. *nervifolium* (Thwaites) Edgew. & Hook. f. in Fl. Brit. India 1: 437. 1874.

Herbs, stems very short, erect, unbranched. Leaves numerous forming a crowded rosette, almost on ground; leaflets 8 - 12 (-14) pairs, generally overlapping, terminal one largest, broadly oblong, apiculate, glabrous, paler beneath; lateral nerves very prominent. Peduncles stiff with appressed hairs. Flowers in dense umbels, crowded; pedicels shorter than sepals; bracts hairy. Sepals linear-lanceolate, attenuate, very acute; nerves 7, prominent, parallel. Petals much exceeding sepals. Styles hairy. Capsules ovoid, shorter than sepals; seeds strongly transversely ribbed, not tuberculate.

Fl. & Fr. Dec. - March.

Distrib. India: Andhra Pradesh and Tamil Nadu.

Sri Lanka.

7. *Biophytum nudum* (Arn.) Wight, Ill. 1: 161. 1840; Edgew. & Hook. f. in Fl. Brit. India 1: 438. 1874. *Oxalis nuda* Arn. in Nova Acta Phys. Med. Acad. Caes. Lep. Carol. Nat. Cur. 18(1): 326. 1836.

Herbs, perennial, semiwoody; stems erect, umbellately branched, 15 - 60 cm high. Leaflets 15 - 20 pairs, oblong, slightly falcate, truncate at base, strongly cuspidate, 3 - 8 cm long, faintly hairy, glaucous or whitish beneath with prominent nerves; lower ones smaller. Peduncles exceeding leaves, appressed hairy. Flowers few in small umbels; pedicels slender, as long as sepals, hairy; bracts numerous, lanceolate, crowded. Sepals lanceolate, acute, mucronate, nerves nearly glabrous. Capsules ovoid, blunt, almost equalling sepals; seeds not furrowed, slightly tuberculate.

Fl. & Fr. March - Sept.

Distrib. India: Madhya Pradesh and Tamil Nadu.

Sri Lanka.

8. *Biophytum petersianum* Klotzsch in Peters, Reise Mossamb. Bot. 1: 81, t. 15. 1862; Veldk., Fl. Thailand 2: 18. 1970 & in Steenis, Fl. Males. ser. 1. 7(1): 161. 1971. *Oxalis apodiscias* Turcz. in Bull. Soc. Imp. Naturalistes Moscou 36: 595. 1863. *Biophytum apodiscias* (Turcz.) Edgew. & Hook. f. in Fl. Brit. India 1: 437. 1874.

Herbs, stems simple, up to 15 cm long. Leaves 3 - 9 pairs; rachis 5 - 3 mm long, glabrous to appressed-pubescent mainly at nodes; leaflets overlapping; terminal ones 2 - 8 x 2 - 5 mm, obovate, midnerve eccentric; others triangular, orbicular or elliptic, rounded to obtuse at apex, glabrous or sparsely ciliate along margins, midnerve median. Pedicels 1 - 3 mm long with few bristly hairs. Sepals ovate-lanceolate, acute, 3 - 5 x 1 - 2 mm, sparsely hairy. Petals lanceolate, 5 - 6 x 1 - 2 mm, yellow. Ovary 1 - 2 x 1 mm;

ovules 4 - 5 per locule; styles 1 - 2 m long; stigma flattened, bifid. Capsules 3 - 4 x 2 - 2.5 mm.

Fl. & Fr. Jan. - Oct.

Distrib. India: W. Bengal, Assam, Meghalaya and Karnataka.

Tropical Africa, Madagascar and S.E. Asia.

9. *Biophytum polyphyllum* Munro in Wight, Ill. 1: 162. 1840; Edgew. & Hook. f. in Fl. Brit. India 1: 439. 1874; Gamble, Fl. Pres. Madras 133. 1915. **Fig. 55.**

Herbs, silky and villous; stems stout, umbellately branched, slender, flexuous. Leaves 5 - 8 cm long; rachis villous with long hairs; leaflets crowded, 30 - 50 pairs, ca 3 mm long, terminal pair smallest. Flowers small. Sepals 5, lanceolate. Petals 5. Stamens 10; filaments free. Styles 5. Capsules ovoid.

Fl. & Fr. Jan. - June.

Distrib. India: In sholas of Nilgiris, Tamil Nadu.

Sri Lanka.

10. *Biophytum proliferum* (Arn.) Wight, Ill. 1: 162. 1840; Edgew. & Hook. f. in Fl. Brit. India 1: 438. 1874. *Oxalis proliferum* Arn. in Nova Acta Phys.-Med. Acad. Caes. Leop. Nat. Cur. 18(1): 327. 1836.

Herbs, perennial; stems many, prostrate or ascending, branched; branches dichotomous or whorled, filiform, nodes thickened, rooting, pubescent or hairy, with tufts of long deflexed hairs below nodes; leaflets 5 - 15 pairs, very small, ca 4 mm long, crowded, overlapping, oblong, truncate at base, obliquely apiculate at apex, both sides bristly hairy; hairs few, long. Peduncles very slender. Flowers 3 - 6 mm across, solitary or 2 together; pedicels as long as or longer than sepals; bracts setaceous. Sepals linear-lanceolate, attenuate at base, acute at apex, long hairy. Capsules shorter than sepals; seeds tuberculate; not furrowed.

Fl. & Fr. Throughout the year.

Distrib. India: Tamil Nadu.

Sri Lanka.

11. *Biophytum reinwardtii* (Zucc.) Klotzsch in Peters, Reise Mossamb. Bot. 1: 85. 1862; Edgew. & Hook. f. in Fl. Brit. India 1: 437. 1874, incl. var. *metziana*. *Oxalis*

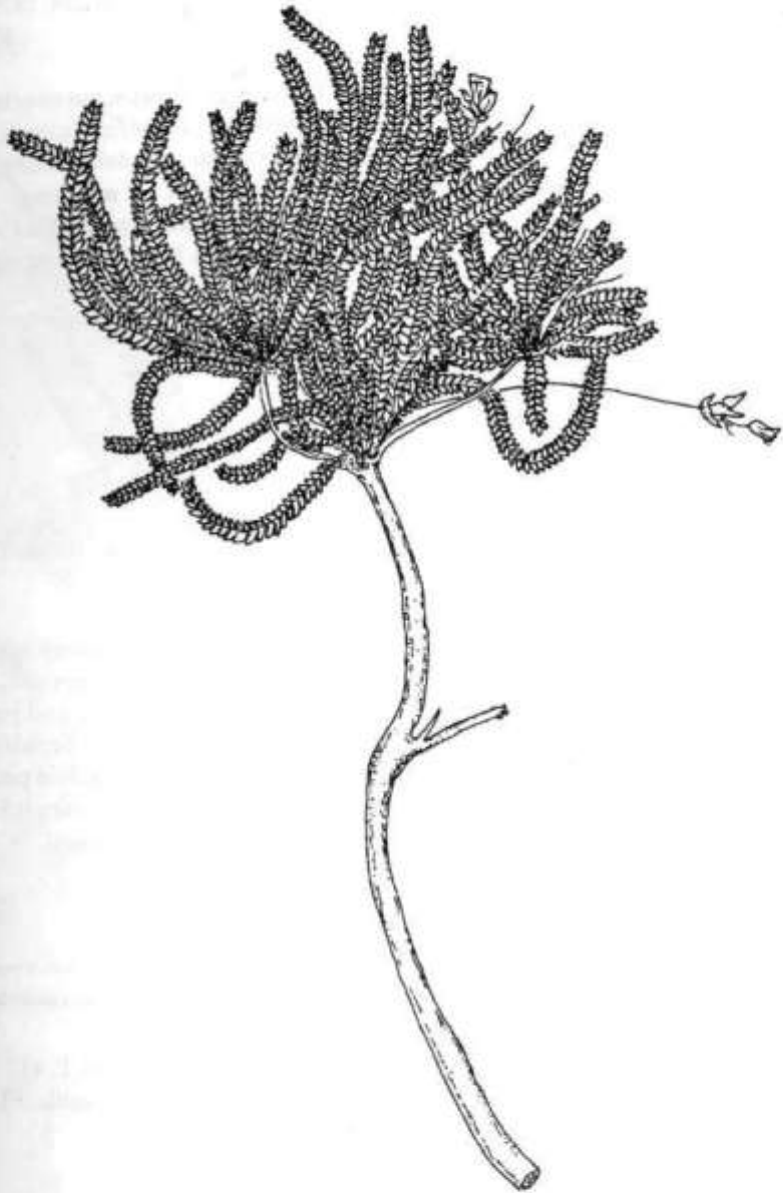


Fig. 55. *Biophytum polyphyllum* Munro : habit

reinwardtii Zucc. in Abh. Math.-Phys. Cl. Koenigl. Bayer. Akad. Wiss. 1: 274. 1829-1830.
Fig. 56.

Herbs, annual; stems simple, up to 35 cm high. Leaflets 6 - 11 pairs, not overlapping; terminal ones largest, obovate, 7 - 15 x 4 - 7 mm; midnerve eccentric, curved; others elliptic. Peduncles up to 12 cm long, appressed-strigose to glandular hairy, up to 8-flowered; pedicels up to 5 mm long; bracts ovate-attenuate, 1 - 2 mm long. Sepals ovate-lanceolate, acute, 2 - 4 x ca 1 mm. Petals elliptic to oblanceolate, 6 - 8 x 1 - 2 mm. Filaments 2 - 3 mm long. Ovary ca 1 x 0.5 mm, glabrous; ovules 3-4 per locule; styles 0.5 - 0.75 mm long; stigmas flattened.

Fl. & Fr. Oct. - Dec.

Distrib. Throughout India.

Tropical S.E. Asia.

12. *Biophytum sensitivum* (L.) DC., Prodr. 1: 690. 1824; Edgew. & Hook. f. in Fl. Brit. India 1 436. 1874. *Oxalis sensitiva* L., Sp. Pl. 434. 1753.

Herbs, annual; stems simple, up to 35 cm, hispidly pubescent. Leaves sensitive, crowded on top of stem; rachis 8 - 15 cm long; petioles short; leaflets opposite, 6 - 15 pairs. Peduncles of various lengths, up to 14 cm long, appressed-strigose and patently glandular-hairy; bracts lanceolate, small, crowded beneath short pedicels. Sepals ovate-lanceolate, acute, 4 - 7 x 0.5 - 1.5 mm, strigose and glandular hairy, longer than pedicels. Petals lanceolate, 5 - 7 x 1 - 2 mm, yellow. Anthers 1.5 - 2.5 mm long. Ovary 0.5 - 0.75 mm, apically ciliate; ovules 2 - 5 per locule; style 0.5 - 1 mm; stigma flattened.

KEY TO THE VARIETIES

- | | |
|---|---------------------------------|
| 1a. Leaflets more or less glabrous; seeds prominently ridged, not tubercled | 12.2. var. sensitivum |
| b. Leaflets strigosely hirsute; seeds ridged and tubercled | 12.1. var. candolleianum |

12.1. var. candolleianum (Wight) Edgew. & Hook.f. in Fl. Brit. India 1: 437. 1874. *Biophytum candolleianum* Wight, Ill. 1: 161. t. 62. 1840, 'candolleianum'; Gamble, Fl. Pres. Madras 1: 133. 1915.

Fl. & Fr. Feb. - Sept.

Distrib. India: In hilly areas, Karnataka, Tamil Nadu and Kerala.

12.2. var. sensitivum

Fig. 57.

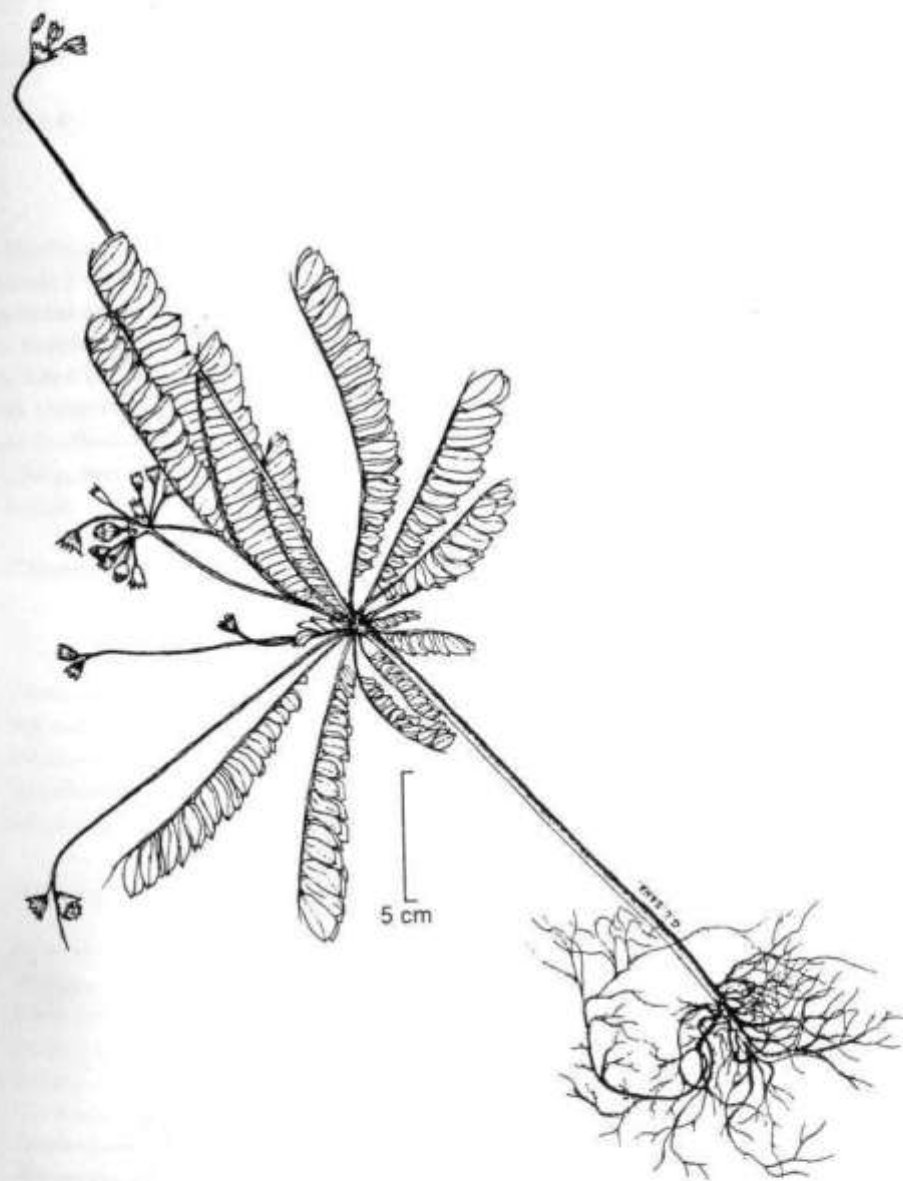


Fig. 56. *Biophytum reinwardtii* (Zucc.) Klotzsch : habit

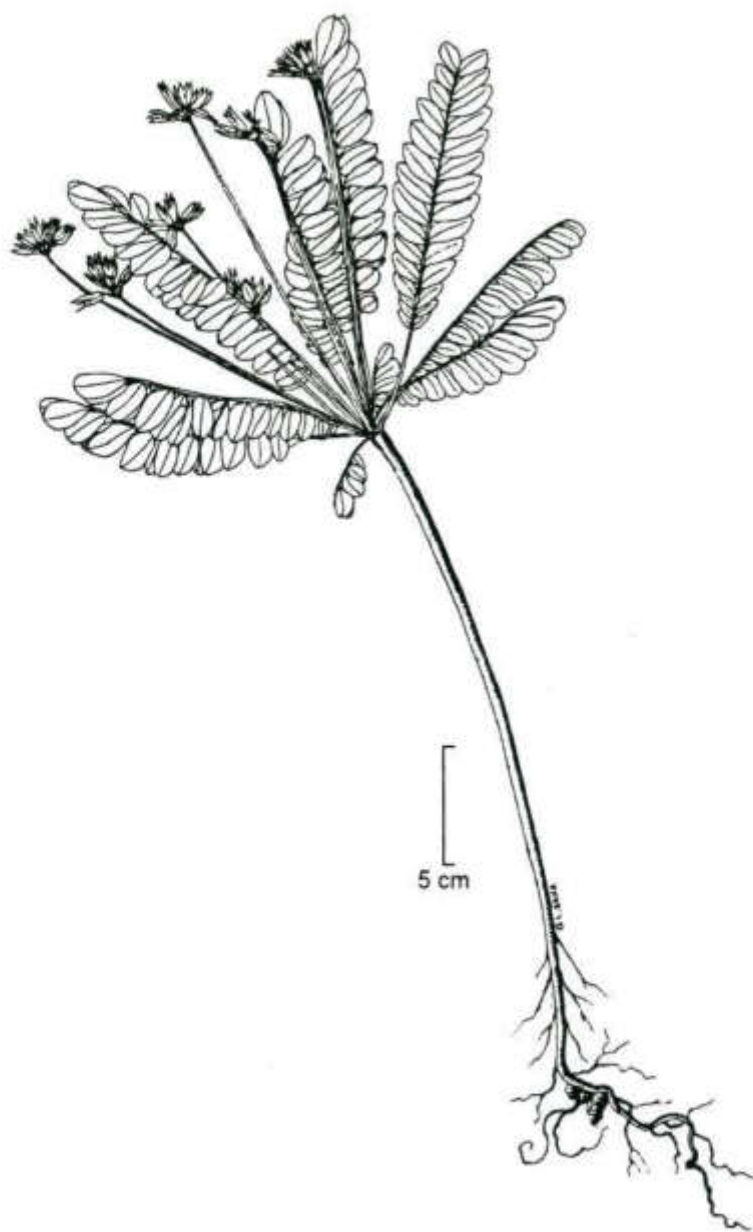


Fig. 57. *Biophytum sensitivum* (L.) DC. var. *sensitivum* : habit

Fl. & Fr. Oct. - Jan.

Distrib. India: Throughout.

Widely distributed in Indo-Malesian tropics.

2. *Oxalis* L.

Herbs, annual or perennial, sometimes with rhizomes or bulbs. Leaves digitately or pinnately 3 - 4-foliolate; stipules when present adnate to base of petiole. Peduncles basal from bulbs or solitary and axillary. Inflorescence cymose or umbellate, 1 to many-flowered; bracteoles 2 to several, sometimes with apical calli; pedicels articulate at base and sometimes beneath calyx. Sepals shortly connate at base with or without apical calli. Petals coherent above claw, contorted, glabrous. Long filaments sometimes with a dorsal tooth each. Ovules 1 - 10 in 1 - 2 rows per locule; stigma cylindric, minutely bilobed to peltate, sometimes papillose. Capsules loculicidal by longitudinal slits; seeds 1 - 10 per locule.

Cosmopolitan, chiefly C. and S. America and S. Africa; ca 800 species, 10 in India.

KEY TO THE SPECIES

- | | |
|--|----------------------------|
| 1a. Inflorescence 1-flowered | 2 |
| b. Inflorescence 2- or more flowered | 4 |
| 2a. Plants not bulbous; petals white | 3 |
| b. Plants bulbous; petals red | 10. <i>O. variabilis</i> |
| 3a. Stipules conspicuous, much broader than petiole; leaflets broadly obovate, outlines rounded | 1. <i>O. acetosella</i> |
| b. Stipules narrow, slightly broader than petiole; leaflets distinctly triangular, outlines straight | 16. <i>O. griffithii</i> |
| 4a. Plants acaulescent; leaves radical, arising from rootstock | 5 |
| b. Plants caulescent; usually creeping, rarely erect | 9 |
| 5a. Leaflets 3 | 6 |
| b. Leaflets more than 3 | 8 |
| 6a. Leaflets cordate, bilobed with a wide sinus; petals yellow | 2. <i>O. cernua</i> |
| b. Leaflets broadly deltoid or obovate; petals purple | 7 |
| 7a. Stolons present; leaflets broadly deltoid, not punctate | 5. <i>O. dehradunensis</i> |
| b. Stolons absent; leaflets broadly obovate with a narrow sinus, minutely punctate | 4. <i>O. corymbosa</i> |
| 8a. Leaflets 4 | 6. <i>O. deppei</i> |
| b. Leaflets 7 - 9 | 8. <i>O. lasiantha</i> |
| 9a. Flowers in simple umbels; petals yellow | 3. <i>O. corniculata</i> |
| b. Flowers in broad umbelliform false racemes; petals orange - yellow | 8. <i>O. pubescens</i> |

1. *Oxalis acetosella* L., Sp. Pl. 433. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 436. 1874; Calder in Rec. Bot. Surv. India 6(8): 325-341. 1919. **Fig. 58.**

Herbs, acaulescent; rhizomes monopodial. Leaves ternate; petioles 5-15 cm long, pubescent; stipules large, broad; leaflets broadly obcordate, 1-3 x 1-4 cm, appressedly hairy along margins and beneath. Peduncles axillary, slender, 6 - 18 cm long. Flowers 1.5 - 1.75 cm across, white. Sepals oblong, rounded to emarginate, ca 16 x 6 mm. Petals spathulate-oblong, ca 16 x 6 mm. Stamens 10, alternately short and long. Ovary 2 - 3 x ca 1.5 mm, glabrous; ovules 1 - 5 per locule. Capsules ovoid, ca 6 x 5 mm, longitudinally ribbed.

Fl. & Fr. May - Sept.

Distrib. India: Himalayas, Jammu & Kashmir, Sikkim and Tamil Nadu.

China, Japan, Taiwan, Philippines and Malesia.

2. *Oxalis cernua* Thunb., Diss. Oxal. 14. t. 2. f. 2. 1781; Matthew in Rec. Bot. Surv. India 20(1): 56. 1969. *O. pescaprae* Savign. in Lam., Encycl. 4: 685. 1798, non L. 1753; Calder in Rec. Bot. Surv. India 6: 6329. 1919; Fyson, Fl. South Indian Hill Stat. 1: 5. 1932. **Fig. 59.**

Herbs, acaulescent, up to 20 cm high. Leaves 20 - 35, arising from bulbous rootstock, 3-foliolate; petioles slender, terete, up to 10 cm long, glabrous; leaflets sessile, cordate, bilobed, cuneate at base, ca 5 x 15 mm, glabrous above and villous beneath. Umbels few- or many-flowered; pedicels unequal, ca 1 cm long; bracts few, minute, hairy, persistent. Flowers ca 1.5 cm long. Sepals 5, shorter than petals, lanceolate, acute, 15 x 5 mm, glabrous with two glands at apex. Petals 5, shortly clawed, oblong, ca 15 x 5 mm, glabrous, golden yellow. Stamens 10, alternately short and long, united into a tube below; long filaments ca 2 cm long, short ones ca 1.3 cm long; anthers oblong, 2-locular. Ovary ovoid, ca 8 x 4 mm; styles 5, very short, pubescent; stigmas 5.

Fl. & Fr. Aug. - March.

Distrib. India: Gujarat, Himachal Pradesh, Punjab, Uttar Pradesh and Tamil Nadu.

Native of S. Africa.

3. *Oxalis corniculata* L., Sp. Pl. 135. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 436. 1874. *O. corniculata* L. var. *hispida* Blatt. in J. Bombay Nat. Hist. Soc. 34: 898. 1931. **Fig. 60.**

Herbs, perennial, procumbent; sometimes much thickened and woody; stems several, branched, puberulous to pubescent. Leaves 3-foliolate, scattered, distant or in

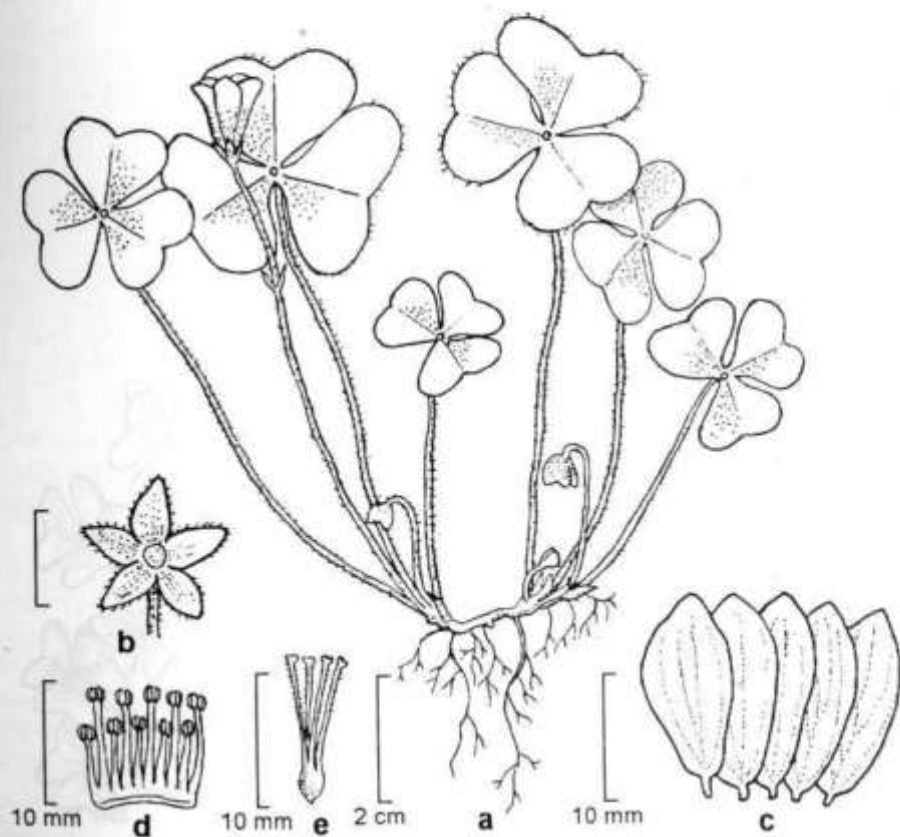


Fig. 58. *Oxalis acetosella* L.: a. habit; b. calyx; c. corolla; d. androecium; e. gynoecium.

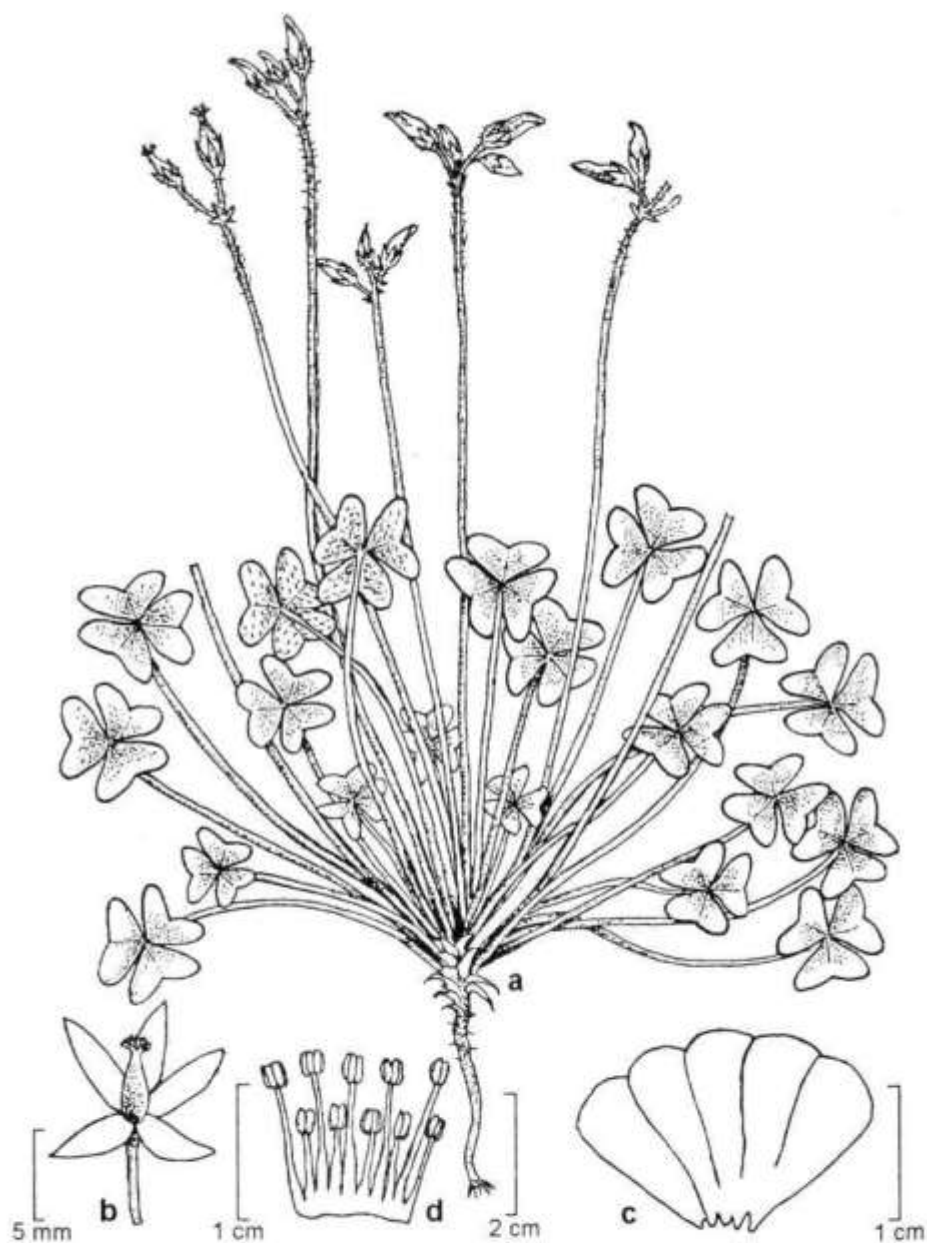


Fig. 59. *Oxalis cernua* Thunb.: a. habit; b. calyx and gynoecium; c. corolla; d. androecium

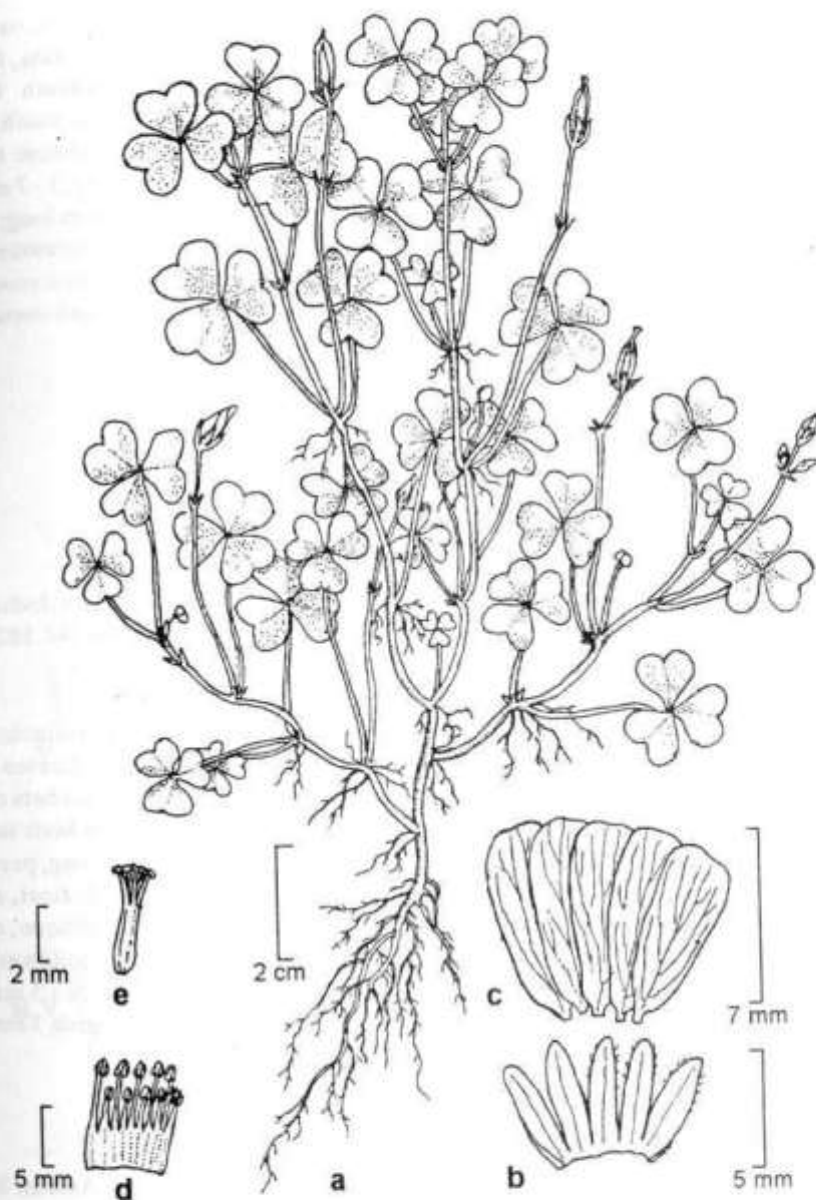


Fig. 60. *Oxalis corniculata* L.: a. habit; b. calyx; c. corolla; d. androecium; e. gynoecium.

small tufts; petioles very slender, 1-9 cm long, pubescent; stipules indistinct, sometimes conspicuous, up to 3 x 1 mm, rectangular; leaflets broadly elliptic-obcordate, 4-20 x 5-18 mm, glabrous to sericeous above, paler and sometimes glaucous beneath. Inflorescence cymose to pseudo-umbellate; peduncles up to 20 cm high, usually much shorter. Flowers 2 or more; pedicels up to 20 mm long. Sepals lanceolate, obtuse to rarely obliquely-retuse with narrow pale margins, 2-6 x 2 mm. Petals 5, oblong, 3-7 mm long, yellow. Stamens 10, united; long ones ca 5 mm long; short ones ca 4 mm long; anthers dehiscing longitudinally. Ovary ellipsoid to cylindric, ca 2 x 1 mm, puberulous; stigma small, sometimes flattened and minutely bifid; ovules 5-11 per locule in a row. Fruits usually linear-cylindric, 9-20 x 2-4 mm; seeds 5-11 per locule, flattened-ovoid, ca 1 x 0.75 mm.

Fl. & Fr. March - Dec.

Distrib. India: Throughout.

Cosmopolitan.

4. *Oxalis corymbosa* DC., Prodr. 1:696. 1824; Calder in Rec. Bot. Surv. India 6:337. 1919. *O. martiana* Zucc. in Denkschr. Königl. Akad. Wiss. Muenchen 9:144. 1823-1824.

Fig. 61.

Herbs, acaulescent, bulbous at base; bulbs globose, acute at tip, producing many lateral bulbils, scaly; outer scales numerous, thin, papery, brownish. Leaves 9-12, stipulate, trifoliolate; petioles very thin, 13-24 cm long, sparsely hairy; leaflets cuneate at base, 1.2-1.8 x 1.8-2.5 cm, equal, membranous, appressed-hairy on both surfaces. Inflorescence a pseudo-umbel, 6-7-flowered; bracts minute, ca 1 mm long, persistent, membranous, pilose. Flowers pedicellate, ca 1.5 cm long. Sepals 5, distinct, elliptic, erect, acute, 5-6 mm long, sparsely hairy outside. Petals 5, cuneate, oblique, ca 1.5 x 0.5 cm, slightly hairy outside, violet. Stamens 10 in two series alternately long and short; long ones free; filaments erect, ca 3 mm long, hairy; short ones flattened, ca 1.5 mm long, glabrous; anthers oblong, short, yellow. Ovary obtusely 5-angled, oblong, ca 3 mm long, glabrous; ovules 3-8 in each locule; styles 5.

Fl. & Fr. Sept. - Jan.

Distrib. India: Jammu & Kashmir, Punjab, Delhi, Uttar Pradesh, Assam, Sikkim, Meghalaya, Mizoram, Manipur, Bihar, W. Bengal, Tamil Nadu and Kerala.

Tropical S. America.

5. *Oxalis dehradunensis* Raiz., Suppl. Fl. Upp. Gang. Plain 37-38. 1976. *O. intermedia* A. Rich., Ess. Fl. Cuba 315. 1845, non Steudel 1841. *Oxalis richardiana* Babu, Herb. Fl. Dehra Dun 104. 1977. *O. latifolia* auct. plur. non H.B.K. 1821; Calder in Rec.

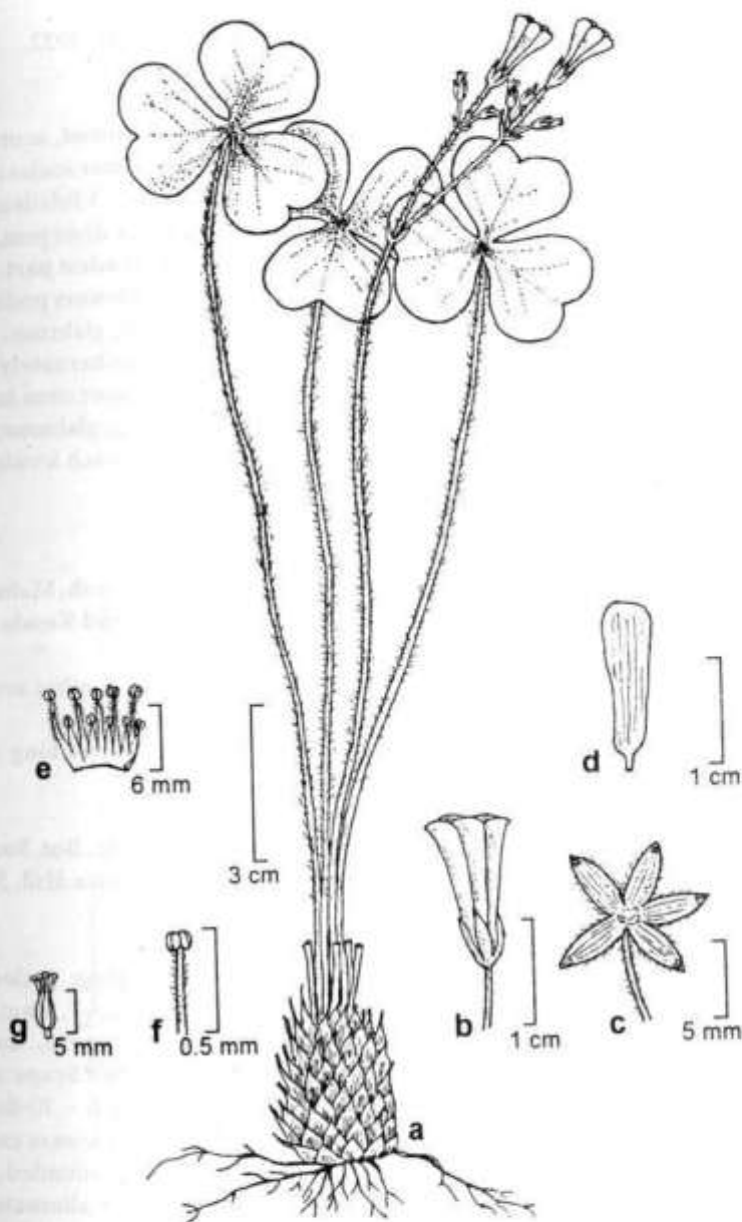


Fig. 61. *Oxalis corymbosa* DC. : a. habit; b. flower; c. calyx; d. petal; e. androecium; f. stamen; g. gynoecium.

Bot. Surv. India 6(8): 335. 1919; Fyson, Fl. S. Indian Hill Stat. 2: t. 51. 1932.

Fig. 62.

Herbs, acaulescent, 15 - 25 cm high; roots few, filiform, bulbs ovoid, acute, up to 5 x 2 cm, with numerous basal erect stolons with a few small scales; outer scales ovate-oblong, acute, imbricate, inner scales fleshy. Leaves 2-6, long petiolate, 3-foliolate; leaflets subsessile, fishtail-shaped, broadly deltoid, sub-bilobed with lobes divergent, acute at apex, broadly but distinctly cuneate at base, ca 1.5 cm x 3 cm at broadest part. Umbels with 5 - 6 flowers, bracteate; bracts minute, less than 1 mm long. Flowers pedicellate, 8 - 9 mm long. Sepals 5, elliptic-oblong, equal, ca 4 mm x 1.5 mm, glabrous. Corolla infundibuliform, 1 - 1.5 cm long; petals 5, purple violet. Stamens 10, alternately long and short; longer filaments inapendiculate, pubescent, ca 4 mm long; short ones hairy, ca 2 mm long; anthers oblong. Ovary elongate, 5-lobed, ca 2.5 mm long, glabrous; styles 5, distinct, glabrous; stigmas 5, discoid with wavy margins; ovules 4 in each locule.

Fl. & Fr. May - Nov.

Distrib. India: Himachal Pradesh, Meghalaya, Punjab, Uttar Pradesh, Maharashtra, Madhya Pradesh, Bihar, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Native of Mexico and West Indies; introduced and naturalised in other areas.

Notes. Closely allied to *Oxalis latifolia* H.B.K., but in latter species long staminal filaments are apendiculate and short ones glabrous.

6. *Oxalis deppei* Lodd., Bot. Cab. 15: t. 1500. 1828; Matthew in Rec. Bot. Surv. India 20: 56. 1969. *O. tetraphylla* auct. non Cav. 1794: Fyson, Fl. South Indian Hill. Stat. 2: t. 50. 1932.

Fig. 63.

Herbs, acaulescent, bulbous at base; bulbs large, ca 2 cm long; scales many, lanceolate, acuminate, brownish white. Leaves 4-foliolate; petioles 6 - 7, long; leaflets subsessile, deltoid to triangular, ca 2.5 x 3.6 cm long, membranaceous, somewhat glaucous and punctate beneath, appressed-hairy on nerves beneath. Scape solitary, terete, longer than petioles, ca 2.5 cm long, puberulous. Umbels 6 - 10-flowered, bracteate; bracts many, involucrate, lanceolate, acute, ca 9 x 2 mm. Flowers ca 1.5 cm long. Sepals 5, ovate, acute, ca 5 x 2 mm. Petals 5, spatulate-oblong, rounded, retuse, often oblique, ca 12 x 3 mm, glabrous, dark red when dry. Stamens 10, alternately long and short; long filaments densely hairy, ca 2 mm long, short filaments ca 1 mm long; anthers oblong. Ovary narrow, obscurely 5-angled, ca 2 mm long, glabrous; styles 5, erect, thrice as long as ovary; stigmas 5, peltate; ovules 3 - 5 per locule.

Fl. & Fr. May - Nov.

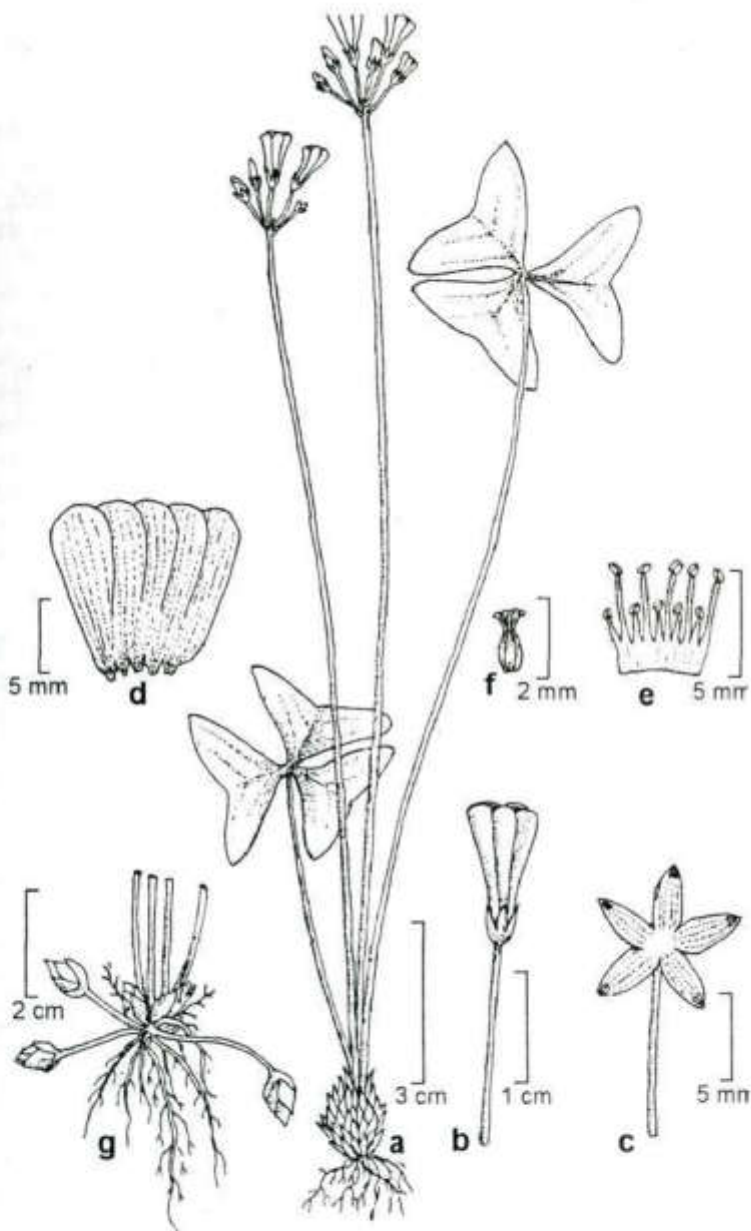


Fig. 62. *Oxalis dehradunensis* Raiz. : a. habit; g. flower; c. calyx; d. corolla; e. androecium; f. gynoecium; g. bulbils.

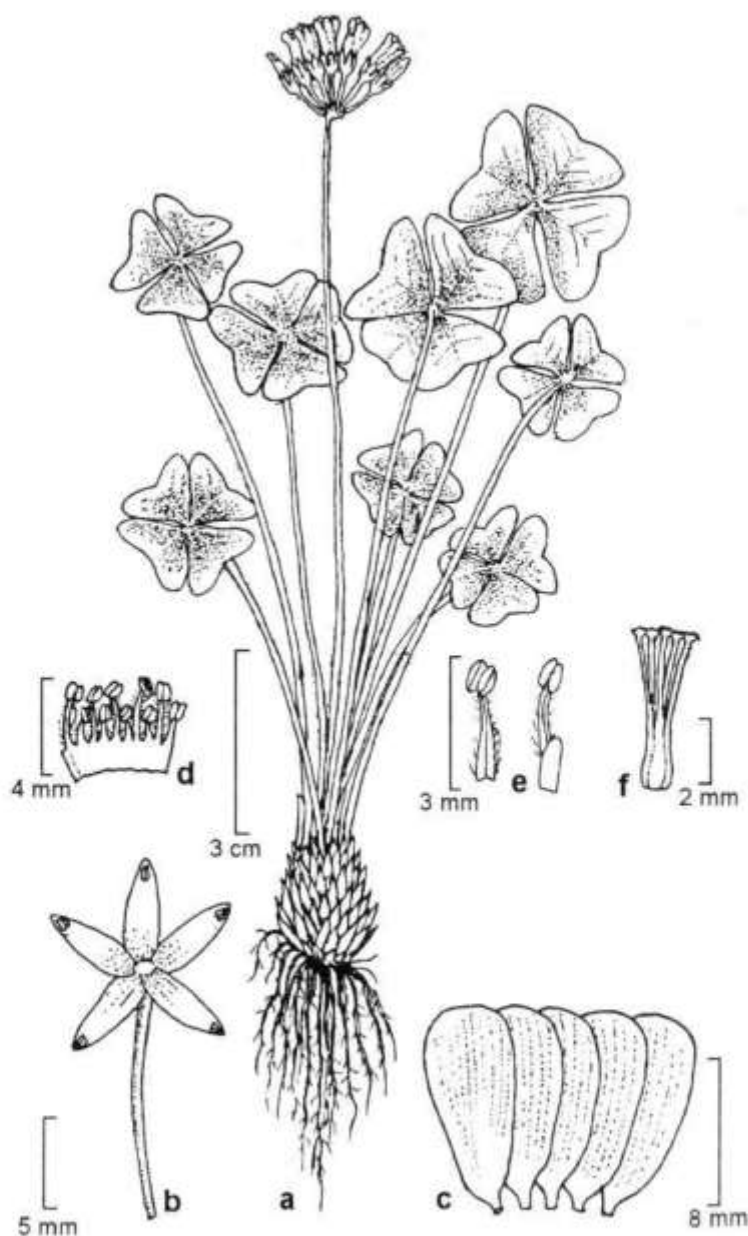


Fig. 63. *Oxalis deppei* Lodd. : a. habit; b. calyx; c. corolla; d. androecium; e. long stamens; f. gynoecium.

Distrib. India: Uttar Pradesh, Himachal Pradesh, Meghalaya, Maharashtra and Tamil Nadu.

Native of Mexico; introduced and naturalized in many other areas.

7. *Oxalis griffithii* Edgew. & Hook.f. in Fl. Brit. India 1: 436. 1874; Calder in Rec. Bot. Surv. India 6(8): 327. 1919. **Fig. 64.**

Herbs, perennial, 5 - 15 cm high; rootstock creeping, thick, bearing numerous fibrous roots and densely clothed with persistent bases of leaves. Leaves radical, 3-foliolate; petioles somewhat thickened, 5 - 12 cm long, more or less ridged hairy; stipules ovate-lanceolate, small; leaflets broadly triangular, slightly retuse. Flowers solitary, axillary; pedicels as long as or longer than petioles, stout, hairy; bracteoles two, at above middle of pedicel, linear-oblong, hairy. Sepals narrowly ovate to oblong, ca 4 mm long, pubescent especially along margins. Petals 5, narrowly obovate, ca 1 cm long. Stamens 10, 5 long (ca 5 mm long) and 5 short (ca 3 mm long). Ovary obtusely 5-angled, glabrous; style 5, diverging, equalling long stamens.

Fl. & Fr. May - Sept.

Distrib. India: Himachal Pradesh (Simla), Arunachal Pradesh, Meghalaya, Nagaland, Manipur and Sikkim.

China to Japan, Malesia and Taiwan.

8. *Oxalis lasiandra* Zucc. in Abh. Math.-Phys. Cl. Koenigl. Bayer. Akad. Wiss. 2: 353. 1837; Pangtey et al. in J. Econ. Tax. Bot. 9(2): 411. 1987.

Herbs, acaulescent, 9 - 40 cm high, base bulbous; bulbs scaly, bulb-scales ribbed. Leaves shorter than scape; petiole sparingly pubescent; leaflets 7 - 9, spatulate, narrowly cuneate, 3 - 8 cm long, margins and surfaces with scattered hairs. Scape glabrous or nearly so; inflorescence 10 - 24-flowered. Pedicels 1.5 - 3 cm long. Sepals narrowly oblong, obtuse with 2 short tubercles at apex, 4 - 5 mm long, finely glandular pubescent. Petals shorter than filaments, 14 - 18 mm long, glabrous, crimson. Longer filaments pubescent above, each with an appendage on back.

Distrib. India: Report (Pangtey et al. l.c.) based on collections from areas adjoining Chaubattia garden in Ranikhet, probably an escape from cultivation; Uttar Pradesh (Kumaon).

Native of Mexico; introduced to many countries as an ornamental, at times runs wild.

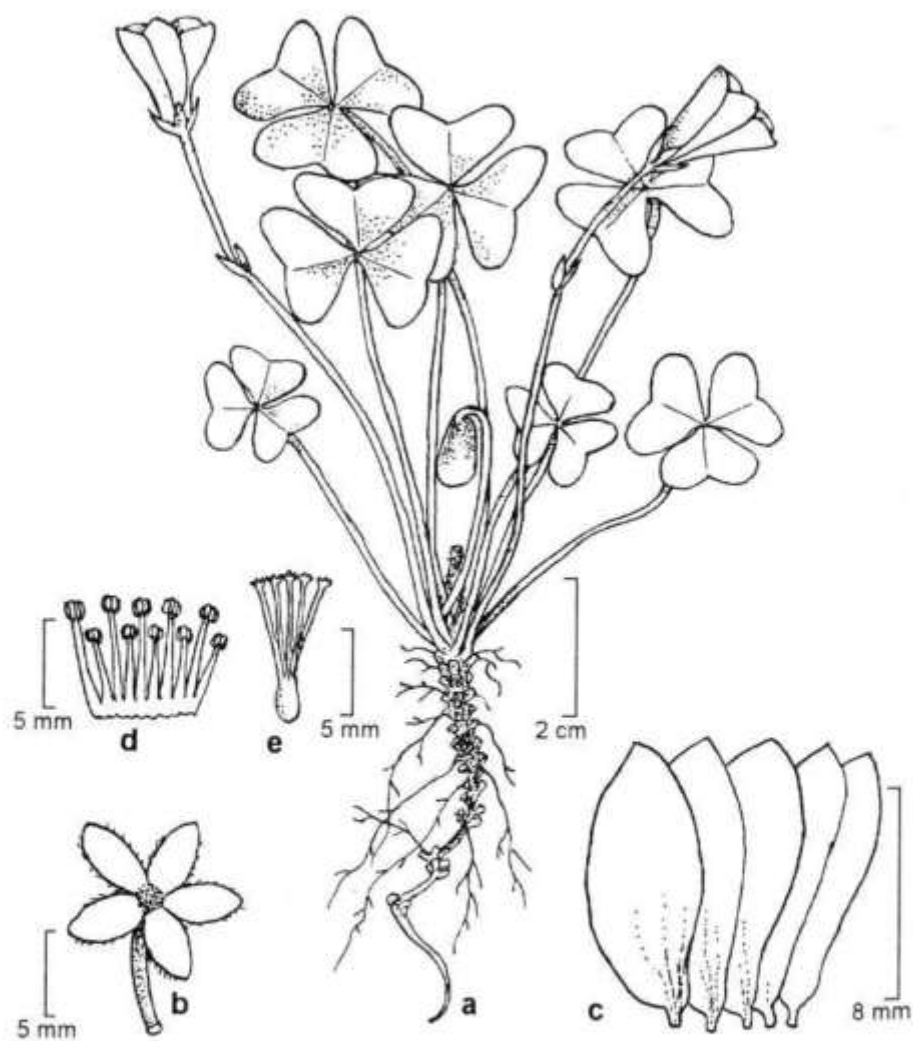


Fig. 64. *Oxalis griffithii* Edgew. & Hook.f. : a. habit; b. calyx; c. corolla; d. androecium; e. gynoecium.

9. *Oxalis pubescens* H.B.K., Nov. Gen. Sp. 5: 240. 1820; Calder in Rec. Bot. Surv. India 6(8): 333. 1919; Fyson, Fl. S. Indian Hill Stat. 74, t. 48. 1932. **Fig. 65.**

Herbs, procumbent, rooting at nodes. Leaves elongate, acute, ca 5 mm long, hairy; petioles 4 - 7 cm long, sparsely hairy; stipules oblong; leaflets 3-foliolate, unequal; median leaflet obcordate, ca 2.5 cm x 1.5 cm, membranous, very sparsely hairy above, appressed-hairy beneath. Cymes umbelliform with irregular branches with flowers arranged in a pseudo-raceme; peduncles axillary, solitary, 15 - 17 cm long, arising chiefly towards apices of stem. Pedicels hairy, 5 - 7 mm long; bracts subulate, minute, 2 - 3 mm long, pubescent. Sepals 5, lanceolate, acute, ca 4 mm x 1 mm, pubescent, membranous, persistent. Petals 5, twice as long as sepals, ca 8 mm long, connate in middle, bases and apices free, orange-yellow. Stamens 10, 5 long and 5 short, glabrous. Ovary sessile, oblong but tapering towards top, glabrous, 5-lobed, 5-locular; styles 5, erect, capillary, pubescent; stigmas 5.

Fl. & Fr. Aug. - Jan.

Distrib. India: Tamil Nadu.

10. *Oxalis variabilis* Jacq., Oxal. 89, t. 53, 1794, incl. var. *rubra*; Calder in Rec. Bot. Surv. India 6: 328. 1919; Fyson, Fl. S. Indian Hill. Stat. 74, t. 49. 1932. **Fig. 66.**

Herbs, usually acaulescent, bulbous, 6 - 12 cm high; bulbs globose, but acute at both ends, ca 1.5 cm long, dull black, shiny. Leaves 3-foliolate, 6 - 12 cm long, long petiolate; petioles slender, up to 12 cm long, with sparsely scattered shining hairs; leaflets inconspicuously pulvinate, median one large, faintly emarginate, ca 1.2 x 1.4 cm, membranous, punctate with dark glands; lateral leaflets smaller, unequal, cuneate at base. Scapes 2 - 3, ca 5 cm long; bracteoles 2, placed below middle of scape, subulate, ca 2 mm long, laxly hairy to almost glabrous. Flowers solitary, 2.5 - 3 cm long, ca 2 cm across. Sepals 5, unequal, lanceolate, 4 - 6 mm x 1 - 2 mm, pilose outside, with elongate longitudinal dark spots. Petals 5, united below into a wide funnel-shaped tube; claws short, free, densely shining hairy in bud. Stamens 10, united at base into a cup; filaments somewhat flattened, membranous, alternately long and short; long filaments ca 8 mm long, glabrous with a dorsal scale; short ones 4 - 5 mm long; anthers oblong, glabrate, 2-locular, introrse. Ovary somewhat elongate, slightly narrowed at apex, distinctly 5-lobed, glabrous, ca 3 mm long, 5-locular, ovules many in each locule; styles 5, very short, reflexed, minutely hairy; stigmas 5, lacinate.

Fl. & Fr. June - Feb.

Distrib. India: A weed in hill stations, Tamil Nadu.

Native of S. America; introduced and naturalized in many other parts of the World.

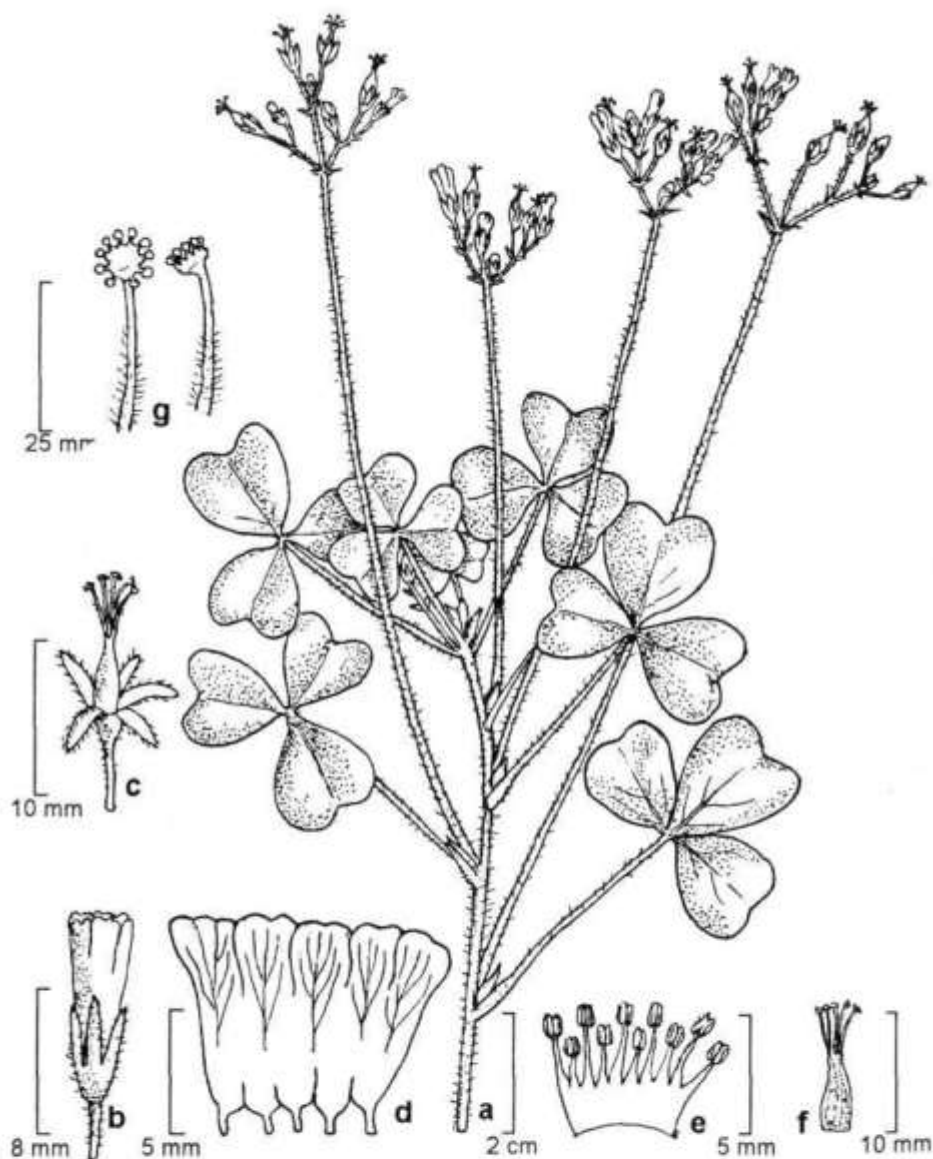


Fig. 65. *Oxalis pubescens* H.B.K. : a. habit; b. flower; c. calyx and gynoecium; d. corolla; e. androecium; f. gynoecium; h. style and stigma.

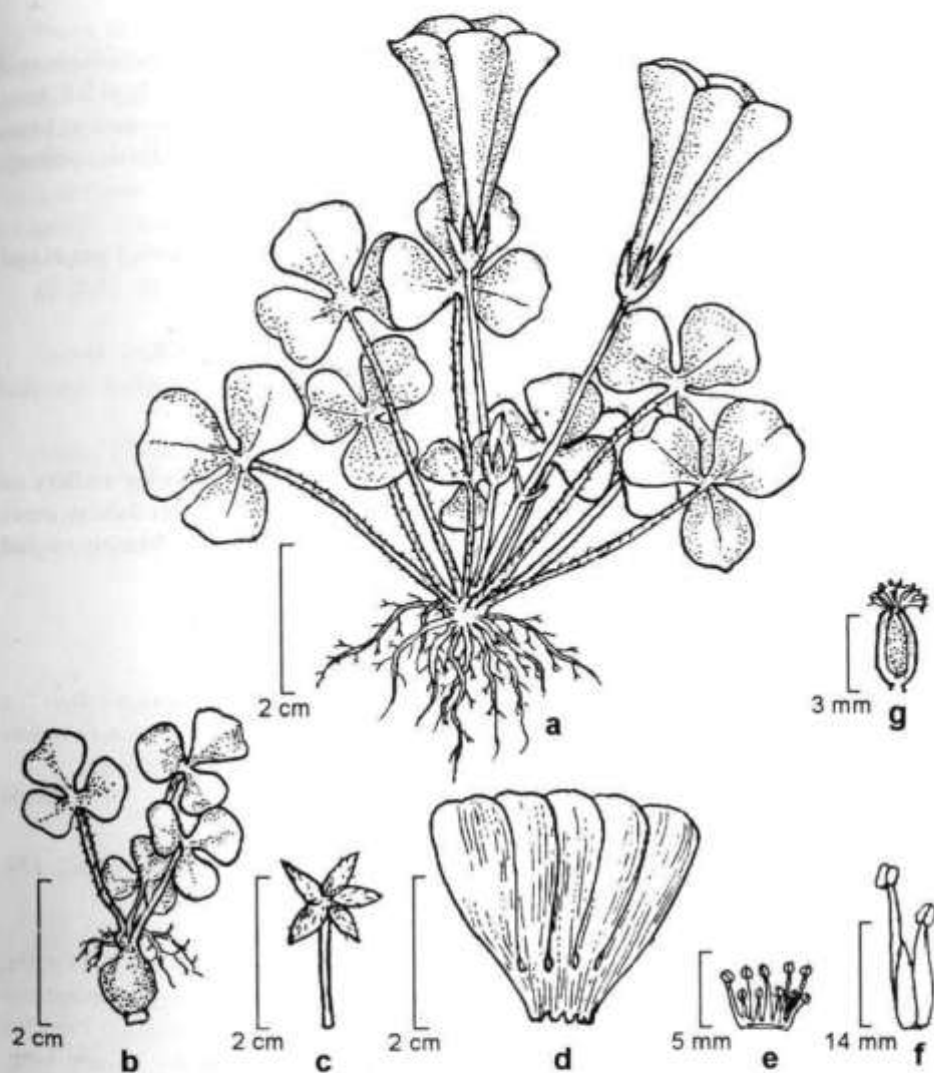


Fig. 66. *Oxalis variabilis* Jacq.: a. & b. habit; c. calyx; d. corolla; e. androecium; f. stamen; g. gynoecium.

AVERRHOACEAE

(M.K. Manna)

Trees, shrubs or lianas. Leaves alternate, odd-pinnate, exstipulate. Panicles in leaf axils or directly on stems and branches. Flowers small, regular, bisexual. Sepals 5, free. Petals 5, imbricate. Stamens 10, obdiplostemonous, filaments shortly connate at base. Ovary superior, 5-lobed, 5-locular; ovules 2 - 6 per locule, pendulous. Berries oblong; seeds arillate or exarillate.

Distrib. Malesia, Madagascar, Myanmar and S. America; ca 16 species, 1 genus and 2 species in India.

Literature. VELDKAMP, J.F. (1971) In: STEENIS, Fl. Males. ser. 1. 7(1): 151-178.

Averrhoa L.

Trees or shrubs. Leaflets subopposite, subsessile, entire. Panicles axillary or cauliflorous. Flowers in scattered, stalked loose cymes. Stamens 10, outer 5 short, inner 5 long, sometimes only 5 fertile. Disk absent, berries with acute or obtusely angled ridges; seeds arillate or exarillate.

KEY TO THE SPECIES

- 1a. Leaflets 4 or 5 pairs; panicles axillary, petals less than 5 mm long; berry with acutely angled ridges
2. A. carambola
- b. Leaflets 5 - 17 pairs; panicles cauliflorous, petals more than 5 mm long; berry with obtusely angled ridges
1. A. bilimbi

1. Averrhoa bilimbi L., Sp. Pl. 428. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 439. 1874.

Trees or shrubs up to 15 m high, hispid. Rachis 17 - 57 cm long; leaflets 5 - 17 pairs, basal and terminal pairs small, subopposite, oblong, ovate or lanceolate, acuminate or caudate, 4 - 7 x 1.5 - 2 cm, glabrescent above and pubescent beneath. Panicles cauliflorous on tubercles, pendulous, up to 20 cm long. Pedicels 4 - 16 mm long, articulate. Sepals ca 5 mm. Petals free. Stamens 10, all fertile. Ovary ca 4 mm. Fruits terete, obtusely angular; seeds up to 14, 6 - 7 x 4 - 6 mm, exarillate.

Fl. & Fr. March - May.

Distrib. India: Maharashtra, Uttar Pradesh, Bihar, Orissa, W. Bengal, Tamil Nadu, Kerala and also in some other states.

2. *Averrhoa carambola* L., Sp. Pl. 428. 1753; Edgew. & Hook. f. in Fl. Brit. India 1: 439. 1874.

Trees, ca 14 m high; branches often drooping; branchlets hispid. Leaves 3 - 5 pairs; rachis up to 20 cm long; leaflets acute to acuminate, ca 10 x 4 cm, glaucous beneath; nerves 4 - 10 pairs. Panicles axillary, ascending, up to 7 cm long. Flowers heterodistylous; pedicels 3 - 6 mm long, articulate 1 - 2 mm below calyx. Sepals ca 4 x 2 mm, bright red. Petals ca 8 x 2 mm. Stamens 10, 5 shorter stamens anantheriferous or sometimes 1 or 2 of these longer and antheriferous. Ovary elliptic, up to 2.5 mm long; ovules 3 - 5 per locule. Fruits ca 12 x 5 cm, covered by a fleshy aril; seeds up to 10, ca 12 x 5 mm.

Fl. & Fr. May - August.

Distrib. India: Cultivated; Maharashtra, Bihar, Orissa, W. Bengal, Assam, Tamil Nadu and Kerala, also in some other states.

Notes. Fruits are edible, fresh or pickled.

TROPAEOLACEAE

(M.K. Manna)

Herbs, succulent. Leaves alternate (rarely opposite), peltate, orbicular, 6.5 cm across; pedicels 20 cm or more long. Flowers ca 3 cm long. Sepals 5, 10 - 15 mm long, connate at base, usually petaloid, posterior sepals produced below into a long pointed spur. Petals 5, oblanceolate to orbicular, 3 cm long. Stamens 8, in two rows of four, free; anthers 2-celled, basifixed. Ovary 3-lobed, placentation axile; style apical, simple.

Mexico to temperate S. America; ca 92 species, one genus and one species in India.

Literature. LINNAEUS, C. (1753) Sp. Pl. 428; WOODROW (1910) Gard. Trop. (ed. 6). 206; SAULIERE (1914) List n. 720; BAILEY (1917) Encycl. Hort. 3369.

Tropaeolum L.

Herbs, succulent, tuberous, with watery juice, climbing by sensitive petioles. Leaves alternate, peltate. Flowers solitary. Calyx 5, produced into a short or long spur below; lobes imbricate. Corolla 5, upper 2 often different from lower 3, clawed, inserted on calyx. Anthers 8, basifixed; filaments filiform. Ovary 3-carpellate; style simple; stigma 3-lobed.

Tropaeolum majus L., Sp. Pl. 345. 1753; Bailey, Man. Cult. Pl. 602. f. 99. 1949.

Stems branched, climbing. Leaves peltate, 7-9 cm across; petioles 7 - 19 cm long. Flowers ca 3 cm long, in different shades of orange and yellow. Sepals 5, 10 - 15 mm long, connate at base, usually petaloid, posterior ones produced below into a long pointed spur. Petals 5, oblanceolate to orbicular, entire or undulate; anterior 3 small or usually clawed, claws with ciliate margins at base; posterior 2 perigynous and large, situated and attached to base of spur. Stamens, 8 in two rows on each side of ovary; anthers basifixed, 2-celled, oblong, 3 mm long. Ovary 3-lobed, 3-locular; ovules pendulous, one in each locule; placentation axile; style apical, simple; stigma 3, unequal, linear.

Fl. & Fr. Dec. - Jan.

Cultivated as an ornamental plant.

RUTACEAE

(K. Narayanan Nair & M.P. Nayar)

Trees, shrubs, or sometimes woody climbers, or rarely herbs, often armed with spines or prickles, aromatic, glandular with pellucid glands containing fragrant essential oil; wood often yellowish. Leaves exstipulate, alternate, opposite or whorled, pinnately compound, digitately trifoliolate, pinnatisect, uni- or bifoliolate, or simple, pellucid gland-dotted throughout or along margins of leaf/leaflet blades; petioles often articulated at base of blade (mostly as in unifoliolate leaves), cylindrical, marginate, or sometimes winged. Inflorescences terminal and/or axillary, paniculate, cymose, racemose, or rarely of solitary flower. Flowers bracteate, bracteolate, bisexual and/or functionally unisexual (mostly polygamous), more usually hypogynous, regular, or rarely irregular, often fragrant. Sepals 5 or 4, rarely 2 or 3, seldom undifferentiated, distinct or connate at base, usually imbricate, rarely valvate. Petals generally as many as and alternate with sepals, distinct, or rarely connate into a tubular corolla, imbricate or sometimes valvate, variously coloured as greenish, white, cream, yellow, or purplish, glandular or not, rarely absent. Stamens usually twice as many as the petals, generally obdiplostemonous, sometimes as many as or, 3 or 4 times as many as petals, or rarely even up to 60, sometimes one whorl reduced to staminodes; filaments distinct or sometimes monadelphous or irregularly polyadelphous; anthers dithecous, tetrasporangiate, dehiscing by longitudinal slits, often dorsifixed; connectives usually gland-tipped; pollen grains (2-) 3 - 6 (-8)-colporate, binucleate or rarely trinucleate. Disk nectariferous, intrastaminal, annular or cupulate, sometimes modified into a more or less elongated gynophore, rarely obsolete. Gynoecium of (2) 4 or 5, or rarely up to 20 carpels or sometimes only one carpel completely united to form a compound, multilocular, entire or apically indented ovary with terminal, single style, or only partly united at base or free with coherent styles, or rarely septa of carpels incompletely united into a unilocular ovary with intruded parietal placentae or sometimes reduced as pistillodes; ovules 1 or 2, or rarely many in each locule, superposed, collateral or rarely biseriate. Fruits of various types, capsular, follicular, baccate, drupaceous or hesperidia; seeds 1 or 2, or many per fruit, variable in size, shape and colour; cotyledons large, straight or curved, convolute or conduplicate; endosperm more or less abundant or rarely wanting.

Chromosome no. $x = 9$.

Tropical, subtropical and warm temperate regions of the world, but most abundant in arid zones of the southern hemisphere in Australia and S. Africa; ca 150 genera and ca 1600 species, 27 genera and 76 species in India, of which *Ruta*, *Severenia*, *Triphasia* and some species of *Citrus* are cultivated and getting naturalized; 8 species which are occasionally but exclusively cultivated in India are treated separately.

Notes. The family Rutaceae is of great economic importance as the source of citrus fruits of commerce such as the citrons, lemons, limes, oranges, pomelos (all from the

genus *Citrus*), the kumquat (*Fortunella*), and the trifoliolate orange (*Poncirus*). The aromatic herb, the 'common rue' (*Ruta*), has traditionally been known in popular medicine. The curry leaf plant (*Murraya koenigii*) is grown in several countries for its aromatic leaves that are esteemed in cooking and medicine. The East Indian satinwood tree (*Chloroxylon swietenia*) and several other trees (e.g. *Vepris bilocularis*) are valued for their timber. The Indian bael fruit tree (*Aegle mameelos*) and the wood apple (*Limonia acidissima*) provide edible fruits which possess high medicinal properties. The wampee (*Clausena lansium*) is widely cultivated in many tropical and subtropical countries including India for its delicious fruits. Rutaceae also includes many ornamental plants such as *Calodendrum capense*, *Choisya temata*, *Dictamnus albus* (dittany), *Murraya paniculata* (orange jasmine), *Triphasia trifolia* (Chinese lime berry) and *Severinia buxifolia* (box orange) which are cultivated for their glossy green foliage, sweet-scented flowers or bright attractive fruits.

Rutaceae is a heterogeneous family comprising various divergent groups, some of these with many unusual or exceptional characters. It is rather difficult to link Rutaceae with any particular related family. But, it has generally been believed that morphological, phytochemical, anatomical and palynological evidences show closer relationships with the Simaroubaceae, Meliaceae, Burseraceae and Anacardiaceae.

The most important and diagnostic character of the Rutaceae is the presence of pellucid gland dots in leaves, floral parts and fruits. These oil dots are lysigenous in origin and more usually they contain aromatic etherial oils or sometimes oil cells or scattered resin cells.

It is considered that the Rutaceae comprises 7 subfamilies and 12 tribes. In the present treatment Engler's (1931) classification is followed for the subfamilies Rutoideae, Flindersioideae and Toddaloideae while that of Swingle (1967) for the subfamily Aurantioideae.

Literature. CHAKRABORTY, D.P. (1964). Family Rutaceae : a biochemical systematic viewpoint. *Bull. Bot. Soc. Bengal* 18: 103-118. DASILVA, M.F., G.F. DAS, & F. EHRENDORFER (1988). Chemosystematics of the Rutaceae : suggestions for a more natural taxonomy and evolutionary interpretations of the family. *Pl. Syst. Evol.* 161: 97-134. ENGLER, A. (1931). Rutaceae. in ENGLER & PRANTL, (continued by HARMS, H.) *Nat. Pflanzenfam.* ed. 2, 19a : 187-358. PAKRASHI, S.C. (1964). Versatility of family Rutaceae in producing alkaloids. *Bull. Bot. Soc. Bengal* 18: 119-134. STONE, B.C. (1976) Rutaceae in: WHITEMORE, T.C. (ed.), *Tree flora of Malaya* 1: 367-387. STONE, B.C. (1985). Rutaceae. in: DASSANAYAKE, M.D. (ed.), *A revised handbook to the flora of Ceylon* 5: 406-176. STONE, B.C. & T.G. HARTLEY (1994). Supplement to the Rutaceae in peninsular Malaysia. *Gard. Bull. Straits Settlements* 34: 121-140. SWINGLE, W.T. (1944). The botany of *Citrus* and its wild relatives of the orange subfamily (Family Rutaceae, subfamily Aurantioideae). in: WEBBER, H.J. & L.D. BATCHELOR (ed.), *The Citrus Industry* 1: 129-474. SWINGLE, W.T. & P.C. REECE (1967). The botany of *Citrus* and its wild relatives of the orange subfamily (Family Rutaceae, subfamily Aurantioideae) in REUTHER, W., WEBBER, H.J. & L.D. BATCHELOR (ed.), *The Citrus Industry* 1: 190-430. TANAKA, T. (1930). Enumeration of Indian species of Rutaceae - Aurantioideae

(Revisio Aurantiacearum VI). *J. Bot.* 68: 225-236. TANAKA, T. (1936). The taxonomy and nomenclature of Rutaceae - Aurantioideae. *Blumea* 2: 101-110. TANAKA, T. (1937). Further revision of Rutaceae - Aurantioideae of India and Ceylon (Revisio Aurantiacearum VIII). *J. Indian Bot. Soc.* 16: 227-240. UMA DEVI, I., M. DANIEL & S.D. SARNIS (1990). Chemotaxonomy of some Rutaceae. *Indian J. Bot.* 13: 23-28. WATERMAN, P.G. (1975). Alkaloids of the Rutaceae: their distribution and systematic significance. *Biochem. Syst. Ecol.* 3: 149-180. WATERMAN, P.G. (1990). Chemosystematics of the Rutaceae - Comments on the interpretation of Da Silva & al. *Pl. Syst. Evol.* 173: 39-48.

KEY TO THE SUBFAMILIES

- 1a. Carpels usually 4 or 5, often united only by the styles above but free below; fruits follicles or capsules, splitting along the upper suture (loculicidal) with a detached endocarp 3. **Rutoideae**
- b. Carpels 2 - 20, completely or sometimes incompletely united; fruits not as above, dry or fleshy, indehiscent (except in subfamily Flindersioideae) 2
- 2a. Carpels 3 - 5, united, each locule with 2 - 8 ovules in 2 rows; fruits loculicidal or septicial capsules with an adherent endocarp; seeds winged 2. **Flindersioideae**
- b. Carpels 2 - 20, completely united or nearly so, each locule with 1 or 2 ovules (rarely more); fruits drupaceous or baccate; seeds not winged 3
- 3a. Carpels 2 - 5, rarely only one developing, fully united or sometimes only incompletely united; fruits 2 - 4 drupelets united only at the base or a complete 2 - 5-locular single drupe; seeds endospermous 4. **Toddalioidae**
- b. Carpels 2 - 20, completely united; fruits baccate or hesperidia, with a glandular leathery or woody pericarp, with more or less juicy or mucilaginous pulp with or without pulp-vesicles; seeds nonendospermous 1. **Citroideae**

Subfamily 1. CITROIDEAE

KEY TO THE TRIBES

- 1a. Twigs never spiny; leaves usually pinnate with alternate leaflets attached to a non-articulate rachis; rarely trifoliolate or unifoliolate or simple; ovary 2 - 6-locular with 1 or 2 ovules in each locule; fruits small, without pulp-vesicles, semidry or slightly juicy 1.2. **Clauseneae**
- b. Twigs of young plants often with axillary, single or paired spines; leaves usually pinnate with leaflets often opposite, attached to an articulate rachis, or sometimes tri- to unifoliolate or simple; ovary usually 2 - 5-locular with 1 or 2 ovules in each locule (rarely 6 - 18- or up to 20-locular with 4 - 18 ovules); fruits small to large, usually juicy with well developed pulp-vesicles, or rarely with rudimentary pulp bodies; pericarp thin, soft (as in *Severinia buxifolia* and *Triphasia trifolia*) or glandular-leathery (*Atalantia* and *Citrus*) or woody (*Aegle* and *Limonia*) 1.1. **Citreae**

Tribe 1.1. CITREAE

KEY TO THE GENERA

- 1a. Woody climbers, stem with recurved spines in leaf axils 2
- b. Trees or erect shrubs, stem with straight spines in leaf axils 3
- 2a. Mature leaves trifoliolate on long and stiff petioles; inflorescence racemose or paniculate 5. **Luvunga**

- b. Mature leaves unifoliolate (or simple) on short, slender and twisted petioles; inflorescence more usually solitary or in 2- or 3-nate clusters **9. Paramignya**
- 3a. Fruits larger, up to 15 cm across, with a thick, hard and woody pericarp; seeds woolly-pubescent 4
- b. Fruits small to large (up to 12 cm across or more as in some species of *Citrus*), with a thin or soft skin or a coriaceous, glandular pericarp; seeds glabrous 5
- 4a. Leaves imparipinnate; petioles and rachis marginate or narrowly winged; leaflets 5 or 7, smaller (ca 3 x 2 cm); stamens 10 - 12; filaments free, woolly-pubescent below; ovary incompletely septate, unilocular with 5 or 6 parietal placentae **4. Limonia**
- b. Leaves pinnately trifoliolate; petioles wingless; leaflets up to 13 x 7 cm; stamens many (30 - 40); filaments irregularly united at base, glabrous; ovary 8 - 12 (-20)-locular with many, biseriate ovules **1. Aegle**
- 5a. Fruits thin-skinned soft berries; locules filled with mucilaginous gum without pulp-vesicles 6
- b. Fruits with an outer leathery glandular pericarp; locules with or without pulp-vesicles, semidry or juicy 7
- 6a. Leaves simple; berries purplish, turning black when ripe **11. Severenia**
- b. Leaves trifoliolate; berries deep reddish when ripe **12. Triphasia**
- 7a. Leaves imparipinnate; leaflets smaller, sessile, opposite; petiole and rachis winged; fruits bluish-black when ripe **7. Naringi**
- b. Leaves simple, or tri- or unifoliolate; leaflets larger, petiolulate; petioles wingless or narrow to broadly winged; fruits orange or lemon-like when ripe 8
- 8a. Leaves simple, thick, fleshy with rather indistinct venation; fruits without pulp-vesicles 9
- b. Leaves uni- or trifoliolate, thin, moderately coriaceous, with rather prominent venation; petioles articulate; fruits with rudimentary or well developed pulp-vesicles 10
- 9a. Inflorescence of a solitary flower (rarely in pairs), axillary; fruits strongly angled, triangular in cross section, tapering above, 3-locular **6. Merope**
- b. Inflorescence a raceme or panicle, few- to many-flowered, axillary or pseudoterminal; fruits globose, obtuse to rounded above, 5- or 4-locular **8. Pamurus**
- 10a. Stamens 4 or more times as many as the petals, often irregularly polyadelphous; ovary 8 - 20-locular with 4 or more ovules in each locule; fruit a hesperidium **3. Citrus**
- b. Stamens twice as many as the petals, often free (rarely polyadelphous); ovary 2 - 5-locular with 1 or 2 ovules in each locule; fruit a juicy berry resembling small-sized lemons or oranges 11
- 11a. Leaves unifoliolate; petioles wingless; leaflet blades with many, close, parallel secondary veins connected with fine reticulate tertiary veinlets **2. Atalantia**
- b. Leaves tri- or unifoliolate; petioles winged; leaflet blades with fewer, prominent secondary veins with inconspicuous veinlets **10. Pleiospermium**

Tribe 12. CLAUSENEAE

KEY TO THE GENERA

- 1a. Petals valvate; ovary locules twisted along their radial walls; cotyledons thin, folded **15. Micromelum**
- b. Petals imbricate; ovary locules not twisted; cotyledons thick, fleshy, plano-convex 2
- 2a. Buds densely covered with rusty reddish brown hairs; leaves imparipinnate with 5 - 7, or 2 or 3 equilateral leaflets or rarely unifoliolate or simple; style very short, often not clearly demarcated from ovary, persistent **14. Glycosmis**

- b. Buds glabrous or if pubescent the hairs grey or whitish; leaves imparipinnate with 5 to 9 or more than 15, sometimes up to 27, asymmetric leaflets; style as long as or longer than ovary, distinctly demarcated from ovary, often caducous (rarely persistent) 3
- 3a. Flowers ca 6 mm long (ripe buds), subglobose in bud; staminal filaments much dilated and hollow at base; ovary borne on a distinct, hourglass-shaped gynophore 13. *Clausena*
- b. Flowers 8 - 15 mm long (ripe buds), cylindrical or long-ovoid in bud; staminal filaments linear-subulate; ovary borne directly on an annular or cylindrical fleshy disk 16. *Murraya*

Subfamily 2. FLINDERSIOIDEAE

Tribe 2.1. FLINDERSIAE

17. *Chloroxylon*

Subfamily 3. RUTOIDEAE

KEY TO THE TRIBES

- 1a. Perennial herbs, often with a woody stem, or rarely shrubs; flowers bisexual, regular or slightly irregular as in *Dictamnus*; ovary with more than 2 ovules in each locule (except in *Ruta* subgen. *Haplophyllum*); embryo usually curved 3.1. *Ruteae*
- b. Trees or shrubs, or climbers; flowers often functionally unisexual or bisexual, regular; ovary usually with 2 ovules in each locule, seldom more than 2; embryo flat 3.2. *Zanthoxyloae*

Tribe 3.1. RUTEAE

KEY TO THE GENERA

- 1a. Leaves pinnatisect; flowers yellow 20. *Ruta*
- b. Leaves pinnately compound; flowers white or pink 2
- 2a. Leaves bi- or tripinnately compound with smaller, more or less entire leaflets; inflorescence a leafy, compound panicle; flowers regular, white; carpels borne on a gynophore of varying length 18. *Boeninghausenia*
- b. Leaves unequally simple pinnate with medium-sized, serrulate leaflets; inflorescence racemose; flowers irregular, white with pinkish stripes; carpels sessile 19. *Dictamnus*

Tribe 3.2. ZANTHOXYLEAE

KEY TO THE GENERA

- 1a. Stem and leaf stalks with recurved or conical prickles; leaves alternate 23. *Zanthoxylum*
- b. Stem and leaf stalks unarmed; leaves opposite 2
- 2a. Leaves digitately trifoliolate or unifoliolate 21. *Melicope*
- b. Leaves imparipinnately compound with 3 - 13 leaflets 22. *Tetradium*

Subfamily 4. TODDALIOIDEAE

Tribe TODDALIEAE

KEY TO THE GENERA

- 1a. Leaves opposite; flowers usually bisexual 24. *Acronychia*

- b. Leaves alternate; flowers usually functionally unisexual 2
- 2a. Stem, leaves, leaf stalks and sometimes peduncles prickly 26. *Toddalia*
- b. Stem, leaves, leaf stalks and peduncles unarmed 3
- 3a. Leaves simple with rather indistinctly reticulate venation; petals 4 or 5; stamens as many as petals 25. *Skimmia*
- b. Leaves digitately trifoliolate or unifoliolate; leaflets with very many (20 - 40 pairs), distinct, parallel, secondary veins, finely reticulate; petals 2 or 3; stamens 6 27. *Vepris*

Subfamily 1. CITROIDEAE

Tribe 1.1. CITREAE

1. *Aegle* Correa, nom. cons.

Unispecific.

Aegle marmelos (L.) Correa in Trans. Linn. Soc. London 5: 223. 1800; Hook.f., Fl. Brit. India 1: 516. 1875. *Cratava marmelos* L., Sp. Pl. 444. 1753. *Aegle marmelos* (L.) Correa var. *mahurensis* Zate in Indian J. For. 5: 35. 1982.

Beng., Hindi & Mar.: *Bel*, *Sriphal*; Guj.: *Bil*; Kan.: *Bilpatre*; Mal.: *Kovalam*; Sans.: *Bilva*; Tam.: *Vilvam*; Tel.: *Maredu*.

Trees, deciduous, up to 12 m high, sometimes up to 20 m, armed; main trunk ca 30 cm across; branchlets cylindrical when old, slightly angular when young, armed with straight, stout, sharp, solitary or paired, axillary spines (ca 4 cm long), puberulent to glabrous; bark bluish-grey, irregularly broken on older stems. Leaves alternate, pinnately trifoliolate, occasionally also 5-foliolate, dimorphic; petioles slender, to 6 cm long, glabrous or puberulous when young; leaflets ovate-elliptic or elliptic-lanceolate, terminal ones ca 13 x 6.5 cm; the laterals ca 7 x 4 cm, oblique at base, tapering into a bluntish tip at apex, shallowly crenate-serrulate along margins, thin, membranous to chartaceous, pale green on both surfaces, profoundly glandular-punctate, glabrous; petioles of lateral leaflets obsolete to ca 3 mm long, puberulent or glabrous; terminal leaflet often on an extension of rachis to 2 cm long, articulated, sometimes short, ca 7 mm long. Inflorescences axillary and terminal, racemose or cymose, few-flowered, up to 5 cm long; peduncles densely puberulent; pedicels 2 - 4 mm long, densely puberulent. Flowers subglobose in bud, fragrant. Calyx cupular with 5 small deltate or suborbicular teeth, finely puberulent, caducous. Petals 4 or 5, ovate-oblong, obtuse, ca 12 x 6 mm, coriaceous, glandular, glabrous, greenish-white. Stamens numerous, 30 - 40 (-45) in irregular 2 or 3 series, free or irregularly coherent at base, unequal; filaments subulate, ca 7 mm long, glandular, glabrous; anthers linear-oblong, apiculate, ca 8 mm long. Disk cylindrical, ca 1 mm high, greenish, glabrous. Ovary ovoid-oblong, 3.5 - 5 mm long, faintly ridged, glabrous, greenish, 8 - 12 (-20)-locular; locules with many biseriate ovules; style very short, glabrous; stigma cylindrical or bluntly conical, longitudinally grooved, light greenish, often sticky. Fruits subglobose or oblate, 5 - 10 cm across, 8 - 20-locular;

pericarp hard, woody, grey or yellowish, depressed above, many seeded; seeds oblong, flattened, acuminoid, large, mono- or polyembryonic, embedded in a sweet, thick, orange or flesh-coloured mucilaginous pulp; testa white, woolly-pubescent.

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

Distrib. India: Moist deciduous forests in the subtropical W. Himalayas at elevations up to 1200 m; also in C. and S. India. Jammu, Himachal Pradesh, Uttar Pradesh, Punjab, Rajasthan, Bihar, W. Bengal, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Kerala and Andaman Islands.

Myanmar and Sri Lanka. Widely cultivated in S. E. Asia, Malesia, tropical Africa and the United States.

Notes. Root and root bark are highly medicinal and used for the cure of intermittent fever. Leaves are used in the treatment of ophthalmia. Diluted fresh juice extracted from leaves is applied in catarrhs and fever. Unripe fruits are astringent, stomachic, digestive and good remedies for chronic diarrhoea and dysentery. Ripe fruits are sweet, nutritious and cooling. The pulp of ripe fruits is used for preparing a sherbet which is effective in dyspepsia. The mucilaginous substance surrounding the seeds is an adhesive which is used as a varnish for pictures and water-colour paints.

Leaves, stem bark, root, fruit and seeds contains essential oils, chiefly 'marmalolin' (Dixit & Dutta in J. Indian Chem. Soc. 9: 271. 1932).

Wood is not durable but used for making pestles for oil and sugar mills, naves and other parts of carts and also for agricultural implements.

The plants can be grown as slow growing fence in warmer countries as they can endure a fair degree of coldness (Howe in Kew Bull. 1946: 59. 1946).

The Hindus regard this plant as sacred and its leaves are used for various rituals. It is often grown in and around Shiv Temples in India.

2. *Atalantia* Correa, nom. cons.

Shrubs or small trees, armed or sometimes unarmed. Leaves alternate, foliolate or rarely simple; blades shiny, coriaceous, prominently nerved with frequent reticulations between lateral nerves; petioles short, horizontally grooved above, wingless, often articulated with the base of leaflet blade. Inflorescences axillary or rarely terminal, fascicled or racemose or corymbose to umbelliform or paniculate. Flowers medium to large, short- or long-pedicellate, fragrant. Calyx usually of 3 - 5 sepals or sometimes irregularly 2- or 4-lobed. Petals 4 or imbricate. Stamens 6 - 10, free or monadelphous or irregularly fused at base; anthers small, ovoid. Disk annular, sometimes lobed, fleshy.

Ovary ovoid, oblong to subglobose, glabrous, 3-5-locular, each locule with 1 or 2 ovules; style cylindrical, as long as or longer than ovary, glandular, glabrous; stigma capitate, subglobose or truncate, lobed, in some species with stylar canals corresponding to number of locules. Fruit a berry resembling small sized lemons, subglobose to globose, yellowish when ripe, 2-5-locular, each locule with few-many conical pulp vesicles with tapering acute apex and facing the inner angle of locule; the pericarp thin, glandular; seeds 2-4, oblong-ellipsoid occasionally polyembryonic; cotyledons green.

Tropical forests of India, Sri Lanka, Myanmar, S. China, Cambodia, Laos, Vietnam, Malasia and Sumatra; ca 11 species, 4 in India.

KEY TO THE SPECIES

- 1a. Calyx hollow or cupular rupturing into 2-4 irregular scarious lobes at anthesis; stamens fused into a staminal tube at 2/3 or 3/4 of its entire length, free above; inflorescence corymbose or umbelliform
1. *A. monophylla*
- b. Calyx differentiated into normal sepals; stamens monadelphous into a complete tube almost throughout their entire length or irregularly united or all free; inflorescence racemose or fascicled 2
- 2a. Leaflets shallowly narrowed at base, caudate-acuminate at apex; stamens free 3. *A. simplicifolia*
- b. Leaflets cuneate, obtuse or rounded at base, obtuse, acute, or acuminate at apex; stamens monadelphous or irregularly united 3
- 3a. Fruits ellipsoid or fusiform with few pulp-vesicles 4. *A. wightii*
- b. Fruits globose or subglobose with abundant pulp-vesicles 2. *A. racemosa*

1. *Atalantia monophylla* (L.) DC., Prodr. 1: 535. 1824; Hook.f., Fl. Brit. India 1: 511. 1875; Nicolson et al. in Regnum Veg. 119: 231. 1988. *Limonia monophylla* L., Mant. Pl. 237. 1775. *Malnaregam malabarica* Raf., Sylv. Tellur. 143. 1838 (as *Malnarega*) nom. rej. *Atalantia floribunda* Wight, Icon. Pl. Ind. Orient. 4: t. 1611. 1850. *A. malabarica* (Raf.) Tanaka in J. Indian Bot. Soc. 16: 233. 1937, nom. illegit.

Large ramous shrubs or medium-sized trees, 3-13 m high; branchlets woody, cylindrical, usually with single, axillary, stout spine (up to 2 cm long), or occasionally unarmed, pubescent or densely hairy, soon becoming glabrous; bark grey, lenticellate. Leaves unifoliolate; stipuloid paraphylls at leaf axils awl-shaped; petioles up to 1 cm long; leaflet blades ovate to ovate-lanceolate or elliptic to elliptic-oblong, 2-13 x 1-6 cm, obtuse, emarginate at apex, broadly cuneate at base, entire along margins, dark green and glossy above, pale green beneath, coriaceous, glabrous; secondary nerves 8-14 pairs, slender, faint above, prominent beneath, spreading, finely reticulate. Inflorescences axillary, racemose, corymbose or umbelliform, shorter or longer than leaves; peduncle slender, puberulous or glabrous; bracteoles subulate, ca 1.5 mm long, hairy, caducous. Pedicels more or less equal in length, slender, filiform, 8-15 mm long, puberulous or glabrous. Flowers ovoid or oblong in bud, widely opening, up to 2 cm

across, scented. Calyx cupular, splitting irregularly into 2, or sometimes 3 or 4 irregular lobes at anthesis; lobes obtuse, 0.5 - 1.5 mm long, densely puberulent to glabrous, persistent. Petals 4 or 5, white, oblong-elliptic, rounded at apex, clawed below, ca 10 x 4 mm, midnerve prominent, glabrous. Stamens 8 or 10, alternately short and long, united into a tube almost 3/4 of their entire length, glabrous; anthers ovoid, ca 1 mm long, yellowish. Disk annular, obscurely 8- or 10-lobed, ca 1 mm high, ca 1.5 mm, fleshy, whitish. Ovary ovoid, 2.5 - 4 x 1 - 1.5 mm, smooth, 3- or 4-locular; each locule with 1- or 2- ovules; style as long as ovary, cylindric, ending in an irregularly 3- or 4-lobed capitate stigma, caducous. Berries globose, 2-5 mm, greenish-yellow, 3- or 4-locular; each locule filled with many, sessile, cuneate, distally tapering pulp- vesicles; rind densely glandular; seeds usually one per berry.

KEY TO THE VARIETIES

- 1a. Leaflet blades 2 - 8 x 1 - 4 cm; fruits up to 2 cm across
 b. Leaflet blades 6 - 15 x 3 - 6 cm; fruits 3 - 5 cm across

- 1.2. var. *monophylla*
 1.1. var. *macrophylla*

1.1. var. *macrophylla* Oliver in J. Linn. Soc., 5. Suppl. 2: 24. 1861; Hook. f., Fl. Brit. India 1: 512. 1875. *Atlantia macrophylla* (Oliver) Kurz in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 136. 1875.

Fig. 67.

Fl. Aug.-Feb.; Fr. Feb.-July.

Distrib. India: Coastal forests of Andaman & Nicobar Islands.

Myanmar, Bangka Islands and Java.

Notes. The original status of this taxon as a variety is recognized here. It represents a larger form with magnificent growth habit, stout pedicels, and larger leaflets and berries. Otherwise it shares many characters with typical var. *monophylla*.

1.2. var. *monophylla*

Fig. 67.

Kan.: *Kadunimb*; Mal.: *Kattunaregam*; Mar.: *Makad-limbu*; Or.: *Kattanarangi*; Sans.: *Atavi-jabira*; Tam.: *Kattelumichai*; Tel.: *Yerramunukudu*, *Adavi-nimma*; U r.: *Kattanarunga*.

Fl. Aug.-Feb., peak in Nov.-Dec.; Fr. Feb.-July.

Distrib. India: In coastal scrub jungles or moist or dry deciduous forests up to 1325 m. Common in western parts of peninsular India, throughout Eastern Ghats. Rather

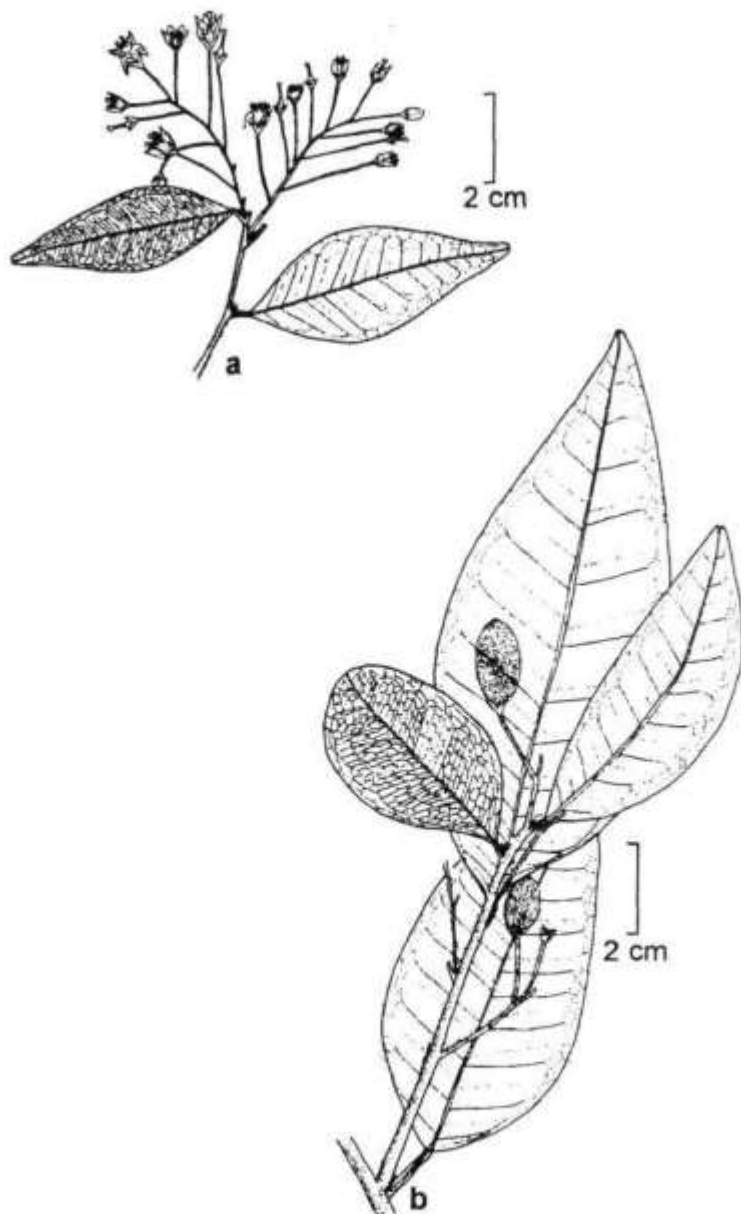


Fig. 67. a. *Atalantia monophylla* (L.) DC. var. *monophylla*; b. *A. monophylla* (L.) DC. var. *macrophylla* Oliver.

scarce on W. Ghats. Madhya Pradesh, Maharashtra, Orissa, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Andaman Islands.

Sri Lanka, Myanmar, Thailand, Vietnam, Laos, Cambodia and Malesia.

Notes: Wood which is hard and close-grained, is used for cabinet work and furniture. Because it is strong and shock-resistant, wood is also recommended for camp furniture. Berries are pickled. They yield an oil which is used in native medicine for chronic rheumatism and paralysis. Fresh leaves are applied as an antidote to snake bite.

2. *Atalantia racemosa* Wight in Hooker's J. Bot. Kew Gard. Misc. 1: 64, t. 122 (Jan.) 1834; Hook.f., Fl. Brit. India 1: 512. 1875. *Sclerostylis atalantioides* auct. non Wight & Arn. 1834; Wight, Icon. Pl. Ind. Orient. 1: t. 71. 1838. *S. racemosa* Wight, Ill. Ind. Bot. 1: 109. 1840. *S. parviflora* Wight, l.c. **Fig. 68.**

Shrubs or medium trees, 2 - 15 m high; branchlets cylindrical, glabrous or minutely puberulous, often armed with strong, axillary spines (up to 2.5 cm long), or rarely unarmed; bark greenish to brown, smooth or longitudinally striate, lenticellate. Leaves unifoliolate; petioles 5 - 10 mm long, shallowly channelled above or obscurely margined, articulate above at base of blade, puberulent to glabrous; leaflet blades ovate-oblong to oblong-elliptic or obovate, cuneate at base, obtuse or shortly acuminate at apex with ca 5 mm long acumen, crenulate or subentire along margins, 4.5 - 9.5(-16) x 2 - 4.5 cm, dark green above, pale beneath, coriaceous, glabrous, emarginate tip; secondary nerves 8 - 22 pairs, oblique, anastomosing, finely reticulate. Inflorescences terminal and axillary racemes; peduncles single or sometimes fascicled, up to 4 cm long, pubescent or glabrous; bracteoles subulate, minute, ciliolate; pedicels slender, 3 - 8 mm long, shortly pubescent to glabrous. Sepals 3 - 5, triangular to suborbicular, subacute, ca 1.5 mm long, scarious and ciliate along margins. Petals usually 4, broadly elliptic or linear-oblong to obovate, obtuse, 6 - 8 x 2 - 4 mm, glandular, penninerved, glabrous, white. Stamens usually 8, as long as or slightly longer than petals; filaments usually connate into a partial basal tube, occasionally 1 or 2 free; anthers ovoid or oblong, cordate at base, 1 - 2 mm long, subdorsifixed. Disk annular, ca 0.5 mm high, ca 1.5 mm fleshy, glabrous. Ovary ovoid or subglobose, 1 - 2 mm long, glandular or not, with or without styler canals, glabrous, 2- or 3-locular; each locule with 2 ovules; style short, ca 1.5 mm long, glabrous; stigma capitate. Berries globose, 2- or 3-locular, up to 2 cm, 2-seeded, orange-coloured when ripe.

KEY TO THE VARIETIES

- 1a. Secondary nerves in leaflets 8 - 12 pairs; stigma capitate without styler canals; ovary eglandular **2.2. var. racemosa**
- b. Secondary nerves in leaflets 12 - 22 pairs; stigma not clearly distinguished from style, with styler canals corresponding to the number of locules; ovary glandular **2.1. var. bourdillonii**

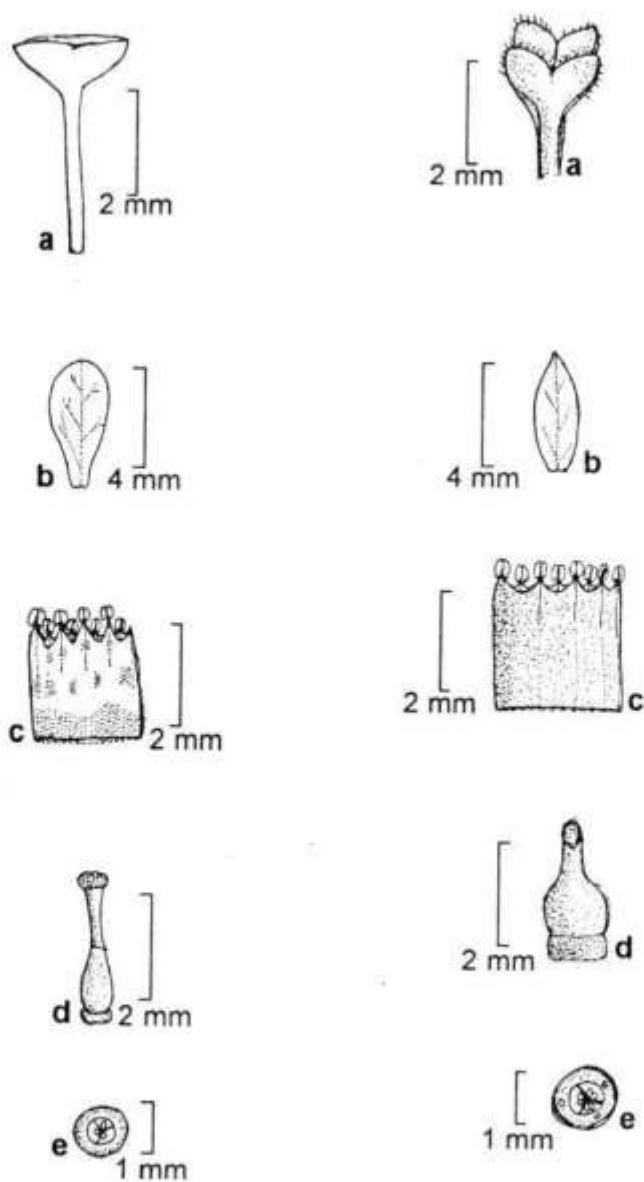


Fig. 68. Comparison of floral parts in *Atalantia monophylla* (L.) DC. and *A. racemosa* Wight.

2.1. var. *bourdillonii* Narayanan & Nayar in Indian J. For. 13: 69. 1990. **Fig. 69.**

Fl. Dec. - April.

Distrib. India: In evergreen forests of southern W. Ghats, at 600 m. Karnataka, Tamil Nadu and Kerala.

2.2. var. *racemosa*

Tam.: *Kattunaregam*

Fl. Oct.-April; Fr. April onwards.

Distrib.: India: In semievergreen forests of W. Ghats, up to 1370 m. Maharashtra, Karnataka, Kerala and Tamil Nadu.

Sri Lanka.

3. *Atalantia simplicifolia* (Roxb.) Engl. in Engl. & Prantl, Nat. Pflanzenfam. 3(4): 192. 1896; ed. 2, 19a: 328. 1931 excl. descr. *A. simplicifolia* (Roxb.) Tanaka in J. Bot. 68: 232. 1930, comb. superfl. *Amymis simplicifolia* Roxb., Fl. Ind. 2: 244. 1832. *Sclerostylis roxburghii* Wight, Icon. Pl. Ind. Orient. 1: 72. 1840. *Atalantia roxburghii* (Wight) Oliver in J. Linn. Soc., Bot. 5. Suppl. 2: 25. 1861. *A. caudata* Hook.f., Fl. Brit. India 1: 513. 1875. *A. roxburghiana* Hook.f., l.c., p.p., excl. specim. Griffith. **Fig. 70.**

Shrubs or small trees, up to 5 m high; branchlets slender, cylindric, glabrous. Leaves unifoliolate; petioles 5 - 10 mm long, horizontally grooved above, articulate with base of blade, glabrous; leaflet blades elliptic-lanceolate or elliptic-oblong, shallowly narrowed at base, caudate-acuminate at apex with 10 - 15 mm long acumen, entire along margins, 7.5 - 13.5 x 2.5 - 5.2 cm, coriaceous, glabrous, notched at tip; secondary nerves ca 10 pairs with as many fainter ones in between arising at angles 50 - 60° with the midnerve, finely reticulate. Inflorescences axillary racemes, up to 2.5 cm long, few-flowered, glabrous; pedicels slender, ca 7 mm long, glabrous. Flowers small. Calyx small with 4 minute, acute sepals. Petals 4, obovate-oblong. Stamens 8, free; anthers ovoid. Ovary seated on an annular disk, 2-locular; each locule with 2 collateral ovules; stigma subcapitate. Berry globose, glandular, 2-locular, young (unripe) fruits ca 10 x 8 mm.

Distrib. India: So far known only from a few sporadic collections made in N.E. India : Assam (Cachar hills), Meghalaya (Khasi hills), Mizoram (Lushai hills) and Nagaland (Naga hills).

Notes. The name *Atalantia simplicifolia* (Roxb.) Engl. is retained here for this species, although Engler had erroneously applied it to a different taxon, *Atalantia roxburghiana* Hook.f. The latter is reported to occur in S.E. China, Thailand, Indo-

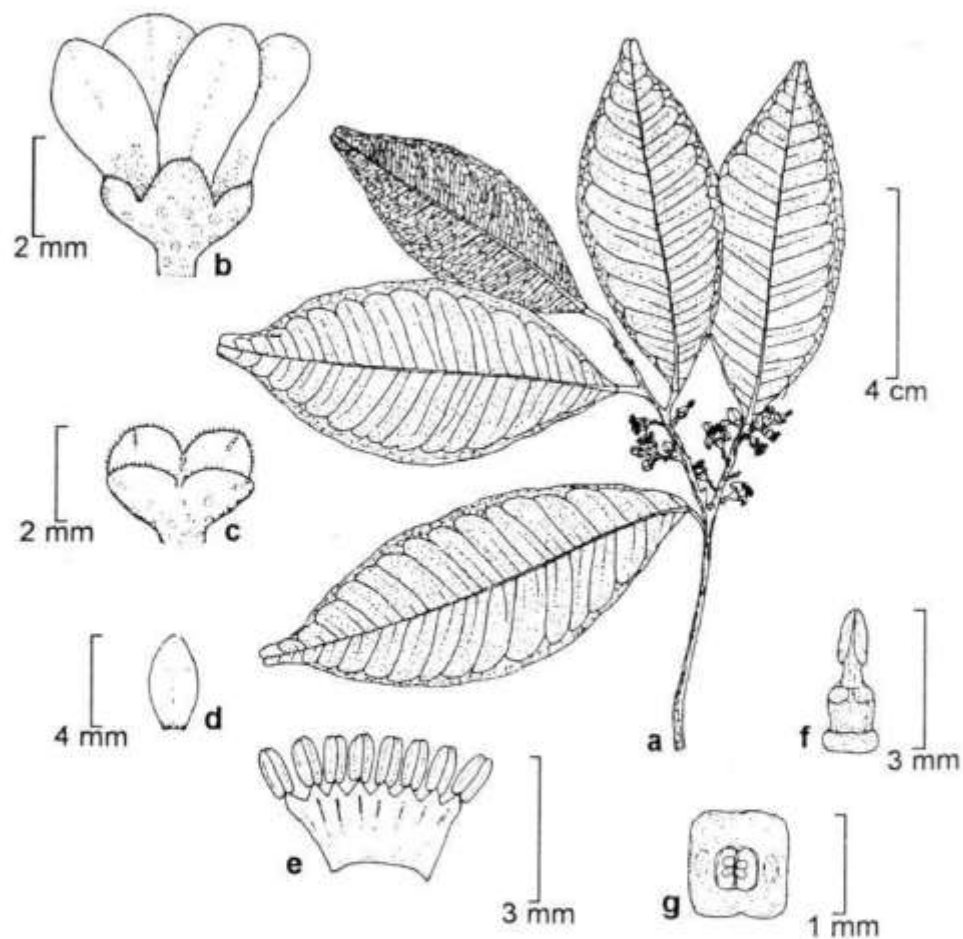


Fig. 69. *Atalantia racemosa* Wight var. *bourdillonii* Narayanan & Nayar: a. Habit; b. flower (half-opened); c. calyx; d. petal; e. stamens; f. pistil; g. c.s. of ovary.

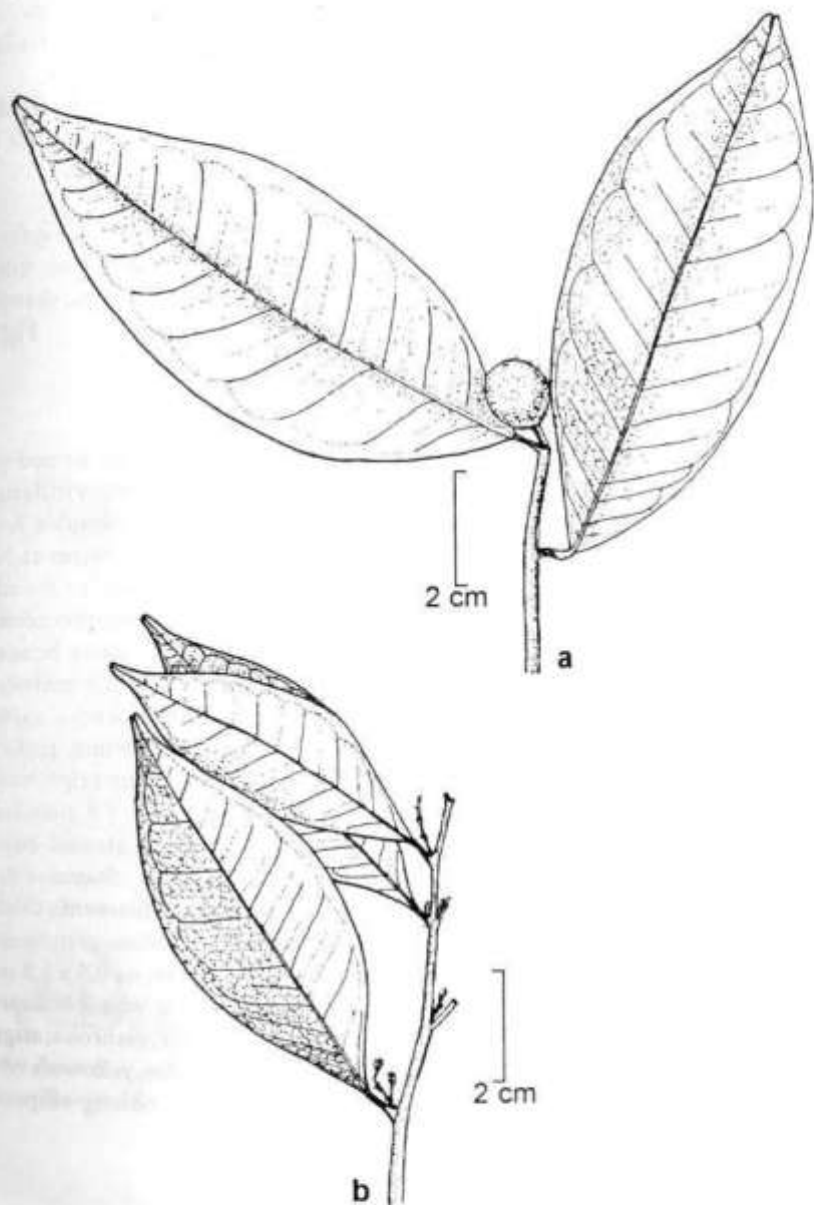


Fig. 70. *Atalantia simplicifolia* (Roxb.) Engl.: a. branchlet with fruit; b. flowering twig.

China, Malay peninsula and Sumatra, and is distinct from *Atalantia simplicifolia* in having unusually larger leaves (9-21 x 2-4 cm) with acute or abruptly acuminate leaflets.

It is interesting to note that although the type of *Amyris simplicifolia* Roxb. (BM) is reported to have been taken from a plant brought from Pulo-Penang (Malaya), it has not been found again or reported anywhere near Penang (Swingle 1967: 322).

4. *Atalantia wightii* Tanaka in Bull. Soc. Bot. France 75: 714. 1928. *A. ceylanica* (Arn.) Oliver in J. Linn. Soc. Bot., 5. Suppl. 2: 25. 1861, p.p., excl. basionym, quoad tantum specim. Nilgiri (Hb. Hook.); Hook.f., Fl. Brit. India 1: 512. 1875, p.p.; Gamble, Fl. Pres. Madras 160. 1957. Fig. 71.

Kan.: *Kadumbi*.

Shrubs or small trees, 4-10 m high; branchlets woody, cylindric, usually armed with axillary, strong, sharp spines (ca 3.5 cm long) or sometimes unarmed, minutely to densely puberulent to glabrous; bark greenish, lenticellate. Leaves 1-foliolate; petioles 5-10 mm long, horizontally grooved or obscurely marginate above, articulate above at base of blade, glabrous; leaflet blades ovate-oblong or elliptic-lanceolate, obtuse to rounded or cuneate at base, acute at apex with emarginate tip, entire or rarely obscurely crenate along margins, 5.5-15.5 x 2.5-6 cm, coriaceous, dull green above, paler beneath, glabrous; secondary nerves 10-18 pairs, arising at angles 60-70° with the midnerve, prominently raised beneath, anastomosing, finely reticulate. Inflorescences axillary racemes or fascicles, few- to several-flowered, up to 2 cm long, glabrous; pedicels slender, 4-7 mm long, glabrous. Flowers medium-sized, ca 7 mm long (ripe buds), fragrant. Calyx deeply 4-lobed; sepals ovate, acute or subacute, ca 1.5 mm long, glandular, ciliate along margins. Petals 4, oblong or elliptic-ovate, acute, clawed below, ca 6 x 4 mm, 3-5-nerved, white or pale yellowish, glandular, glabrous. Stamens 8, all distinct or sometimes cohering in groups near base, 3.5-5.5 mm long; filaments dilated at base, abruptly narrowed at apex, glabrous; anthers cordate-ovoid, obtuse or occasionally shortly apiculate, 1-1.5 mm long, yellowish. Disk annular, minute, ca 0.5 x 1.5 mm, glabrous. Ovary ovoid, ca 2 x 1.5 mm, smooth, 2-locular; each locule with 2 collateral ovules; styles cylindric, continuous with ovary, ca 2 mm long, glandular, glabrous; stigma capitate, 2-lobed. Berries ellipsoid, ca 14 mm across, smooth, glandular, yellowish when ripe, 2-locular; locules filled with few pulp-vesicels; seeds 2-4, large, oblong-ellipsoid.

Fl. Oct.-March; Fr. March-Sept.

Distrib. India: Evergreen or moist deciduous forests of W. Ghats, 500-1600 m; occasionally also at lower elevations, ca 125 m. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

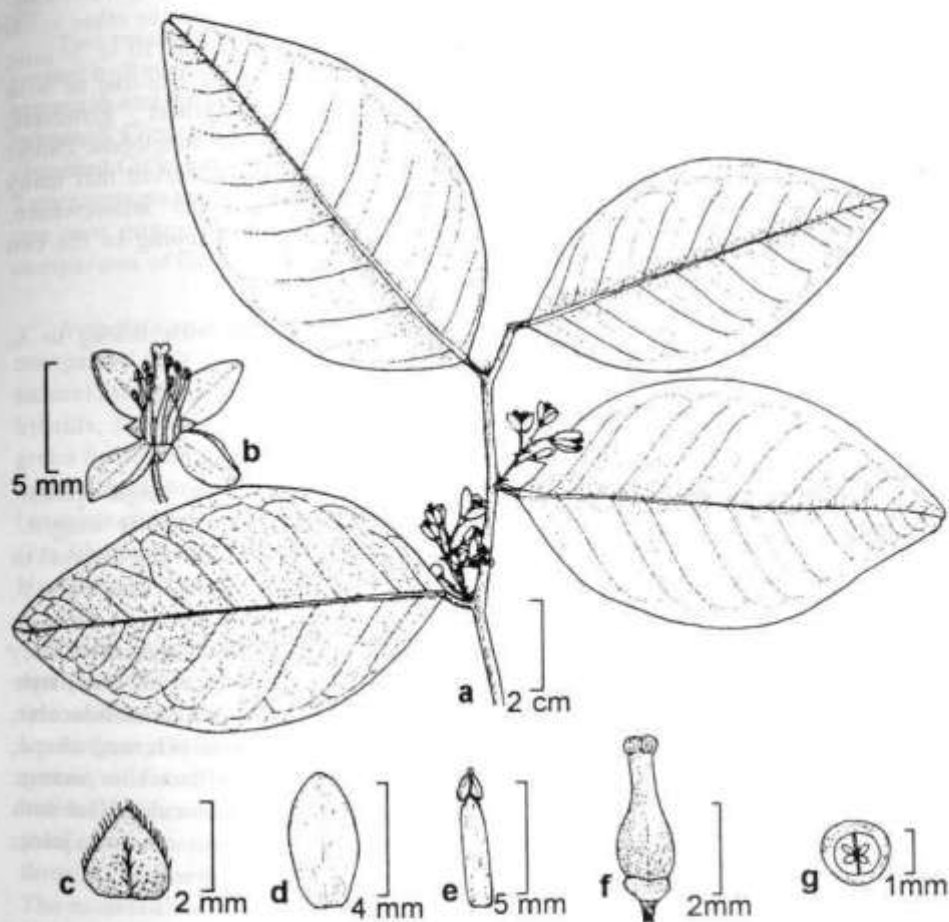


Fig. 71. *Atalantia wightii* Tanaka: a. flowering twig; b. flower; c. sepal; d. petal; e. stamen; f. pistil; g. c.s. of ovary.

Notes. *Atalantia wightii* has closer affinities with *A. ceylanica* (Arn.) Oliver of Sri Lanka but several characters make these two distinct from each other. Paraphylls minute, scaly, linear, or absent; inflorescences a raceme, often few-flowered (5 - 7); calyx deeply lobed with narrow to broadly ovate, acute or subacute, less glandular sepals; anthers mostly obtuse at apex and non-apiculate, without a dorsal gland on the connective and berries fusiform or ellipsoid with a few pulp-vesicles; on the other hand, paraphyll is single or paired, axillary, elliptic-oblong, stipuloid, ca 10 x 3 mm; inflorescence racemose or cymose or fascicled; calyx cupular often rim-like or with minute, deltate or broadly obtuse profusely glandular sepals; anthers glandular, apiculate with a dorsal pellucid gland on the connective and berries subglobose almost dry with very few pulp-vesicles in *A. ceylanica*. However, it is observed that many characters like size and shape of leaflets, number of flowers per inflorescence, morphology of petals and nature of stigma have been found overlapping in the two species.

All earlier reports of *Atalantia ceylanica* from peninsular India belong to *A. wightii* only.

3. Citrus L.

Shrubs or small trees; young branchlets angular with axillary, single spines. Leaves alternate, unifoliolate or simple (as in *C. medica*); petioles usually winged. Inflorescences axillary, racemose, or cymose or of a solitary flower. Flowers bisexual or functionally unisexual. Calyx cupular or urceolate with 4 or 5 sepals. Petals 4 - 8, imbricate, fleshy, white or tinged purplish or reddish. Stamens numerous, 4 times or more as many as the petals (20 - 40), free or polyadelphous. Disk annular. Ovary depressed-subglobose, 8 - 18-locular; locule with 4 - 8 ovules in 2 collateral rows; style cylindric, caducous; stigma globose or capitate, glandular-sticky. Fruits multilocular, many-seeded. Berries specialized known as hesperidia, of variable size and shape; pericarp leathery; outer layer densely glandular, often glossy, yellowish or orange coloured when mature; inner layer white; endocarp spongy; interior of locules filled with numerous stalked, soft or firm, purple vesicles containing sweet, sour or acidic juice; seeds angular-obovoid, mono- or polyembryonic; cotyledons white or green.

A native of S.E. Asia, particularly Indo-Malesia and China, and now under cultivation in the tropics and subtropics throughout the world; ca 17 species with innumerable cultivars and hybrids; 10 in India.

Notes. *Citrus* includes some of the principal fruit crops of the world like the citrons, lemons, limes, grape fruits, oranges and pomelos. The genus is very diverse in nature and the classification of its innumerable cultivated forms has ever been a difficult problem. An untraceable wild ancestry of many of the presently known cultivated species coupled with the peculiarities in their mode of reproduction makes the taxonomic delimitation in this genus and related genera a complex and rather perennial problem. Most of the species of *Citrus* not only breed true but also form hybrids with

species of its related genera like *Fortunella* and *Poncirus*. This leads to intrageneric or inter-generic hybrids (simple or complex) which by means of adventive nucellar polyembryony multiply true to their maternal genotype and exist as stable natural populations. The spontaneous formation of autotetraploids and budsports is also not uncommon.

Two principal systems of *Citrus* taxonomy in current use are that of Swingle (1943) revised by Reece in 1967 and of Tanaka (1954, 1961). The former is basically a biological approach and the latter a horticultural one. Swingle's system recognized two subgenera: subgenus *Citrus* with 10 species, and subgenus *Papeda* with 6 species. Tanaka (1954) classified *Citrus* consisting 2 subgenera, 8 sections, 13 subsections, 8 groups, 2 subgroups, 2 microgroups and a total of 145 species. Later, Tanaka (1961) added 2 new subsections, one new group and 12 new species, thus recognising a total of 157 species (for a comparison of the above 2 classifications, refer to Swingle and Reece 1967: 364 - 367).

Swingle's and Tanaka's systems differed chiefly in their basic concepts. Swingle recognized only 16 valid species and did not accord species status to 'budsports' or natural hybrids. But, Tanaka accepted 157 species that mostly represented variants and hybrids. However, some of the basic species commonly called citron, lemon, sourlime, grape fruit, oranges (mandarin, sour orange, sweet orange) and pomelos were accepted in both the systems. Subsequent classifications on the genus proposed by various other botanists and citrologists are mere modifications of either Swingle's or Tanaka's system (e.g. Bhattacharya & Dutta, 1956; Hodgson, 1961; Hodgson, Singh & Singh, 1963a,b,c; Hodgson, 1965; Singh, 1967; Singh & Nath, 1969).

India enjoys a remarkable position in the '*Citrus* belt of the world' due to her rich wealth of *Citrus* genetic resources, both wild and cultivated. The introduction, cultivation and trade of *Citrus* fruits in India have a very remarkable past (Bonavia, 1890; Lushington, 1910). Apart from the most important and widely known cultivated species, certain wild and indigenous species of *Citrus* like *C. ichangensis* (Ichang papeda), *C. indica* (Indian wild orange), *C. latipes* (Khasi papeda) and *C. macroptera* var. *annamensis* (Melanesian papeda) also occur on the Khasi hills and adjoining areas in N.E. India. Of these, *C. indica* is considered the most primitive and progenitor of all *Citrus* species. The natural diversity of *Citrus indica* was observed on the Garo hills of Meghalaya (Singh, 1984). A '*Citrus* gene sanctuary' for preserving the indigenous *Citrus* germplasm, particularly the Indian wild orange, has been set up in the 'Nakrek Biosphere Reserve' along the Tura ridges of the Garo hills in Meghalaya.

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KEY TO THE SUBGENERA

- 1a. Pulp-vesicles of fruits free of acrid oil droplets; petioles wingless, marginate or narrow to broadly winged; wings never exceeding more than 3/4 of the breadth of blade; stamens usually polyadelphous
1. subgen. *Citrus*
- b. Pulp-vesicles of fruits contain acrid oil droplets; petioles broadly winged; wings as broad as blade; stamens usually free
2. subgen. *Papeda*

Subgenus 1. *Citrus*

KEY TO THE SPECIES

- 1a. Petioles wingless, imperfectly or not articulate at base of blade; fruits longer than broad 6. *C. medica*
- b. Petioles marginate or narrow to broadly winged, articulate at base of blade; fruit not as above 2
- 2a. Petioles narrowly marginate 3
- b. Petioles narrowly to broadly winged 4
- 3a. Leaflets attenuate at apex, entire or slightly crenate above along margins; petals white; fruits with a thin slightly adherent pericarp; seeds 12 - 15 x ca 8 mm 3. *C. indica*
- b. Leaflets subacute or obtuse at apex, glandular-serrulate along margins; petals purplish tinged; fruits with rather thick, strongly adherent pericarp; seeds 5 - 10 x 5 - 6 mm, ovoid 4. *C. limon*
- 4a. Flowers 20 - 25 mm across; fruits up to 5 cm across, oblong, ovoid or subglobose, lemon yellowish in colour; pericarp thin, leathery 1. *C. aurantifolia*
- b. Flowers 40 - 45 mm across; fruits more than 6 cm across, variously shaped, variously coloured; pericarp rather thick 5
- 5a. Petioles broadly winged; wings 15 - 25 mm broad 6
- b. Petioles marginate or narrowly winged; wings up to 6 mm broad 7
- 6a. Petiolar wings oblong-spathulate or obcordate; fruits 10 - 20 cm across, pale green to yellow; mesocarp (albedo) very thick and spongy 5. *C. maxima*
- b. Petiolar wings oblong-obovate; fruits up to ca 8 cm across, reddish-vermilion; mesocarp scanty, fibrous 2. *C. aurantium*
- 7a. Leaflets 5 - 10 x 2.0 - 3.5 cm, tapering at apex; fruits with loosely attached pericarp 7. *C. reticulata*
- b. Leaflets 7 - 10.5 x 3.5 - 5 cm, obtusely emarginate at apex; fruits with adherent pericarp 8. *C. sinensis*

1. *Citrus aurantifolia* (Christm. & Panz.) Swingle in J. Wash. Acad. Sci. 3: 465. 1913 & in Citrus Indust. 1: 374. 1967. *Limonia aurantifolia* Christm. & Panz., Pflanzenr. Syst.

1: 618. 1777. *Citrus acida* Roxb., Fl. Ind. 3: 390. 1832. *C. medica* L. var. *acida* (Roxb.) Hook.f., Fl. Brit. India 1: 515. 1875.

Asm.: *Abhayapuri lime*, *Karimganj lime*; Beng.: *Kaghzinimbu*, *Patainebu*; Guj.: *Khata limbu*; Hindi: *Kaghzinimbu*; Kan.: *Limbe*, *Nimbe*; Mal.: *Erumichinarakam*, *Cherunaregam*; Tam.: *Elumichai*; Tel.: *Nimma*. The sour lime.

Shrubs or small bushy trees, up to 3 m high; branchlets slender, angular when young, with sharp spines. Leaflets small; petioles narrowly winged; wings spatulate to obcordate, up to ca 15 x 13 mm, articulate above with the base of blade; leaflet blades ovate, elliptic to oblong, rounded at base, obtusely acute at apex, crenate along margins, 5 - 7.5 x 3.5 - 5 cm. Inflorescences lax, axillary racemes, 2 - 7-flowered, or rarely of a solitary flower. Flowers 20 - 25 mm across, bisexual and staminate, whitish in buds. Calyx cupulate, 4- or 5-lobed, greenish-white; lobes deltoid, acute, glandular. Petals 4 or 5, oblong, acute, glandular, white. Stamens 20 - 28; filaments polyadelphous, white; anthers oblong, yellowish. Ovary depressed-globose, greenish; style cylindrical, white; stigma capitate. Fruits oblong, ovoid or subglobose, 4.5 - 7 x 4 - 5 cm, smooth, pitted, glandular, glossy, green to greenish-yellow; pericarp thin, coriaceous, strongly adherent; mesocarp spongy, white; endocarp segments 9 - 12, strongly adherent, centre solid, pulp - vesicles slender, fusiform, greenish-white; juice abundant, intensely acidic and sour; seeds ovoid; plump, pale; embryo white.

Distrib. Probably a native of Malesia. Cultivated in many parts of India and other subtropical countries.

Notes. This is the most valued *Citrus* fruit for culinary purposes, medicine, beverages and lime juice.

2. *Citrus aurantium* L., Sp. Pl. 782. 1753; Hook.f., Fl. Brit. India 1: 515. 1875, excl. var. 3, *bergamia*; Swingle in *Citrus Ind.* 1: 375. 1967. *C. madraspatana* Hort. ex Tanaka in *J.IndianBot.Soc.* 16:238.1937. Fig. 72.

Asm.: *Chakla-tenga*, *Dewa-tenga*, *Karun-jamir*, *Tita-karuna*; Hindi: *Khatta*; Kan.: *Herlay*; Kh.: *Soh-thang*; Tam.: *Kitchili Narengam*, *Naruttai*; Tel.: *Mallika narangi*. The sour orange.

Small trees. Leaves unifoliolate; petioles ca 2 cm long, winged; wings spatulate to oblong-obovate, ca 15 mm broad; leaflets ovate or ovate-elliptic, cuneate or rounded at base, tapering at apex with emarginate tip, undulate or slightly crenulate along margins. Inflorescences axillary, few-flowered. Flowers bisexual and staminate. Sepals 4 or 5, deltoid, acute, ciliate along margins. Petals oblong, attenuate at apex, coriaceous, glandular, pure white. Stamens 22 - 27, polyadelphous or, 1 or 2 sometimes free; filaments white; anthers oblong, ca 3 mm long, yellow. Ovary barrel-shaped; style cylindrical, white; stigma capitate. Fruits subglobose or oblate, depressed at base and

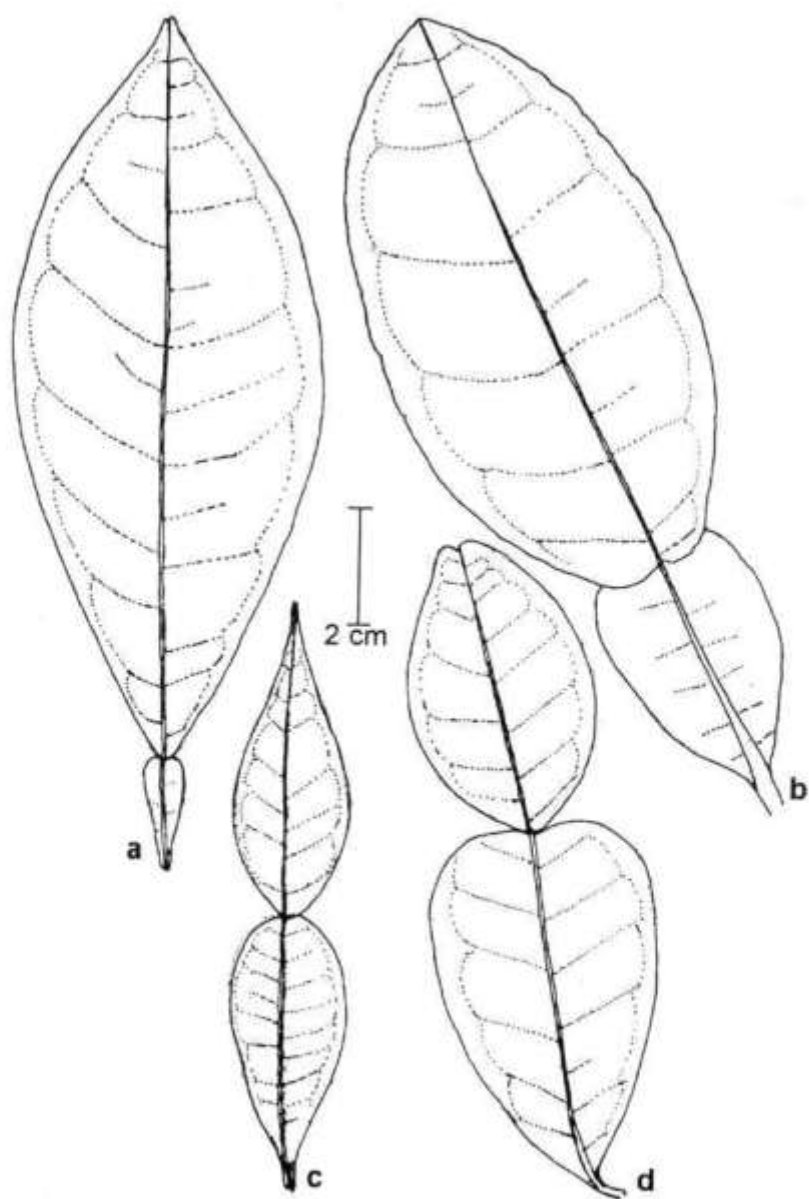


Fig. 72. Foliage in *Citrus* spp.: a. *C. aurantium* L.; b. *C. maxima* (Burm.) Merr.; c. *C. ichangensis* Swingle; d. *C. macroptera* Montr. var. *annamensis* Tanaka.

apex, 4 - 8 cm across, rather rough, surface pitted, deep orange to scarlet red; pericarp closely adherent; mesocarp white, scanty, fibrous; endocarp segments 9 - 12; pulp-vesicles orange coloured with scanty or abundant sour juice; seeds numerous, ovoid, smooth end rugose, chalazal and red; cotyledons white.

Distrib. Probably a native of S. China and Indochina. Frequently cultivated in India, perhaps becoming naturalized in Assam.

Notes. Fruits are esteemed for their medicinal properties and increasingly used in the preparation of confections, marmalades, liquors and other soft drinks. The fruit juice, although bitterly sour, is medicinal due to the presence of provitamin A and vitamin B₁. The outer peel of fruits is medicinal and also a flavouring agent. Fresh flowers yield two high quality fragrant oils. Known commercially as 'oil of Neroli Bigarade' and 'orange flower water'. 'Oil of petit grain' is another product obtained by steam-distillation of leaves and young shoots.

Wood is hard and used in cabinet works. The seedling is used as a rootstock for grafting sweet oranges and lemons.

The seville or sour oranges in India are known to have a number of varieties and forms, some of them with a supposed hybrid origin.

3. *Citrus indica* Tanaka, Stud. Citrol. 2: 164. 1928; Bhattacharya & Dutta, Class. Citrus Fr. Assam 56. 1956; Swingle, Citrus Ind. 1: 384. 1967. Fig. 73.

Kh.: *Memang-narag*. The Indian wild orange.

Shrubs or small trees, to 3 m high; branchlets cylindrical, spreading, spiny, glabrous. Leaves unifoliate; petioles short, ca 12 mm long, slightly winged, articulated at apex; leaflet blades oblong or lanceolate to elliptic-oblong, acute at base, attenuate at apex, entire or crenate towards apex along margins, 6.5 - 11 x 2.5 - 4 cm; nerves oblique, reticulate. Inflorescences usually of a solitary flower, very rarely also in pairs, axillary; pedicels ca 4 mm long, glabrous. Flowers bisexual. Calyx cupular, 4- or 5-lobed; lobes deltoid, conspicuously pellucid-punctate abaxially. Petals 5, oblong, obtuse, 10 - 15 x 3 - 6 mm, glandular, white. Stamens 22 - 25; filaments united at base, free above, glabrous, white; anthers ca 3 mm long, introrse. Ovary vase-shaped, 8 - 11-locular; style terete, white; stigma capitate. Fruits small, depressed globose to subpyriform or obovoid, up to 4 cm across, depressed or obtuse at apex, obtuse at base, deep orange to scarlet red, smooth, glandular; pericarp thin, slightly adherent; mesocarp thin, white, spongy, soft, sweet; endocarp segments 8 - 11, slightly adherent, central axis hollow or semihollow; pulp-vesicles white, irregularly shaped, fusiform or polygonal, stalked, white, shiny; juice scanty, bitterly sour; seeds 5 - 7 per fruit, suborbicular with pointed ends, 12 - 15 x ca 8 mm, smooth; cotyledons green.

Fl. March-April; *Fr.* Ripens during Nov.-Jan.

Distrib. India: Evergreen forests of N.E. India. Assam, Manipur, Meghalaya and Nagaland.

Myanmar (recorded here based on 2 collections (CAL) made by I. H. Burkill in Kobo in 1911).

Notes. Swingle (1967) suspected that the Indian wild orange, *C. indica*, might be of hybrid origin, probably between *Citrus latipes* (Khasi papeda) and some other species of the subgenus *Citrus*.

The fruits are inedible and hence of less possibility for commercial exploitation. The plant may be used as a rootstock for grafting other species of *Citrus*.

4. *Citrus limon* (L.) Burm.f., *Fl. Ind.* 173. 1768. *C. medica* L. var. *limon* L., *Sp. Pl.* 782. 1753. *C. limonum* Risso, *Ann. Mus. Natl. Hist. Nat.* 20: 201. 1813. *C. aurantium* L. var. *limonum* Wight & Arn., *Prodr.* 98. 1834. *C. medica* L. var. *limonum* (Wight & Arn.) Hook.f., *Fl. Bit. India* 1: 515. 1875. Fig. 73.

Beng.: *Goranebu*; Guj.: *Motulimbu*; Hindi: *Baranimbu*, *Gulgul*, *Paharinimbu*, *Pa-harikaghi*; Kan.: *Bijapura*, *Bijori*; Kh.: *Dieng-soh*; Mal.: *Odichukuthinaregam*; Mar.: *Idalimbu*, *Thoralimbu*; Tam.: *Periyaelumichai*; Tel.: *Bijapuram*. The Lemon.

Shrubs or small trees, up to 3 m high, spinous; branchlets glabrous; bark green. Leaves unifoliate, reddish or purplish when young; petioles marginate or narrowly winged, often articulate at apex with base of blade; leaflet blades ovate or elliptic-oblong, obtuse to rounded at base, subacute or obtuse at apex, glandular-serrulate along margins, 5.5 - 11.5 x 2 - 5 cm. Inflorescences axillary condensed racemes, usually 5 - 7-flowered. Flowers shortly pedicellate, usually bisexual or staminate, 5-merous, purplish in buds. Calyx urceolate; sepals suborbicular, minute, glabrous. Petals ovate-oblong, obtuse, 15 - 20 x 3 - 5 mm, coriaceous, glabrous, purplish tinged abaxially, greenish-white adaxially. Stamens 30 - 40; filaments monadelphous or irregularly polyadelphous at base, free above, glabrous or pubescent; anthers oblong, apiculate, 4 - 6 mm long, greenish-yellow. Disk annular, fleshy, ca 3 mm broad, glandular, glabrous, greenish-white. Ovary subcylindric, 5 - 7 x 3 - 4 mm, greenish; style thick, ca 4 mm long, caducous; stigma globose. Fruits ovoid-oblong or oblate, small to medium-sized, up to ca 6 cm across, 8 - 12-locular; rind thick, glandular, strongly adherent, mamillate, yellowish when ripe; pulp-vesicles pale green to yellowish; juice scanty or abundant, sour, acidic; seeds ovoid, acute, small, 5 - 10 mm long, 5 - 6 mm, whitish inside when cut.

Distrib. Native of S. E. Asia : cultivated throughout India and other tropical and subtropical countries.

Notes. Fruits are used in the preparation of lemonade, squash and sherbet. Fresh fruits are also used in various culinary preparations. Citric acid, pectine and lemon oil are by-products of the lemonade. Lemon oil is an effective remedy for scurvy, rheumatism, dysentery and diarrhoea. Fruits are pickled. They are a rich source of vitamin C, vitamin B₁ and carotene (Wealth of India 2: 190-191. 1976).

Nath & Randhawa (in Indian J. Hort. 26: 99-109. 1969), Singh and Nath (1969) and Malik *et al.* (in Hilgardia 42: 361-382. 1974) believed that various types of cultigens classed under Indian lime might have a percentage involving citron (*C. medica*) and lime (*C. aurantifolia*). Dass *et al.* (in Indian J. Exp. Biol. 15: 158-160) conducted flavanoid analysis in various cultivars of *Citrus lemon* through thin layer chromatography and observed that one group of lemons consisting of Asian lemon, Coorg lemon, seedless lemon, matta lemon, hill lemon or gulgul was close to true lemon while another group consisting of Kagzikalan, Italian round, Dominica spineless, Nepali oblong, Lucknow lemon and Baramasi lemon was close to citron.

5. *Citrus maxima* (Burm.) Merr., Interpr. Herb. Amboin. 46. 1917; Scora & Nicolson in Taxon 35: 592. 1986. *Aurantium maximum* Burm. in Rumph. Herb. Amboin. Actuar. nd. Univ. unnumbered p. 16 (leaf 2, verso p. 16, sub 'Pomplemoes') 1755. *Citrus aurantium* L. var. *grandis* L., Sp. Pl. 783. 1753. *C. grandis* Osbeck, Dagb. Ostind. Resa 98. 1757. *C. aurantium* L. var. *decumana* L., Sp. Pl. ed. 2, 2: 1101. 1763, nom. illeg. *C. decumana* L., Syst. Nat. ed. 12, 508. 1767 (as '*decumanus*'), nom. illeg.; Hook.f., Fl. Brit. India 1: 516. 1875.

Fig. 72.

Small to medium-sized trees, 5 - 10 m high; young parts grey-pubescent; bark grey-brownish, lenticellate. Leaves unifoliolate; petioles broadly winged; wings oblong-spathulate or obovate, 1/4 to 1/3 as long as lamina, 20 - 25 mm broad; leaflet blades ovate to elliptic, obtuse or acute at apex, crenate along margins, 6.5 - 10 x 3 - 7 cm, softly pubescent beneath and along margins when young, soon becoming glabrate. Inflorescences of an axillary, solitary flower or a cluster of few flowers, softly pubescent; pedicels up to 2.5 cm long, pubescent. Flowers bisexual, oblong in bud. Calyx cupular, ca 1 x 1.5 mm, irregularly lobed; lobes pubescent, greenish-white. Petals oblong-obovate, obtuse, concave, ca 25 x 13 mm, glandular, glabrous, cream. Stamens up to 30; filaments irregularly polyadelphous at base, free above, linear, subulate, white; anthers oblong, apiculate, ca 1 mm long. Disk annular, ca 6 mm broad, greenish-white. Ovary obovoid, deeply inserted in the disk, 5 x 7 mm, smooth, greenish white, glabrous, 10 - 14-locular; locules with many ovules; style cylindrical, thick, dilated above, longer than ovary, ca 1 cm long; stigma broadly capitate, glandular-sticky. Fruits large to very large, up to 20 cm across, oblate to pyriform; pericarp light greenish to yellowish, glandular, smooth; mesocarp very thick, spongy, white; segments firm, large; pulp-vesicles numerous, firm but easily separable, pale green to pinkish, acidic or sweet; seeds large, wrinkled.

Distrib. Probably a native of S. E. Asia and cultivated in India and various other subtropical countries.

KEY TO THE VARIETIES

- 1a. Young parts grey-pubescent; fruits 15 - 20 cm across 5.1. var. *maxima*
 b. Young parts glabrous or nearly so; fruits 8 - 12 cm across 5.2. var. *uvacarpa*

5.1. var. *maxima*

Guj.: *Obakotru*; Mar.: *Panis*, *Papnasa*; Mal.: *Pamparamasam*; Kan.: *Chakotre*, *Sakkota*; Tam.: *Pambalimasu*; Tel.: *Pampalamasam*. The Pomelo.

Notes. Widely cultivated in India for its nutritive and refrigerant fruits. Leaves are used in epilepsy and convulsive cough.

5.2. var. *uvacarpa* Merr. & Lee in Amer. J. Bot. 11: 383. 1924. *Citrus paradisi* Macf. in Hook., Bot. Misc. 1: 304. 1830. *C. decumana* L. var. *racemosa* M. Roemer, Syn. Mon. Hesper. 1: 67. 1846. *C. decumana* L. var. *pationiana* Riccob. in Boll. Reale Orto Bot. Giardino Colon. Palermo 7: 211. 1908. *C. grandis* Osbeck var. *racemosa* (M. Roemer) Stone in Dassan., Rev. Handb. Fl. Ceylon 5: 427. 1985.

Small to large, densely foliaged trees; young twigs glabrous or nearly so. Leaves smaller than those of pomelo (var. *maxima*) with narrower obovate-oblong petiole wings. Petals shorter. Fruits smaller, globose to oblate, 8 - 12 cm across, yellowish; pulp-vesicles coherent, pinkish, not easily separable, juice abundant.

Distrib. Probably a native of Jamaica where it might have originated as a chance hybrid between the true pomelo and the sweet orange (Janaki Ammal in Curr. Sci. 22: 178-179.). Cultivated in N. India and other subtropical countries for its fruits, commonly called grape fruit.

Notes. The grape fruit tree shares many characters of both pomelo and sweet orange, often with more of that of the pomelo. In habit, leaves, flowers and internal characters of fruits, it resembles the pomelo while in the external fruit structure and nature of pulp-vesicles it resembles the sweet orange.

6. *Citrus medica* L., Sp. Pl. 782. 1753; Swingle in Citrus Ind. 1: 370. 1967. *C. aurantium* L. var. *medica* Wight & Arn., Prodr. 98. 1834. **Fig. 73.**

Asm.: *Bira-jora*; Beng.: *Bara nimbu*, *Begpura*; Guj.: *Turanj*, *Bijoru*; Hindi: *Bara nimbu*, *Bijaura*; Mar.: *Maha lunga*, *Mavalung*; Mal.: *Gilam*, *Rusakam*, *Curry narenga*; Kan.: *Madela*, *Mahaphala*, *Rusaka*; Tam.: *Kadaranarathai*; Tel.: *Lungamu*. The Citron.

Shrubs or small trees, up to ca 3 m high; branchlets angular and purplish when young, glabrous with sharp, stout, axillary spines (ca 4 cm long). Leaves simple; petioles ca 10 mm long, wingless or slightly marginate, imperfectly or not articulated above; leaf blades

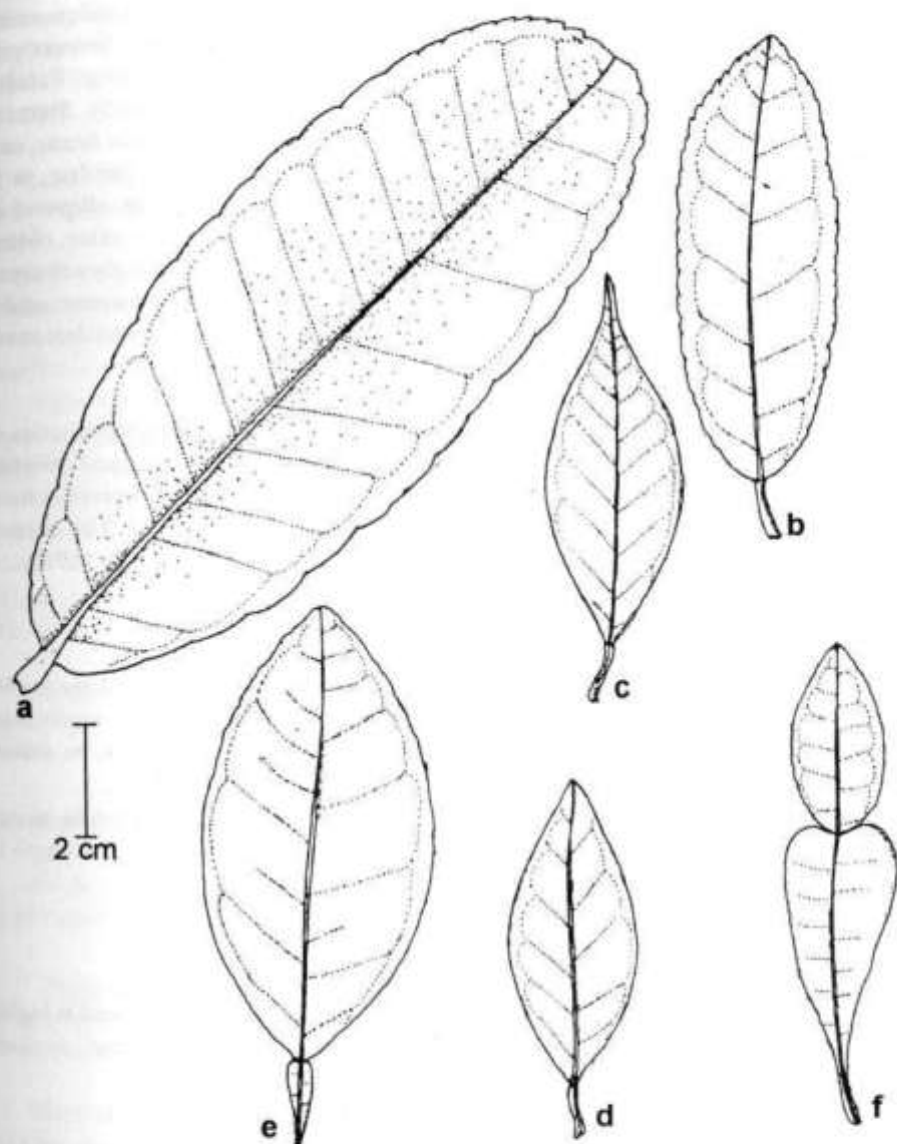


Fig. 73. Foliage in *Citrus* spp.: a. *C. medica* L.; b. *C. limon* (L.) Burm. f.; c. *C. sinensis* (L.) Osbeck; d. *C. reticulata* Blanco; e. *C. indica* Tanaka; f. *C. latipes* (Swingle) Tanaka.

variable in shape, obtuse or rounded at base, acute or rounded at apex, crenate, serrulate along margins, 10 - 18 x 3 - 9 cm, glabrous. Inflorescences axillary, few-flowered racemes. Flowers oblong in bud, pink or purplish, bisexual and staminate; staminate flowers with or without abortive pistil. Calyx urceolate, 4- or 5-lobed; lobes ca 4 mm long. Petals 4 or 5, oblong or oblanceolate, 2 - 4 x 1 cm, glandular, pink or purplish abaxially. Stamens 30 - 40 or more; filaments polyadelphous, shortly pubescent, white; anthers linear, ca 5 mm long, yellowish. Ovary cylindric, ca 8 x 4 mm, 12 - 14-locular; style cylindric, ca 15 mm long, purplish; stigma globose, pinkish, sticky. Fruits ovoid-oblong, ellipsoid or obovoid, 10 - 20 x 6 - 14 cm, yellowish, surface smooth, rough or warty on outer, obtuse or depressed at base, obtuse or mamillate at apex; rind very thick, strongly adherent, glandular, foveolate, aromatic; mesocarp whitish, hard, carrot-like consistence; endocarp segments 10 - 12, small, with pale greenish acidic or sweetish pulp-vesicles; seeds numerous, acute at base, ca 10 x 5 mm, smooth, white when cut.

Notes. Based on acidity and sweetness of pulp, different horticultural varieties of Citron have been recognized in India. Swingle (1967) admits three botanical varieties of Citron viz. *C. medica* var. *medica*; var. *sarcodactylis* (Noot.) Swingle (fingered-citron - occasionally cultivated in India) and var. *ethrog* (not known from India). The correct name of the fingered-citron is accepted here as *C. medica* var. *digitata* Lush. (1910).

KEY TO THE VARIETIES

- | | |
|---|---------------------------|
| 1a. Fruits obtuse or rounded and mamillate at apex; pulp-vesicles present | 6.2. var. <i>medica</i> |
| b. Fruits with the apical end splitting into finger-like projections as many as the number of carpels; pulp wanting | 6.1. var. <i>digitata</i> |

6.1. var. *digitata* Lush. in Indian Forester 36: 352. 1910. *C. sarcodactylis* Noot., Fleurs Fruits Fuiell. Java 1: t. 3. 1863. *C. medica* L. var. *sarcodactylis* (Noot.) Swingle in Sargent, Pl. Wilson. 2: 141. 1914.

Distrib. Cultivated occasionally in N. India, Japan and China.

Notes. In China and Japan the plant is known as 'Budhas hand citron' and is highly esteemed for its fragrant fruits. It is grown in gardens as an ornamental plant.

6.2. var. *medica*

Distrib. Probably indigenous in India, particularly in the foot-hills of the Himalayas and Khasi hills.

Notes. Fruits used for pickles. The outer rind of fruits preserved in sugar is used in dysentery. The peel and pulp are made into marmalades and other preserves. Juice is refrigerant and astringent.

7. *Citrus reticulata* Blanco, Fl. Filip. 610. 1837; Swingle in *Citrus Ind.* 1: 380. 1967. *C. crenatifolia* Lush. in *Indian Forester* 36: 343. 1910. *C. crenatifolia* Lush. var. *lycopersicaeformis* Lush. in *Indian Forester* 36: 343. 1910. *C. chrysocarpa* Lush. in *Indian Forester* 36: 344. 1910. *C. poonensis* Hort. ex Tanaka in *Int. Rev. Sci. Pract. Agric.* n.s. 1:34.1923. **Fig. 73.**

Beng.: *Kamala*; Hindi: *Santra*; Kan.: *Kudag orange*; Kh.: *Soh-myntra, Soh-nimantra*; Tam.: *Walaja Kamara*. The Indian loose jacket orange, Mandarins.

Small trees; branches slender, erect or spreading, spinous. Leaves unifoliolate; petioles short, slightly marginate, ca 2 mm broad, articulate above; leaflet blades narrowly to broadly lanceolate, acute or rounded at base, tapering at apex with tip sometimes emarginate, irregularly crenate or crenulate along margins, 5 - 10 x 2.5 - 3.5 cm. Inflorescences axillary, 2 - 3-nate clusters or a solitary flower. Flowers bisexual. Sepals 5, light greenish, glabrous. Petals 5, oblong, glandular, pure-white. Stamens 14 - 19; filaments polyadelphous, usually 2 or 3, free, white; anthers yellow. Disk annular, fleshy. Ovary globose or oblate; style cylindric, greenish-white; stigma capitate. Fruits variable in size and shape, oblate-globose or pyriform; pericarp thin, orange-yellow, loosely attached, baggy; endocarp segments 7 - 14, easily separable; pulp-vesicles orange-coloured; juice sweetish with a characteristic flavour; seeds usually 10 - 15 per fruit, acute at base, smooth; embryo green.

Distrib. Probably a native of S. E. Asia. Cultivated in India and other subtropical countries.

Notes. *C. reticulata* (The Indian loose jacket mandarin) is the commonest commercial citrus fruit in India.

8. *Citrus sinensis* (L.) Osbeck, *Dagb. Ostind. Resa* 41. 1775; Swingle in *Citrus Ind.* 1:379.1967 *C. aurantium* L. var. *sinensis* L., *Sp. Pl.* 782. 1753. **Fig. 73.**

Beng., Guj., Hindi, Mar.: *Kamala nambu, Musambi, Narangi*; Kan.: *Kittile, Sathagudi*; Kh.: *Soh-niungriang*; Punj.: *Malta Orange*; Tam.: *Sathagudi, Chini*; Tel.: *Battavinarinja, Buddasini, Satghudi, Sini*. The sweet orange.

Medium-sized trees; branchlets angular when young, spinous. Leaves unifoliolate; petioles ca 2 cm long, narrowly winged; wings oblong-spathulate, ca 3 mm broad on either side; leaflet blades ovate to elliptic, cuneate at base, emarginate at apex, obtusely crenate along margin, 7 - 10.5 x 3.5 - 5 cm. Inflorescences axillary, racemose (5 - 7-flowered) or of a solitary flower; pedicels 7 - 12 mm long, glabrescent. Flowers bisexual. Calyx 4- or 5-lobed; sepals suborbicular, acuminate, membranous, ciliate, glandular. Stamens 19 - 25; filaments polyadelphous, unequal in length; anthers linear-oblong, obtuse, cordate below. Disk annular, ca 2.5 mm broad. Ovary globose; style cylindric, white; stigma capitate. Fruits medium-sized, subglobose to oblate; surface

smooth, pitted, glossy, greenish-yellow to orange; pericarp thin, adherent; mesocarp white, mildly sweet; centre usually solid; endocarp segments 10-13; pulp-vesicles yellow to orange-coloured, stalked, fusiform, cuneate-obovoid, acute at tip, narrowed at apex with rough marginate plane surface, white when cut.

Distrib. Probably a native of N. E. India or S. China and Indochina. Cultivated in India.

Notes. *C. sinensis* (sweet orange) is the well known and most esteemed *Citrus* of the world. The fruits are a rich source of antiscorbutic vitamin.

Subgenus 2. **Papeda**
KEY TO THE SPECIES

- 1a. Leaflets acuminate to caudate at apex; flowers solitary; fruits 3-5 cm across; seeds up to 30 per fruit, ca 20 x 18 mm **9. *C. ichangensis***
- b. Leaflets acute or obtuse (rarely subcaudate) at apex; flowers in 2-8-nate clusters, (very rarely solitary); fruits up to 12 cm across; seeds 30-60 per fruit, ca 17 x 10 mm **2**
- 2a. Petiolar wings 4-6.5 x 1.5-3 cm, crenate along margins; fruits 4-8.5 x 4.5-10 cm, pitted or papillate **10. *C. latipes***
- b. Petiolar wings 4.5-10 x 2.5-6 cm, subentire at margins; fruits 5-9 x 7-12 cm, smooth **11. *C. macroptera* var. *annamensis***

9. *Citrus ichangensis* Swingle in J. Agric. Res. 1: 4. 1913 excl. descr. fructus & in *Citrus Ind.* 1:388.1967; Bhattacharya & Dutta, *Class. Citrus Fr. Assam* 80. 1956. **Fig. 72.**

Shrubs or small trees, up to 5 m high; young twigs angular, glabrous, spinous; spines sharp, stout, ca 3 cm long, often wanting in flowering twigs. Leaves unifoliolate, up to 12 cm long; petioles broadly winged, 3.5-5 x 1.5-2 cm; wings oblong-spathulate, tapering at base, crenate along margins, rounded at tip; leaflet blades ovate-lanceolate, rounded or abruptly blunt at base, acuminate or, more or less caudate at apex, emarginate at tip, slightly crenate along margins, ca 5 x 2 cm; pedicels ca 3 mm long. Flowers solitary, axillary, bisexual, subglobose in bud. Sepals 5, orbicular, thick, ciliate along margins. Petals 5, oblong, ca 20 x 8 mm, white. Stamens 20, free or rarely polyadelphous. Ovary depressed-globose, 7-9-locular; style short, thick, caducous; stigma globose, as large as ovary. Fruits small, oblong with tapering ends, 3-5 cm across, lemon yellow; surface smooth, finely papillate; pericarp thin, medium to strongly adherent; mesocarp white, soft, spongy, tasteless; endocarp segments 7-9, medium to strongly adherent; pulp-vesicles white, separable, stalked, globose to ellipsoid, obtuse at apex; juice scanty; seeds 22-30 per fruit, bluntish at both ends, 12-20 x 10-18 mm; chalazal cap light brownish; cotyledons white.

Distrib. India: Evergreen forests of the E. Himalayas, Arunachal Pradesh and Nagaland.

S.W. China.

Notes. Fruits are inedible and hence of no commercial value. The plant has been successfully employed in evolving cold resistant hybrids such as ichandrins, ichag lemon and yuzu (Swingle 1967: 389-390).

10. *Citrus latipes* (Swingle) Tanaka, *Studia Citrologia* 2: 155. 1928; Bhattacharya & Dutta, *Class. Citrus Fr. Assam* 81. 1956; Swingle, *Citrus Ind.* 1: 392. 1967. *C. ichangensis* Swingle subsp. *latipes* Swingle in *J. Agric. Res.* 1: 12. 1913. *C. hystrix* auct. non DC. 1824: Hook. f., *Fl. Brit. India* 1: 515. 1875. Fig. 73.

Kh.: *Suh-kymphorshireh*, *Soh-shyrkoit*

Medium trees, up to 9 m high, branching almost from base, densely foliated; branchlets spreading, spiny; spines up to 6 cm long. Leaves unifoliolate, up to 12 cm long; petioles winged; wings oblong-spathulate, truncate above, tapering towards base, often larger than lamina, 4 - 6.5 x 1.5 - 3 cm; nervation similar to that of lamina; leaflet blades ovate-elliptic to lanceolate, obtuse to rounded at base, subacute at apex, obscurely crenate along margins, ca 5 x 3 cm, deep green and glossy above, glabrous, coriaceous, pellucid-punctate, emarginate at tip. Inflorescences axillary, 2 - 8-nate racemes or occasionally of a solitary flower; pedicels slender, 5 - 10 mm long, glabrate. Flowers bisexual, sweet scented, ovoid in buds, purplish tinged. Calyx 4-lobed; lobes deltoid, acute, ciliate along margins, scarious, green. Petals 4, ovate-oblong, concave, obtuse, ca 12 x 6 mm, glandular, glabrous, white with purplish, turgid dorsally, Stamens 20 - 23; filaments unequal in length, in groups of 2 or 3, sometimes 1 or 2 free, staminal tube ca 8 mm long, white; anthers ovoid, cordate below, ca 2.5 mm long, yellow, glandular-apiculate. Disk annular, lobed, ca 4 mm broad, whitish. Ovary depressed-globose, ca 2 x 3 mm, greenish, 9 - 11-locular; style ca 4 mm long, cylindrical, dilated above, articulate with ovary, white; stigma depressed-globose, as much as or broader than ovary, sticky. Fruits globose to oblate, depressed on both ends, 4 - 8.5 x 4.5 - 10 cm, yellowish, surface pitted or papillate; rind medium-thick, moderately to strongly adherent; mesocarp white, spongy, tasteless; central axis solid; endocarp segments 9 - 15, moderately to strongly adherent, the pulp-vesicles irregular in shape, usually fusiform, greenish-white; juice scanty, white, sour; seeds 30 - 60 per fruit, ovoid, smooth at one side, wrinkled at other, pointed at tip; cotyledons white.

Fl. March-April; *Fr.* Nov.-Jan.

Distrib. India: Evergreen forests of the Khasi and Naga hills in N.E. India. Meghalaya and Nagaland. Wild and semiwild.

N. Myanmar.

Notes. Fruits are hardly of any commercial importance. It is reported that the fruits mixed with salt are consumed by the Khasi hill people of Meghalaya.

11. *Citrus macroptera* Montr. var. *annamensis* Tanaka in Bull. Mus. Hist. Nat. (Paris), 2 ser. 2: 164. 1930 (as *C. macroptera*); Bhattacharya & Dutta, Class. Citrus Fr. Assam 84. 1956; Swingle, Citrus Ind. 1: 399. 1967. *C. combata* Raf., Sylva Tell. 142. 1838. *C. macroptera* Montr. var. *combata* (Raf.) Tanaka in J. Indian Bot. Soc. 16: 238. 1937. **Fig. 72, 74.**

Asm.: Satkara; *Kh.:* Sooh-kwit.

Medium to large trees, up to 15 m high, densely foliaged, thickly branched, very spinous. Leaves up to 20 cm long; petioles broadly winged, often longer than blade; wings obovate or obcordately oblong, abruptly attenuate at base, obtuse or subtruncate at apex, entire to slightly crenate along margin, 4.5 - 10 x 2.5 - 6 cm; leaflet blades ovate-elliptic, 4.5 - 7 x 3 - 4.5 cm, obtuse and emarginate at apex, obtuse at base, subentire or obscurely crenate along margin, dark green and glossy above. Inflorescences axillary, glomerate, 2 - 10-flowered, cymosely arranged or rarely solitary. Flowers bisexual and staminate with abortive pistil, sessile, globose in bud. Calyx cupular, 4- or 5-lobed; sepals deltate, acute. Petals 4 or 5, ovate, obtuse, ca 10 x 8 mm, white. Stamens 23 - 30; filaments free, white; anthers linear, ca 3 mm long. Ovary oblate, 13 - 15-locular; style cylindrical, very short, white; stigma capitate. Fruits medium to large, 5 - 9 x 7 - 12 cm, oblate to pyriform, yellow; surface smooth, pitted, papillate; pericarp thick, strongly adherent; mesocarp spongy, tasteless, white; segments 13 - 15; axis solid or semihollow; pulp-vesicles stalked, ovoid to obovoid, obtuse, small; juice abundant, greenish-white, bitterly sour; seeds 20 - 40 per fruit, cuneate or triangular, pointed at tip, plump, smooth; chalazal spot reddish; cotyledons white.

Fl. March; *Fr.* Nov.-Jan.

Distrib. India: Evergreen forests of N.E. India and moist deciduous forests of the N. Himalayas. Assam (Cachar, Mikir, Nowgong and Sibsagar), Meghalaya (Khasi hills) and Uttar Pradesh (Almora-Gori Valley).

Bangladesh, Myanmar, Indochina and Thailand.

Notes. Fruits are edible and used in culinary preparations and also in making squashes.

CULTIVATED TAXA WITH PROBABLE HYBRID ORIGIN AND UNCERTAIN AFFINITIES

1. *Citrus assamensis* Dutta & Bhattacharya

Asm.: Ada-jamir; *Kh.:* Soh-sying.

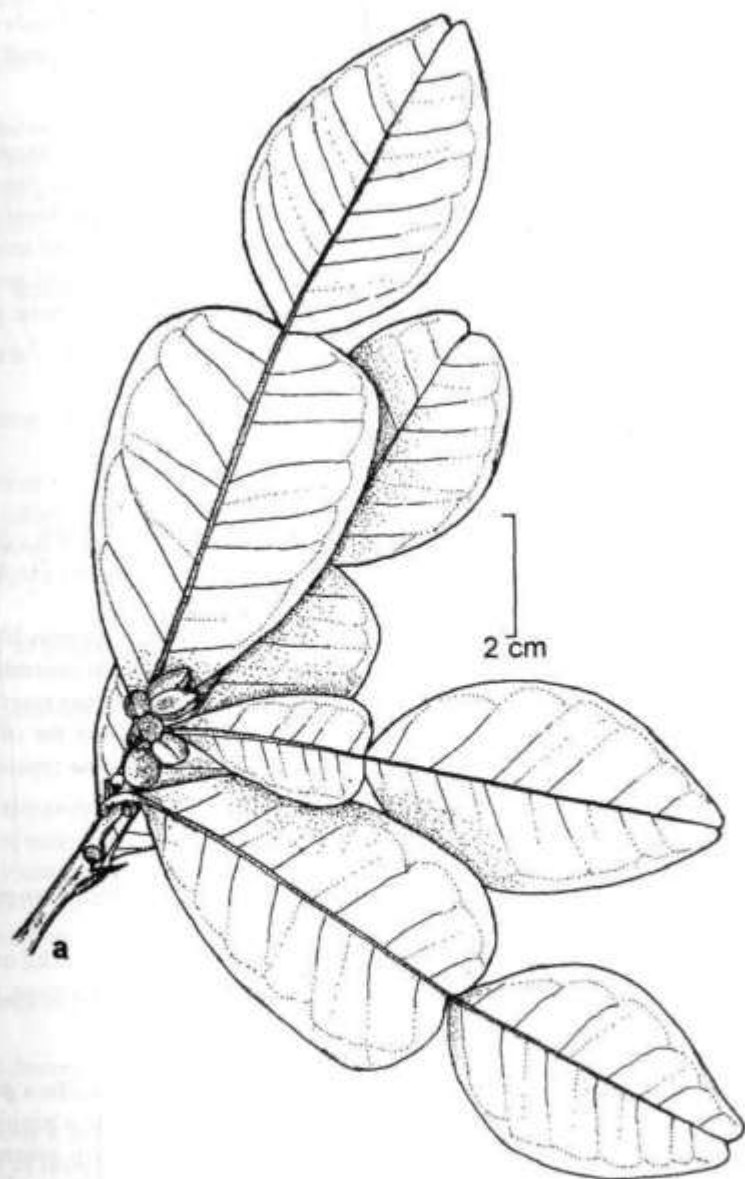


Fig. 74. *Citrus macroptera* Montr. var. *annamensis* Tanaka

This was originally described based on plants cultivated in homestead gardens in Assam, Meghalaya and Sylhet (Bangladesh). The aroma of the rind is similar to that of eucalyptus but the Assamese consider it to be similar to that of ginger, and hence the name *Ada-jamir* (*ada* = ginger; *jamir* = *Citrus*).

Ada-jamir is very closely related to amilbed or sour pomelo (*Citrus megaloxycarpa* Lush. ?) in having purplish corolla and fruits with intensely sour juice. However, the presence of larger leaves with broadly winged petioles brings this much closer to the true pomelo (*Citrus maxima* Burm.) but the fruits at any rate suggest that of sour pomelo. This could probably be a variant of the sour pomelo. But the identity of sour pomelo itself is a mystery and hence it is not possible to deem a correct systematic placement for *C. assamensis*.

The fruits are used as flavouring agents.

2. *Citrus jambhiri* Lush.

Asm.: *Godha-tulia*, *Mithu-thulia*, *Nemu-tenga*; Hindi: *Jambhiri*; Kh.: *Soh-Jhulia*, *Soh-myndog*; Kan.: *Kada-narangi*; Punj.: *Jathi-Katti*. The rough lemon of India.

Fruit is characterized by its warty-bumpy, rough rind and has a lemon-like appearance. The rind is only moderately adherent. The interior of the fruit resembles that of a lime but the segments are only slightly adherent. The rough lemon has no commercial importance except that the plants are frequently used as rootstocks for other *Citrus* species. This is considered a hybrid between the true lemon and some type of citron.

3. *Citrus karna* Raf.

Kh.: *Soh-sarkar*; Mar.: *Id-limbo*; Punj.: *Khama-khatta*. The karna orange.

This is probably an indigenous citrus fruit of India, but with a doubtful origin. It is now being cultivated in N.W. and N.E. India. In its habit and floral features, the Karna orange resembles lemon.

Fruits are ovoid-oblong or subglobose up to 12 x ca 10 cm, the surface golden-yellowish or orange-coloured, pitted, glandular, mamillate, bumpy with a nipple at apex, depressed at base, the rind thick, moderately adherent, the mesocarp greenish-white, the segments 10 - 13, adherent, central axis solid, pulp-vesicles orange-coloured and juice abundant, sour and orange flavoured.

The description of the fruits is suggestive of its suspected hybrid origin from parents like lemon (*C. limon*) and the sour orange (*C. aurantium*).

Plants are used as rootstocks for grafting other commercial *Citrus* fruits.

4. *Citrus limetta* Risso

Asm.: *Mitha-kaghzi*; Hindi: *Sakhar nimbu*; Kan.: *Shi-nimbu*. The sweet lime.

The sweet lime is believed to be a native of India but its taxonomic identity is yet to be ascertained. Although it appears to be morphologically distinct from the sour lime (*C. aurantifolia*), its supposed hybrid origin cannot be ruled out. The fruit juice is sweet and delicious.

Sweet lime is cultivated in different parts of India for its delicious fruits.

5. *Citrus x madurensis* Lour.

Calomondin or Hazara kumquat.

Shrubs or small trees with smaller, subglobose, 7 - 10-locular fruits 2 - 3 cm across. It is more often grown in Northern India as an ornamental plant. This is most probably a hybrid between a kumquat and the sour mandarin orange (i.e. *C. reticulata* Blanco var. *austera* Swingle).

6. *Citrus megaloxycarpa* Lush.

Asm.: *Bor-tenga, Jamir-tenga*; Hindi: *Attara*; Tam.: *Gajanimma*. Amilbed or sour pomelo.

This apparently resembles the true pomelo (*C. maxima*) but is distinct in the presence of marginate or slightly winged petioles, purplish tinged petals, fruits containing bitterly sour juice and seeds with purple-coloured chalazal spot. The flowers look like that of a true lemon. The sour pomelo is suspected to be a hybrid between true pomelo and lemon.

7. *Citrus nobilis* Lour.

Asm.: *Janery-tenga*. The king orange.

Probably a native of Cochinchina and cultivated in the Assam plains. Except for the aroma of the pulp juice the king orange much resembles the true mandarin orange (*C. reticulata* Blanco). This is believed to have originated as a chance hybrid between mandarin orange and sweet orange or pomelo.

4. *Limonia* L.

Unispecific.

Limonia acidissima L., Sp. Pl. ed. 2, 1: 554. 1762; Airy Shaw in Misc. Inform. 1939: 293. 1939; Stone & Nicolson in Taxon 27: 551. 1978. *Schinus limonia* L., Sp. Pl. 389. 1753, p.p. *Feronia elephantum* Correa in Trans. Linn. Soc. London 5: 225. 1800. *Hesperuthusa acidissima* (L.) M. Roemer, Syn. Mon. Hesper. 1: 38. 1846. *Feronia limonia* (L.) Swingle in J. Wash. Acad. Sci. 4: 328. 1914 & Citrus Ind. 1: 416. 1967. *Limonia elephantum* (Correa) Panigrahi in Taxon 26: 576. 1977. **Fig. 75.**

Beng.: *Kait*; Guj.: *Kavit*; Hindi: *Bilin, Kait, Kabel*; Kan.: *Balal, Byala*; Mal.: *Vila, Vlatti*; Mar.: *Kavat*; Sans.: *Kapitha*; Tam.: *Vilanga*; Tel.: *Velaga*.

Small trees, up to 8 m high, semideciduous; branchlets slightly zig-zag when young, armed with axillary sharp spines ca 3.5 cm long, glabrous; bark greyish or white, sometimes with scabrous dots. Leaves alternate, imparipinnate, up to 11 cm long; petioles and rachis marginate or narrowly winged; wings ca 1 mm broad; leaflets 5 or 7, opposite, obovate, ca 3 x 2 cm, coriaceous, gland-dotted, glabrous, cuneate at base, obtuse or rounded at apex with emarginate tip, entire or faintly glandular-crenulate along margins; petiolules of lateral leaflets obsolete, up to 2 mm long, those of terminal ones on an extension of rachis, up to 12 mm long, puberulent, soon becoming glabrous; secondary nerves 2 - 4 pairs, slender, oblique, inarching near margins, finely reticulate beneath. Inflorescences axillary and terminal, many-flowered panicles, up to 5 cm long, finely puberulent. Flowers small, reddish in bud, turning to pale-yellowish, bisexual, polygamous by abortion; pedicels to ca 5 mm long, glabrescent. Calyx 5-toothed; teeth lobes small, deltoid, ca 0.5 mm long, puberulent, ciliate near tip, caducous. Petals 5, ovate-oblong, acute, ca 6 x 2 mm, acute, glandular, glabrous. Stamens 10 or 12; filaments dilated at base, subulate above, ca 4 mm long, woolly-pubescent on inner face, glabrous above; anthers linear-oblong, acute, ca 4 mm long. Disk minute. Ovary globose, green, incompletely 4 - 6-locular with many ovules in several series; style very short, thick, fleshy; stigma oblong-fusiform. Fruits globose, 5 - 7 cm, woody, 1-locular, with sweet-sour mucilaginous pulp; seeds numerous, oblong, slightly compressed, ca 5 x 3 mm; testa brownish, hairy.

Fl. March-April; *Fr.* Ripens during Aug.-Dec.

Distrib. India: Dry or moist deciduous forests at lower elevations. Punjab, Uttar Pradesh, Madhya Pradesh, W. Bengal, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Myanmar, Thailand, Indochina and Sri Lanka. Also cultivated in many other countries.

Notes. Ripe fruits are aromatic, antiscorbutic and alexipharmic. The pulp of fruits is edible and is usually consumed in the form of sherbet. A jelly is also made out of the pulp. Unripe fruits are astringent, antidiarrhoeic and antidiarrhoeic. A gum, resembling 'gum arabic' in properties, is extracted from the stem bark.

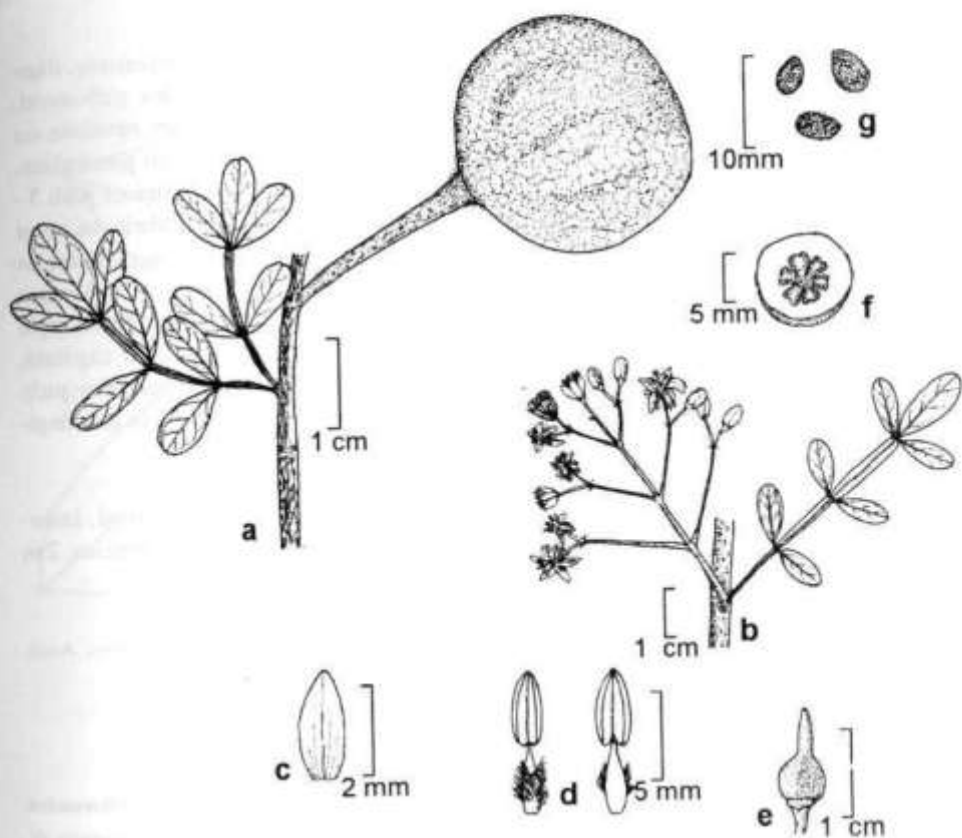


Fig. 75. *Limonia acidissima* L.: a. branchlet with fruit; b. flowering twig; c. petal; d. stamens (dorsal and ventral views); e. pistil; f. c.s. of ovary; g. seeds.

Leaves are aromatic and carminative and they yield an essential oil.

Wood is yellowish-white, hard and used for house building, naves of wheels and agricultural implements.

5. *Luvunga* Buch.-Ham. ex Wight & Arn.

Lianas, armed with axillary, retrorse or recurved spines. Leaves alternate, digitately trifoliolate, unifoliolate on seedlings and juvenile shoots; petioles pulvanoid, articulate at both ends; leaflets on short petiolules, entire along margins, revolute on drying, coriaceous, glandular-punctate. Inflorescences axillary, racemose or paniculate. Flowers 4- or 5-merous, oblong or subglobose in bud. Calyx cupular, entire or with 3 - 5 deltate sepals. Petals 3 - 5, linear-oblong or lanceolate, thick, fleshy, imbricate, soon caducous. Stamens 8 - 10, rarely less, free or connate; anthers linear-oblong, obtuse or slightly apiculate, dorsifixed. Ovary long-ovoid, seated on a thick, fleshy, columnar gynophore, 2 - 4-locular; each locule with 2 collateral or superimposed ovules; style continuous with the ovary, cylindric, long, thick, caducous; stigma obtuse or capitate. Fruits ellipsoid or globose berries with thick densely glandular or pustular pericarp; pulp mucilaginous, without vesicles; seeds 1 - 3, ovoid, light greenish, embedded in mucilaginous matter.

Tropical and subtropical regions of India, Sri Lanka, Myanmar, Thailand, Indochina, Malesia, Sumatra, Java, Borneo, Philippines and New Guinea; ca 12 species, 2 in India.

Literature. STONE, B.C. (1985). New and noteworthy paleotropical species of Rutaceae. Proc. Acad. Sci. Philadephia 137: 213-228.

KEY TO THE SPECIES

- 1a. Flowers subglobose in bud, 5 - 10 mm long; calyx puberulent; stamens free **1. *L. eleutherandra***
 b. Flowers ovoid-oblong in bud, 12 - 15 mm long; calyx glabrous with ciliolate sepals; stamens connate at base **2. *L. scandens***

1. *Luvunga eleutherandra* Dalz. in Hooker's J. Bot. Kew Gard. Misc. 2: 258. 1850; Hook.f., Fl. Brit. India 1: 509. 1875; Mohanan et al. in J. Econ. Tax. Bot. 5: 457. 1984. *L. samentosa* auct. non (Blume) Kurz : Gandhi in C.J. Saldanha & Nicolson, Fl. Hassan Dist. 386. 1976. **Fig. 76.**

Large, woody liana; branches strong, cylindric, glabrous, armed with axillary, recurved spines (ca 2.5 cm long); bark greyish, smooth or lenticellate as in older stems, often with scattered oil dots. Petioles 2.5 - 6 cm long, grooved above, glabrous; leaflet blades elliptic-oblong or obovate, acute at base, abruptly and obtusely acuminate at apex, entire along margins, 6 - 16.5 x 2.5 - 6 cm, coriaceous, prominently gland dotted on both

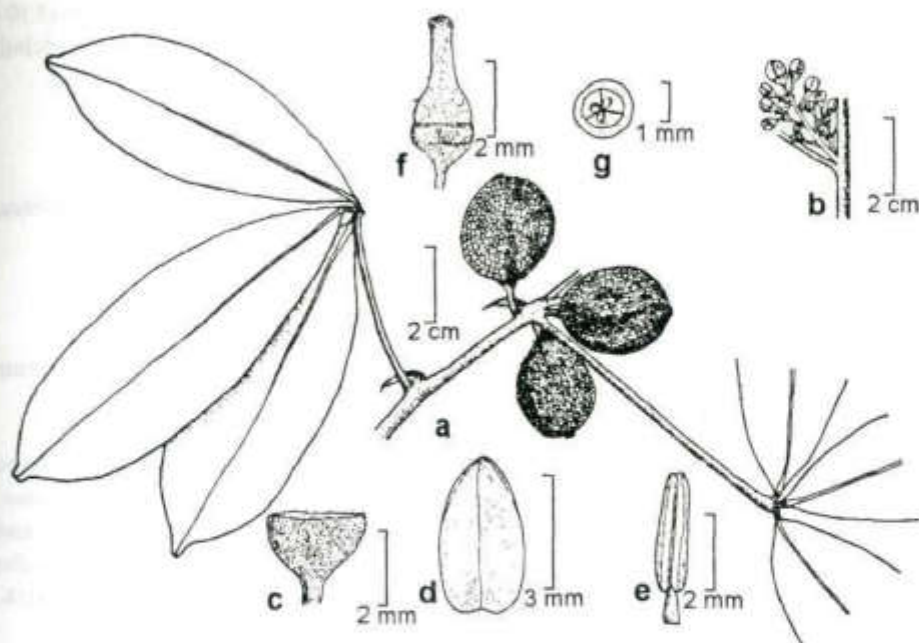


Fig. 76. *Luvunga eleutherandra* Dalz.: a. fruiting twig; b. inflorescence; c. calyx; d. petal; e. stamen; f. pistil; g. c.s. of ovary.

surfaces, glabrous; petiolules short, ca 5 mm long; secondary nerves 5 - 8 pairs, prominent, oblique, sometimes forming an indistinct intramarginal loop. Inflorescences racemose or paniculate, up to 3 cm long; peduncles puberulent; pedicels ca 5 mm long, puberulent. Flowers small, 5 - 10 mm long (ripe buds). Calyx cupular, entire or obscurely 4-lobed, 1.5 - 2.5 mm long, glandular, puberulent. Petals oblong, obtuse, fleshy, ca 4 x 2 mm, glandular, glabrous, white. Disk annular or cupulate, ca 0.5 x 1.5 mm, fleshy, glabrous. Stamens 8, shorter than petals, all free; filaments linear-subulate, glabrous; anthers ca 3 mm long, linear, apiculate, ca 2 mm long. Ovary long-ovoid, ca 1 mm long, glabrous, 3-locular; each locule with 2 superimposed ovules; style continuous with ovary, short, thick, ca 1.5 mm long, glabrous; stigma capitate. Fruiting pedicel 10 - 15 mm long, glabrous. Berries oblong-ellipsoid, to 25 x 15 mm, warty or tubercled, yellowish when ripe, 3-locular; each locule with 2 or 3 seeds.

Fl. Dec.-Jan.; *Fr.* Feb.-June.

Distrib.: India: Evergreen forests of the W. Ghats, up to 900 m. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Endemic.

Notes. Stem bark and leaves are used for aches and rheumatism. An exudate from the stem is applied in tooth-ache.

Following Tanaka (in *Meded. Rijks-Herb.* 69: 1-13. 1931) *L. eleutherandra* is treated here as distinct from *L. samentosa* (Blume) Kurz (= *Triphasia samentosa* Blume) which enjoys a far wider distribution in Malay peninsula, Java, Sumatra, Borneo and New Guinea, and is characterised by smaller leaflets with obscure venation; smaller flowers with free very hirsute filaments and smaller fruits with a small persistent calyx.

2. *Luvunga scandens* (Roxb.) Wight, *Ill. Ind. Bot.* 1: 108. 1840; Hook.f., *Fl. Brit. India* 1: 509. 1875; Stone in *Proc. Acad. Nat. Sci. Philadelphia* 137: 221. 1985. *Limonia scandens* Roxb. (*Hort. Bengal.* 32. 1814, nom. nud.) *Fl. Ind.* 2: 380. 1832. Fig. 77.

Beng.: *Luvunga lata*, *Luvung phul*; Sans.: *Kakoil*.

Liana with strong, flexuous branches armed with axillary, slightly recurved spines often from a conical base; bark smooth when young, rather rough on ageing, greyish. Petioles 3 - 6.5 cm long, horizontally grooved above, glabrous; leaflet blades variable, oblong-elliptic or oblanceolate, cuneate at base, acute or shortly acuminate at apex, entire along margins, 6.5 - 18 x 2.5 - 4 cm, thick, coriaceous, glabrous; secondary nerves obscure. Inflorescences paniculate-racemes, often 4 - 6-flowered; peduncles short, glabrescent. Calyx cupular, 3.5 - 5 mm long; lobes 4, truncate, minute, ciliolate along margins. Petals 4, oblong, obtuse, 12 - 16 x 3 - 4 mm, glabrous, fleshy, white. Stamens 8 - 10; filaments linear-subulate, connate almost to tip; staminal tube ca 12 mm long,

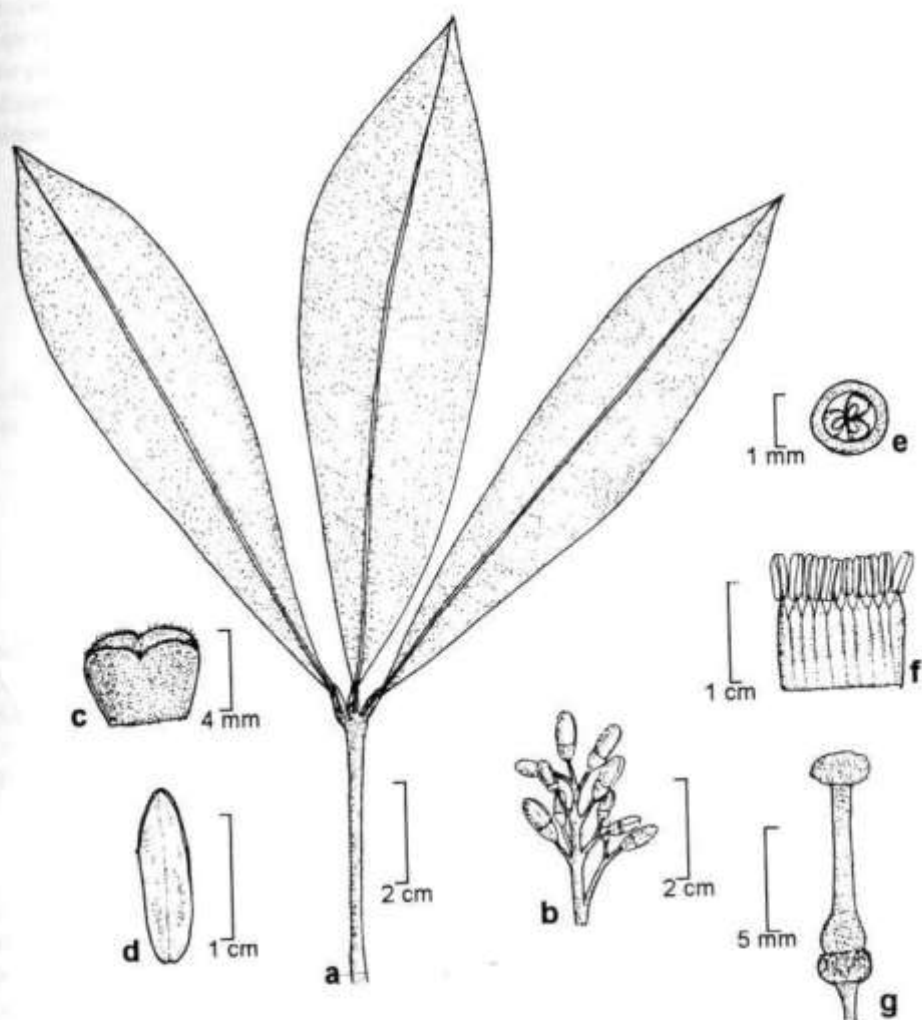


Fig. 77. *Luvunga scandens* (Roxb.) Wight: a. leaf; b. inflorescence; c. calyx; d. petal; e. c.s. of ovary; f. stamens; g. pistil.

glabrous; anthers linear, apiculate, ca 5 mm long. Ovary long-ovoid, ca 2.5 x 1.5 mm, seated on a columnar fleshy glandular disk (ca 1 x 3 mm), glabrous, 3-locular; each locule with 1 or 2 superimposed ovules; style continuous with ovary, cylindric, up to 7 mm long, glandular, glabrous; stigma capitate, ca 2.5 mm broad, glandular. Berries oblong, up to 20 x 25 mm; pericarp smooth, densely glandular or pustular, 3-locular; each locule with a solitary seed embedded in a mucilaginous matrix, the latter devoid of pulp-vesicles; seeds ovoid, rather pointed at apex; outer integument of testa membranous, greenish.

Fl. March-April; *Fr.* Ripens in Sept.

Distrib. India: Evergreen forests, up to 1500 m. Assam and Meghalaya. Rare.

Laos, Vietnam and Thailand.

Notes. Fruits are used in the preparation of a perfumed medicinal oil, called kakoli oil. Roots and fruits are reported to be used as antidotes for snake poison and scorpion-sting.

6. *Merope* M. Roemer

Unispecific.

Merope angulata (Willd.) Swingle in J. Wash. Acad. Sci. 5: 420. 1915 & *Citrus* Ind. 1: 258. 1967. *Citrus angulata* Willd., Sp. Pl. 3: 1426. 1801. *Atalantia longispina* Kurz in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 42: 295. 1872. *Paramignya angulata* (Willd.) Kurz in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 44: 135. 1875. *P. longispina* Hook.f., Fl. Brit. India 1: 511. 1875. Fig. 78.

Beng.: *Ban-nimbu*.

Shrubs or small trees, evergreen; branchlets cylindric, armed with strong, sharp, straight, axillary, solitary or paired spines (to ca 2 cm long), glabrous; bark greyish, lenticellate. Leaves simple, alternate, to 12 cm long, often crowded on short lateral branchlets; petioles short, to 8 mm long, slightly marginate, articulate with stem at base, glabrous; leaf blades oblong, obtuse at base, entire along margins, obtusely acute at apex, 3 - 15 x 1 - 5.5 cm, thick, coriaceous, profusely pellucid-gland dotted, glabrous; secondary nerves 5 - 8 pairs, visible in larger leaves, rather faint in smaller ones, arising at angles 55°-60° with midnerve, anastomosing near margins; tertiaries indistinct; pedicels ca 5 mm long, glabrous. Flowers axillary, solitary or in pairs, ellipsoid in bud, to 7 mm long. Calyx cupular, ca 1.5 x 2 mm, 5-lobed; lobes ovate, subacute, ca 1 mm long, glandular-punctate, glabrous. Petals 5, elliptic-oblong, obtuse above, subtruncate at base, ca 10 x 4 mm, conspicuously pinnately veined, glandular, glabrous, imbricate, white or yellowish. Stamens 10, subequal; filaments ca 3 mm long, shorter than anthers, linear, with a prominent midnerve, glabrous; anthers linear-oblong, apiculate, ca 4.5 x 1 mm; apiculum

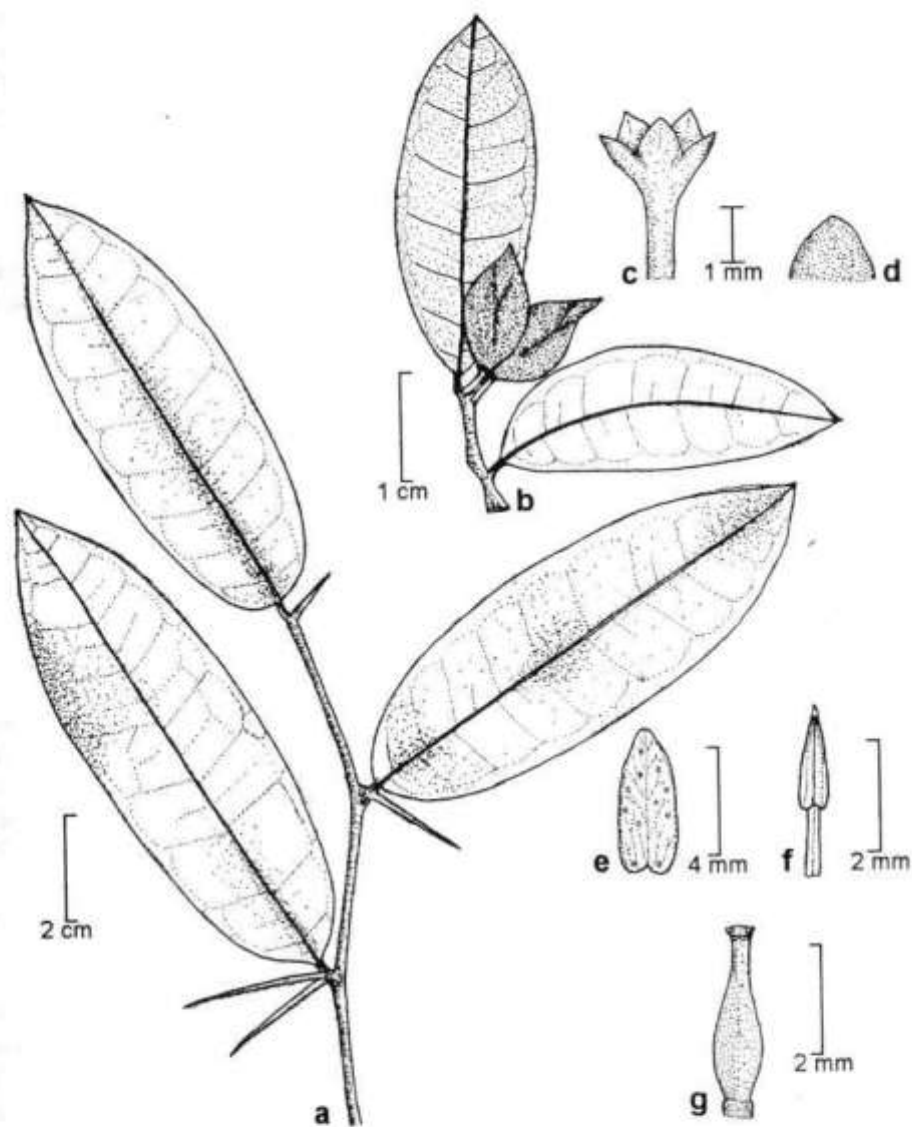


Fig 78. *Merope angulata* (Willd.) Swingle : a. twig with simple leaves; b. fruiting twig; c. calyx; d. sepal; e. petal; f. stamen; g. pistil.

ca 0.5 mm long. Disk annular, ca 0.8 mm high, glabrous, thick, fleshy. Ovary ovoid-ellipsoid, ca 4 mm long, 3 - 5-locular; each locule with 4 ovules; style cylindrical, ca 3 mm long, glabrous; stigma truncate or subcapitate, minute. Berries semidry, strongly angled, with a narrow tapering end, triangular in cross sections, ca 5 x 2.5 cm; pericarp glandular, 3-loculed, the interior of each locule filled with a mucilaginous fluid devoid of pulp-vesicles; seeds 3, large, reniform, flattened with tapering ends.

Fl. April-July; *Fr.* Ripens in Nov.

Distrib. India: Tidal forests and marshy swamps of the Sunderbans in W. Bengal and the Mahanadi delta in Orissa. Rare (Banerji et al., (1989). Mangroves of India 99. (1989).

Myanmar, Malesia, Java, Singapore and New Guinea.

Notes. Fruits are medicinal and used in colic.

This species is salt tolerant and may be useful as a rootstock for *Citrus* spp.

7. *Naringi* Adanson

Unispecific.

Naringi crenulata (Roxb.) Nicolson in C.J. Saldanha & Nicolson, Fl. Hassan Dist. 387. 1976; Panigrahi in Bull. Bot. Surv. India 17: 196. 1978. *Limonia crenulata* Roxb., Pl. Coromandel 1: 60, t. 86. 1798. *Hesperuthusa crenulata* (Roxb.) M. Roemer, Syn. Mon. Hesper. 1: 38. 1846. *Limonia acidissima* auct. non L. 1762: Hook.f., Fl. Brit. India 1:507.1875.

Fig. 79.

Hindi: *Beli*; Kan.: *Nayibullal*; Mal.: *Kattunaregam*, *Seru-Kattunaregam*; Mar.: *Tondsha*; Tam.: *Nayvila*, *Billuvam aram*, *Kurangu*; Tel.: *Tor-elega*.

Small trees, up to 10 m high, semievergreen, spinous; branchlets cylindrical, angular in younger twigs, glabrous; spines solitary or in pairs, 10-25 mm long; bark corky, rugose, grey-brownish. Leaves alternate, imparipinnate, to 15 cm long; petioles and rachis marginate or narrowly winged; petiolar wings 1 - 3 mm broad; rachis wings oblanceolate, entire or obscurely crenate along margins, 8 - 12 mm broad; leaflets usually 5 or 7, rarely also 3 on the same branchlets, opposite, sessile, ovate, elliptic or oblanceolate, oblique and acute at base, obtuse and emarginate at apex, crenulate or irregularly serrulate along margins, 1 - 5 x 1 - 2 cm, dark green and glossy above, pale green beneath, membranous to thinly coriaceous, profusely pellucid-gland-dotted; glands dimorphic, often raised and prominent on both surfaces, glabrous; secondary nerves 3 - 8 pairs, faint above, prominent beneath, oblique, finely reticulate. Inflorescences axillary or sometimes terminal on short leafy branchlets, subumbellate racemes; peduncles to 2 cm long,

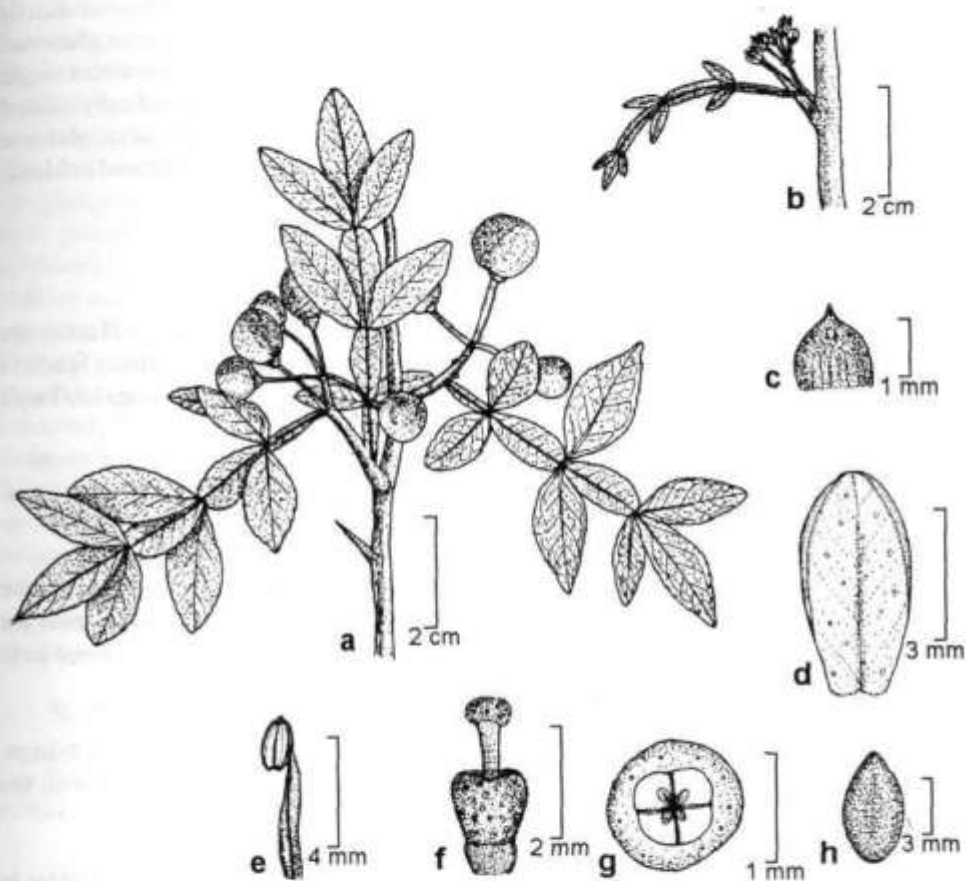


Fig. 79. *Naringi crenulata* (Roxb.) Nicolson: a. fruiting twig; b. branchlet showing a young inflorescence; c. sepal; d. petal; e. stamen; f. pistil; g. c.s. of ovary; h. seed.

shortly pubescent; pedicels filiform, 8 - 12 mm long, glabrous or pubescent. Flowers bisexual. Sepals 4, ovate-orbicular or deltate, acute or abruptly acuminate, ca 1.5 mm long, glandular, glabrous or finely pubescent abaxially, glabrous adaxially. Petals 4, elliptic or oblong, obtuse, concave, ca 7 mm long, profusely glandular, glabrous, white. Stamens 8, subequal or alternately shorter and longer, 3.5 - 6 mm long; filaments linear-subulate, with a prominent midnerve, glabrous; anthers oblong, obtuse or shortly apiculate, ca 1.5 mm long, yellowish. Disk annular or cupular, ca 0.5 x 1 mm, glabrous. Ovary subobovoid, ca 1 mm long, glandular, glabrous 4-locular; each locule with a single ovule; style ca 1 mm long, inserted at the depression of ovary lobes, gradually dilated above with a ring of glands below the subglobose stigma. Berries semidry, globose, bluish-black when ripe, to 1 cm across, glandular, 4-locular, 1 - 4-seeded; seeds oblong, 3 - 5 mm across, brownish, shiny.

Fl. March-April; *Fr.* August onwards, but ripens in January.

Distrib. India: Moist deciduous forests of peninsular India and sub - Himalayan tracts of N.W. India, up to 1200 m. Himachal Pradesh, Punjab, Rajasthan, Madhya Pradesh, Uttar Pradesh, Bihar, W. Bengal, Orissa, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Sri Lanka, Pakistan, Myanmar, Bhutan, Bangladesh, S. W. China, Indochina, Thailand and Java.

Notes. The roots are purgative, sudorific and used for colic and cardialgia. Dried fruits which are often used as a condiment are also a good source of a tonic used for intestinal disorders, pestilent fever and resisting the contagion of small pox. Fruit pulp is used as a substitute for soap by Javanese.

The plant is highly valued as an ornamental because of its attractive green foliage. It is also being used as a rootstock for grafting *Citrus* spp. and *Swinglea glutinosa*; the latter belongs to the subtribe Balsamocitrinae).

Plants from N.W. Himalayas differ from those that occur in other parts of India in having finely pubescent pedicels and presence of a median apical gland on the sepals as well as the ovary locules.

8. *Pamburus* Swingle

Unispecific.

Pamburus missionis (Wallich ex Wight) Swingle in J. Wash. Acad. Sci. 6: 338. 1916 & *Citrus* Ind. 1: 263. 1967. *Limonia missionis* Wallich (Num. List No. 6358. 1832, nom. nud.) ex Wight in Wight & Arn., Prodr. 92. 1834. *Atalantia missionis* (Wallich ex Wight)

Oliver in *J. Linn. Soc. Bot. 5. Suppl. 2: 25. 1861*; Hook.f., *Fl. Brit. India 1: 513. 1875.*

Fig. 80.

Tam.: *Kuruntu.*

Shrubs or small trees, up to 12 m high, evergreen, spinous, profusely branching; branchlets cylindric, smooth, angular when young, older ones armed with sharp, solitary (or sometimes in pairs) spines (ca 3 cm long); bark grey, longitudinally fissured, lenticellate. Leaves simple, alternate; petioles short, to 15 mm long, marginate, glabrous; leaf blades oblong-elliptic or elliptic, broadly cuneate and slightly oblique at base, rounded or sometimes slightly emarginate at apex, entire or minutely crenulate along margins, 4.5 - 12.5 x 2 - 5.5 cm, glandular-punctate; gland-dots more prominent above, dark greenish above, pale green beneath, glabrous; secondary nerves 6 - 8 pairs, slender, horizontal, indistinct, prominent beneath on drying; tertiaries obscure. Inflorescences axillary and from uppermost leaf axils (pseudoterminal), racemose-paniculate, up to 3 cm long, few- to many-flowered, glabrous; pedicels slender, to 4 mm long, glabrous. Flowers bisexual, ca 2 cm across, fragrant. Sepals 4 or 5, deltoid, acute, ca 1.5 mm long, glandular, glabrous. Petals 4 or 5, oblong-lanceolate or oblong-obovate, acute or obtuse, recurved, 3.5 - 6.5 x ca 2.5 mm, prominently nerved, glandular, glabrous, pure white. Stamens 8 or 10, subequal, ca 5 mm long; filaments subulate, slender, glabrous; anthers linear-oblong, obtuse, cordate below, ca 2 mm long. Disk obscure. Ovary subglobose or oblong-ellipsoid, ca 1 mm long, less than 1 mm across, smooth, glandular, stipitate below, 4- or 5-locular; each locule with 2 ovules; style ca 2.5 mm long, glandular, glabrous; stigma capitate or truncate, glandular. Berries globose, 5- or 4-locular, ca 2.5 cm across; pericarp thick, orange-coloured when ripe, densely glandular; each locule with 1 or 2 seeds, surrounded by a gelatinous-mucilage; seeds globose or ellipsoid.

Fl. March-April; *Fr.* Aug.-Sept.

Distrib. India: Dry coastal scrub jungles. Andhra Pradesh and Tamil Nadu. Occasionally cultivated.

Sri Lanka.

Notes. Wood is yellowish-white, moderately hard, close-grained and used for furniture and cabinet work.

Ghosh et al.'s (*J. Bombay Nat. Hist. Soc. 68: 851-852. 1971*) reported occurrence of this species in Burdwan district, W. Bengal was probably based on a cultivated tree.

9. *Paramignya* Wight

Woody climbers or scandent shrubs, evergreen; armed with retrorse axillary spines. Leaves alternate, unifoliolate or simple; petioles pulvanoid, often articulated above with

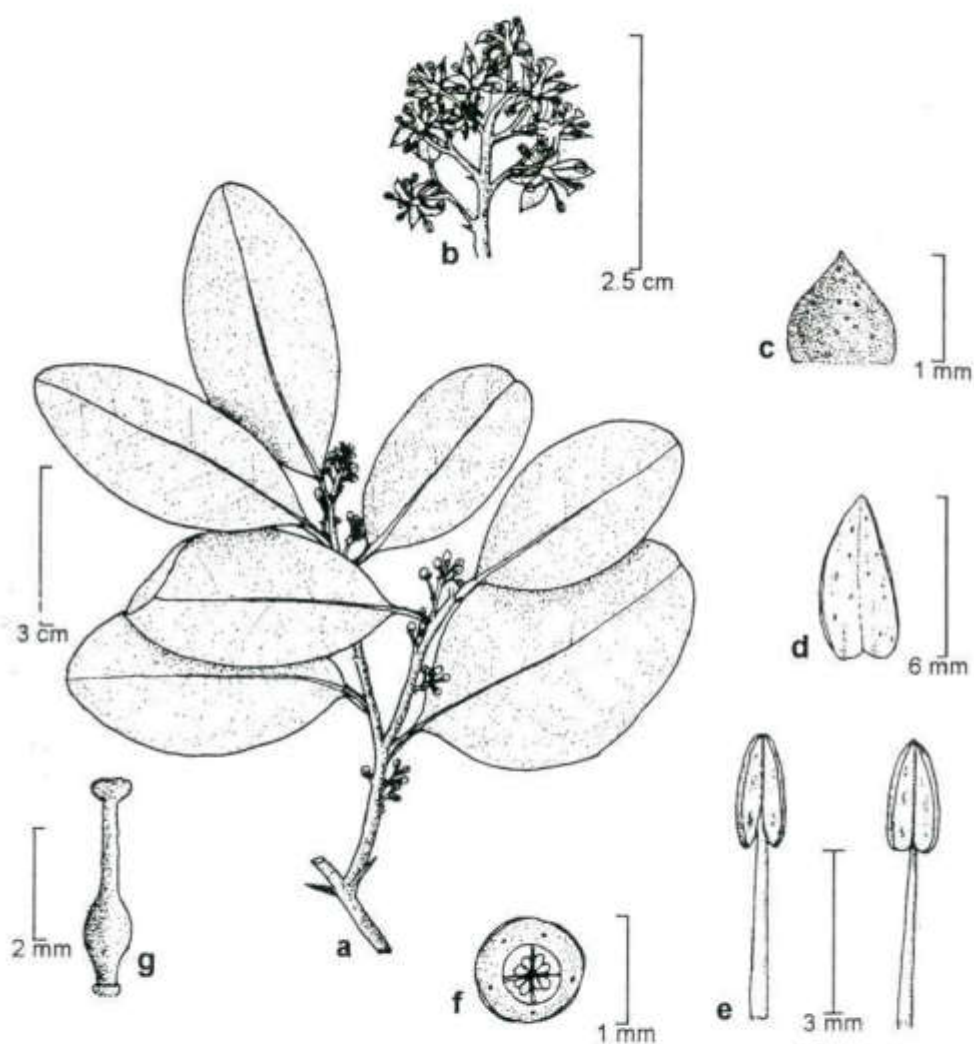


Fig. 80. *Pamburus missionis* (Wallich ex Wight) Swingle.: a. branchlet with inflorescence; b. inflorescence; c. sepal; d. petal; e. stamens; f. c.s. of ovary; g. pistil.

the leaflet blade. Flowers axillary, fascicled or solitary, medium to large, fragrant. Calyx cupular with 4 or 5 distinct sepals, persistent. Petals 4 or 5, imbricate, white. Stamens 8 or 10, alternately shorter and longer; filaments linear, subulate above; anthers linear-oblong, larger. Ovary on a distinct elongated gynophore, 3 - 5-locular; each locule with 1 or 2 ovules; style cylindric, longer than ovary; stigma capitate, globose or oblate. Berries subglobose, ellipsoid to pyriform or obovoid, entire or obscurely lobed or sometimes furrowed, apiculate or obtuse at apex; pericarp thick, glandular, variously pubescent, yellowish or orange-coloured to deep pinkish when ripe, 3 - 5-locular with 1 - 5 large, compressed seeds; seeds embedded in a mucilaginous substance; pulp-vesicles absent.

Tropical and subtropical parts of India, Sri Lanka, Myanmar, S. China, Laos, Cambodia, Vietnam, Thailand, Malay peninsula, Sumatra, Sumbawa, Borneo, Philippines and Australia; ca 12 species, 5 in India.

KEY TO THE SPECIES

- | | |
|---|-------------------------|
| 1a. Sepals broad, obtuse | 2 |
| b. Sepals narrow, acute | 4 |
| 2a. Pedicels shorter than or as long as flowers, softly pubescent; style pubescent below, glabrous above; berries subglobose or obovoid, 3 - 5-grooved, downy-pubescent | 4. <i>P. monophylla</i> |
| b. Pedicels much longer than flowers, glabrate; style glabrous throughout; berries globose or pyriform, obscurely 2- or 3-lobed, glabrous | 3 |
| 3a. Petioles not articulated with base of blade; style 10 - 15 mm long, slender; stigma capitate | 1. <i>P. andamanica</i> |
| b. Petioles articulated with blade at middle or of its entire length; style 5 - 7 mm long, unevenly cylindric, dilated above; stigma oblate | 2. <i>P. beddomei</i> |
| 4a. Plants pubescent to tomentulose; filaments longer than anthers | 5. <i>P. scandens</i> |
| b. Plants glabrous or nearly so; filaments shorter than anthers | 3. <i>P. citrifolia</i> |

1. *Paramignya andamanica* (King) Tanaka in Bull. Soc. Bot. France 75: 712. 1928; Swingle, *Citrus Ind.* 1: 275. 1967. *P. amata* (Thwaites) Oliver var. *andamanica* King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 62: 223. 1893; Parkinson, For. Fl. Andaman Isl. 108. 1923.

Fig. 81.

Climbing shrubs; stem woody, cylindric, armed with axillary, slightly recurved, sharp, glabrous or pubescent spines; branchlets puberulent, soon becoming glabrous; bark greenish, lenticellate. Leaves simple; petioles 8 - 20 mm long, inarticulate, twisted, densely puberulent above or glabrous; leaf blades elliptic-oblong, rounded at base, subacute or acuminate at apex, entire along margins, 8 - 20 x 3 - 8 cm, dark green and glossy above, pale greenish beneath, sweet-scented when bruised, coriaceous, glandular-punctate; gland dots very numerous, closely set; secondary nerves 6-12 pairs, prominent, spreading, reticulate. Bracteoles 2, at base of pedicels, minute; pedicels slender, 15 - 35 mm long, glabrate. Flowers axillary, often in pairs, sometimes solitary, cylindric

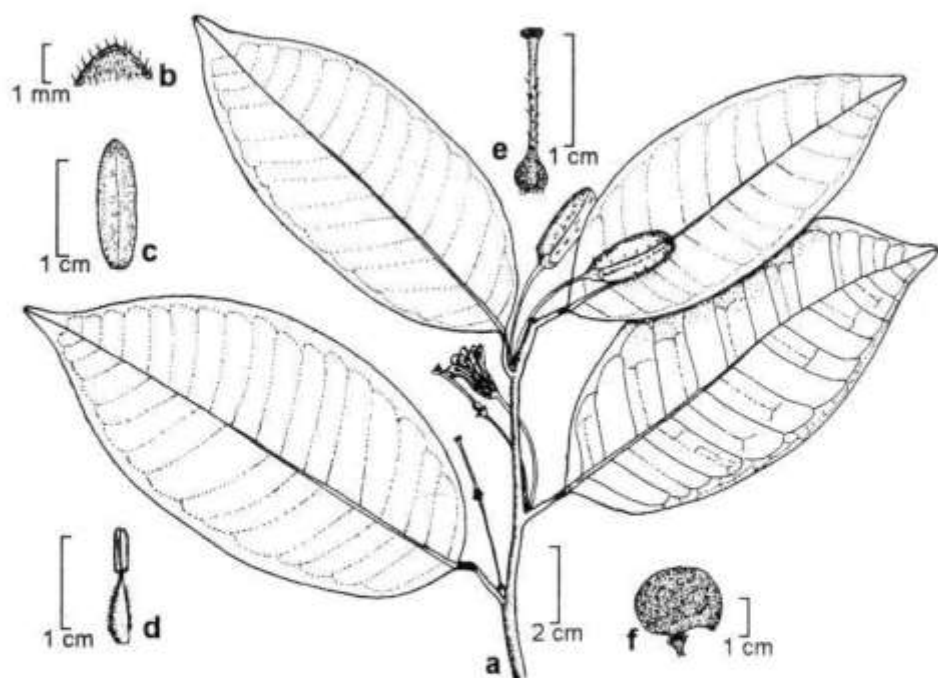


Fig. 81. *Paramignya andamanica* (King) Tanaka: a. flowering twig; b. sepal; c. petal; d. stamen; e. pistil; f. fruit.

in bud, 12 - 20 x 30 mm, fragrant. Calyx cupular; sepals 5, obtuse, 1 - 2 mm long, pubescent outside, glabrous inside, ciliolate along margins. Petals 5, linear-oblong, obtuse, 12 - 20 x 3 - 4 mm, glandular, glabrous, white. Stamens 10, shorter than petals; filaments linear, subulate above to 17 mm long, woolly below for 3/4 of their length, glabrous above; anthers linear-oblong, ca 5 mm long. Ovary borne on a cylindrical gynophore, ovoid, slender, ca 2 mm long, glandular, glabrous; style slender, 10 - 15 mm long, glandular, glabrous; stigma capitate. Berries subglobose or pyriform, obscurely 2-lobed, ca 2 cm across, glandular, yellowish when ripe with remnants of the eccentrically placed style; seeds several, flat, compressed, large.

Fl. May-Aug.; *Fr.* Nov.-April.

Distrib. India: Coastal and inland forests of Andaman & Nicobar Islands, up to 80 m.

Vietnam, Sumatra, Sumbawa and Borneo.

Notes. *P. andamanica* is the only species of this genus showing largest dimensions regarding the size of leaves, spines, flowers etc.

2. *Paramignya beddomei* Tanaka in J. Bot. 68: 230. 1930; C. Fischer in Gamble, Fl. Pres. Madras 1872. 1936; K.N. Nair in J. Bombay Nat. Hist. Soc. 88: 135. 1991. *P. amata* auct. non (Thwaites) Oliver 1861: Beddome, Icon. Pl. Ind. Orient. 65. t. 275. 1874(excl.descr.); Gamble, Fl. Pres. Madras 1: 158. 1915. **Fig. 82.**

Woody climbers, armed with retrorse spines in leaf axils; branchlets often zigzag, cylindrical, densely puberulent with adpressed hairs, later becoming glabrous or nearly so; bark green, smooth or lenticellate. Petioles slender, 8 - 20 mm long, articulated with the leaflet in middle or at base of blade, twisted, puberulent; leaflet blades ovate to ovate-lanceolate, obtuse to broadly rounded, rarely cuneate at base, caudate-acuminate at apex; entire along margins, acumen to 15 mm long; tip bluntish, 3.5 - 9.5 x 1.5 - 4.5 cm, chartaceous to coriaceous, glabrous or occasionally with scattered and adpressed hairs, beneath; secondary nerves 5 - 10 pairs, prominent on both surfaces, spreading, reticulate. Bracteoles 2, oblong, minute, thick, thinly hairy abaxially; pedicels slender, 14 - 18 mm long, glandular, glabrous or nearly so. Flowers solitary or rarely in pairs in leaf axils, cylindrical in bud, ca 13 mm long. Calyx cupular, ca 2 mm long, profusely glandular abaxially; sepals 5, auricular, obtuse, glabrate, ca 0.5 mm long. Petals 5, white, oblong, obtuse, 12 x 4 mm, glandular, white; midnerve prominent, glabrous. Stamens 10, subequal; filaments linear, subulate above, 4 - 6 mm long, densely pubescent throughout; anthers linear, obtuse, 5 - 6 mm long. Ovary subglobose, ca 2 x 1.5 mm, 5-lobed, glabrous or nearly so, seated on a columnar gynophore; gynophore as long as ovary; ovary 5-locular; each locule with one ovule; style cylindrical, ca 7 mm long, glandular, glabrous, dilated above ending in a broad, 5-lobed oblate stigma. Fruiting

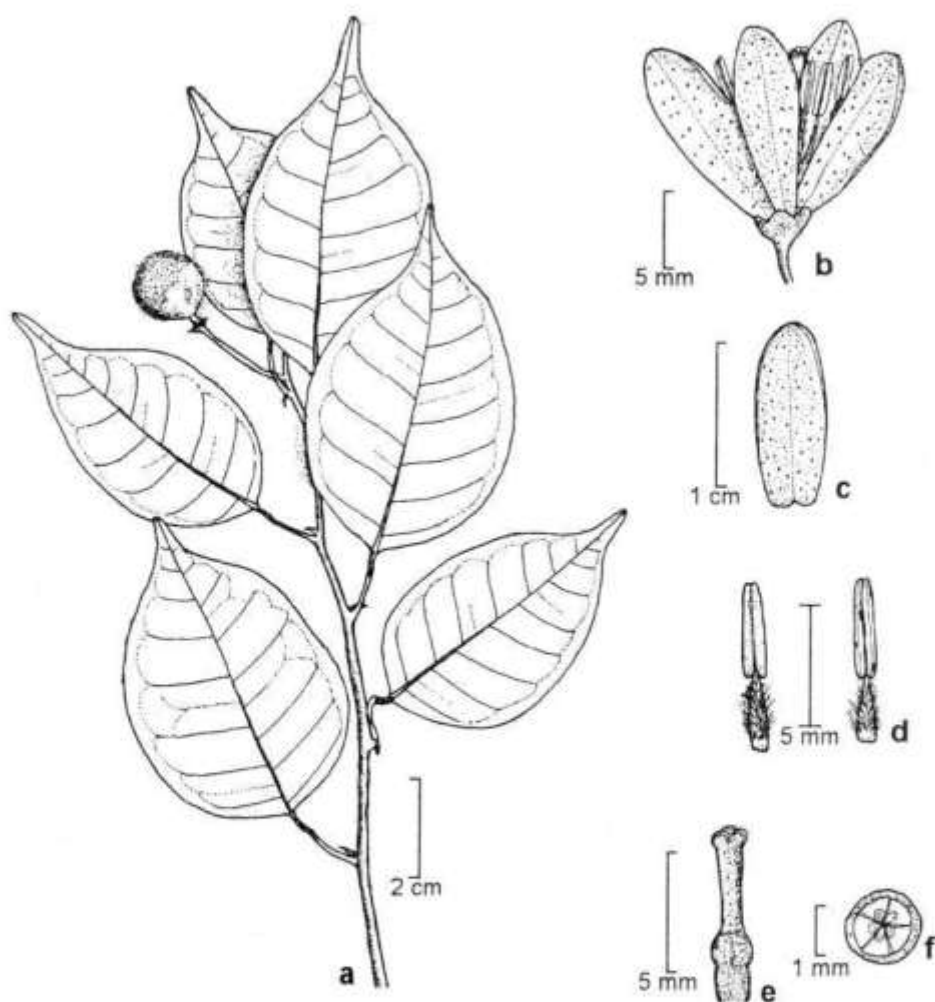


Fig. 82. *Paramignya beddomei* Tanaka: a. fruiting twig; b. flower; c. petal; d. stamens; e. pistil; f. c.s. of ovary.

pedicels 20 - 30 mm long, glabrous. Berries globose, non-apiculate, ca 2 cm, glandular, deep pinkish when ripe, sometimes obscurely 3-5-lobed; seeds 3-5, compressed, large.

Fl.: June - Nov.; *Fr.* Dec. - July.

Distrib. India: Evergreen forests of the southern W. Ghats, 850-1350 m. Tamil Nadu and Kerala.

Sri Lanka.

Notes. Though closely related to *P. amata* (Thwaites) Oliver, it is a distinct species. In *P. amata* the branchlets are straight and glabrous, flowers in fascicles of 3 - 8 and medium-sized (up to 10 mm long), calyx lobes triangular, acute, staminal filaments sparsely pubescent up to the middle from base, anthers shorter and berries apiculate.

All earlier reports of *P. amata* from peninsular India were based on misidentification of *P. beddomei* only (Nair in J. Bombay Nat. Hist. Soc. 88: 135-136. 1991).

3. *Paramignya citrifolia* Oliver in J. Linn. Soc. Bot. 5. Suppl. 2: 42. 1861, valid only for name, quoad syn. *Limonia citrifolia* Roxb., Fl. Ind. 2: 379. 1832, non Salisb. 1796. *Atalantia citrifolia* Kurz, And. Rep. App. 4: 33. 1870. *Paramignya citrifolia* (Roxb.) Hook.f., Fl. Brit. India 1: 510. 1875, non Oliver 1861. *P. micrantha* Kurz in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 44: 135. 1875, pro syn.; Balakr., Fl. Jowai 1: 117. 1981.

Kh.: *Mei-soh-khar-khlaw*.

Scandent shrubs, armed with recurved spines in leaf axils; spines greenish at base, shiny at tip; bark grey, lenticellate. Leaves simple; petioles 8 - 11 mm long, not articulated with leaf blade, twisted, glabrescent; leaf blades elliptic-oblong, rounded at base, abruptly acuminate at apex, acumen 15 mm long, bluntish at tip, entire along margins or nearly so, 8 - 16 x 3 - 7 cm, coriaceous, profusely gland-dotted; glands convex on both surfaces but more prominently raised beneath, minutely adpressed hairy beneath; secondary nerves 12 to 14 pairs, prominent on both sides. Flowers axillary, small. Sepals 5, acute, minute, glandular. Petals 5, oblong, glabrous, white. Stamens 10; filaments short; anthers linear. Ovary ovoid or oblong, 5-grooved, 5-locular; each locule with 2 ovules; style thick, short; stigma subpeltate. Berries ovoid, obtusely 5-angled, pointed, yellowish when ripe, 5-locular; seeds 3 - 5, oblong, laterally compressed, large, ca 15 x 10 mm; testa brownish.

Distrib. India: Evergreen forests at lower elevations. Meghalaya (Khasi & Jaintia hills).

Bangladesh.

Notes. *P. citrifolia* is an imperfectly known species whose identity and nomenclature have been in a state of confusion. When Oliver (1861) published *Paramignya citrifolia* with two varieties, viz. *pubescens* and *malaccensis*, he cited two synonyms, *Limonia citrifolia* Roxb. (1832) and *Citrus scandens* Griffith (1854). According to Kurz (1870: 33) *P. citrifolia* Oliver and *C. scandens* Griffith represent 2 species distinct from Roxburgh's *Limonia citrifolia*. Following Kurz's view, J.D. Hooker (1875: 510) treated Oliver's *P. citrifolia* under a new name *P. griffithii* Hook.f., and included *C. scandens* Griffith in its synonymy. J.D. Hooker, however, subsequently called *L. citrifolia* Roxb. as *Paramignya citrifolia* Hook.f. (text reads as 'non Oliver'). Tanaka (1930, 1937) consistently used *P. citrifolia* Hook.f. as the correct name for this taxon while Swingle (1943, 1967) cited *P. citrifolia* (Roxb.) Oliver for it.

In fact, Oliver must be regarded as the author who first recognized *Limonia citrifolia* Roxb. as a species under *Paramignya* although the accompanying description included the type of another name (i.e., *Citrus scandens* Griffith) as well. The name was erroneously applied to a different taxon that ought to have been called *P. scandens*. Since *Limonia citrifolia* Roxb. also forms part of *Paramignya citrifolia*, Oliver's name must be retained for the taxon which includes Roxburgh's type. *P. citrifolia* Oliver need to be treated as a new name published for *Limonia citrifolia* Roxb. and not a new combination because *L. citrifolia* Roxb. is a later homonym of *L. citrifolia* Salisb. (1796).

4. *Paramignya monophylla* Wight, Ill. Ind. Bot. 1: 108, t. 42. 1840; Hook.f., Fl. Brit. India 1: 510. 1875.

Mar.: *Karivageti, Kurvivageti*; Kan.: *Kadukanji, Kan-nimbu*.

Woody climbers; stem armed with recurved spines in leaf axils; bark greenish, gland-dotted, lenticellate. Leaves simple; petioles slender, 6 - 15 mm long, twisted, not articulated with leaf blades, shortly pubescent to glabrous; leaf blades elliptic, elliptic-oblong, ovate-lanceolate or subobovate, obtuse to rounded at base, acute, obtuse or abruptly acuminate at apex, entire or rarely obscurely crenate towards apex from middle along margins, 6 - 13.5 x 2 - 6 cm, coriaceous, greenish glossy above, pale green beneath, glabrous; secondary nerves 9 - 20 pairs, prominent, spreading, finely reticulate; pedicels slender, 4 - 8 mm long, pubescent. Flowers in axillary cymes or sometimes solitary, ca 25 mm across when open, fragrant. Calyx cupular, ca 5 mm long; sepals 5, rounded, obtuse, ca 2 mm long, glandular, finely pubescent abaxially, glabrous adaxially, persistent. Petals 4 or 5, oblong to oblanceolate, obtuse, slightly narrowed at base, ca 15 x 5 mm, pinnately 3 - 4-nerved, glandular, glabrous, fleshy, white. Stamens 8 or 10, equal or subequal in length; filaments linear, subulate above, 7 - 13 mm long, often gland-dotted, pilose or glabrous; anthers linear, obtuse or minutely glandular-apiculate, ca 4 mm long. Ovary ovoid, ca 2 x x 1.5 mm, tawny-pubescent to densely puberulent to glabrous, 3 - 5-locular; each locule with 2 collateral ovules; style cylindric, 5 - 12 mm long, pubescent at base, glabrous above; stigma capitate. Berries subglobose or obovoid, ca 25 mm

across, 3 - 5- grooved above, orange-coloured when ripe, downy-pubescent; seeds 3 - 5, flat, large.

Fl. April-May; *Fr.* August onwards and ripens mostly during winter.

Distrib. India: Wet evergreen forests up to 1520 m. W. Bengal, Sikkim, Assam, Meghalaya, Mizoram, Arunachal Pradesh, Maharashtra, Karnataka, Tamil Nadu and Kerala.

Nepal, Bhutan, Myanmar and Sri Lanka.

Notes. Root contains calcium oxalate and is bitter in taste. It is used as a tonic and diuretic and also given to cattle in haematuria and other bloody fluxes from the abdomen.

5. *Paramignya scandens* (Griffith) Craib, *Fl. Siam. Enum.* 1: 235. 1926. *Citrus scandens* Griffith, *Not. Ad. Pl. As.* 4: 495. 1854. *Paramignya citrifolia* Oliver in *J. Linn. Soc. Bot.* 5. *Suppl.* 2: 42. 1861, quoad descr., excl. syn. *Limonia citrifolia* Roxb. 1832. *Paramignya griffithii* Hook.f., *Fl. Brit. India* 1: 510. 1875, *p.p.*, excl. specim. Malacca (Griffith) **Fig. 83.**

Asm.: *Bonjora*; *Kh.:* *Soh-nari-khla*.

Scandent shrubs, spinous; young parts finely pubescent to tomentulose; stem cylindrical, gland-dotted; spines 5 - 20 mm long, recurved, tomentose; bark grey, lenticellate. Leaves simple; petioles 5 - 12 mm long, rather strong, inarticulate, slightly swollen near point of attachment below leaf blade, pubescent or glabrous; leaf blades elliptic-oblong to oblong-lanceolate or elliptic-obovate, rounded, sometimes also subcordate or rarely cuneate at base, abruptly and obtusely acuminate with 5 - 8 mm long acuminate at apex, entire along margins, coriaceous, dark green above, paler beneath, pubescent or minutely hairy beneath, glabrous otherwise; secondary nerves 6 - 12 pairs, faint above, rather prominent beneath, obliquely arching upwards, finely reticulate. Bracteoles 2, deltate, ca 0.5 mm long, densely pubescent abaxially, glabrous adaxially; pedicels short, ca 5 mm long, finely tawny-pubescent. Flowers axillary, in 2 - 3-nate clusters or sometimes solitary, to 14 mm long. Calyx ca 5 mm long, deeply 5-lobed; lobes deltoid, acute, ventrally, ca 1 mm long, pubescent dorsally, glabrous within. Petals 5, elliptic, obtuse, to 12 mm long, glabrous, white. Stamens 10, subequal; filaments linear-subulate, to 10 mm long, glabrous; anthers oblong, ca 3 mm long. Ovary seated on a distinct gynophore, oblong-ovoid, ca 1.5 mm long, finely pubescent, 5-locular; style filiform, ca 10 mm long, pubescent at 1/4 below, glabrous above; stigma capitate. Fruiting pedicels very stout, to 5 mm long. Berries globose, pellucid-punctate, dark green (unripe), 4-locular with a oblong solitary seed.

Fl. Feb.-April; *Fr.* Sept.-Dec.

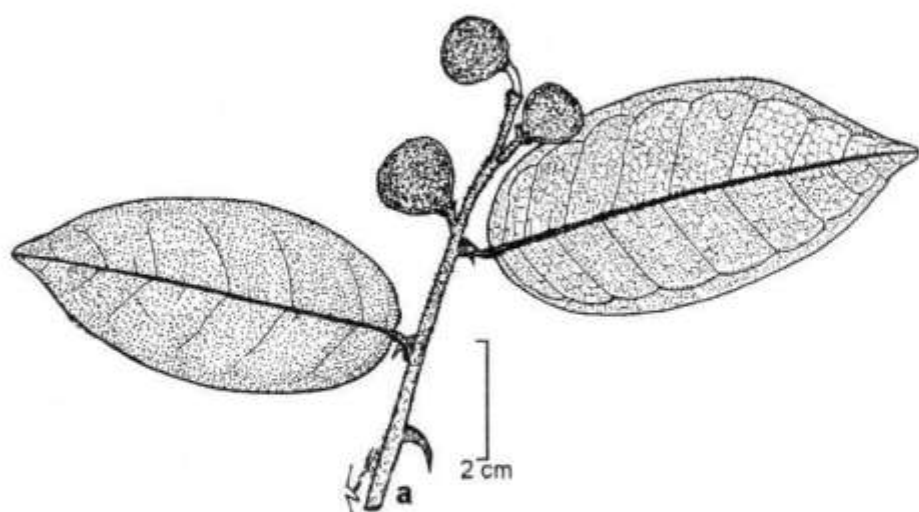


Fig. 83. *Paramignya scandens* (Griffith) Craib: fruiting twig.

Distrib. India: Evergreen forests at lower elevations, 90-150 m. Tripura, Assam, Meghalaya, Orissa and Andhra Pradesh.

Myanmar, Thailand and China.

Notes. *P. scandens* has superficial resemblance to *P. monophylla* but differs in its finely pubescent to tomentose branches and foliage and smaller flowers (8 - 14 mm long) with minute, deltoid, acute sepals. This species can be distinguished from *P. citrifolia* by its stamens with filaments longer than anthers and the indumentum of vegetative parts.

10. *Pleiospermium* (Engl.) Swingle

Shrubs or small trees; stems and branches armed with single or sometimes paired spines, occasionally unarmed. Leaves alternate, uni- to trifoliolate; petioles cylindrical or narrowly to broadly winged or marginate; leaflets entire along margins, coriaceous, glabrous, gland-dotted. Inflorescences axillary or pseudoterminal (from uppermost leaf axils) paniculate cymes, or uniflowered. Calyx usually cupular with 4 or 5 deltate to lanceolate sepals. Petals 4 or 5, linear-oblong. Stamens 8 or 10, free; filaments glabrous; anthers linear-oblong. Disk cupulate, glabrous. Ovary sessile or stipitate, glabrous or hairy to pilose, 3 - 5-locular; each locule with 2 ovules; style continuous with ovary, slender or thick; stigma capitate or subglobose with 4 or 5 stylar canals and a pair of oil glands between each pair of stylar canals. Fruit subglobose to oblong, 4- or 5-locular with rudimentary pulp-vesicles; pericarp soft, glandular; seeds 4 or 5, subobovoid, compressed, ca 1 cm long, embedded in an oily or resinous matrix; testa smooth or wrinkled.

Tropical and subtropical parts of S. and S. E. Asia. S. India and Andamans. Sri Lanka, Java, Borneo and Sumatra; 5 species, one in India.

Notes. *Pleiospermium* is very closely related to *Pamburus* and *Merope* chiefly in fruit characters but is distinct. It differs from *Pamburus* in having thinner, finely reticulate, uni- or trifoliolate leaves with the lamina distinctly articulated with the petiole, and the ovary seated on an annular fleshy disk. From *Merope* it can be distinguished by its floral, fruit and seed characters.

Pleiospermium alatum (Wight & Arn.) Swingle in J. Wash. Acad. Sci. 6: 428. 1916. *Limonia alata* Wight & Arn., Prodr. 92. 1834; Hook.f., Fl. Brit. India 1: 508. 1875. *Hesperuthusa alata* (Wight & Arn.) Alston in Trimen, Handb. Fl. Ceylon 6(Suppl.): 38. 1931. *Naringi alata* (Wight & Arn.) Ellis in Bull. Bot. Surv. India 22: 193. 1980.

Fig. 84

Small trees, up to ca 8 m high; branchlets usually armed with single, stout, straight, ca 25 mm long spines in leaf axils, or rarely unarmed, especially in fruiting branchlets; bark grey, lenticellate. Leaves trifoliolate, rarely bi- or unifoliolate; petioles ca 25 mm



Fig. 84. *Pleiospermium alatum* (Wight & Arn.) Swingle

long, articulated at base of leaflet blades, narrowly winged; wings linear-oblong to obovate, obtuse above, shallow at base, ca 5 mm broad on either side, glandular-puberulent to glabrous; leaflets subsessile; terminal one the largest, ca 6.5 x 4.5 cm, the laterals smaller, ca 4 x 3 cm, elliptic-obovate to obovate or oblong-elliptic, cuneate, sometimes slightly oblique at base, rounded and emarginate at apex, entire or obscurely crenate along margins, dark green on both surfaces, coriaceous, glandular-punctate; secondary nerves 5 - 7 pairs, slender, prominent on both surfaces, rather faintly reticulate. Inflorescences axillary or sometimes terminal (from upper most leaf axils), paniculate, ca 5 cm long; peduncles and axes slender, softly grey-pubescent; pedicels short, to 2 mm long, pubescent. Flowers small, cylindric in bud, pubescent. Sepals 4 or 5, free to the base, ca 2 mm long, sometimes unequal in size, ovate-oblong, obtuse or rounded at apex, green, obscurely glandular, finely pubescent abaxially, imbricate. Petals 4 or 5, oblong-ovate, obtuse, ca 3 x 2 mm, glandular-punctate, glabrous or shortly pubescent abaxially, imbricate, white. Stamens 8 or 10, ca 2.5 mm long, unequal; filaments linear, subulate above, glabrous; anthers linear-oblong, sometimes apiculate, ca 1.5 mm long. Disk annular, fleshy. Ovary obovoid, ca 3 x 1.5 mm, smoothly glandular, glabrous, 4- or 5-locular; each locule with 2 ovules; style cylindric, as long as ovary, glabrous; stigma capitate, ca 1 mm broad. Fruits subglobose, resembling small oranges, to 25 mm across; pericarp rough when dry, glandular, glabrous; interior of locules filled with a mucilaginous aromatic pulp; seeds 1 or 2 in each locule, ovoid, flattened with a hard, smooth testa.

Fl. March-April; *Fr.* June-Sept.

Distrib. India: Moist deciduous or semievergreen forests, up to 1250 m; occasionally also found at lower elevations, 50-100 m. Andhra Pradesh, Karnataka, Tamil Nadu and the Andaman Islands.

Sri Lanka.

Notes. Leaves and bark are used in fomentations for rheumatic pains. Carefully seasoned wood can be used for making tool-handles.

11. *Severinia* Tenore

Shrubs or small trees with strong, rigid twigs, armed with axillary, solitary spines. Leaves simple, alternate, with very short, wingless, non-articulated petioles, conspicuously parallel-nerved with distinct reticulations. Flowers in 2- or 3-nate clusters or in corymbs or panicles. Calyx cupular or campanulate, 3 - 5-lobed. Petals 3 - 5, imbricate. Stamens 6 or 10, free, shorter than petals. Disk cupular, enclosing ovary to its base. Ovary 1 - 5-locular; each locule with a solitary ovule. Fruits small, juicy or semidry berries with a glandular pericarp; locules filled with rudimentary pulp-vesicles; seeds 1 - 5, large, plump, smooth, green.

Tropical and subtropical regions of S. China, Malay peninsula, East Indian archipelago and the Philippines to New Guinea; 6 species, one in India, known in cultivation.

Severinia buxifolia (Poir.) Tenore, Ind. Sem. Hort. Neap. 3. 1840; Swingle, *Citrus* Ind. 1: 284. 1967. *Citrus buxifolia* Poir. in Lam., *Encycl. Meth.* 4: 580. 1797. *Limonia bilocularis* Roxb., *Fl. Ind. ed.* 2: 377. 1832; Hook. f., *Fl. Brit. India* 1: 508. 1875. *Sclerostylis atalantioides* Wight & Arn., *Prodr.* 93. 1834, non Wight 1840. *Severinia monophylla* (L.) Tanaka in *J. Bot.* 63: 232. 1930.

Shrubs up to 1.5 m high; branches strong, rigid, armed with sharp, straight, solitary spine in leaf axils; bark green or grey, lenticellate. Leaves shortly petiolate, ovate-elliptic, narrow or rounded at base, obtuse and emarginate at apex, crenulate along margins, 2 - 4 x 1 - 2 cm, thick, rigid, dark green, profusely gland dotted, glabrous; secondary nerves many, parallel, very distinct and finely reticulate. Flowers usually in 2- or 3-nate fascicles. Calyx campanulate, 5-lobed; lobes rounded, obtuse. Petals 5, erect, oblong, obtuse, ca 4 x 1.5 mm, glandular, glabrous, imbricate, white. Stamens 10; filaments linear-subulate, 2 - 3 mm long; anthers ovoid. Ovary sessile, deeply sunken in a cupular, fleshy, greenish-white disk, subglobose, glabrous, 2- or 3-locular with 1 ovule in each locule; style short; stigma capitate, 2- or 3-lobed. Berries globose, depressed above, fleshy, glandular, purplish or turning blackish when ripe; seeds ovoid, large, 2 or 3, rarely one.

This species is known only under cultivation in India. It is indigenous in S. China, N. Vietnam, S. Vietnam, Thailand, Hongkong, Cambodia and Laos.

It has been used as a successful rootstock for *Citrus*. Chinese use the leaves for preparing yeast cakes.

This species, like *Citrus limon*, is tolerant to boron and hence could probably be considered as an ecological indicator.

12. *Triphasia* Lour.

Shrubs or small trees; armed with slender, straight, axillary spines. Leaves alternate, simple or trifoliolate; petioles short, wingless; leaflets soft, profusely gland-dotted. Flowers solitary or in groups of 2 or 3 in leaf axils, fragrant. Calyx 3 - 5-lobed; lobes small, green. Petals 3 - 5, glandular, imbricate, white. Stamens twice the number of petals; filaments linear, sometimes broadened at base; anthers linear-oblong. Disk annular, fleshy. Ovary ovoid or ellipsoid, 3 - 5-loculed with 1 or 2 ovules in each locule. Berries ovoid or subglobose, sometimes apiculate, reddish-orange or crimson-red when ripe, glandular; seeds 1 - 3, green, embedded in a mucilaginous matter, polyembryonic as in *T. trifolia*.

Tropics and subtropics of S.E. Asia, Malesia, Philippines and New Guinea; 3 species, one in India (widely cultivated).

Triphasia trifolia (Burm.f.) P. Wils. in *Torreya* 9: 33. 1909. *Limonia trifolia* Burm.f., Fl. Ind. 103. 1768. *L. trifoliolata* L., Mant. Pl. Alt. 237. 1771. *Triphasia aurantiola* Lour., Fl. Cochinch. 152. 1790; Gamble, Fl. Pres. Madras 156. 1915. *T. trifoliolata* (L.) DC., Prodr. 1: 536. 1824; Hook.f., Fl. Brit. India 1: 507. 1875.

Beng. & Hindi: *Cheeninarangi*; Kan.: *Aramaralu*, *Kadusirinimbu*; Mar.: *Chin-Kelumbu*.

Erect or straggling shrubs; evergreen; branches cylindrical, armed with paired spines in leaf axils; bark green, lenticellate. Leaves trifoliolate; petioles short, wingless, 3 - 5 mm long; leaflets variable in size; terminal one much larger, 2 - 5 x 1.5 - 2 cm; lateral ones smaller, 1 - 2 x 0.5 - 1 cm, ovate-elliptic, cuneate at base, rounded and emarginate at apex, crenulate along margins, dark green and glossy above, light greenish beneath, pellucid-punctate, glabrous; mid- and lateral nerves inconspicuous; petiolules short, to 2 mm long. Flowers solitary or, 2 or 3, axillary, cylindrical in bud, 3-merous, fragrant. Sepals 3, ovate, obtuse, small, ciliolate, green. Petals 3, linear-oblong, obtuse, 8 - 12 x ca 4 mm, glandular, glabrous, white. Stamens 6, subequal; filaments linear, 7 - 9 mm long, glabrous; anthers oblong, ca 2 mm long. Disk annular, fleshy, white. Ovary ovoid, ca 2 mm long, glabrous, 3-locular with one ovule in each locule; style slender, deciduous; stigma capitate, 3-lobed, glandular. Berries subglobose or ellipsoid-ovoid, ca 1 cm long, dull reddish when ripe; pericarp glandular; seeds 1 - 3, green, embedded in a whitish, mucilaginous pulp.

Distrib. Probably a native of S. E. Asia and widely cultivated in gardens in many tropical and subtropical countries. In India it is frequently cultivated and naturalized on the Andaman & Nicobar Islands and probably also in S. India.

Notes. *T. trifolia* is an excellent garden plant due to its dark green and glossy foliage and reddish berries. It is often grown as a hedge plant. Chinese use the berries for making pickles. Wood is useful in making tool-handles and other small articles.

Rangaswami and Ranganathan (in *Curr. Sci.* 15: 76-77. 1964) reported the occurrence of uni- or bifoliolate leaves and transition of uni- to trifoliolate leaves in *T. trifolia* based on their observations on certain plants met with on the Palani hills (Tamil Nadu). They do not seem to have preserved any voucher specimens. But their illustration of leaf samples show a distinctly winged petiole characteristic of *Pleiospermium alatum*, a species besides being common on the Palani hills also exhibits leaf polymorphism (tri-, bi- and unifoliolate leaves on the same plant) of the kind reported by the said authors.

Subfamily 1. CITROIDEAE

Tribe 1.2. CLAUSENEAE

13. *Clausena* Burm.f.

Shrubs or small trees, unarmed, often aromatic. Leaves alternate, imparipinnate; rachis terete or occasionally marginate or winged; leaflets usually 5 - 11 or rarely 1 - 3 or, up to 35, alternate, oblique and often asymmetric (except terminal one). Inflorescences terminal and/or axillary, paniculate or racemose. Flowers subglobose to oblong in bud, fragrant. Calyx cupular; sepals small, green. Petals glandular, imbricate in buds, cream-white or pale yellowish. Stamens 8 or 10, alternately long and short, or subequal; filaments dilated below, subulate above, glabrous; anthers ovoid, oblong or rhombohedral, often glandular. Ovary entire or lobed, variously pubescent or glabrous, borne on a distinct gynophore, 2 - 5-locular, with usually 2 (sometimes 1) collateral or superimposed ovules per locule; gynophore usually hourglass shaped or cylindrical, arising from an annular disk; style cylindrical, short or long, or as long as ovary, blending with the ovary or clearly demarcated, caducous; stigma truncate or capitate. Fruit a berry, subglobose to oblong or ovoid, yellow or reddish or black when ripe, 2 - 5-locular, often 1-seeded; pericarp glandular; seeds green, aromatic.

Tropical Africa eastward to Australia through tropical and subtropical Asia and Malacia; 15 species, 7 in India.

Literature. MOLINO, J.F. 1994. Revision du genre *Clausena* Burm.f. (Rutaceae). Bull. Mus. Natl. Hist. Nat. Paris 4 ser. 16. Section B, Adansonia 1: 105-153. STONE, B.C. & K.N. NAIR (1994), A new species of *Clausena* (Rutaceae) from India. Nord. J. Bot. 14: 491-493.

KEY TO THE SPECIES

- | | |
|---|--------------------------|
| 1a. Inflorescence exclusively axillary | 1. <i>C. anisata</i> |
| b. Inflorescence terminal and/or axillary (from uppermost leaf axis) | 2 |
| 2a. Ovary pilose or hirsute | 3 |
| b. Ovary glabrous or rarely slightly hairy | 5 |
| 3a. Leaflets 15 - 23 or up to 35; filaments excavate and papillose at base; gynophore hourglass shaped; ovary hirsute | 3. <i>C. excavata</i> |
| b. Leaflets 5 - 9 or sometimes 1 - 3-foliolate; filaments plane, smooth, dilated at base; gynophore cylindrical; ovary pilose | 4 |
| 4a. Evergreen tree; ovary globose, 5-angled, densely pilose; berries subglobose, downy | 7. <i>C. lansium</i> |
| b. Deciduous shrub; ovary subglobose or oblong, entire, sparingly pilose; berries ovoid, glandular-papillose | 6. <i>C. kempurensis</i> |
| 5a. Ovary cylindrical, ovoid or tetragonal, sulcate, 4-lobed | 4. <i>C. heptaphylla</i> |
| b. Ovary subglobose, profusely glandular-papillate | 6 |
| 6a. Leaflets rhomboid-obovate, deep black when dry; ovary 3-locular | 5. <i>C. indica</i> |

b. Leaflets oblong-elliptic or lanceolate, yellowish-green when dry; ovary 4 (rarely 5)-locular

2. *C. austroindica*

1. *Clausena anisata* (Willd.) Hook.f. ex Benth. in Hook., Niger Fl. 256. 1849; Molino in Bull. Mus. Hist. Nat. (Paris) 16: 128. 1994. *Amyris anisata* Willd., Sp. Pl. ed. 4(2): 337. 1799. *A. dentata* Willd., l.c. *Clausena dentata* (Willd.) M. Roemer, Syn. Mem. Hesper. 44. 1846. *Clausena willdenowii* Wight & Arn., Prodr. 96. 1834, nom. superfl.; Hook.f., Fl. Brit. India 1: 506. 1875. *Amyris nana* Roxb., Fl. Ind. 2: 249. 1832. *Clausena willdenowii* Wight & Arn. var. *nana* (Roxb.) Balakr. in Bull. Bot. Surv. India 22: 173. 1982. *Clausena pubescens* Wight & Arn., Prodr. 96. 1834. *C. willdenowii* Wight & Arn. var. *pubescens* (Wight & Arn.) Hook.f., Fl. Brit. India 1: 506. 1875. *Cookia dulcis* Beddome in Madras J. Lit. Sci. ser. 2, 22: 73. 1861. *Clausena willdenowii* Wight & Arn. var. *dulcis* (Beddome) Beddome, Fl. Sylv. S. India 45. 1871. *C. dentata* (Willd.) M. Roemer var. *dulcis* (Beddome) Swingle, J. Wash. Acad. Sci. 28: 532. 1938.

Mal.: *Kattukariveppila*; Tam.: *Kattukariveppilai*.

Shrubs or treelets, up to 6 m high; branchlets cylindric, pubescent to tomentulose or glabrous. Leaves imparipinnate, 15 - 40 cm long; leaflets 7 - 13, occasionally more than 20, alternate, ovate, ovate-lanceolate or ovate-oblong, alternate, oblique at base, obtuse or caudate-acuminate at apex, often notched at tip, glandular-crenulate along margins (2-) 5 - 10 x (1-) 1.5 - 3 cm membranous to chartaceous; secondary nerves 6 - 10 pairs, prominent, finely reticulate; petiolules slender to 10 mm long, puberulent or glabrous. Racemes axillary, shorter than leaves, confined to apices of branchlets, 8 - 10(-15) cm long, glabrous or pubescent; pedicels slender, 4 - 10 mm long, glabrous or pubescent. Flowers globose in bud, bracteolate. Sepals ovate-deltate to rounded, acute or obtuse, 0.5 - 1 mm long, glandular, ciliolate or glabrescent. Petals oblong, obtuse, concave, 2.5 - 6 x 1.5 - 3 mm, prominently nerved, glabrous, white. Stamens 8; filaments linear, subulate above, 1.5 - 4 mm long, glabrous; anthers ellipsoid or oblong, cordate at base, obtuse, glandular-apiculate at apex, 1 - 2 mm long. Gynophore rather distinct, ca 1 mm high, narrow below, as broad as ovary above, glandular, glabrous (sometimes obscure in var. *paucijuga*). Ovary oblong or ovoid, sulcate, 4-grooved, 1 - 3 x 0.8 - 2.5 mm, glandular tuberculate, glabrous, 4-locular, with one ovule in each locule; style cylindric, as long as or longer than ovary, merging into depression of ovary lobes above; (clearly demarcated in var. *paucijuga*), glabrous; stigma capitate, broader than style, 4-lobed. Berries globose or ovoid, greenish-white or orange before becoming ripe, glandular, 7 - 15(-25) mm across, one seeded.

Notes. Molino (1994) who united the Indo-Sri Lankan *C. dentata* with the tropical African *C. anisata* recognised two varieties in it: *C. anisata* var. *anisata* and *C. anisata* var. *paucijuga* (Kurz) Molino.

KEY TO THE VARIETIES

- 1a. Leaflets persistent or rarely caducous; style merging into ovary lobes; stigma lobed, broader than style; berries subglobose, greenish-white before becoming ripe 1.1. var. *anisata*
- b. Leaflets caducous; style clearly demarcated from ovary; stigma simple, not clearly marked from style; berries ovoid, orange coloured before becoming ripe 1.2. var. *paucijuga*

1.1. var. *anisata*

Fl. Feb.-April; *Fr.* May-Sept.

Distrib. India: Moist deciduous, semievergreen or evergreen forests, up to ca 2000 m. W. Bengal, Sikkim, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Nepal, China, Sri Lanka and Africa.

Notes. Leaves yield an aromatic essential oil. Berries are edible.

1.2. var. *paucijuga* (Kurz) J.F. Molino in Bull. Mus. Hist. Nat. (Paris) 16: 132. 1994. *Clausena suffruticosa* (Roxb.) Wight & Arn. ex Steudel var. *paucijuga* Kurz in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 44: 133. 1875. *Amyris suffruticosa* Roxb., Fl. Ind. 2: 250. 1832. *Clausena suffruticosa* (Roxb.) Wight & Arn. ex Steudel, Nomencl. Bot. ed. 2, 1: 378. 1840; Hook.f., Fl. Brit. India 1: 506. 1875.

Fl.: March-May; *Fr.* April-June.

Distrib. India: Evergreen forests along ravines, up to 1200 m. Tripura, Assam, Meghalaya, Mizoram and Nagaland.

Bangladesh, Myanmar and S. China.

Notes. Berries are reported to be eaten in China.

This taxon was earlier treated as a distinct species by Oliver (1861), Tanaka (1937), Swingle (1967) - as *Clausena suffruticosa* (Roxb.) Steudel and by Craib (in Bull. Misc. Inform. 1926: 340. 1926) as *Clausena longipes* Craib. Molino (1994) while redefining the *C. anisata* - *C. dentata* complex reduced *C. suffruticosa* to a variety under *C. anisata*.

2. *Clausena austroindica* Stone & K.N. Nair in Nord. J. Bot. 14: 491. 1994. Molino in Bull. Mus. Hist. Nat. (Paris) 16: 127. 1994. *C. heptaphylla* auct. non (Roxb.) Wight & Arn. ex Steudel (1840): Gamble, Fl. Pres. Madras 155. 1915. **Fig. 85.**

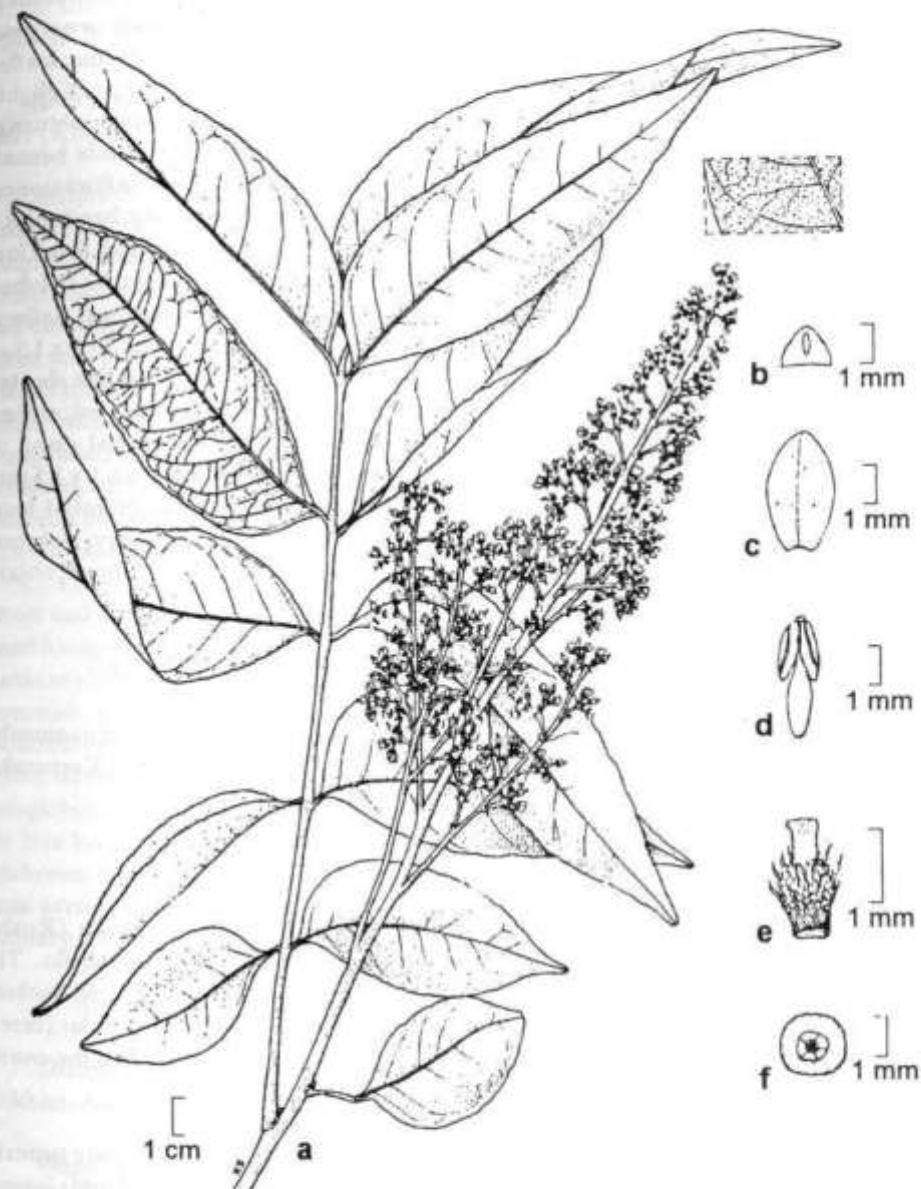


Fig. 85. *Clausena austroindica* Narayanan : a. flowering twig; b. sepal; c. petal; d. stamen; e. pistil; f. c.s. of ovary.

Shrubs or small trees, up to 10 m high; branchlets cylindrical, minutely puberulous or glabrous; bark greenish, lenticellate. Leaves up to 40 cm long with marginate or narrowly winged (wings ca 1.5 mm wide on either side), puberulent or glabrous rachis; leaflets generally 5 to 9, subopposite to alternate, 5.5 - 16 x 2.5 - 6 cm; lateral ones slightly asymmetric, lanceolate to obovate, attenuate to cuneate at base, acuminate, obtuse or rounded at apex, crenate or undulate, often revolute along margins; glands beneath usually convex; secondary nerves 6 - 12 pairs; tertiaries finely reticulate. Inflorescences terminal and from uppermost axils, narrowly paniculate, up to 20 cm long; bracteoles 2, oblong-lanceolate, unequal, ca 1 mm long, ciliate. Flowers subglobose in bud, 6 mm long (ripe bud), borne on short (2 - 5 mm long), glabrescent pedicels. Calyx 5-(4)-lobed, glabrous; lobes rounded, deltate, 0.5 mm long, with a conspicuous terminal pellucid gland, margins ciliolate minutely. Petals 5(4), imbricate, elliptic, obtuse, 3 - 5 x 1.5 - 3 mm with obscure glands, white. Stamens 10, five longer, alternating with five shorter; filaments slightly thickened in middle; upper part subulate and the lower dilated; anthers oblong or rhomboid, cordate, ca 1.5 mm long, sometimes with a terminal gland on connective. Ovary seated on a small but distinct gynophore, subglobose, ca 1 x 1.5 mm, distinctly papillate-glandular, usually also slightly puberulent, 5-locular, (rarely 4-locular), each with 2 collateral ovules; style short, caducous, shorter than ovary, glabrous, tipped by a truncate stigma manifestly wider than the style. Berries globose, obovate, usually about 8 x 12 mm broader than long, greenish, glandular.

Fl. Feb.-April; *Fr.* May-Sept.; ripening usually during July and August.

Distrib. India: Evergreen forests or 'sholas' in the southern W. Ghats of peninsular India; found at as low as 200 m but usually up to 1650 m. Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Endemic.

Notes. This species was previously included in *Clausena heptaphylla* (Roxb.) Steudel, by Gamble (1915). In general, *C. austroindica* resembles *C. heptaphylla*. The most distinctive characters that distinguish *C. austroindica* from *C. heptaphylla* include the presence of a cylindrical-obovoid, conspicuously glandular-papillate, 5-locular (rarely 4-locular) ovary with two collateral ovules in each locule, style shorter than the ovary, and a capitate stigma which is distinctly broader than the style.

Many recent collections of this species are from higher altitudes, differing superficially from the few collections from 200 - 400 m altitude in having smaller, shorter leaves, with rather thick texture and more distinctly crenate leaflets, and comparatively short and narrow, rather few-flowered panicles. In essential floral features there are no differences and there are vegetative intermediates so that it is clear that the characters seen in the plants of higher altitudes are ecologically determined.

3. *Clausena excavata* Burm.f., Fl. Ind. 87, t. 29, 2. 1768; Hook.f., Fl. Brit. India 1:504.1875. Fig. 86.

Asm.: *Narasingha, Bengjari, Theng-Sah-Soh-arong*; Garo: *Sam-sweng*; Kh.: *Dieng-ryner* (Kh.); Or.: *Agnijhal*.

Shrubs or small trees, up to 6 m high; branchlets cylindrical, 4 - 5 mm across, shortly pubescent to grey-tomentose, sometimes also glandular-pubescent. Leaves up to 40 cm long; petiole and rachis 15 - 30 cm long, softly tomentose or glabrescent; leaflets 15 - 23, sometimes up to 35, subopposite to alternate, ovate, ovate-oblong to lanceolate, oblique and cuneate at base, acute or acuminate at apex, entire, undulate or obscurely crenate, often with pubescent glands along margins, 2 - 7 x 1 - 3 cm, membranous to chartaceous, glands often dimorphic, pubescent or adpressedly tomentose on both surfaces, sometimes becoming glabrescent on ageing; petiolules short (ca 5 mm long), pubescent to tomentose; secondary nerves 4 - 7 pairs, faint above, prominent beneath. Panicles terminal, up to 30 cm long, peduncle and lateral branches densely white or greyish-pubescent; pedicels very short, ca 1 mm long, pubescent. Flowers borne in cymes. Sepals 4, ovate, acute or obtuse, ca 1 mm long, ciliate. Petals broadly elliptic, concave, obtuse, 3 - 4.5 x 2 mm, with few pellucid glands, greenish, pilose abaxially. Stamens 8, alternately short and long; filaments greenish-white, subulate above, dilated below, with a prominent hump on abaxial surface, concave adaxially, 2 - 3.5 mm long, papillate or glabrous; anthers ellipsoid or subcordate, versatile, orange-yellow. Gynophore hourglass-shaped, greenish, glabrous, ca 1 mm long from a broad annulus ca 1 mm wide at base, then contracts to ca 0.8 mm across, which further expands into a cupular top with its edges often having glandular projections where it joins the base of ovary. Ovary ovoid or subglobose, often with a few pellucid glands at the point of attachment of style, strongly or less hirsute, 4-locular with 2 ovules in each locule; style cylindrical, ca 1 mm long, glabrous; stigma subcapitate, minute, scarcely broader than style. Berries oblong, to 20 mm across; greenish-white when young, pink when mature, glandular-punctate; seeds solitary, oblong, large.

Fl. March-May; Fr. Aug.-Oct.

Distrib. India: Tropical evergreen or mixed forests up to 600 m. Bihar, W. Bengal, Sikkim, Assam, Mizoram, Meghalaya and Orissa.

Nepal, Bhutan, Bangladesh, Thailand, S. China, Vietnam, Myanmar, Malay Peninsula, Sumatra, Java, Borneo, Philippines and New Guinea.

Notes. Plants are diuretic and used in indigestion. Dried and powdered rootstock is used for decayed teeth by the 'Kols'. The timber is used for making handles of axes. In northeastern India the leaves and twigs are used as those of the curry leaf plant (*Murraya koenigii*).

Sunderraj and Nagarajan's (in J. Bombay Nat. Hist. Soc. 66: 657-659. 1970) report on the occurrence of this species in southern India was based on an imperfect specimen in MH (V. Narayanaswamy s.n., Arambha, Travancore (Kerala), 5.12.1928, MH), which, in fact, represents a sterile twig (in poor condition) of *C. anisata*.

4. *Clausena heptaphylla* (Roxb.) Wight & Arn. ex Steudel, Nomencl. Bot. ed. 2, 1: 377. 1840; Hook.f., Fl. Brit. India 1: 504. 1875. *Amyris heptaphylla* Roxb., Fl. Ind. 2: 248. 1831. **Fig. 86.**

Beng.: *Karan phal, Pan-kafur.*

Undershrubs to small trees, up to 6 m high. Leaves up to 45 cm long; petiole and rachis cylindrical or rarely in young leaves obscurely marginate between internodes, puberulous; leaflets 9 - 11, subopposite and alternate, lower ones smaller, 6.5 - 11.5 x 3.5 - 4.5 cm, terminal one often largest (11 - 15(-19) x 3.5 - 5(-6.5) cm), ovate to oblong-lanceolate or elliptic-oblong, asymmetric, cuneate at base, acuminate at apex, acumen 5 - 15 mm long, undulate or obscurely crenate along margins with uniseriate glands throughout, membranous to chartaceous, dark green and glossy above, light green beneath, profusely gland-dotted, glands dimorphic appearing as white dots above, greenish beneath, glabrous except the puberulent midnerve above; petioles ca 5 mm long, slightly marginate, secondary nerves 5 - 11 pairs, impressed above, raised beneath, spreading, inarching near margins, tertiaries reticulate. Inflorescences terminal and axillary (from uppermost leaf axils), corymbose, paniculate cymes, up to 25 cm long; peduncle and branches densely puberulent. Flowers ca 5 mm long; pedicels short (ca 3 mm long), glabrous. Sepals 4(5), deltate, acute, often with a terminal gland, ca 1 mm long, ciliate. Petals imbricate, oblong, rarely suborbicular, obtuse or rounded, concave, 3 - 3.5 x 1 - 1.5 mm, greenish-yellow, pellucid-punctate, glabrous. Stamens 8, subequal in length; filaments subulate above, dilated below, ca 2 mm long, glabrous; anthers oblong or rhombohedral, ca 1 mm long, yellow, occasionally with a terminal gland at tip of connective. Gynophore distinct, hourglass-shaped, as broad as ovary above, joining at base of ovary, narrowed below, ca 1 mm long, glabrous. Ovary cylindrical, ovoid or tetragonal, sulcate, 4-lobed, 4-locular, each with 2 superimposed ovules, glandular, often with a medium sized gland at top of each locule; style as long as or longer than ovary, cylindrical, sunken in depression of ovarian lobes, glabrous; stigma truncate, as broad as style. Berries oblong or ovoid, 10 - 15 mm long, yellowish or red; seeds 1 or 2, strongly aromatic.

Fl. March-April; *Fr.* May-Aug.

Distrib. India: Evergreen forests of Himalayas and North East India at altitudes up to 1500 m; rarely also occurring in the Eastern Ghats of Orissa; south of Orissa it is replaced by *C. austroindica*. Sikkim, Arunachal Pradesh, Assam, Nagaland, Mizoram, Meghalaya, Tripura and Orissa.

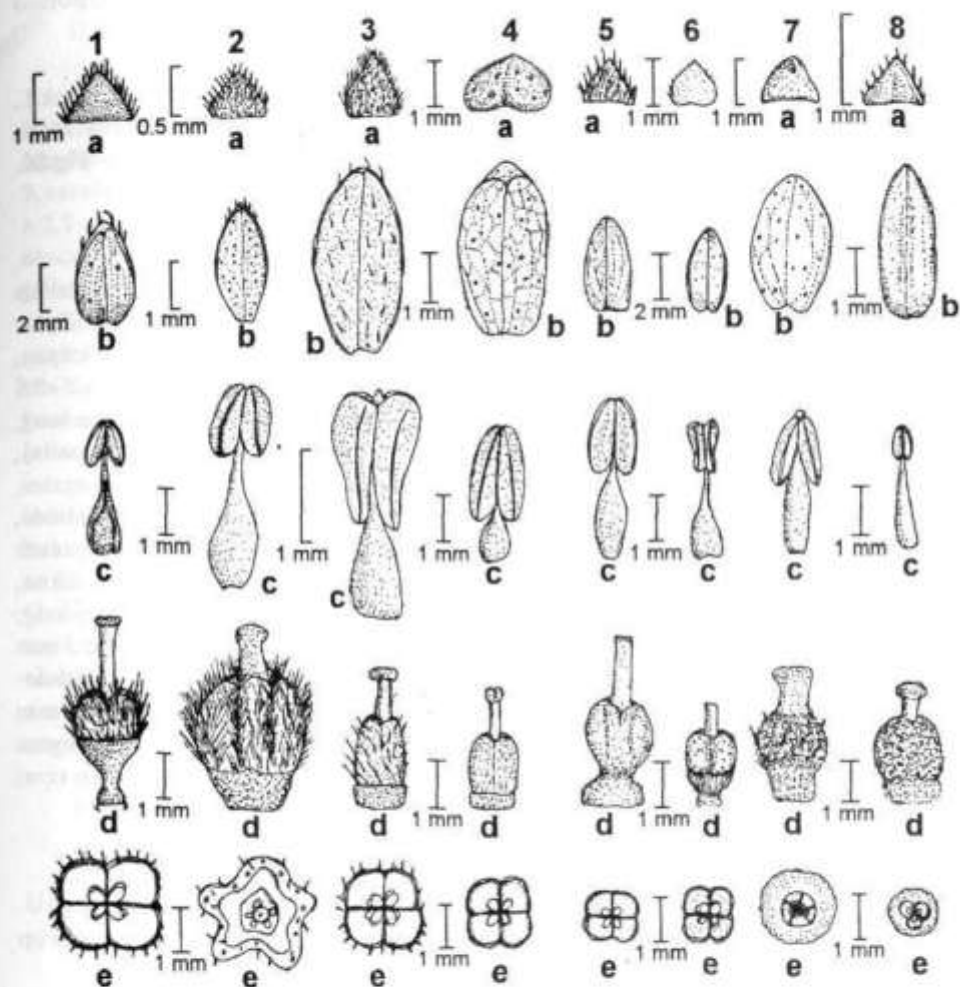


Fig. 86. Comparison of floral parts in species of *Clausena* Burm.f. : a. sepal; b. petal; c. stamen; d. pistil; e. c.s. of ovary: 1. *Clausena excavata* Burm.f.; 2. *C. lansium* (Lour.) Skeels; 3. *C. pentaphylla* DC.; 4. *C. dentata* (Willd.) M. Roem.; 5. *C. suffruticosa* (Roxb.) Wight & Arn.; 6. *C. heptaphylla* (Roxb.) Wight & Arn.; 7. *C. austroindica* Narayan; 8. *C. indica* (Dalz.) Oliver.

Bangladesh, Myanmar, Thailand, Cambodia, Laos, N. & S. Vietnam, Java and Sumatra.

Notes. Fresh leaves of this plant are chewed with betle leaves; they are also reported to be used for flavouring tobacco.

5. *Clausena indica* (Dalz.) Oliver in J. Linn. Soc. Bot. 5. Suppl. 2: 36. 1861; Hook.f., Fl. Brit. India 1: 505. 1875. *Piptostylis indica* Dalz. in Hooker's J. Bot. Kew Gard. Misc. 3: 33, t. 2. 1851.

Fig. 86.

Kan.: *Kadu-bevu*.

Shrubs or small trees, up to 15 m high. Leaves up to 25 cm long; petiole and rachis slightly zig-zag, puberulous or glabrous; leaflets 7 - 13, alternate and opposite, elliptic or elliptic-ovate to oblong, oblique at base, obtuse or abruptly acuminate at apex, subentire or crenulate and often with pubescent glands along margins, 3.5 - 7.5 x 2 - 3.5 cm, glabrous, membranous, gland dots raised on both surfaces; petiolules 3 - 6 mm long, puberulous; secondary nerves faint above, rather prominent beneath (5 - 8 pairs), spreading, tertiaries indistinct. Inflorescences terminal, paniculate corymbose cymes, up to 10 cm long, peduncle and branches densely puberulous. Flowers globose in buds, borne on short (2 mm long) pedicels; bracts minute, deltate, ciliate. Sepals deltate, acute or rounded, ca 0.5 mm long, ciliate. Petals oblong, acute, ca 3.5 x 1.2 mm, white, glandular, glabrous. Stamens 10; filaments subulate above, dilated below, ca 2 mm long; anthers ellipsoid, ca 1 mm long. Gynophore annular, as broad as the ovary, ca 0.5 mm high, fleshy, glandular-papillate. Ovary subglobose, ca 1.5 mm long, glabrous, papillate-glandular, 3-locular, each with one or two pendulous ovules; style very short (0.5 mm long), thick, cylindric, inserted in the depression at top of ovary, caducous; stigma capitate, broader than style. Berries globose, ca 15 mm across, yellowish when ripe; 1-seeded.

Fl. April-Sept.; *Fr.* Oct.-March.

Distrib. India: Evergreen forests of the W. Ghats of peninsular India at altitudes up to 1000 m. Maharashtra, Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

Notes. Fruits are edible. Leaves are used in culinary purposes. Wood is close grained and used for lathe.

There has been varied reports on the number of ovary locules in this species. Oliver (1861) and J.D. Hooker (1875) reported forms with 4- or 5-locular ovary. But, it has consistently been observed that in the peninsular Indian specimens the ovary is 3-locular with 1 or 2 pendulous, superimposed ovules in each locule.

6. *Clausena kanpurensis* J.F. Molino in Bull. Mus. Hist. Nat. (Paris) 16: 117. f. 2, 8-9. 1994. *Amyris pentaphylla* Roxb., Fl. Ind. ed. 2: 247. 1832. *Clausena pentaphylla* auct. non DC. 1824: Hook.f., Fl. Brit. India 1: 503. 1875.

Hindi: *Ratanjote, Rowana, Surjmukha, Teyrer, Tharu.*

Undershrubs, deciduous, up to 2 m high, strongly aromatic, innovations silky-tomentose; branchlets cylindrical, dense puberulous to tomentose; bark lenticellate. Leaves up to 40 cm long; petiole and rachis down-pubescent; leaflets 5-7 or sometimes 3, rarely also 1 on the same branchlet, alternate or subopposite, ovate-lanceolate, 7-20 x 2.5-7.5 cm, cuneate and more or less oblique at base, acuminate at apex, entire or obscurely crenate and often glandular-pubescent along margins, membranous, densely puberulent to downy-pubescent on both surfaces; petioles short (5 mm long), pubescent; secondary nerves 8-14 pairs, prominent, arising at angles, 60-65° with the midnerve, anastomosing. Inflorescences terminal and axillary (from uppermost leaf axil), up to 25 cm long; peduncle stout, dichotomously branched, downy-pubescent. Flowers subglobose in buds, 4-merous; bracts minute; pedicels to 2 mm long, pubescent. Calyx 4-lobed, lobes deltate to ovate, acute, ca 1.5 mm long, glandular, pubescent externally, glabrous internally. Petals imbricate, oblong or elliptic, obtuse, ca 4.5 x 2.5 mm, yellowish, indistinctly nerved, hairy on both surfaces. Stamens 8; filaments subulate above, dilated below, ca 3.5 mm long; anthers dorsifixed, oblong, sometimes apiculate. Disk annular, ca 0.5 mm high, as broad as ovary, with minute projections which often end in oil glands. Ovary subglobose or ovoid, ca 1 x 0.8 mm, glandular, pilose, 4-locular, each with 2 superposed ovules; style short, thick, 4-angular, ca 1 mm long, ca 3.5 mm broad, not clearly demarcated from ovary; stigma capitate. Berries ovoid, ca 15 mm across, orange-coloured when ripe, rind papillate-glandular; seed single, ovoid, ca 7 mm across, smooth, aromatic.

Fl. March-April; Fr. Ripening in August.

Distrib. India: Moist deciduous forests (sal forests) of the Garhwal Himalayas in Uttar Pradesh, at moderate elevations.

Nepal.

Notes. Stem-bark of the plant is highly valued in veterinary medicine. The powdered bark boiled in oil is a good remedy for bruises, abrasions, and sprains of ligaments.

This species was known earlier as *Clausena pentaphylla* (Roxb.) DC. as Oliver (1861) followed by many other Botanists including J.D. Hooker (1875), Tanaka (1928-37) and Swingle and Reece (1967) mistakenly believed it to be a new combination based on *Amyris pentaphylla* Roxb. However, it is not true; *Clausena pentaphylla* DC. (Prodr. 1: 538. 1824) is evidently not a new combination because De Candolle did not give any direct or indirect reference leading to Roxburgh's *Amyris pentaphylla* in the protologue.

According to Molino (1994) *C. pentaphylla* DC. is a new species created by De Candolle, which however, not belong either to *Clausena* or even the Rutaceae family. Molino, therefore, proposed *C. kanpurensis* as a new name to include Roxburgh's *Amyris pentaphylla*.

7. *Clausena lansium* (Lour.) Skeels, U.S.D.A. Bur. Pl. Industr. Bull. 168: 31. 1909. *Quinaria lansium* Lour., Fl. Cochinch. 272. 1790. *Cookia wampii* Blanco, Fl. Filip. 358. 1837. *Clausena wampii* (Blanco) Oliver in J. Linn. Soc. Bot. 5: Suppl. 2: 34. 1861; Hook.f., Fl. Brit. India 1: 505. 1875. **Fig. 86.**

Trees, 4 - 12 m high; branchlets, petiole and inflorescences glandular pustulate. Leaves up to 30 cm long; leaflets 7 - 9, alternate, ovate, elliptic-lanceolate, oblique at base, obtuse or acuminate at apex, entire or crenulate along margins, 3.5 - 9.5 (-13) x 2 - 4.5 (-6.5) cm, coriaceous, glabrous; secondary nerves 6 - 8 pairs, spreading. Panicles terminal and axillary (from uppermost leaf axils), branching at base, up to 25 cm long, densely puberulous. Flowers obovoid in buds, ca 6 mm long; pedicels short, stout. Calyx 5-lobed, lobes ovate, acute, ca 0.5 mm long, pubescent. Petals elliptic-oblong, narrowed at base, obtuse at apex, ca 5 x 2.5 mm, white, glandular, puberulent abaxially, glabrous adaxially. Stamens 10; filaments subulate above, dilated below, ca 4 mm long, glabrous; anthers oblong, ca 1.5 mm long. Gynophore ca 1 mm high and broad, cupular, glandulose, glabrous. Ovary globose, ca 2 x 2 mm, pilose, 5-lobed, 5-locular, each with 2 superimposed ovules; style short, 1 mm long, glandular, glabrous; stigma capitate, 5-lobed, as broad as or slightly broader than the style. Berry subglobose, 5-lobed, ca 15 mm across, downy; seeds 5 or 1, oblong-ovoid.

Fl. March-April; *Fr.* June-July.

Distrib. Native of S. China and Indochina. Cultivated in India for its edible fruits that are used for making jams.

Notes. The species is distinct from all other species of the genus in having a star-shaped flower bud and a 5-angled densely pilose ovary. The ovary locules contain scattered hairs arising from the dorsal and outer portion of the lateral walls, which usually grow towards the central axis of the ovary.

14. *Glycosmis* Correa, nom. cons.

Shrubs or trees, unarmed, evergreen, often inodorous; innovations, young inflorescences, bracts, bracteoles and sepals densely ferruginously-tomentulose, mature parts glabrescent. Leaves alternate, or rarely opposite, usually imparipinnate, (1) 3 - 5- (or sometimes up to 15-) foliolate or occasionally also simple; leaflets alternate or opposite, entire or serrate-crenate to denticulate to subentire, equilateral, pinnately veined, the veins usually prominent; petiolules often articulated at base. Inflorescences terminal and/or axillary (sometimes from uppermost leaf axils), racemose or cymose panicles.

Flowers bisexual, fragrant or not. Sepals imbricate, distinct or connate at base. Petals imbricate, greenish to creamy-white, often glandular, glabrous or minutely puberulent or scurfy abaxially. Stamens 8 or 10, free, alternately short and long; filaments linear, subulate above, flat or sometimes with a central ridge at inner face near the apex, glabrous or rarely pubescent; anthers ovoid-cordate, glandular-apiculate. Disk minute, annular, fleshy, glabrous. Ovary ovoid-cylindric, fusiform or ellipsoid, glabrous or rusty-puberulous to densely rusty-pilose, smooth or pitted glandular, often raised on a gynophore that is tumid, disciform and broader than the ovary, or sometimes seated on a narrow stipe, 2 - 5-locular, each locule with 1 - 2 ovules; style often indistinct, occasionally clearly marked, cylindric, glabrous or rusty puberulent or tomentulose; stigma broad, obtuse and depressed or sometimes subcapitate or subglobose. Fruits small to medium sized berries, subglobose, obovate, oblong-ellipsoid or obovoid, 1 - 3-seeded, with thin pulp, smooth or pitted-glandular or mamillate rind, creamy-white to salmon-reddish or purplish-black when ripe; seeds greenish, often plano-convex with thin, white shiny outer layer.

Tropical and subtropical; from India and Sri Lanka, eastward, throughout S. E. Asia and S. China, to New Guinea and N. E. Australia; ca 43 species, 7 species and 8 varieties in India.

Notes. In the past, *Glycosmis* was regarded as a problematic genus due to its taxonomic and nomenclatural perplexities. For example, [Swingle (1943); Swingle & Reece (1967)] who had thoroughly studied all other genera of the subfamily Citroideae including *Citrus*, however, did not venture for a revisionary account of *Glycosmis*. He was presumably apprehended by the so-called chaotic state of taxonomy of this genus, which he stated in his own words "the taxonomy (of *Glycosmis*!) is in such a chaotic state of confusion that it is not yet possible to key out all the species or even to tell with certainty how many should be recognized as valid" He, therefore, restricted his treatment of *Glycosmis* by mere listing of the species accepted by earlier botanists like Oliver, J.D. Hooker, Kurz, Engler, Tanaka etc., along with a detailed description of *Glycosmis citrifolia*.

Thanks to the contributions of Stone (1978, 1985), the earlier scenario has considerably been unravelled. Stone's (1985) synoptic account of *Glycosmis* can be a precursor for a monographic study on the genus. He redefined *Glycosmis* as a clearcut genus comprising 43 tentatively acceptable and 6 dubious species. His 'conspectus' on *Glycosmis* included many new taxa, new combinations, new synonyms and new distributional records. Except a few complex groups such as *G. cyanocarpa*, *G. chlorosperma* and *G. mauritiana*, all other species recognized by Stone are quite distinct and less variable.

In the present treatment 7 species and 8 varieties are recognised in India, of which 7 taxa are endemic to different phytogeographic regions: *G. boreana*, *G. cyanocarpa* var. *linearifolia*, *G. singuliflora* endemic to the East Himalayas and North-East India; *G.*

macrocarpa, *G. mauritiana* var. *angustifolia* in peninsular India; *G. mauritiana* var. *andamanensis*, *G. pilosa* in Andaman and Nicobar Islands.

The reported occurrence of *G. sapindoides* in the Andaman Islands by Tanaka (1930) and Stone (1985) seems to be rather erroneous. The specimens in DD and CAL, which Tanaka determined as belonging to *G. sapindoides*, however, represent *G. pilosa* Narayanaswami - a distinct species characterized with the presence of a 5-locular ovary. Since no specimen identified as *G. sapindoides* could be traced in any of the Indian herbaria, we exclude this species from the present account. Similarly *G. chlorospema* which was reported as occurring in the Andaman Islands by Stone (1985) is not included here because of the above reasons.

Literature. BRIZICKY, G.K. (1962) Taxonomic and nomenclatural notes on *Zanthoxylum* and *Glycosmis* (Rutaceae). *J. Arn. Arb.* 43: 80-93. KURZ, S. (1876) On the species of *Glycosmis*. *J. Bot.* 14: 33-40, t. 174-175. MITRA, R.L. & K. SUBRAMANYAM (1969) *Glycosmis pentaphylla* (Rutaceae) and related Indian taxa. *J. Arn. Arb.* 50: 153-157. NARAYANASWAMI, V. (1941) A revision of the Indo-Malayan species of *Glycosmis*. *Rec. Bot. Surv. India* 14: i-v, 1-72, t. 1-30. NICOLSON, D.H. & C.R. SURESH (1985) Proposal to conserve 4087 *Glycosmis* against *Panel* (Rutaceae). *Taxon* 34: 715-716. STONE, B.C. (1978) Studies in Malesian Rutaceae 1: Notes toward a revision of the genus *Glycosmis* Correa. *Fed. Mus. J. n.s.* 23: 75-109. STONE, B.C. (1985) A conspectus of the genus *Glycosmis* Correa: Studies in Malesian Rutaceae III. *Proc. Acad. Nat. Sci. Philadelphia* 137: 213-228. TANAKA, T. (1928) A note on *Retzius* *Limonia pentaphylla*. *Bot. Not.* 1928: 156-160.

KEY TO THE SPECIES

- | | |
|---|---------------------------|
| 1a. Ovary seated on a distinct gynophore | 2 |
| b. Ovary seated on a minute, annular, fleshy disk | 6 |
| 2a. Ovary glabrous; gynophore tumid, lobulate, broader than ovary | 3 |
| b. Ovary rusty-puberulent or shortly to densely pilose; gynophore a narrow, short stipe | 5 |
| 3a. Ovary 3-locular; leaves up to 10 cm long; leaflets up to 2 cm broad, obtusely acute at apex | 1. <i>G. angustifolia</i> |
| b. Ovary 5-locular; leaves up to 40 cm long; leaflets up to 8 cm broad, obtusely acuminate or caudate at apex | 4 |
| 4a. Sepals deltoid, less than 1 mm long; staminal filaments with a central ridge at inner face near apex; style continuous with ovary, not clearly distinct, glabrous | 4. <i>G. macrocarpa</i> |
| b. Sepals broadly ovate, 1.5 mm long; staminal filaments flat without a central ridge at inner face; style distinct, deciduously tomentose | 2. <i>G. boreana</i> |
| 5a. Ovary ellipsoid, minutely to densely rusty-pilose; style distinct, stigma subcapitate; berries ca 15 mm across | 7. <i>G. pilosa</i> |
| b. Ovary ovoid-cylindric (rarely subglobose), minutely puberulous; style often scarcely distinct from ovary; stigma truncate; berries up to 10 mm across | 5. <i>G. mauritiana</i> |
| 6a. Berries creamy-white or salmon-reddish when ripe, outer rind mamillate | 6. <i>G. pentaphylla</i> |

- b. Berries purplish-black when ripe, outer rind smooth or pitted glandular 7
 7a. Berry solitary, axillary 8. *G. singuliflora*
 b. Berries few to many on axillary or terminal paniculate imfrutescence 3. *G. cyanocarpa* (vars.)

1. *Glycosmis angustifolia* Lindl. in Wallich ex Wight & Arn., Prodr. 1: 93. 1834, quoad Wallich Num. List. No. 6378-HB. Heyne excl. specim. Wight 315. *G. pentaphylla* var. 2, subvar. *angustifolia* Hook.f., Fl. Brit. India 1: 500. 1875. *G. triphylla* Wight var. *angustifolia* Kurz in J. Bot. 14: 37. 1876. **Fig.87.**

Shrubs, up to 3 m high; branchlets cylindric, glabrate or ferruginously tomentulose when young; bark shiny, smooth or longitudinally fissured, brownish on drying. Leaves pinnate, up to 10 cm long; leaflets 3 - 5, alternate or subopposite, shortly petiolulate, oblanceolate or elliptic-lanceolate, cuneate at base, obtusely acute or acuminate at apex, entire along margins, 5.5 - 7.5 x 1.5 - 2 cm, coriaceous, glabrous; secondary nerves 7 - 9 pairs, slender, faint above, prominent beneath, finely reticulate. Inflorescences axillary, short, condensed, paniculate cymes, up to 1.5 cm long, puberulent to ferruginous pubescent; pedicels short, ca 0.5 mm long, glabrous or nearly so. Sepals 5, ovate, acute, ca 1 mm long, puberulent with ciliolate margins. Petals 5, oblong, obtusely acuminate, ca 4.5 x 1.5 mm, glandular, glabrous. Stamens 10; filaments ca 3.5 mm long, strap-shaped, flat below, inner surface with a central ridge near apex, glabrous; anthers ellipsoid, ca 0.5 mm long, apiculate. Ovary ovoid-cylindric, glabrous, 3-locular, each locule with one ovule, ca 1.5 mm long; style not clearly marked from ovary; stigma obtuse. Berries globose (or subglobose), ca 10 mm across, cream or becoming pink when ripe, rind glandular; seed usually single per berry.

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

Distrib.: India: Semievergreen forests of southern W. Ghats, up to 800 m altitude. Tamil Nadu and Kerala.

Sri Lanka.

2. *Glycosmis boreana* Narayanaswami ex Tanaka in J. Indian Bot. Soc. 16: 228. 1937; Narayanaswami in Rec. Bot. Surv. India 14: 45, f. 18. 1941; Stone in Proc. Acad. Nat. Sci. Philadelphia 137: 2. 1985.

Branches cylindric, red-scurffy. Leaves pinnate, 17 - 27.5 cm long; leaflets 5 or 6, distantly alternate, thin, coriaceous, ovate-elliptic, abruptly acuminate at base, caudate-acuminate at apex, acumen up to 12 mm long, entire along margins, 5 - 11.5 x 2.5 - 5.5 cm, dull grey above, pale beneath on drying, glabrous except midrib which is puberulent above; petiolules 5 - 8 mm long, wrinkled on drying; secondary nerves 7 - 10 pairs, prominent above, more distinct beneath, obliquely spreading, inarching near margins, rather faintly reticulate. Inflorescences axillary, lax, corymbose, paniculate; peduncle

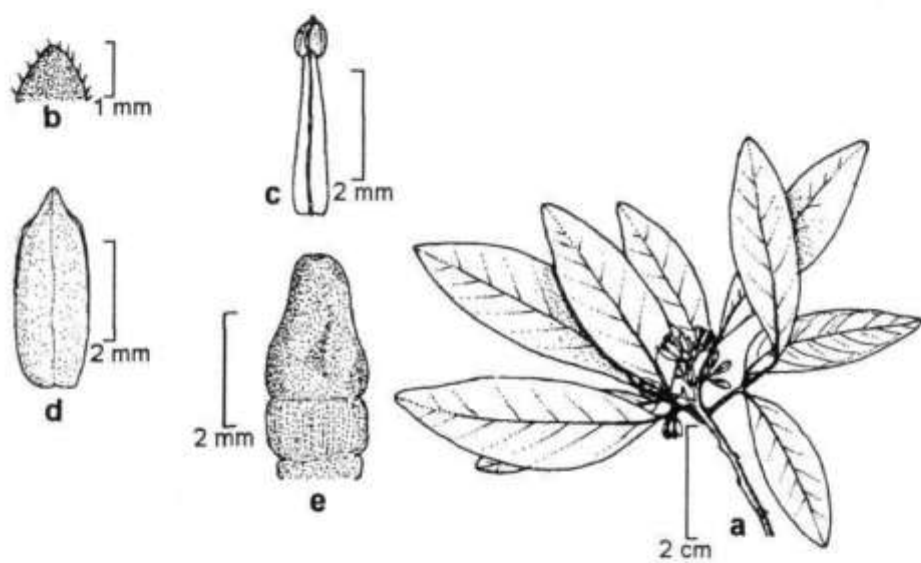


Fig. 87. *Glycosmis angustifolia* Lindl. ex Wight & Arn.: a. flowering twig; b. sepal; c. stamen; d. petal; e. pistil.

slender, up to 3.5 cm long, branched, branchlets flexuous, ending in lax cymes, rusty-scurffy, tomentulose; pedicels ca 1 mm long, brownish-scurffy. Sepals 5, broadly ovate, acute or rounded at apex, ca 1.5 mm long, scurffy abaxially, margins ciliolate. Petals 5, elliptic-ovate, obtuse, truncate at base, ca 7 x 4 mm, glabrous. Stamens 10; filaments linear, tapering gradually towards tip, ca 6 mm long, glabrous; anthers oblong, cordate, ca 1 mm long, obscurely gland-tipped. Ovary seated on a swollen, tumid gynophore which is longer and broader than ovary, subglobose, less than 1 mm long, glabrous, smoothly glandular, 5-locular, each locule with one ovule; style distinct, cylindric, ca 1 mm long, deciduously tomentulose; stigma subglobose. Fruits not known.

Distrib. India: Evergreen forests of Balipara Frontier tracts (Aka hills) in Arunachal Pradesh; known so far from two original collections by N.L. Bor (Bor 1658, 578 in CAL) in the above locality.

3. *Glycosmis cyanocarpa* (Blume) Sprengel, Syst. Veg. ed. 16: 161. 1827. *Cookia cyanocarpa* Blume, Bijdr. 3: 136. 1825.

Shrubs or small trees, 3 - 10 m high. Leaves imparipinnate or simple, up to 30 cm long; leaflets 5 or 3 or 1 (varying on same branchlet) or rarely 6, alternate or subopposite, variable in size and shape. Inflorescences axillary (also from uppermost leaf axils), condensed or lax panicles. Flowers subsessile, borne in cymes. Sepals 4 or 5, suborbicular, minute, ca 1 mm long, puberulous, ciliolate or glabrous. Petals 4 or 5, imbricate, oblong-obovate, obtuse or rounded at apex, greenish-white, glandular, glabrous. Stamens 8 or 10; filaments linear, dilated below, subulate or abruptly acuminate above, sometimes ridged at inner face near apex, 3 - 5 mm long, glabrous; anthers oblong or ovoid, ca 1 mm long, often gland tipped. Disk annular, broader than the ovary, ca 1 mm high and broad, fleshy, glabrous. Ovary ovoid, broadly oblong or subglobose, smoothly glandular, glabrous, 5- or 4-locular, each locule with one ovule; style short, ca 1 mm long, not clearly marked from ovary but with a different shade or colour, glabrous; stigma truncate or subcapitate, persistent in fruits. Berries obovoid or ellipsoid, up to ca 15 x 10 mm, glandular; seed 1.

KEY TO THE VARIETIES*

- | | |
|---|---------------------------------|
| 1a. Leaves simple | 3.4. var. <i>simplicifolia</i> |
| b. Leaves 5- or 3-, or 1-foliolate | 2 |
| 2a. Leaflets narrow, up to 1.5 cm broad, tapering at both ends; panicles short, condensed, up to 2.5 cm long | 3.3. var. <i>linearifoliola</i> |
| b. Leaflets broad up to 5.5 cm, caudate acuminate or abruptly and obtusely acuminate at apex; panicles often spreading, to 10 cm long | 3 |
| 3a. Leaflets turning to deep brown on both surfaces on drying, apex abruptly and obtusely acuminate | 3.2. var. <i>fuscescens</i> |
| b. Leaflets turning pale greenish to yellow on drying, apex caudate-acuminate | 3.1. var. <i>cymosa</i> |

*var. *cyanocarpa* is not known to occur in India. This, according to Stone (1985:5) is found in Java, Sumatra, S. Borneo and doubtfully in Halmancira).

3.1. var. *cymosa* Kurz in J. Bot. 14: 34. 1876. *Glycosmis oxyphylla* Wallich ex Voigt, Hort. Suburb. Calc. 129. 1845. *G. tetraphylla* Wallich ex Voigt, Hort. Suburb. Calc. 129. 1845. *G. pentaphylla* var. 2, subvar. 4. Hook.f., Fl. Brit. India 1: 500. 1875. *G. cymosa* (Kurz) Narayanaswami in Rec. Bot. Surv. India 14: 26, f. 8. 1941.

Shrubs or small trees, up to 10 m high. Leaves 5- or 3- or rarely 6-foliolate, up to 30 cm long; leaflets oblong-lanceolate or elliptic, 5 - 16 x 2 - 5.5 cm, acuminate at base, caudate-acuminate at apex, acumen 4 - 15 mm long, bluntish at tip. Berries obovoid or oblong, 10 - 15 mm long, ca 6 mm broad, bluish, pitted glandular; seed 1.

Fl. Dec.-May; Fr. April-June.

Distrib. India: Evergreen forests, up to 1500 m altitude. Sikkim, W. Bengal, Tripura, Assam, Meghalaya, Mizoram and Arunachal Pradesh.

Bangladesh, Bhutan, Myanmar, China, Taiwan, and Philippines.

3.2. var. *fuscescens* (Kurz) Narayanan comb. nov. *G. trifoliata* var. *fuscescens* Kurz in J. Bot. 14: 37. 1876. *G. pentaphylla* var. *fuscescens* (Kurz) Narayanaswami in Rec. Bot. Surv. India 14: 20. 1941. *G. mauritiana* var. *fuscescens* (Kurz) Mitra & Subramanyam in J. Arn. Arb. 50: 156. 1969.

Leaves pinnate, up to 15 cm long; petiole and rachis distinctly marginate, glabrous; leaflets 3 or 5, 7.5 - 13 x 2.5 - 5 cm, obtusely and abruptly acuminate at apex, acumen up to 15 mm long, deep brownish on both surfaces when dry, shiny, obscurely glandular-punctate above, glabrous.

Distrib. India: Evergreen forests of S. Andaman Islands and Khasi hills (Meghalaya).

Myanmar.

Notes. This taxon was originally placed under *G. trifoliata* (Blume) Sprengel by Kurz (1876), which according to Stone (1985) is found only in Indonesia, Papua New Guinea and Australia. Tanaka (1937: 229) considered *G. trifoliata* as conspecific with *G. cyanocarpa*. Narayanaswami (1941: 20), however, maintained var. *fuscescens* as a distinct variety under *G. pentaphylla*. It was subsequently transferred to *G. mauritiana* (Lam.) Tanaka by Mitra & Subramanyam (1969) as Narayanaswami had incorrectly used the name *G. pentaphylla* for *G. mauritiana* and used *G. arborea* for true *G. pentaphylla*. Tanaka's interpretation seems basically sound but Kurz's plant appears to be distinguishable as a variety.

We have examined all original materials indicated by Kurz (1876) and are convinced that nature of inflorescence and floral characters warrant its placement under *G. cyanocarpa* more appropriately than in *G. mauritiana*. In var. *fuscescens* inflorescence is an axillary or subterminal, spreading, glabrous panicle, and ovary is broadly oblong, smooth, nonstipitate, constricted below with the annular fleshy disk which is often broader than ovary; in *G. mauritiana* panicle is short, axillary, rather contracted, ferruginously puberulent, and ovary is ovoid-cylindric, distinctly stipitate. Besides, in *G. mauritiana* leaves are often trifoliolate (or even 1-foliolate but may also be 5-foliolate); petals routinely have a small patch of rusty hairs dorsally near the apex. We therefore feel that above distinctions are sufficient enough to deem var. *fuscescens* under *G. cyanocarpa*.

3.3. var. linearifolia Narayanaswami ex Tanaka in J. Indian Bot. Soc. 16: 229. 1937 (*'linearifoliolis'*) var. *changsiliana* Narayanaswami in Rec. Bot. Surv. India 14: 32, f. 10. 1941.

Small trees up to 4 m high; leaflets 3 - 5, linear-oblong or linear-lanceolate, tapering at both ends. Panicles axillary, condensed, up to 2.5 cm long, rusty-puberulent. Flowers aggregate. Fruits not known.

Fl. Oct.-March.

Distrib. India: Evergreen forests, up to 1300 m. Assam (Brahmaputra plains), Meghalaya (Khasi and Garo hills) and Mizoram (Lushai hills).

Endemic.

3.4. var. simplicifolia Kurz in J. Bot. 14: 35. 1876. *G. pentaphylla* var. B. subvar. 1. *longifolia* Oliver in J. Linn. Soc. Bot. 5. Suppl. 2: 37. 1861; Hook.f., Fl. Brit. India 1: 500. 1875. *G. pentaphylla* var. *longifolia* Trimen, Handb. Fl. Ceylon 1: 218. 1893. *G. longifolia* Tanaka in Bull. Soc. Bot. France 75: 709. 1928. *G. cymosa* (Kurz) Narayanaswami (nom. illegit.) var. *simplicifolia* (Kurz) Narayanaswami in Rec. Bot. Surv. India 11: 30, f. 9. 1941.

Shrubs or small trees. Leaves simple, oblanceolate or elliptic-oblong, 13 - 23.5 x 4.5 - 7 cm, acuminate at base, caudate or sometimes obtusely acuminate at apex, acumen 10 - 25 mm long. Panicles 3 - 6 cm long, spreading or condensed, rusty-puberulent or glabrous. Berries obovoid or ellipsoid, up to 15 x 10 mm, glandular; seed 1.

Fl. Nov.-Feb.; *Fr.* April.

Distrib. India: Evergreen forests up to 1200 m altitude. Assam, Meghalaya, Arunachal Pradesh, and Nagaland.

Sri Lanka.

Notes. Tanaka (1928) described this taxon first as a species, *G. longifolia* Tanaka, but later changed his view and considered it only as a form of *G. cyanocarpa* (see Tanaka 1937). Narayanaswami (1941) maintained it as a variety, *G. cymosa* (Kurz) Narayanaswami var. *simplicifolia* (Kurz) Narayanaswami, and included *G. longifolia* Tanaka under its synonymy, and thereby invalidating the name *G. cymosa* (Kurz) Narayanaswami, which ought to have been correctly called as *G. longifolia* Tanaka.

4. *Glycosmis macrocarpa* Wight, Ill. Ind. Bot. 1: 109. 1840; Ramachandran & Nair, Fl. Cannanore 8: 1988; Subramanian et al. in J. Econ. Tax. Bot. 12: 233. 1989. *G. pentaphylla* (Retz.) DC. var. *macrocarpa* (Wight) Hook.f., Fl. Brit. India 1: 500. 1875.

Fig. 88.

Shrubs or small trees, up to 3 m high. Leaves pinnate, 13 - 27 cm long; petiole and rachis glabrous or ferruginously puberulous when young; leaflets 3 or 5 or rarely 6, alternate, oblong-elliptic or ovate-lanceolate to oblanceolate, cuneate at base, acuminate at apex, acumens up to 10 mm long, bluntish at tip, more or less entire along margins, 7.5 - 16 x 3 - 7.5 cm, coriaceous, glabrous, dark brownish beneath on drying; petiolules 5 - 10 mm long, glabrous; secondary nerves 5 to 7 pairs, prominent beneath, faint above, oblique, spreading, inarching near margins, tertiaries finely reticulate. Inflorescences usually from uppermost leaf axils, paniculate cymes, up to 3 cm long, grey to ferruginously pubescent. Sepals 5, deltate, obtuse, less than 1 mm long, puberulous with ciliolate margins. Petals 5, oblong-elliptic, obtuse, ca 3 x 1.5 mm, white or pale yellowish, obscurely glandular, glabrous. Stamens 10; filaments linear, flattened, slightly ridged at inner face almost near apex, subulate above, up to 2 mm long, glabrous; anthers oblong, cordate, apiculate, sometimes with minute dorsal apical gland, less than 1 mm long. Disk (gynophore) broader than ovary, tumid, lobulate, ca 0.5 mm high, glabrous. Ovary ovoid-cylindric, ca 1 mm high, smoothly glandular, glabrous, 5-locular, each with one ovule; style continuous with ovary, not clearly distinct from it, glabrous; stigma minute, depressed. Berries subglobose, constricted at base, depressed above, ca 2 x 1.5 cm, punctate; seed 1.

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

Distrib. India: Evergreen forests of southern W. Ghats, between 550 - 1800 m altitude. Tamil Nadu and Kerala.

Endemic (Rare).

Notes. Reports on occurrence of *G. macrocarpa* Wight in Malaya [(see Ridley in J. Roy. As. Soc. Str. Br. 75: 12. 1917; Narayanaswami (194: 43-45)] are, however, no longer accepted (Stone 1985: 13). Narayanaswami's description and figure of *G. macrocarpa* was based on a Malayan specimen, Wray 264 (K, SING, CAL !) which according to Tanaka (unpublished) and Stone (1985:4) represented an undescribed taxon in *Glycosmis*. Stone described it as a new species *G. collina* which differs from *G. macrocarpa*

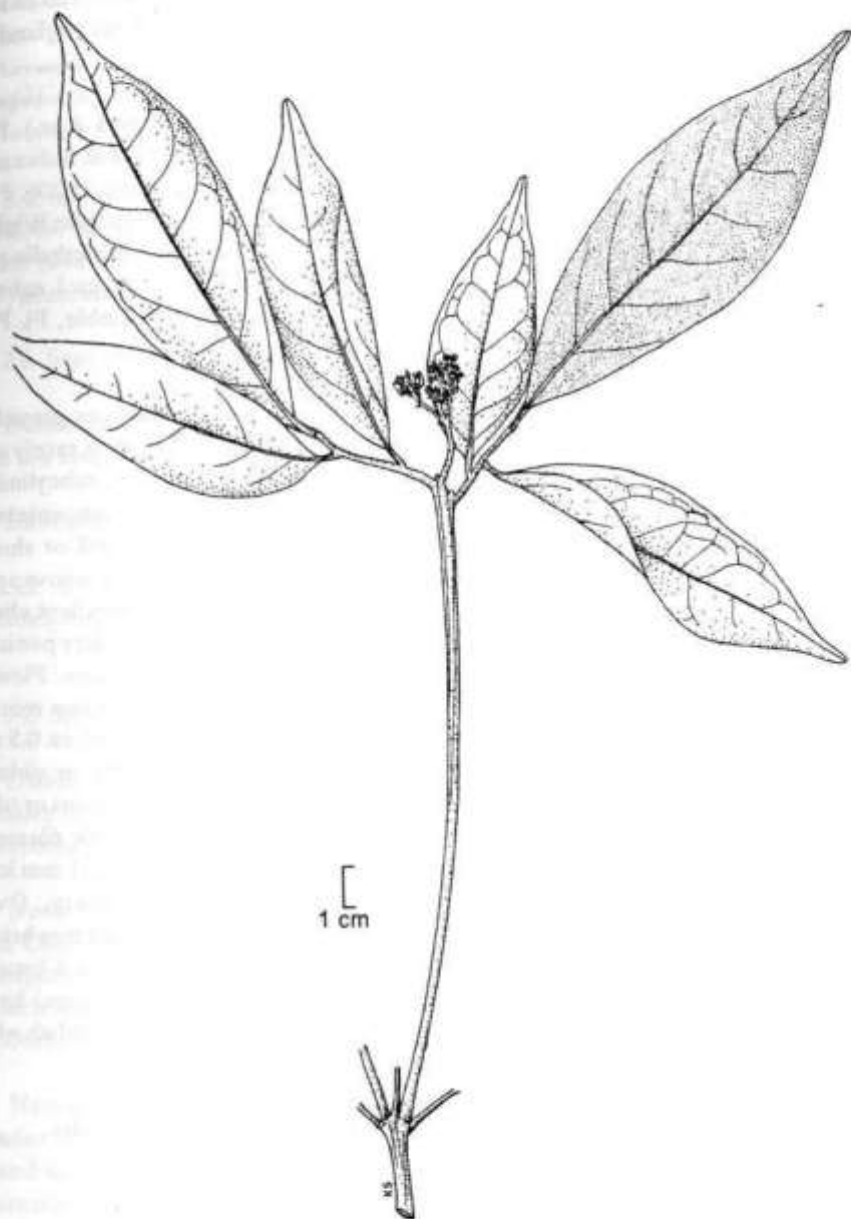


Fig. 88. *Glycosmis macrocarpa* Wight

Wight in the following characters : Inflorescence larger, terminal, few flowered paniculate racemes; petals with puberulent hairs dorsally at apex; petals and ovary glandular and petiolules slightly longer, up to 20 mm long.

5. *Glycosmis mauritiana* (Lam.) Tanaka in Bot. Not. 1928: 159(4 Apr.) 1928; Brizicky in J. Arn. Arb. 43: 90. 1962 (excl. syn. *G. pentaphylla* DC.); Mitra & Subramanyam in J. Arn. Arb. 50: 157. 1969; Stone in Matthew, Fl. Tam. Carnatic 1: 206. 1983. *Limonia mauritiana* Lam., Encycl. Meth. Bot. 3: 517. 1792. *Glycosmis triphylla* Wight in Bot. Misc. 3: 298. 1833. *G. nitida* Wight & Arn., Prodr. 1: 38. 1846. *G. pentaphylla* auct. non (Retz.) DC. 1824: Hook.f., Fl. Brit. India 1: 499. 1875 - quoad var. 2, excl. subvars. 1 to 4. *G. cochinchinensis* auct. non (Lour.) Pierre ex Engl. 1896: Gamble, Fl. Pres. Madras 1: 153. 1915, p.p.

Shrubs or small trees, up to 10 m high; branchlets cylindric, glabrous or greyish or rusty-puberulent when young. Leaves imparipinnate, 6 - 15 cm long, 3 - 5 or rarely even 1- or 2-foliolate (on the same branchlets); petiole and rachis slender, subcylindric, glabrescent; leaflets alternate and opposite, elliptic, ovate, linear-lanceolate to oblanceolate, cuneate at base, slightly oblique or not, obtuse to rounded or shortly acuminate at apex, entire along margins, coriaceous, green and glossy above, pale greenish beneath, glabrous; secondary nerves 5 - 16 pairs, slender, prominent above, rather prominent beneath, inconspicuously reticulate. Inflorescences axillary panicles, up to 10 cm long, peduncle and branches greyish to ferruginously puberulous. Flowers (mature buds) ca 0.5 mm long; pedicels very short (1 mm long); bracteoles minute, deltate, puberulous. Sepals 5 or 4, deltate or suborbicular, acute or obtuse, ca 0.5 mm long, puberulent abaxially, ciliolate along margins. Petals elliptic-oblong or oblong-obovate, obtuse, 2 - 5 x 1.5 - 2 mm, greenish-white, obscurely glandular, glabrous or often with a patch of puberulent hairs near apex abaxially. Stamens (8) or 10; filaments subulate, to 4 mm long, glabrous; anthers ovoid or oblong, cordate below, ca 1 mm long, often with an obscure apical gland. Disk minute, lobulate, as broad as ovary. Ovary cylindric-ovoid or fusiform, narrowed and stipitate below, ca 2 mm long, ca 1 mm broad, pitted or smoothly glandular, rusty puberulent above, rarely glabrous, 5- or 4-locular, each with one ovule; style 0; stigma truncate, persistent in fruits as an apical knob. Berries subglobose, 5 - 15 mm across, smoothly or pitted glandular, pink or reddish when ripe, 1-seeded.

A variable species with 8 varieties and occasional intermediates; 4 in India.

KEY TO THE VARIETIES

- | | |
|---|-------------------------------|
| 1a. Leaflets narrow, up to 2 cm broad, linear-lanceolate and tapering at both ends | 5.2. var. <i>angustifolia</i> |
| b. Leaflets more than 2 cm broad (up to 10 cm), shape not as above | 2 |
| 2a. Leaves up to 16 cm long; secondary nerves of leaflets 5 - 8 pairs, inconspicuously reticulate | 5.4. var. <i>mauritiana</i> |

- b. Leaves comparatively larger up to 35 cm long; secondary nerves 8 - 16 pairs, rather prominently reticulate late 3
- 3a. Leaves up to 23 cm long; leaflets obtuse or rounded or rarely obtusely and shortly acuminate at apex, opaque (not lustrous) 5.1. var. *andamanensis*
- b. Leaves up to 35 cm long; leaflets often long acuminate at apex, very lustrous 5.3. var. *insularis*

5.1. var. *andamanensis* (Narayanaswami) Mitra & Subramanyam in J. Arn. Arb. 50: 157. 1969. *G. pentaphylla* var. *andamanensis* Narayanaswami in Rec. Bot. Surv. India 14: 16. 1941. *G. mauritiana* var. *andamanensis* Tanaka in J. Indian Bot. Soc. 16: 229. 1937, nom. inval. sine latin descript.

Fl. Sept.-March; *Fr.* April-Aug.

Distrib. India: Inland forests and thickets of South Andaman Islands at low altitudes from sea level to 50 m.

Endemic.

5.2. var. *angustifolia* Tanaka in J. Bot. 68: 226. 1930; Stone in Proc. Acad. Nat. Sci. Philadelphia 137: 14. 1985. *G. angustifolia* Wight & Arn., Prodr. 1: 93. 1834, *p.p.*

Fig. 89.

Fl. Sept.-Feb.; *Fr.* March onwards.

Distrib. India: Evergreen forests of southernmost parts of peninsular India at altitudes between 300 - 660 m. Tamil Nadu (Tirunelveli hills) and Kerala (Aryankavu, Bonaccord, Sabarigiri hills).

Notes. Tanaka (1930) based this taxon on Wight 367 (BM) - a specimen collected from Courtallum in peninsular India, and partly also on Wight & Arnott's (1834: 331) *G. angustifolia*. The latter comprised two distinct elements: (i) *Heyne s.n.* (Lindley in Wallich Num. List. No. 6378) - the type of *G. angustifolia* and (ii) Wight 315 (collected in Courtallum) which matches perfectly with Wight 367.

Narayanaswami (1941: 15) did not accord a definite status for this taxon. He placed it under *G. mauritiana* (but incorrectly used the name, *G. pentaphylla* (Retz.) Correa for it) and stated that tree habit observed in these plants was due to edaphic variations. Interestingly, Narayanaswami mentioned *G. mauritiana* var. *angustifolia* Tanaka in the synonymy of *G. angustifolia* as he misunderstood that Tanaka (1930) has reduced true *G. angustifolia* to a variety under *G. mauritiana*.

Stone (1985: 14) maintained this taxon as a distinct variety. To this we would like to add following observations: The typical variety (var. *mauritiana*) is common in eastern parts of peninsular India, particularly in coastal areas and semievergreen forests of the



Fig. 89. *Glycosmis mauritiana* (Lam.) Tanaka var. *angustifolia* Tanaka.

Eastern Ghats, and is more or less uniform as regards its habit and leaflets; whereas the tree forms having characteristically narrower linear-lanceolate leaflets with tapering ends are restricted to a small isolated area in southernmost parts of the peninsula in evergreen forests of W. Ghats.

5.3. var. insularis (Kurz) Tanaka in J. Indian Bot. Soc. 16: 229. 1937; Mitra & Subramanyam in J. Arn. Arb. 50: 156. 1969. *G. arborea* (Roxb.) DC. var. *insularis* Kurz in J. Bot. 14: 38. 1876. *G. trifoliata* var. *latifolia* Kurz in J. Bot. 14: 38. 1876. *G. pentaphylla* var. *insularis* (Kurz) Narayanaswami in Rec. Bot. Surv. India 14: 20. 1941. *G. pentaphylla* var. *latifolia* (Kurz) Narayanaswami l.c. *G. mauritiana* var. *latifolia* (Kurz) Stone in Fedn. Mus. J. n.s. 23: 104. 1978 syn. nov.

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

Distrib. India: Wet evergreen forests from sea level to 30 m. Andaman & Nicobar Islands.

Sri Lanka and Malaya.

Notes. The presence of 1-3-foliolate leaves, larger leaflets and panicles is not found to be sufficient to deem *G. mauritiana* (Lam.) Tanaka var. *latifolia* (Kurz) Stone as a distinct taxon. Comparative studies on the types of *G. mauritiana* var. *latifolia* and *G. mauritiana* var. *insularis* (Kurz) Tanaka, along with some of the recent collections of *Glycosmis* made in Katchal (Nicobar Islands) [e.g. P. Chakraborty 5317, 5273 (both in CAL)] clearly shows that the former merges well into the latter.

5.4. var. mauritiana

Fig. 90.

Fl. Nov.-April (peak during Feb.-March); *Fr.* May-Oct.

Distrib. India: Mostly in coastal scrub forests from sea level to 400 m, occasionally also in semievergreen forests up to 900 m. Orissa, Andhra Pradesh, Tamil Nadu and Andaman & Nicobar Islands.

Sri Lanka, Myanmar, Thailand, Malesia, Hainan, S.E. Borneo and Mauritius.

6. *Glycosmis pentaphylla* (Retz.) DC., Prodr. 1: 538. 1824, quoad basionym; Mitra & Subramanyam in J. Arn. Arb. 50: 155. 1969. *Limonia pentaphylla* Retz., Obs. Bot. 5: 24. 1788. *Limonia arborea* Roxb., Pl. Coromandel 60, t. 85. 1788. *Glycosmis arborea* (Roxb.) DC., Prodr. 1: 538. 1824. *G. quinquefolia* Griffith, Notul. 4: 495. 1856. *G. pentaphylla* auct. non DC. 1824: Hook.f., Fl. Brit. India 1: 499. 1875, p.p. *G. cochinchinensis* auct. non (Lour.) Pierre ex Engl. 1896: Gamble, Fl. Pres. Madras 1: 153. 1915, p.p.

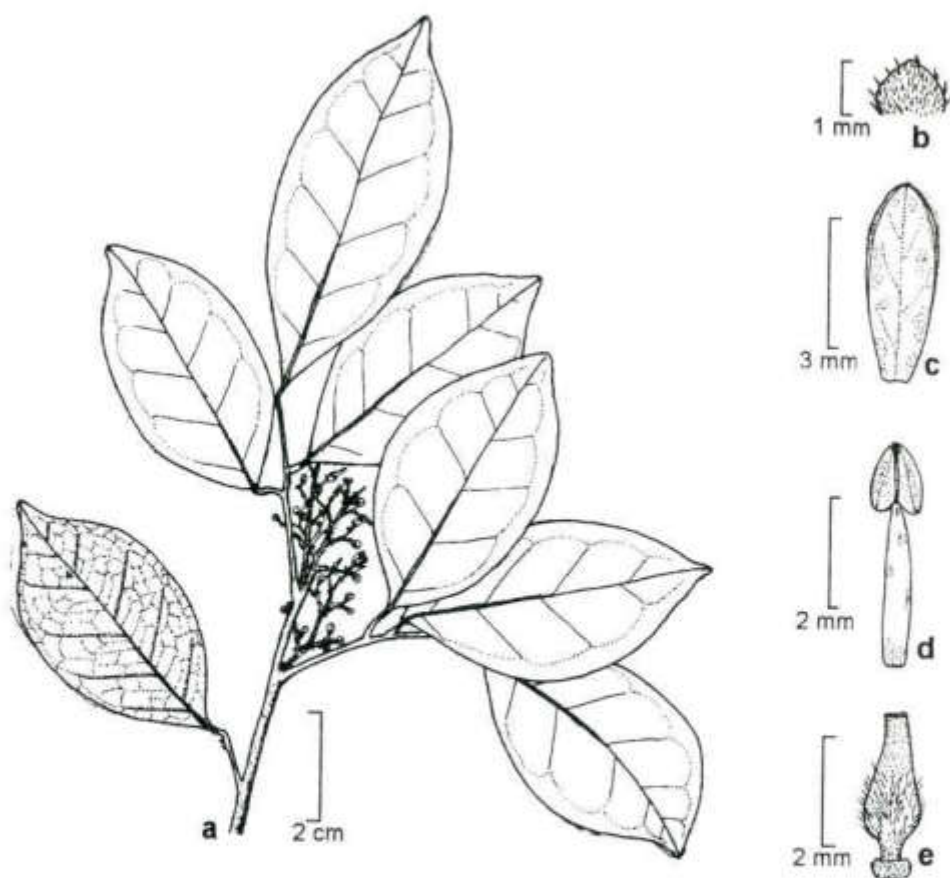


Fig. 90. *Glycosmis mauritiana* (Lam.) Tanaka var. *mauritiana*: a. flowering twig; b. sepal; c. petal; d. stamen; e. pistil.

Shrubs or small trees, up to 4 m or rarely up to 7 m high; branchlets woody, cylindric, finely rusty puberulent when young, soon glabrescent; bark greenish to grey-brownish, lenticellate. Leaves pinnate; petiole and rachis angular or cylindric, glabrous; leaflets 3 - 5, rarely 1 or even 6 or 7 on the same branchlet, opposite and alternate, oblong-elliptic or ovate to oblanceolate, rarely linear-elliptic, cuneate or obtuse at base, acute, obtuse, rounded or acuminate at apex, distantly or closely serrate or sometimes obscurely crenate or denticulate or rarely entire along margins, 7 - 20 x 2 - 6 cm, coriaceous, dark green above, light greenish beneath, glabrous; secondary nerves 10 - 18 pairs, spreading, inarchig near margins, finely reticulate. Inflorescences axillary and terminal, paniculate; peduncle as long as or longer or rarely shorter than leaf rachis, reaching up to 15 cm, branches condensed or spreading, greyish or rusty puberulent. Flowers often in dense clusters, subsessile; bracteoles 2, ovate, rusty-puberulent abaxially, glabrous adaxially, ciliolate along margins. Sepals 5, imbricate, deltate to suborbicular, acute, acuminate or obtuse to rounded, dorsally slightly ridged, scarious along margins, ca 1 mm long, occasionally also glandular with a few semipellucid glands, margins ciliolate. Petals 5, imbricate, elliptic-obovate, obtuse at apex, narrowed below, 2.5 - 4.5 x 2 - 3 mm, creamy-white, profusely pellucid glandular, glabrous. Stamens 10, ca 4 mm long; filaments gradually dilated upwards, amplified at centre almost near the subulate tip, glabrous; anthers ca 1 mm long, oblong, cordate below, prominently gland-tipped, sometimes with a small dorsal gland on the connective. Disk annular, ca 0.5 mm high, as broad as or slightly less than the ovary, obscurely lobed, fleshy, white. Ovary ovoid-cylindric or conical, 1.5 - 2.5 mm high, glandular-papillose, glabrous, usually 5-locular with a single ovule in each locule; style continuous with ovary, scarcely distinct; stigma truncate or globose, obscurely lobed. Berries subglobose, cream to crimson red or pinkish when ripe, mamillate, 1 - 3 seeded; seeds plano-convex, green.

KEY TO THE VARIETIES

- | | |
|--|---------------------------------|
| 1a. Leaflets up to 6 cm broad, cuneate or obtuse at base, acute, obtuse, rounded or acuminate at apex; flowers perfect | 6.2. var. <i>pentaphylla</i> |
| b. Leaflets up to 2 cm broad, tapering at both ends; flowers abortive | 6.1. var. <i>linearifoliola</i> |

6.1. var. *linearifoliola* Tanaka in J. Indian Bot. Soc. 16: 230. 1937, '*linearifoliolis*'; Mitra & Subramanyam in J. Arn. Arb. 50: 155. 1969. *G. arborea* (Roxb.) DC. var. *linearifoliolata* Narayanaswami in Rec. Bot. Surv. India 14: 26, f. 7. 1941.

Leaves paripinnate; leaflets 3 - 6, linear-lanceolate, tapering at both ends, wavy and minutely denticulate along margins, 8 - 18 x 1 - 2 cm, coriaceous, glabrous. Panicles spreading, many flowered, glabrous. Stamens 10, sterile; filaments linear, glabrous; anthers minute, effete. Ovary ca 1 mm long, columnar, mamillate, glabrous. Fruits not known.

Notes. A curious plant with very narrow and minutely denticulate leaflets and abortive flowers.

Known only as a garden cultivar.

6.2. var. *pentaphylla*

Asm.: *Hengenapenka*; Beng.: *Ashshoura*; Hindi: *Ban-nimbu*; Kan.: *Manikyan*; Mal.: *Panel, Panchi*; Mar.: *Kimira*; Or.: *Chowaldua*; Punj.: *Potali, Girgitti*; Sans.: *Ashvashakota, Vananibuka, Pathalagarundi*; Tam.: *Kulappannai, Anam*; Tel.: *Golugu, Gongipadu*.

Fl. & Fr. Almost throughout the year.

Distrib. India: Evergreen or semievergreen forests and also frequently in open places, between sea level to 900 m. Throughout mainland and Andman & Nicobar Islands.

Nepal, Myanmar, Bangladesh, China, Thailand, Philippines, Sumatra, Java and Sri Lanka.

Notes. Pounded root mixed with sugar is used for the treatment of fever. A juice extracted from leaves is used in fever and liver complaints, and also against skin diseases, especially eczema. Ripe fruits are edible. Stem twigs are used as tooth-sticks.

The taxonomy and nomenclature of this and preceding species were matters of strong debate that persisted through years. Following Mitra & Subramanyam's (1969) view the correct name of this species is adopted here as *G. pentaphylla* (Retz.) DC. (For detailed nomenclatural discussion refer to Brizicky (1962), Mitra & Subramanyam (1969), Stone (1976) and Nicolson & Suresh (1985).

7. *Glycosmis pilosa* Narayanaswami in Rec. Bot. Surv. India 14: 36. 1941; Stone in Proc. Acad. Nat. Sci. Philadelphia 137: 17. 1985. *G. sapindoides* Lindl. var. *pilosa* Narayanaswami ex Tanaka in J. Indian Bot. Soc. 16: 230. 1937, nom. inval. sine descr. latin. Fig. 91.

Shrubs or small trees, up to 10 m high; branchlets cylindrical, glabrous, bark brownish when dry, lenticellate. Leaves pinnate, up to 35 cm long; petiole and rachis angular above, glabrous or nearly so; leaflets 3 - 5 or sometimes 7, alternate or subopposite, often crowded towards tip of rachis, ovate or oblong-elliptic to lanceolate, acuminate at base, obtusely acuminate at apex, acumen up to 10 mm long, bluntish at tip, entire along margins, 6 - 19 x 2 - 8 cm, chartaceous, crispate, glabrous; petiolules up to 7 mm long; secondary nerves 7 - 11 pairs, prominent beneath, slightly oblique, inarching near margins, finely reticulate, the reticulæ prominent. Inflorescences axillary, sometimes also from the uppermost leaf axils, paniculate; peduncle rather compressed, up to 6 cm long, scurfy, rusty-puberulent or glabrous. Flowers in cymose clusters densely rusty scurfy in buds. Sepals 5, narrow to broadly ovate, acute or obtuse, ca 1 mm long, scurfy puberulent dorsally. Petals 5, elliptic or obovate, obtuse, truncate at base, ca 4 mm long,

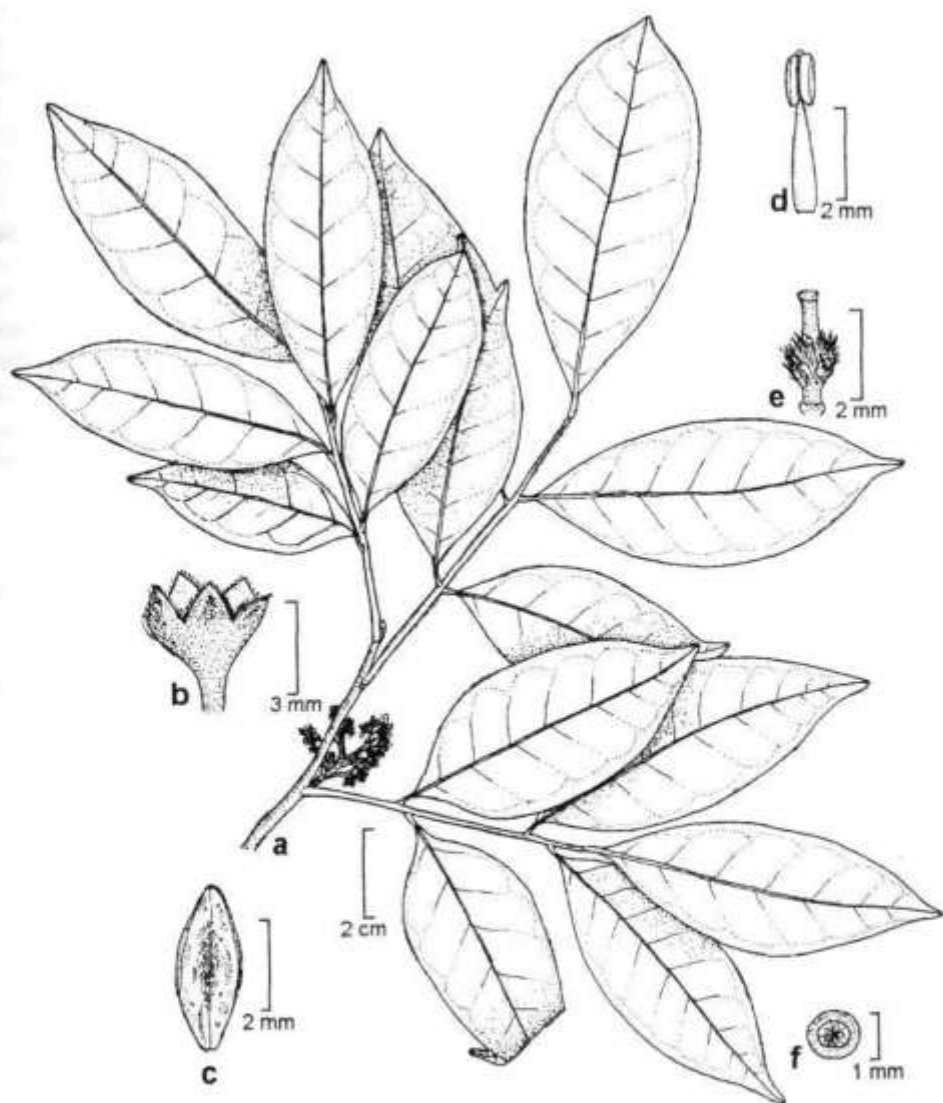


Fig. 91. *Glycosmis pilosa* Narayanaswami: a. flowering twig; b. calyx; c. petal; d. stamen; e. pistil; f. c.s. of ovary.

glandular, rusty scurfy on the back. Stamens 10, up to 3 mm long; filaments subulate, glabrous; anthers ca 1 mm long, oblong, cordate, gland-tipped. Disk minute. Ovary ellipsoid, shortly stipitate below, ca 1.5 mm high, minutely to densely rusty-pilose, 5-locular, each locule with one ovule; style distinct, shorter than ovary, glabrous; stigma subcapitate. Berries globose, ca 1.5 cm across, pitted glandular, glabrous; seed 1.

Fl. Jan.; *Fr.* May.

Distrib. India: Coastal and inland forests of Andaman & Nicobar Islands. Also doubtfully in Karnataka, S. India (Stone, 1985: 17).

Notes. This species is apparently similar to *G. mauritiana* (Lam.) Tanaka var. *insularis* (Kurz) Tanaka in its foliage and 5-locular stipitate ovary. It, however, differs from the latter in having a densely rusty pilose ovary. *G. pilosa* also approaches to *G. macrocarpa* Wight in having larger berries but can be distinguished from the latter due to its ellipsoid, shortly stipitate, minutely to densely rusty-pilose ovary and larger leaves with more number of leaflets.

8. *Glycosmis singuliflora* Kurz in J. Bot. 14: 37, t. 174. f. 1-2, 1876; Tanaka in J. Indian Bot. Soc. 16: 230. 1937; Narayanaswami in Rec. Bot. Surv. India 14: 32. 1941, excl. syn.

Small trees; branchlets slender, cylindric, young parts ferruginous-villous, soon glabrous; bark brownish, shiny when dry. Leaves pinnate, up to 12 cm long; rachis marginate, glabrous; leaflets 3 - 5, alternate, lanceolate, acuminate at both ends, entire along margins, 4.5 - 6.5 x 1 - 2 cm, coriaceous, glabrous; secondary nerves prominent on both surfaces; petiolules very short. Flowers not known. Sepals in fruits broadly ovate, acute, ferruginously-pubescent. Fruit solitary, axillary, oblong or obovoid, narrowed below, ca 15 x 8 mm, smooth, pitted-glandular, glabrous.

Fl. ? ; *Fr.* Feb.

Distrib. India. Assam.

Laos.

Notes. *G. singuliflora* resembles *G. angustifolia* Wight & Arn. in its smaller, narrow lanceolate leaflets, but is distinct from the latter in having solitary flowers and oblong or obovoid fruits. As observed by Narayanaswami (1941) the inflorescence in type sheets of *G. singuliflora* consisted of several flowers, of which only one developed into a solitary fruit.

15. *Micromelum* Blume, nom. cons.

Shrubs or trees, unarmed, evergreen. Leaves alternate, imparipinnate, usually with more than 5 (up to 23) leaflets or rarely 3- or 1-foliolate (as in *M. diversifolium*). Inflorescences terminal, corymbose panicles, often very large and flat topped. Flowers small or medium to large. Calyx urceolate; sepals 5, small deltate. Petals 5, valvate or slightly overlapping in buds. Stamens 10, alternately longer and shorter; anthers subbasifixed. Ovary 3 - 5-locular, sometimes also 6- or even 2-locular, radial walls of ovary twisted, ovules 2 in each locule, superimposed; style slender, cylindric, articulate with ovary; stigma capitate, broader than style. Disk annular, fleshy, glabrous. Fruits baccate, semidry, subglobose or broadly ellipsoid, pericarp thin, glandular, reddish or orange coloured when ripe; seeds 2 or 3, rarely only one, oblong, slightly compressed, cotyledons green, thin, contortuplicate.

Tropical evergreen forests of Sri Lanka, India, S. China, Myanmar, throughout Malesia, S.E. Asia, E. Australia, New Caledonia, extending farther east towards Fiji, Tonga and Samoa; ca 7 species, one in India.

Micromelum integerrimum (Roxb. ex DC.) M. Roemer, Syn. Mon. Hesper. 1: 47. 1846 (as *M. integerrimum* Wight & Arn., 1834, nom. illegit.). *Bergera integerrima* Roxb. (Hort. Bengal. 32. 1814, nom. nud.) ex DC., Prodr. 1: 537. 1824. *Micromelum pubescens* Blume var. *integerrima* (Roxb. ex DC.) Oliver in J. Linn. Soc. Bot. 5. Suppl. 2: 40. 1861. *M. pubescens* auct. non Blume 1825: Hook.f., Fl. Brit. India 1: 501. 1875, p.p., excl. vars. 1 & 3.

Small shrubs or trees, 2 - 10 m high, young parts often finely pubescent; branchlets cylindric, puberulous to glabrescent; bark grey, rather rough, lenticellate. Leaves up to 50 cm long; petioles and rachises cylindric, ca 4 mm across, densely puberulent to glabrescent; leaflets 7 - 15, occasionally also 3-foliolate on the same branchlet, alternate, subopposite, ovate-lanceolate, oblong-lanceolate to broadly ovate, cuneate at base, oblique, caudate-acuminate at apex, acumen up to 25 mm long, bluntish at tip, wavy, entire or nearly so along margins, 6.5 - 20.0 x 2.5 - 7.5 cm, dark greenish above, pale green beneath, chartaceous to coriaceous, minutely pubescent or glabrous; secondary nerves 5 - 15 pairs, faint and impressed above, prominently raised beneath, arising at angles 45 - 55° with the midnerve, tertiaries indistinct. Inflorescences terminal or sometimes from the uppermost leaf axils, corymbose, paniculate-cymes, up to 25 cm long, puberulent to finely pubescent. Flowers subglobose or cylindric in buds, ca 8 mm long; pedicels 2 - 4 mm long, densely puberulent. Calyx 5-toothed; sepals persistent, triangular, acute, ca 0.5 mm long, glandular, adpressedly pubescent abaxially, glabrous adaxially. Petals 5, valvate or slightly overlapping, elliptic or linear oblong, obtuse or deflex-acuminate at apex, ca 7 mm long, white, sparsely hairy or glabrous adaxially. Stamens 10; filaments linear, subulate above, 4 - 6 mm long, glabrous; anthers ellipsoid, ca 1.5 mm long. Disk annular, ca 1.5 mm broad, fleshy, glabrous. Ovary subglobose or ellipsoid, ca 2 mm long, ca 1 mm broad, obscurely and longitudinally furrowed, more or less hairy, hairs grey or

brownish, borne on a narrow, columnar, fleshy gynophore (ca 1 mm long), 5-locular, each locule with one pendulous ovule; style cylindrical, as long as or sometimes slightly exceeding the length of ovary, articulate, glabrous; stigma ca 1 mm long and broad, capitate. Berries ellipsoid or ovoid-oblong, ca 15 x 7 mm, orange or reddish when ripe, pellucid-punctate, obtuse at both ends, shortly stipitate below, mammillate above, epicarp adherent, endocarp fleshy, mucilaginous, white; seeds 2 or 3, green, slightly compressed, bean-shaped.

Fl. Oct.-Feb.; *Fr.* Ripening in April-May.

Distrib. India: Evergreen or semievergreen forests, from sea level to 1500 m altitude. Bihar, W. Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Mizoram, Manipur, Meghalaya, Tripura, Orissa, Andhra Pradesh and the Andaman Islands.

Bangladesh, Nepal, Bhutan, Myanmar and S. China.

Notes. Stem bark and root are used in the treatment of tuberculosis.

M. integerrimum is a variable species as regards to the vestiture of mature plant parts, especially leaves and leaflets. Some of the earlier collections of this species in Sikkim (e.g. *Rhodes* 244, *Cruik* 549, *Smith* 263 - all in CAL) represent the true glabrescent forms while specimens from Darjeeling Himalayas and Bangladesh (e.g. *S.K. Mukherjee* 4497 (Darjeeling - CAL) & *G. Watt* 12442, 12445 (Bangladesh - CAL) have shortly or finely pubescent leaves. J.D. Hooker (1875) described berries in this species as glabrous; but it was observed, at least once, that they could be slightly hairy or pubescent as seen in the specimen, *Modder* 63 - CAL).

16. *Murraya* Koenig ex L., nom. cons.

Shrubs or small trees, unarmed, evergreen or deciduous. Leaves alternate, imparipinnate or very rarely unifoliate; leaflets alternate, often asymmetric. Inflorescences axillary and/or terminal, few to many flowered panicles. Flowers medium to large, cylindrical or long ovoid in buds. Sepals 5, united at base, ovate or lanceolate, glandular. Petals 5, imbricate, linear or ovate-lanceolate, greenish-white to pure white, glandular. Stamens 10, alternately long and short, free; filaments slender or sometimes dilated below; anthers small, ovoid or ellipsoid. Disk annular, lobulate or cylindrical, short. Ovary seated on a distinct gynophore, 2-5-locular, each locule with 2 or rarely 1 ovule; style slender, caducous; stigma capitate. Fruits baccate, ovoid-ellipsoid to subglobose, with thin, glandular pericarp, reddish or black when ripe, 2-5-locular, 1 to few seeded; seeds embedded in a white mucilaginous pulp; cotyledons green, plano-convex.

Tropical and subtropical regions of Sri Lanka, India, S. China to S.E. Asia, Malasia and east to New Guinea, N.E. Australia and New Caledonia; ca 11 species, 2 in India.

KEY TO THE SPECIES

- 1a. Leaves with 15 - 27 leaflets; inflorescences with very numerous flowers (up to 60); berries subglobose, purplish to black when ripe 1. *M. koenigii*
- b. Leaves with 7 leaflets; inflorescences with only 3 - 6 flowers; berries ovoid-ellipsoid, reddish when ripe 2. *M. paniculata*

1. *Murraya koenigii* (L.) Sprengel, Syst. Veg. 2: 315. 1825; Hook.f., Fl. Brit. India 1: 503. 1875. *Bergera koenigii* L., Mant. Pl. Alt. 563. 1771. *Chalcas koenigii* (L.) Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 44: 132. 1875.

Asm.: *Bishahari, Narasingha*; Beng.: *Barsanga, Kariaphulli*; Guj.: *Goranimb, Kurrypatha*; Kan.: *Kari-bevu*; Mal.: *Kurri veppilla*; Mar.: *Karhinimb, Poospala, Gandla*; Or.: *Barsem, Bhursango*; Sans.: *Surabhininiba*; Tam.: *Kari vemp^u, Karuveppilai*; Tel.: *Kari-pakku*.

Large shrubs or small trees, up to 6 m high; branchlets rather cylindric, puberulous or glabrous; bark green or greyish. Leaves up to 50 cm long; petioles and rachises densely white-puberulent; leaflets alternate, conspicuously asymmetric, 15 - 27, dark green above, paler beneath, foetid-scented, thin membranous to chartaceous, glabrous except the puberulent midrib, ovate to lanceolate from an acute and very oblique base, shortly acuminate or tapering at apex, the tip notched, glandular-crenulate along margins, 2 - 8 x 1 - 3 cm (basal leaflets smaller); secondary nerves 4 - 10 pairs, less prominent above, rather raised beneath, slightly oblique, tertiaries reticulate, reticulae prominent beneath. Inflorescence terminal, corymbose paniculate, up to 7 x 8 cm. Flowers many, up to 60, in dense cymes, cylindric in buds, scented; pedicels slender, short (ca 4 mm long), puberulent. Calyx saucer shaped; sepals 5, fused at base (1/3 of its entire length), caducous, small, less than 1 mm long, deltate, puberulent abaxially, glandular. Petals 5, valvate, linear, obtuse, 6 - 8 x 1 - 1.5 mm, greenish-white, glandular, glabrous. Stamens 10; filaments subulate, 5 - 7 mm long, glabrous; anthers dorsifixed, ellipsoid, short, less than 1 mm long, pale greenish. Disk annular, slightly conical, ca 0.5 mm high, ca 2 mm broad, greenish, obscurely 5-lobed. Ovary oblong-ovoid, slightly narrowed towards apex, ca 1 mm long, greenish, 2-locular, each locule with 1 or 2 ovules; style slender below, dilated below the stigma, ca 2.5 mm long, pale green; stigma capitate, glandular. Berries subglobose, ca 9 x 10 mm, purplish to black when ripe, 2-locular, the pulp whitish, mucilaginous; seeds 1 or 2, ovoid-oblong, green; cotyledons glandular.

Fl. March-April; *Fr.* May-July.

Distrib. India: Mostly in moist deciduous forests in the subtropical N.W. Himalayas, N. E. peninsular India. Also in cultivation. Jammu & Kashmir, Himachal Pradesh, Uttar

Pradesh, Bihar, W. Bengal, Sikkim, Assam, Meghalaya, Orissa, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, and Andaman & Nicobar Islands.

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

Notes. Fresh leaves of this plant are used as an ingredient in curries and chutneys. They also yield a highly odoriferous essential oil which is used as a fixative for soap perfume. Leaves, stem, bark and roots are tonic, stomachic and carminative. Infusion of leaves is applied against vomiting, diarrhoea and dysentery. Berries are edible. Wood is used for making agricultural implements.

M. koenigi is frequently cultivated in homestead gardens of southern India for its aromatic leaves. It has been observed that the plants in cultivation are different from those found in the wild in having a tree habit; smaller leaves with very small, membranous and highly odoriferous leaflets, and petiole which often has a reddish tinge almost up to the point from which the first (basal) leaflets arise. In the wild forms the leaves are larger, sometimes reaching up to 50 cm long, and have more number of leaflets which are coriaceous and less aromatic. The cultivated plants widespread in home gardens in southern India could probably be a traditional 'land race' of this species.

2. *Murraya paniculata* (L.) Jack., Malay. Misc. 1: 31. 1820. *Chalcas paniculata* L., Mant. Pl. 68. 1767. *Murraya exotica* L., Mant. Pl. Alt. 563. 1771 ('*Murraea*'); Hook.f., Fl. Brit. India 1: 502. 1875. Fig. 92.

Beng.: *Kamini*; Hindi: *Kamini*, *Marchla*; Kan.: *Angarakanagida*, *Pandry*; Mal.: *Katumulla*; Mar.: *Pandari*, *Kunt*; Or.: *Banmallika*, *Harkankali*; Tam.: *Konji*; Tel.: *Naga golunga*.

Shrubs or small trees up to 10 m high; branchlets slender, cylindrical, puberulent to glabrous; bark pale, lenticellate. Leaves up to 20 cm long; petioles and rachises slender, cylindrical or angular, puberulent or glabrous; leaflets alternate, 3- or 5- or sometimes 7- or very rarely 1-foliolate, varying in size and outline, usually 3.5 - 8 x 2 - 3.5 cm or in smaller forms 1 - 3.5 x 0.5 - 1.5 cm, dark green and glossy above, chartaceous to coriaceous, glabrous or minutely puberulous along the midrib at above and beneath, ovate, ovate-elliptic, oblong-elliptic to obovate, cuneate and oblique at base, obtuse to caudate-acuminate often notched at apex, entire to obscurely and irregularly crenulate along margins; petiolules short, ca 5 mm long, puberulent to glabrous; secondary nerves 4 - 7 pairs, slender arising at angles 50 - 55° with the midrib, prominent on both surfaces, distinctly reticulate. Inflorescences terminal and/or axillary, few-flowered panicles. Flowers medium to large, up to 15 mm long. Pedicels slender, up to 10 mm long, glandular, glabrous. Calyx lobes 5, small, 0.5 - 1 mm long, deltate, acute, glandular, glabrous. Petals 5, oblong-elliptic or obovate, narrowed at base, acute or obtuse at apex, 12 - 15 x 3 - 4 mm, white, glandular, glabrous. Stamens 10; filaments subulate above, dilated below, 5 - 10 mm long, white, glabrous; anthers ellipsoid-oblong, ca 1 mm long,



Fig. 92. Morphological variations in *Murraya paniculata* (L.) Jack.: a. G.V.S. Rao 23246; b. R.S. Rao 10411; c. Dalzell s.n.; d. G. King 614; e. Deka 11166; f. Duthie s.n.; g. Kurz s.n.; h. D.M. Verma 1847 (all in CAL).

yellowish. Disk annular, lobulate, ca 1 mm high, ca 1.5 mm broad, glabrous. Ovary ovoid-ellipsoid, entire, 2 - 3 mm long, greenish, glabrous, 2- or 3- locular, each locule with one ovule; style cylindric, 4 - 8 mm long, glabrous; stigma capitate, 2 - 3-lobed, broader than the style, glandular. Berry ovoid-ellipsoid, ca 2 cm long with a tapering end, reddish when ripe, glandular-punctate, glabrous; seeds 1 or 2, ellipsoid, ca 1 cm long; seed coat pale brownish, hairy.

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

Distrib. India: Evergreen or moist deciduous forests at an altitude up to 2100 m. Himachal Pradesh, Uttar Pradesh, Punjab, Rajasthan, Bihar, W. Bengal, Sikkim, Arunachal Pradesh, Nagaland, Mizoram, Meghalaya, Tripura, Assam, Orissa, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Kerala and Andaman & Nicobar Islands. Also cultivated frequently in gardens throughout the country.

Myanmar, Nepal, Bhutan, Indochina, Thailand, Taiwan, Philippines, Australia, New Caledonia, Melanesian Islands, Mauritius, Madagascar and Sri Lanka.

Notes. The plants are esteemed as handsome garden objects in many tropical and subtropical countries. The wood is hard and close grained and is considered a substitute for box-wood. Leaves are medicinal and used in the treatment of diarrhoea and dysentery. They yield an essential oil. Flowers are esteemed in cosmetics. They yield a glucoside, 'Murrayin'.

Murraya paniculata is considered here as a very variable species with many different forms varying in their growth habit, size and shape of leaflets, number and size of flowers, exomorphology of fruits etc. Two forms of this species are common in India, both in wild and gardens. The one which is more frequently found in cultivation is a bushy shrub with smaller, obovate, obtuse or obtusely acuminate leaflets; many flowered (3 - to 6) inflorescence, and slightly acuminoid berries. The second form which is truly wild but now being cultivated is a shrub or tree with slightly larger, ovate or oblong-elliptic, acuminate or caudate leaflets; few (3- or 4-) flowered inflorescence, and acuminoid fruits. However, the frequent occurrence of intermediates in the wild as well as gardens makes it impossible to recognise them as distinct taxonomic entities. Huang's (in *Acta Phytotax. Sinica* 8: 100. 1959) and Stone's (in Dassan. & Fosb. (eds.), *Rev. Handb. Fl. Ceylon* 5: 460. 1985) treatments of the smaller (cultivated) forms of this species as *Murraya paniculata* var. *exotica* (L.) Huang and *M. exotica* L. respectively, seem therefore untenable.

Subfamily 2. FLINDERSIOIDEAE

Tribe 2.1. FLINDERSIEAE

17. *Chloroxylon* DC. nom. cons.

Unispecific; description and distribution as for the species given below.

Literature. AIRY-SHAW, H.K. (1965) Diagnoses of new families, new names etc. for the seventh edition of Willis's Dictionary. Kew Bulletin 18: 249-273; HARTLEY, T.G. (1969) A revision of the genus *Flindersia*. J. Arn. Arb. 50: 481-526; UMADEVI, I., M. DANIEL & S.D. SABNIS (1988) Chemosystematics of some members of the family Meliaceae. Fedd. Rep. 99: 195-197.

Notes. Airy Shaw (1965) while creating a new family, Flindersiaceae for *Chloroxylon* and *Flindersia* stated that the two genera showed characters intermediate between Rutaceae and Meliaceae, agreeing with former in possession of pellucid gland-dotted leaves and with latter in structure of capsules and winged seeds.

The question of systematic placement of *Chloroxylon* and *Flindersia* was critically reviewed by Hartley (1969) who followed Engler in treating the two genera under Rutaceae, subfamily - Flindersioideae. Dahlgren, Cronquist and Thorne supported inclusion of the two genera under Rutaceae. Phytochemical investigations (see Umadevi et al. (1988) also support that *Chloroxylon* and *Flindersia* at best be treated under Rutaceae, because of the presence of coumarins and alkaloids (Furoquino lines) which are totally unknown in Meliaceae.

Chloroxylon swietenia DC., Prodr. 1: 625. 1824; Heirn in Hook.f., Fl. Brit. India 1: 569. 1875 (sub Meliaceae). *Swietenia chloroxylon* Roxb., Pl. Coromandel 1: 46, t. 64. 1796.

Hindi: *Bhen*; Kan.: *Meshwal*; Mar.: *Halda, Billu*; Or.: *Sengelsali*; Tam.: *Mummarai, Vacimaram*; Tel.: *Billoo*.

Trees, deciduous, up to 15 m high, most parts greyish-pubescent; bark grey-brownish, corky, fissured. Leaves up to 30 cm long; petiole slender, terete, 3 - 4 cm long; leaflets 10 - 20 pairs, alternate and opposite, ovate-oblong, cuneate at base, obtuse at apex, entire along margins; midnerve slightly raised beneath; 2.5 - 3 x 1.2 cm, asymmetric, membranous-chartaceous, green above, pale and glaucous beneath; secondary nerves 3 - 4 pairs, prominent, sparsely reticulate. Inflorescences 10 - 15 cm long, pyramidal, grey-pubescent. Flowers 10 mm across; pedicels ca 5 mm long, puberulent. Sepals 5, minute, deltoid, puberulent. Petals 5, imbricate, spatulate, clawed, acute at apex, 3 - 5 x 1.2 - 3 cm, creamy-white, puberulent on both sides, ciliolate along margins. Stamens 10, shorter than petals; filaments filiform, subulate above, ca 2 mm long, glabrous; anthers broadly ellipsoid, ca 0.5 mm long, creamy. Disk pulvinate, 10-lobed, dense puberulent. Ovary immersed in disk, greenish, ca 2 mm broad, 3-lobed, 3-locular, ovules

2-8 in each locule, biseriate; style slender, glabrous; stigma obliquely-capitate, obscurely 3-lobed. Capsule ovoid-oblong, ca 3 x 1.5 cm, smooth, 3-valved; seeds 4 in each valve, compressed, 15 x 3 mm, distally alate, brown.

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

Distrib. India: Dry deciduous forests at low elevations. Madhya Pradesh, Orissa, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Sri Lanka, Malagasy.

Notes. Wood is deep greenish-yellow, lustrous, closely grained, heavy and durable. It is used for furniture and tool handles. It yields an yellow dye and also a good oil.

Subfamily 3. RUTOIDEAE

Tribe 3.1. RUTEAE

18. *Boenninghausenia* Reichb. ex Meissner, nom. cons.

Herbs, perennial woody; stem and branches cylindric, minutely tubercled, hairy or glabrous. Leaves alternate, bi- or tri-pinnate; rachis slender, sparsely to densely pubescent or glabrous; leaflets smaller, obovate, obcordate or oblong, green above, pale and glaucous beneath. Inflorescences compound, leafy paniculate cymes, terminal, several to many flowered, sparsely pubescent or glabrous. Bracts green, leafy. Flowers bisexual, cylindric-obovoid or subglobose in buds, white. Calyx 4-lobed, glandular, lobes ovate or suborbicular, persistent. Petals 4, obovate or suborbicular, caducous. Stamens 6-8, alternately long and short; filaments white; anthers yellow. Disk fleshy, cupular, white, toothed at margins, with minute yellowish glandular protruberances. Ovary 3-5-lobed, borne on a long stipe of varying length or subsessile, free abaxially, united adaxially, each with 3-6 ovules; styles 3-5, ventral, connate above; stigma simple. Fruits capsular, membranous, glandular, splitting ventrally into 3-5 distinct fruitlets, endocarp thin; seeds reniform, black, finely granulated or ridged.

Subtropical and temperate Himalayas east to Japan, south to Java and south-east to Philippines; 2 species, both occur in India.

KEY TO THE SPECIES

- 1a. Flower buds cylindric-obovoid; calyx lobes ovate; petals obovate; gynophore 2-8 mm long
1. *B. albiflora*
- b. Flower buds subglobose; calyx lobes suborbicular; petals suborbicular; gynophore if present ca 1 mm long
2. *B. sessilicarpa*

1. *Boenninghausenia albiflora* (Hook.) Meissner, Pl. Vasc. Gen. 2: 44. 1837; Hook.f., Fl. Brit. India 1: 486. 1875. *Ruta albiflora* Hook., Exot. Fl. 1: 79. 1823. *Boenninghausenia schizocarpa* Huin J. Arn. Arb. 32: 392. 1951, syn. nov. **Fig. 93.**

Herbs, 30 - 60 cm high. Leaves 6 - 12 cm long; leaflets subsessile, terminal one on an extension of primary rachis of 3 - 5 mm long, narrowly obovate, obcordate or sometimes oblong, cuneate or rounded at base, obtuse or rounded and often emarginate at apex, entire or rarely obscurely crenate along margins, (2-) 5 - 20 x 15 - 11 mm, chartaceous, glabrous; midnerve and secondary nerves faint above, rather prominent beneath, latter oblique. Inflorescences up to 25 cm long. Bracts narrowly obovate or oblanceolate, obtuse, attenuate at base, 5 - 20 x 2.5 - 3 mm, glabrous. Flowers drooping, 3 - 6 mm long, ca 6 mm across, terminal one largest; pedicels filiform, variable in length, 1.5 - 6 mm long, tubercled, glabrous. Calyx urceolate, lobes 4, narrow to widely ovate, obtuse, 0.5 - 1 mm long, glabrous. Petals 4, obovate, obtuse at apex, narrow below, concave, 3 - 6 x 1.2 - 3 mm, glabrous, pinnately nerved. Stamens 8, sometimes 7 or 6, unequal in length, alternate longer, all inserted at base of disk; filaments linear-subulate, 2 - 9 mm long, glabrous; anthers dorsifixed, ellipsoid, 0.5 - 1.0 mm long. Disk cupular, 0.5 - 1 mm high, glabrous. Ovary 4-carpellate, 4 - lobed, on (2-) 3.5 - 8 mm long gynophore, splitting or not at tip; carpels free abaxially, connate adaxially, each lobe oblong, ca 1 mm long, with 4 to 6 pendulous ovules; styles as many as carpels, 1.5 - 2 mm long; stigma simple. Fruiting pedicel filiform, 8 - 12 mm long, glabrous. Capsule 5 - 8 mm across, membranous, splitting into 4 distinct fruitlets when ripe; seeds ovoid-ellipsoid, reniform, ca 1 mm long, black, finely granulate.

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

Distrib. India: Himalayas and foothills, in moist shady places, 900 - 3040 m. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, and W. Bengal, Sikkim, Arunachal Pradesh, Nagaland and Meghalaya.

Pakistan, Nepal, Bhutan, China, Philippines, Thailand, Java and Japan.

Notes. Used as a stimulant by inhabitants of N.W. Himalayas (Royle, Ill. Himal. Bot. 156. 1839). Cultivated in many temperate gardens as an ornamental plant.

Hu (1951) described *B. schizocarpa* based on a specimen collected by Schneider in Yunnan and distinguished it from *B. albiflora* by its elongated stipe splitting apically and hence with an ovary with four carpels separated at base. However, it is found that among specimens of *B. albiflora* gathered in western Himalayas (e.g. *Bhattacharya* 24508, 29655, *Vohra* 54453 - all in BSD) some are characterized by having a tendency to split the stipe apically and with 4 free carpels that are separated at base. There are also specimens collected in north-eastern India and eastern Himalayas (in ASSAM & CAL) which show stipe length varying from 1 - 3 mm with divided or undivided tips. Therefore, *B. schizocarpa* is treated here as a mere variant of *B. albiflora*.

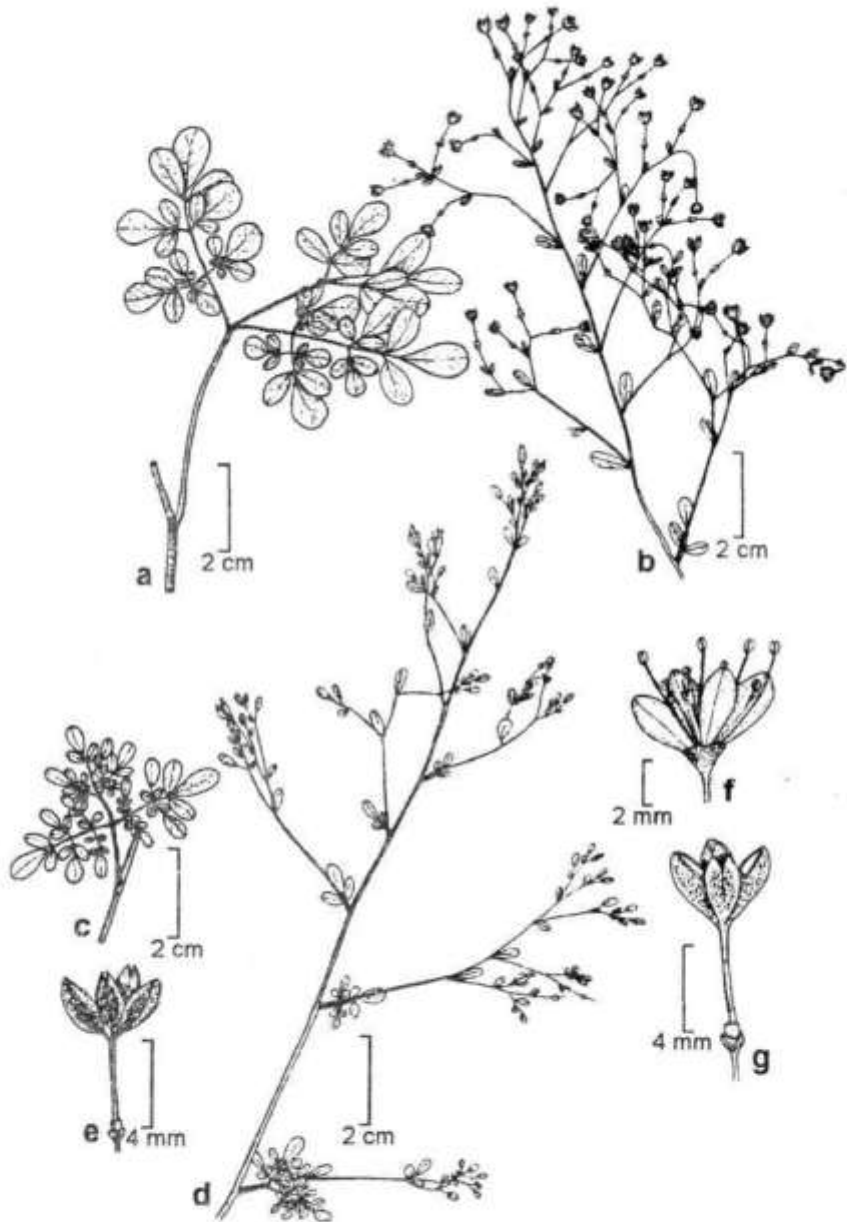


Fig. 93. *Boenninghausenia albiflora* (Hook.) Meissner: a. twig with leaves; b. inflorescence; c. twig with leaves; d. inflorescence; e. fruit showing capsules separate at base; f. flower; g. capsules not detached at base

2. *Boenninghausenia sessilicarpa* Levl. in Feddes Repert. Sp. Nov. Regni Veg. 12: 282. 1913. *B. albiflora* (Hook.) Meissner var. *brevipes* Franch. in Bull. Soc. Bot. France 33:450.1886. *B. brevipes* (Franch.) Levl., Cat. Pl. Yunnan 249. 1917. Fig. 94.

Herbs up to 50 cm high. Leaves 3 - 9 cm long; petiole and rachis of young leaves usually strigose or becoming glabrous on maturity; leaflets 5 to 15, terminal one largest, obcordate or obovate or rarely spatulate, 10 - 20 x 6 - 12 mm, lateral ones smaller, oblong or obovate, cuneate at base, rounded or emarginate at apex, entire along margins, 7 - 15 x 3 - 8 mm. Flowers ca 7 mm across, subglobose in buds before anthesis, each one subtended by a linear-oblongate, leafy bracteole; pedicels filiform, 6 - 12 mm long, pubescent or glabrous. Calyx lobes 4, suborbicular, ca 0.5 mm long, pubescent or glabrous. Petals 4, suborbicular, 2 - 5 x 2 - 2.5 mm. Stamens 6 to 8, unequal; filaments linear-subulate, 2 - 4 mm long, glabrous; anthers oblong, ca 0.5 mm long. Disk annular, ca 0.5 mm high. Ovary sessile or subsessile, carpels 4, almost free to base, each 3 - 4-ovuled; styles 4, ventral, connate; stigma simple. Capsules 2 - 3 mm across, membranous, glandular, separating into 4 distinct fruitlets when ripe; seeds 2 or 3 in each fruitlet, ovoid, tubercled and ridged.

Fl. March-July; *Fr.* Sept.-Feb.

Distrib. India: Himalayas and N.E. India, 1200 - 1900 m, W. Bengal, Assam, Nagaland, Mizoram, Manipur and Meghalaya.

Bhutan, Nepal, China and Philippines.

Notes. Hu (1951) was the first to record this species in India based on specimen, *Gardea 7* from Khasi hills in Meghalaya. It is distinct from *B. albiflora* in having subglobose flower buds (before anthesis), suborbicular to rounded calyx lobes, suborbicular petals, annular fleshy disk and a sessile or subsessile ovary. The leaflets are comparatively smaller in size and leaf rachis softly pubescent but becoming glabrous or nearly so.

19. *Dictamnus* L.

Herbs, perennial, woody. Leaves alternate, unequally pinnate; leaflets usually opposite, occasionally alternate, margins serrulate. Inflorescences terminal, racemose. Flowers large, showy, zygomorphic, bracteate and bracteolate. Sepals 5, caducous or persistent. Petals 5, variously coloured, upper 4 ascending, lowest one declinate. Stamens 10, free; filaments slender, filiform; anthers suborbicular or oblong. Disk annular, lobed. Ovary stipitate, 5-carpellate, 5-lobed, 5-locular; style declinate; stigma simple. Fruits capsular, compressed, 5-lobed, hispid, each lobe bivalved with horny adherent endocarp, 2 - 3-seeded; seeds subglobose, black, shiny.

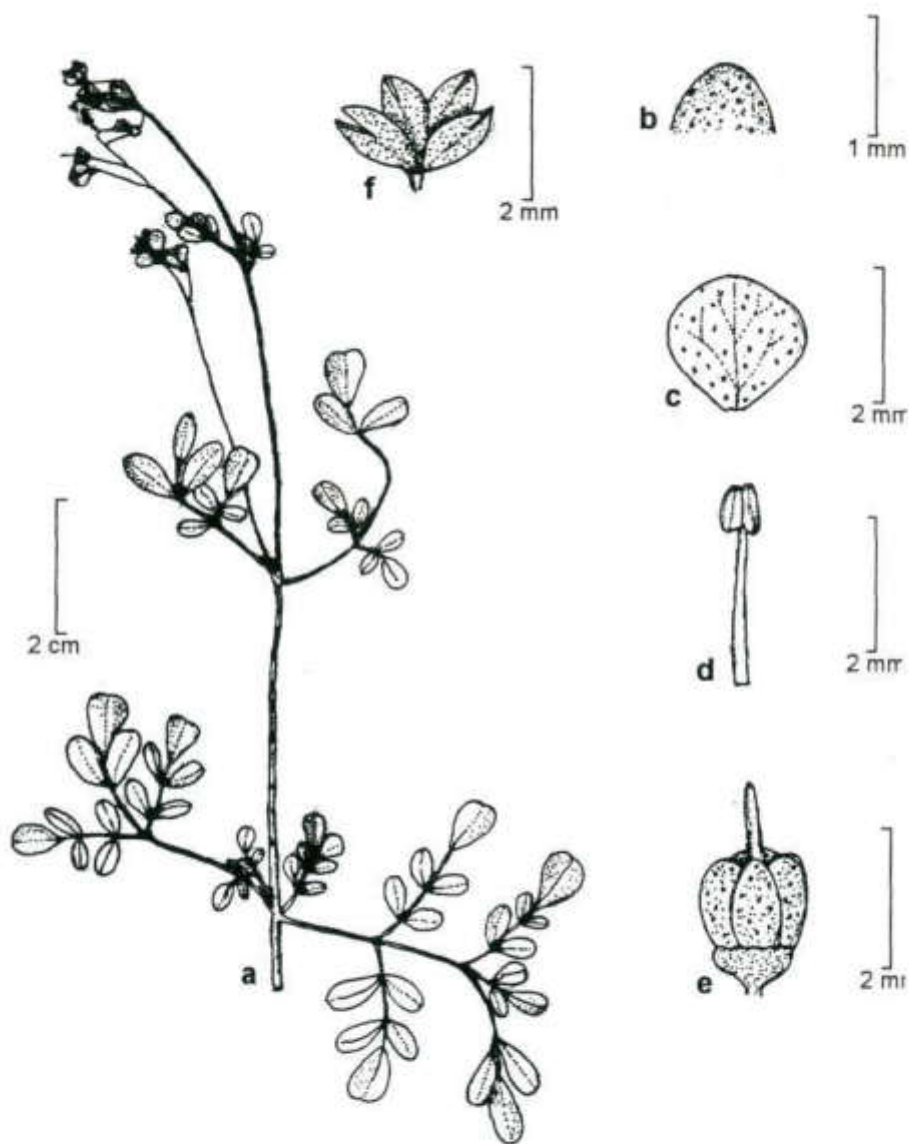


Fig. 94. *Boenninghausenia sessilicarpa* Levl.: a. flowering twig; b. sepal; c. petal; d. stamen; e. pistil; f. mature fruit.

Temperate regions of the Old World, from N.W. Himalayas east to Japan and westward to C. Asia and S.C. Europe; ca 6 species, one in India.

Dictamnus albus L., Sp. Pl. 383. 1753; Hook.f., Fl. Brit. India 1: 487. 1875. *D. fraxinella* Pers., Syn. Pl. 464. 1805. *D. himalayanus* Royle, Ill. Bot. Himal. t. 29. 1834 et 156.1835. Fig. 95.

Eng.: Burning bush, Dittany, Gas plant.

Herbs up to ca 1 m high; branches terete, puberulent or glabrate. Leaves 16 - 30 cm long; petioles 5 - 20 mm long; rachis angular, marginate, glandular, shortly pubescent to glabrate; leaflets 7 to 15, sessile, oblong-elliptic or ovate to ovate-lanceolate, cuneate at base, acute or acuminate at apex, glandular-serrulate along margins, 3.5 - 7 x 1.5 - 3 cm, dark green, membranous, glabrate above, densely puberulent to pubescent beneath especially along midnerve and secondary nerves; midnerve slender, slightly raised beneath; secondary nerves 5 - 7 pairs, slightly oblique. Racemes up to 36 cm long; peduncle densely puberulent to glabrescent, darkish-glandular. Flowers slightly irregular; bracts lanceolate, 8 - 18 mm long, darkish-glandular, usually at base of pedicels; bracteoles at middle or tip of pedicels; pedicels up to 25 mm long, puberulent, darkish-glandular. Sepals 5, free or connate at base, persistent, lanceolate, ca 1 mm long, dark-glandular abaxially and along margins, glabrate. Petals 5, upper 4 erect, lower one declinate, oblong-elliptic, narrowed below, obtuse at apex, ca 3 x 1 cm, dark-glandular abaxially, glabrous, white striped with pinkish lines, conspicuously nerved, nerves rosy-pink in color. Stamens 10, alternately longer and shorter, ca 3.5 cm long; filaments slender, subulate, dark-glandular at extremities, densely hairy adaxially from base almost up to middle, glabrous above; anthers suborbicular or oblong, apiculate, 1.5 - 2.5 mm. Disk obscurely 10-lobed, glabrous. Ovary stipitate, hispid, 5-carpellate, deeply 5-lobed, 5-locular, each locule with 3 - 4 ovules; style slender, ventral, ca 2 cm long, declinate; stigma simple. Capsule compressed, hispid, ca 2 cm across, 5-valved, carpels 2 - 3-seeded; seeds subglobose, black, shiny.

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

Distrib. India: Temperate N.W. Himalayas, often on rocky habitats between 2775-3000 m. Kashmir, Himachal Pradesh and Uttar Pradesh (Tehri-Garhwal).

South C. Europe and C. Asia.

Notes. Root bark is aromatic and used in nervous diseases, fever, amenorrhoea and hysteria. Decoction of root is applied for scabies and various other skin diseases. The plant secretes a volatile, inflammable etherial oil. Roots contain several toxic alkaloids, chiefly 'Dictamnine'. The plant is esteemed as an ornamental and is often grown in gardens of many temperate countries for its bright, attractive flowers.



Fig. 95. *Dictamnus albus* L. : flowering twig.

20. Ruta L.

Herbs, perennial woody. Leaves alternate, 2- 3-pinnatisect or pinnatipartite, strongly aromatic. Inflorescences terminal, corymbose, bracteate cymes. Flowers bisexual, scented. Sepals 4 (5), persistent, green. Petals 4(5) imbricate, concave, cucullate, margins dentate, ciliate or rarely entire and wavy. Stamens twice as many as petals, alternately longer and shorter. Disk thick, glandular-lobulate, often pitted. Ovary 4(-5)-lobed, 4(-5)-locular, ovules 2 - 6 or many in each locule; style ventral; stigma capitate. Fruits 4 - 5-lobed capsules, dehiscent at apex; seeds angled or reniform, pitted, albuminous, embryo rather curved.

Temperate or warm tropics of northern hemisphere in S. Europe to Mediterranean regions and W. Asia; 4 species, one in India only in cultivation, but becoming naturalized.

Ruta chalepensis L., Mant. Pl. 69. 1767. *R. graveolens* L. var. *angustifolia* Hook.f., Fl. Brit. India 1: 485. 1875, non *R. angustifolia* Pers. 1805.

Beng.: *Emul*; Guj.: *Satapa*; Hindi: *Pisamaram*, *Sadab*, *Satari*; Kan.: *Nagadalisopum*, *Simesdanu*; Mal.: *Nagadhali*; Mar.: *Satapu*; Tam.: *Arvadam chedi*, *Arvada*; Tel.: *Arudu*, *Serdapa*.

Herbs, erect, glaucescent, 60 - 70 cm high; stem more or less angular, branches sinuate towards upper half. Leaves pinnatisect or pinnatipartite, pyramidal or oblong in outline, 2.5 - 8.5 cm long; leaflets heteromorphic, obovate, oblong-lanceolate or elliptic, 5 - 15 x 2 - 3 mm, terminal leaflet sometimes digitately 3-fid, obtuse to rounded at apex, margins entire or obscurely crenate, shortly petioluled or sessile. Inflorescences 5 - 15 cm across, lax, dichasial or often flowers of lateral cyme develop in a helicoid fashion. Flowers widely opening, ca 10 mm across; bracts leafy, lanceolate, acuminate at apex, narrowed at base, crenate from middle to apex or otherwise entire along margins, 5 - 7.5 x 2 - 2.5 mm; pedicels up to 10 mm long, elongating in fruits (12 - 15 mm long), glabrous. Sepals 4(5), foliaceous, equal or sometimes unequal in size, broadly ovate or deltate, acuminate at apex, entire or obscurely crenate along margins, ca 4 x 2 mm, green. Petals 4(5), patent, spatulate, concave, gibbous adaxially, obtuse, hooded at apex, ca 6.5 x 4.5 mm, yellow, pinnately nerved, shortly stiped below, stipe ca 1 mm long, margins irregularly fimbriate, fimbriules 2 - 3 mm long. Stamens 8 or 10, outer ones (antisepalous) exerted; filaments linear, subulate above, 5 - 7 mm long, glabrous; anthers dorsifixed, ovoid, obtuse at apex, cordate below, ca 2 mm long. Disk 8- or 10-lobed, ca 1 mm high, ca 4 mm broad. Ovary 4- 5-carpellate, subglobose, carpels free to middle, lobes acute, ca 4 mm long, green, ovules 2 or 3 per locule, collateral; style ca 4 mm long, glabrous; stigma capitate, obscurely lobed. Capsule 4- 5-lobed, 6 - 8 mm across, lobes acute, pitted below, dehiscent inwardly at apex, endocarp crustaceous; seeds 1 - 2 per locule, ca 2 mm long, angled, pitted brown.

Distrib. India: Known only in cultivation in many parts of the country.

Mediterranean region, Atalantic Islands, S. Europe.

Notes. The whole plant is bitter, laxative, tonic, digestive, diuretic, emmanagogue and antiaphrodisiac. It yields an essential oil with properties similar to that of 'Garden Rue Oil'. Decotion of leaves is used in fever. In large doses it acts as an acronarcotic poison. The essential oil is used in hysteria, ammenorrhoea, and epilepsy. Leaves are used in salads and as flavouring agent.

This species has often been confused with *Ruta graveolens* L. by many Indian botanists who reported it as such, attributing many of the properties known for the latter to it. However, both these species are distinct in having certain unique floral, cytological and phytochemical features. (See, Ramanathan & Ramachandran in J. Bombay Nat. Hist. Soc. 70: 238. 1973). In *R. chalepensis* petals have characteristic ciliate or fimbriate margins, and capsules are with very sharply pointed lobes while in *R. graveolens* petals are with more or less undulate or denticulate margins and capsules have obtuse or bluntish lobes. In *R. chalepensis* chromosome number is reported as $2n = 36$ whereas in *R. graveolens* $2n = 72$ or 81. Similarly, the essential oil extracted from *R. chalepensis* contain methyl heptyl ketone while that from *R. graveolens* has mainly methyl nonyl ketone.

Subfamily 3. RUTOIDEAE

Tribe 3.2. ZANTHOXYLEAE

21. Melicope J.R. & G. Forst.

Shrubs (rarely scandent) or trees, evergreen, unarmed. Leaves opposite or whorled, digitately trifoliolate or unifoliolate. Inflorescences axillary or rarely terminal, cymose or thyriform or paniculate, or sometimes reduced to solitary flowers. Flowers bisexual or functionally unisexual, bracteate. Sepals 4, valvate or imbricate. Petals 4, valvate or imbricate. Stamens 8 or rarely 4, free, in carpellate flowers reduced to staminodes. Disk obsolete to ca 1.5 mm high, annular or pulvinate, 4- 8-lobed. Gynoecium 4-carpellate, deeply 4-lobed, connate basally or up to their entire length, 4-locular, each locule with 1 or 2 collateral or superposed ovules; style apical or subapical; stigma capitate, peltate or 4-branched, in staminate flowers reduced to rudimentary pistillodes. Fruits (1)-2- 4, basally connate follicles, grading to syncarpous loculicidal capsules, 1- 2-seeded; epicarp subwoody, punctate; endocarp pergamentaceous to cartilaginous, adherent or free from epicarp; seeds solitary or in pairs, remaining attached in dehisced fruit, black or brownish, shiny, albuminous; embryo straight; cotyledons more or less flattened, ellipsoid.

Tropical regions of Malagasy, Indo- Himalayas, Sri Lanka, eastward to Hawaiian and Marquesan Islands and south to New Zealand; ca 230 species, 4 in India.

Notes. Following Hartley (1981, 1994), *Melicope* is considered here in a wider sense including some of those species formerly treated under *Euodia* J.R. & G. Forst. *Melicope* is characterized by its combination of opposite or whorled, digitately trifoliate or unifoliolate leaves, dehiscent fruits, and shiny, black, pelluculose seeds which remain attached in dehisced fruit (Hartley 1994: 48). According to Hartley (l.c.) *Euodia* J.R. & G. Forster comprises seven species and ranges from New Guinea and north-eastern Australia east to Samoa, Tonga and Niue. Unlike *Melicope*, its seeds are neither shiny nor pelluculose and are forcibly expelled, along with endocarp, when fruit dehisces.

Literature. HARTLEY, T.G. (1981) A revision of the genus *Tetradium* (Rutaceae). Gard. Bull. Straits Settlements. 34: 91-131. HARTLEY, T.G. (1994) The genus *Melicope* (Rutaceae) in Borneo. Sandakania 4: 47-74. NAIR, K.N. & M.P. NAYAR (1989) A revision of the genus *Euodia* J.R. & G. Forst. (Rutaceae) in India. J. Econ. Tax. Bot. 13: 193-203.

KEY TO THE SPECIES

- | | |
|--|--------------------------|
| 1a. Leaves unifoliolate; stamens 8 | 3. <i>M. indica</i> |
| b. Leaves digitately trifoliolate; stamens 4 | 4 |
| 2a. Inflorescence shorter than petioles (up to 2.5 cm long); staminal filaments villous from about middle to base adaxially | 1. <i>M. accedens</i> |
| b. Inflorescence as long as or longer than petiole (up to 17 cm long); staminal filaments glabrous throughout | 3 |
| 3a. Leaflet blades predominantly wide obovate with rounded apex, secondary nerves strong, impressed above, anarching near margins forming a distinct intramarginal nerve | 2. <i>M. glabra</i> |
| b. Leaflet blades ovate, elliptic-oblong or lanceolate, with acuminate apex, secondary nerves slender, ending rather indistinctly near margins | 4. <i>M. lunuankenda</i> |

1. *Melicope accedens* (Blume) T.G. Hartley in Sandakania 4: 67. 1994. *Euodia accedens* Blume, Bijdr. 246. 1825. *E. parkinsonii* Narayanan & Nayar in J. Econ. Tax. Bot. 13: 202. 1989 syn. nov.

Shrubs up to ca 8 m high; branchlets faintly fissured, lenticellate. Leaves up to 28 cm long; petioles rather stout, slightly grooved adaxially, subcylindric, inflated at base, marked by minute, reddish oil dots, 2-7 cm long, pubescent; leaflets elliptic or narrowly obovate or rarely narrowly ovate, acute to cuneate and assymetric at base, shortly acuminate at apex, entire along margins, 7.5-21.5 x (1.5-) 3-7 cm, terminal one distinctly larger than lateral ones, chartaceous, glossy on both surfaces, glabrous; secondary nerves 6-15 pairs, slender, subhorizontal, dividing dichotomously slightly away from margins, interarching with adjacent dichotomies and forming an intermarginal loop. Inflorescence axillary, condensed heads of cymes or rarely pyramidal cymes, up to 2.5 cm long; peduncle slender, striated, tawny-tomentose. Male flowers: Bracts minute; pedicels ca 1 mm long, pubescent. Sepals 4, free to base, narrowly ovate, acute, ca 2 mm long, tomentose abaxially, glabrous adaxially, pellucid-punctate. Petals 4, fleshy, ovate, acuminate, acumen deflexed, 2.5 x 1.5 mm, deciduously tomentose abaxially, scarcely

hairy adaxially. Stamens 4, inserted at base of annular, 4-lobed disk; filaments ca 2 mm long, villous on inner face; anthers oblong, ca 1 mm long, pistillodes minute. Female flowers: Gynoecium ca 4 mm long, ovary glabrous to pubescent or villous or rarely velutinous, carpels 2-ovulate; style pilosulose to pubescent or villosulose; stigma capitate or capitate-peltate, slightly 4-lobed, ca 0.5 mm across. Fruiting carpels connate at base, divergent, subglobose to ellipsoid or obovoid, 3 - 7 mm long, exocarp subfleshy, glabrous to pubescent or rarely velutinous, endocarp adherent, at least towards apex, glabrous; seeds attached to fruit by a funiculus of 0.3 - 1.5 mm long, 0.3 - 1 (-1.5) mm wide at middle, subglobose to ovoid or ellipsoid, sometimes compressed and often assymetrical at chalazal end, 2.5 - 5 mm long.

Distrib. India: Andaman Islands (so far known only from a solitary collection *C.E. Parkinson* 922 in CAL).

Myanmar, east to Vietnam, south to Java and Borneo.

Notes. Description of female flowers, fruits and seeds is drawn from Hartley 1994: 68. The Andaman specimen represents a variant of *M. accedens*, characterized by sepals pubescent abaxially; petals glabrous to pubescent abaxially; fruiting carpels 4 - 5 mm long, exocarp pubescent; leaflet blades sparsely puberulent to pubescent below, with 10 to 16 pairs of secondary nerves. Extra Andaman plants on the other hand represent relatively larger forms with longer petioles, petiolules, larger glabrous leaflets, and larger inflorescences.

2. *Melicope glabra* (Blume) T. G. Hartley in Sandakania 4: 60. 1994. *Fagara glabra* Blume, *Catalogus* 40. 1823. *Euodia glabra* (Blume) Blume, *Bijdr.* 245. 1825; Hook.f., *Fl. Brit. India* 1: 489. 1875; Nair & Nayar in *J. Econ. Tax. Bot.* 195. 1989.

Trees, 5 - 15 m high, dioecious; branchlets cylindric, glabrous; bark lenticellate. Leaves trifoliolate, up to 28 cm long; petioles up to 10 cm long, slightly grooved adaxially, glabrous; petiolules of lateral leaflets obsolete, in terminal ones longer; leaflets widely obovate or obovate-elliptic, middle one largest, acute and often assymetrical at base, rounded or abruptly acuminate at apex, margins entire, 7.5 - 18.5 x 7 - 9.5 cm; secondary nerves 7 - 15 pairs, strong, spreading to arching. Panicles 7 - 17 cm long, peduncle brachiate, branches compressed, glabrous or shortly pubescent at least at apex. Flowers unisexual in dense subumbellate clusters, 4 - 5 mm long; bracts minute; pedicels slender, 3 - 4 mm long, glabrous or nearly so. Male flowers: Sepals 4, free to ca 0.5 mm length, ovate to suborbicular, obtuse or shortly acuminate, puberulent abaxially, glabrous adaxially. Petals oblong, obtusely deflexed, acuminate, 4, 2.5 - 3 mm long, glabrous; midnerve prominent. Disk pulvinate, 0.5 mm high. Stamens 4, exerted; filaments subulate to filiform at apex, 3 - 3.5 mm long, glabrous; anthers oblong, ca 1 mm long. Pistillodes 3 or 4, minute, less than 1 mm long. Female flowers: Sepals, petals and disk as in male flowers. Gynoecium 4-carpellate, 4-lobed, ca 1.5 mm broad, glabrous or minutely hairy, ovules 2 per carpel; style short, glabrous; stigma capitate. Staminodes

ca 2 mm long. Fruits 3 or 4 follicles, each 10 - 12 mm long, exocarp subfleshy, coriaceous, punctate, glabrous, endocarp glabrous, adherent, at least towards apex; seeds attached to follicle by a funiculus, broadly ellipsoid, 4 - 6 mm long, black, shiny.

Distrib. India: Primary or secondary beach forests of Andaman & Nicobar Islands at about 50 m altitude.

West Malesia, Singapore, Sumatra, Borneo and Java.

3. *Melicope indica* Wight, Icon. Pl. Ind. Orient. 3: t. 1051. 1845; Hook.f., Fl. Brit. India 1: 492. 1875; Gamble, Fl. Pres. Madras 1: 149. 1915; Sharma et al., Biol. Mem. 2:26.1977. **Fig. 96.**

Shrubs or small trees, up to 5 m high. Leaves unifoliolate; petioles 2 - 7 cm long, slender, horizontally grooved above, cylindrical otherwise, glabrous; leaflets elliptic or narrowly obovate, cuneate at base, obtusely acuminate or rarely rounded at apex, entire along margins, 4 - 12 x 2 - 6 cm, coriaceous, glabrous; secondary nerves 9 - 15 pairs, slender, prominent, reticulate. Flowers 3 or 5 in axillary cymes or umbels, functionally unisexual; bracts and bracteoles ovate, obtusely acute at apex, ca 1 mm long, pellucid-punctate, pubescent abaxially, glabrous adaxially; pedicels 3 - 5 mm long, densely puberulent. Male flowers: Sepals 4, free to base, imbricate, orbicular, ca 2 x 2.5 mm, ridged on abaxial side, pubescent abaxially along ridge, glabrous adaxially. Petals 4, imbricate, ovate, acute, ca 5 x 3 mm, minutely hairy abaxially, glabrous adaxially. Disk obscure. Stamens 8; filaments linear, 2.5 - 3.5 mm long; anthers oblong or subcordate, ca 1 mm long, yellowish. Pistillodes with an abortive ovary and rudimentary styles at centre. Female flowers: Sepals, petals and disk as in male flowers. Staminodes 8, 2.5 - 3.5 mm long. Gynoecium 4-carpellate, 4-lobed, ca 1.5 mm long, ca 2 mm broad, pubescent, ovules 2 in each carpel; styles 4, coherent above, free below, ca 2 mm long; stigma capitate, 4-lobed, ca 1 mm broad. Fruits capsular, connate almost along entire length, ca 10 mm broad, exocarp subfleshy, glabrous, endocarp crustaceous; seeds one in each locule, remain attached in capsule by a funiculus, ca 5 mm long, black shiny.

Fl. Jan.-July; *Fr.* Ripens in December.

Distrib. India: Evergreen shola forests of Nilgiri Ranges in southern W. Ghats at 1825 - 2275 m altitudes. Rare.

Endemic.

Notes. *M. indica* is so far reported to occur in five localities of Nilgiri ranges viz. Bangitapal, Kundha, Lakkadi, Mudimund and Sispara, where all populations recorded are very low and vulnerable due to human interference.

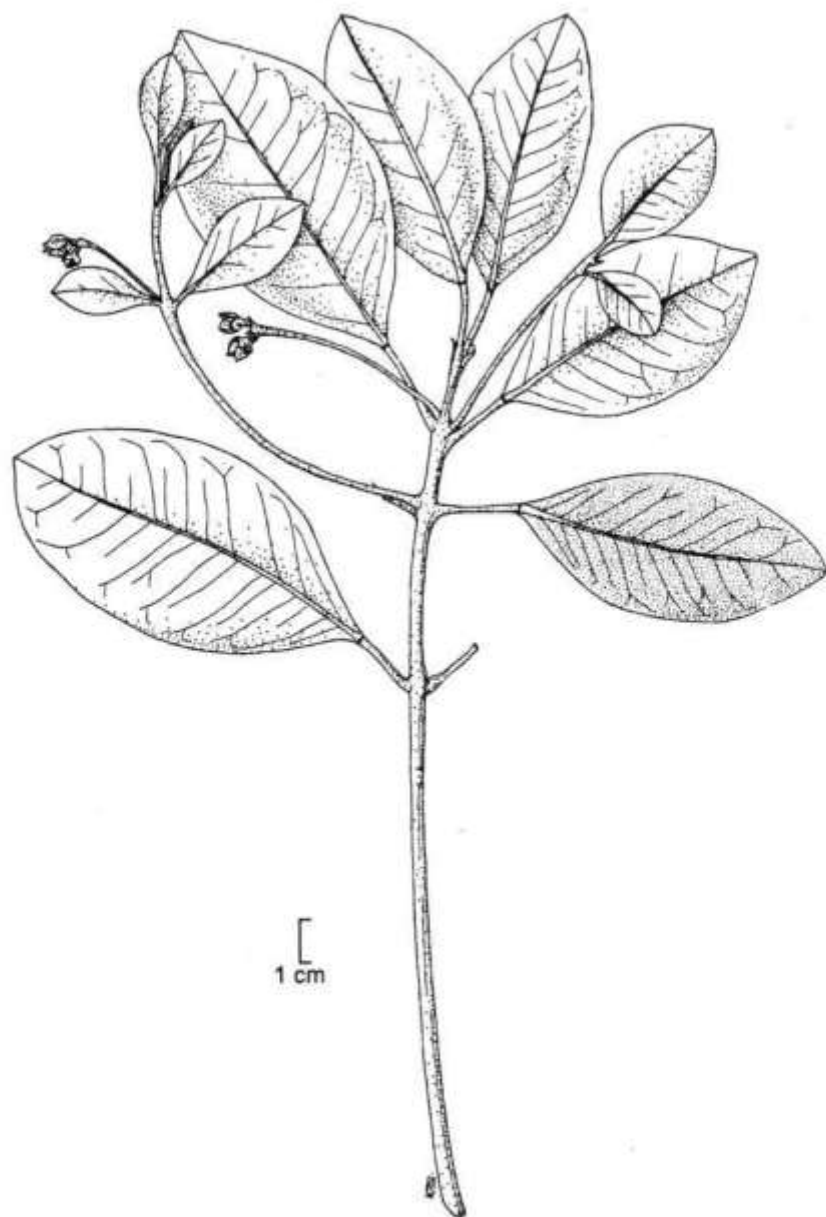


Fig. 96. *Melicope indica* Wight

4. Melicope lunuankenda (Gaertner) T. Hartley in Sandakania 4: 61. 1994. *Fagara lunuankenda* Gaertner, Fruct. Sem. Pl. 334. t. 68. f. 9. 1778. *Euodia lunuankenda* (Gaertner) Merr., Philipp. J. Sci. 7: 378. 1912. *Zanthoxylum roxburghianum* Cham. in Linnaea 5: 58. 1830. *Fagara triphylla* sensu Roxb., Fl. Ind. ed. 2 (Carey) 1: 416. 1832, excl. syn., non Lam. 1788. *Zanthoxylum triphyllum* Wight, Ic. Pl. Ind. Or. t. 204. 1839. *Euodia roxburghiana* (Cham.) Benth., Fl. Hongk. 59. 1861; Hook.f., Fl. Brit. India 1: 487. 1875. *Euodia lunuankenda* (Gaertner) Merr. var. *tinunvelica* Henry & Chandrab. in Bull. Bot. Surv. India 15: 144. 1973, syn. nov.

Asm.: *Midauma-baphang*; Mal.: *Kaneli*.

Trees, up to 20 m high; branches cylindric, glabrate to shortly pubescent; bark grey, smooth or slightly and reticulately fissured, lenticellate. Leaves ca 23 cm long; petioles 4.5-10 cm long, slightly grooved adaxially, cylindric, glabrate; leaflets ovate, elliptic-oblong or lanceolate, grading to obovate, cuneate and asymmetric at base, obtuse or acuminate at apex, entire along margins, coriaceous, glossy, dark green, glabrous; secondary nerves 10 - 18 pairs, slender, horizontal at base, arching upwards, ending indistinctly at margins. Inflorescence paniculate, 9 - 22 cm long, 10 - 19 cm broad, spreading; peduncle brachiate, branches appressedly pubescent to glabrous. Flowers functionally unisexual, in umbellate cymes; pedicels ca 2 mm long, pubescent. Male flowers ca 3 mm long: Sepals 4, connate at base, ovate-orbicular, obtuse, ca 0.5 mm long, greenish, pubescent abaxially, glabrous adaxially. Petals 4, 2 - 3 mm long, white, glabrous. Stamens 4; filaments 2 - 3 mm long, glabrous; anthers oblong, obtuse, ca 0.8 mm long. Disk annular, thick, 4- or more lobed, ca 1 mm high, densely pubescent. Pistillode of 4 rudimentary carpels. Female flowers: Sepals, petals as in male flowers. Disk ca 0.5 mm high, ca 1.5 mm wide. Staminodes 4, ca 1 mm long. Gynoecium 4-carpellate; ovary 4-lobed, 4-locular, subglobose, ca 1.5 mm wide, pubescent abaxially; style short; stigma capitate, 4-grooved. Fruits of 2 - 4 follicles, each 5 - 8 mm long, globose, pale greenish, glabrate; seeds one per follicle and attached to it by a funiculus, globose, 4 - 5 mm long, black, shiny.

Fl. June-Aug.; Fr. Oct.-Dec.

Distrib. India: Evergreen or semievergreen forests from sea level to 2125 m; common in the W. Ghats, E. Ghats, E. Himalayas and N. E. India. Sikkim, Assam, Meghalaya, Orissa, Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka and Kerala.

Java, Celebes, Philippines, Borneo and Sri Lanka.

Notes. Decoction of root or root bark boiled in oil is given to improve complexion. Leaf juice is applied for treatment of fever. Wood is used for making match sticks. Leaves are said to be used for flavouring curries.

Euodia lunuankenda var. *tirunelvelica* Henry & Chandrab. is a montane form which falls well within the range of variability of this polymorphic species.

22. *Tetradium* Lour.

Shrubs or trees, evergreen or deciduous, dioecious or monoecious. Leaves opposite, imparipinnate; lateral leaflets petiolulate, terminal ones on an extension of rachis; leaflets ovate, oblong or oblong-lanceolate, or elliptic-obovate, acute to cuneate or obtuse to rounded and more or less oblique at base, acute or shortly to long acuminate at apex, margins entire or remotely to finely glandular-crenate, predominantly or rarely indistinctly gland-dotted, chartaceous to coriaceous, glabrous or glabrate to pubescent, green above, pale beneath, brown or glaucous when dry, pinnately nerved. Inflorescence corymbose to paniculate, spreading or compact, few to many flowered, terminal or pseudoterminal (from uppermost leaf axils). Flowers abortively unisexual, 5- or 4-merous, greenish-white or yellow, bracteate, pedicellate. Sepals connate at base, valvate, ovate or orbicular. Petals ovate or elliptic-oblong, obtusely acuminate at apex, acumen deflexed, glabrous abaxially, glabrous to pilose adaxially. Stamens as many as petals; filaments linear-subulate, glabrous abaxially, villous adaxially; anthers dorsifixed, ovoid or oblong, obtuse. Staminodes much shorter than petals, rarely persistent in fruits. Disk intrastaminal, conical to cylindrical in staminate flowers or pulvinate to barrel shaped in carpellate flowers, persistent in fruits. Gynoecium 5- or 4-carpellate, ovary 5- or 4-lobed, 5- or 4-locular, subglobose to obovoid, glabrous, punctate, ovules 2 or 1 per locule; style apical, short; stigma capitate. Pistillodes 3 - 5, free or connate at base, subulate, glabrous or hairy. Fruits of 1 - 5, 1 or 2-seeded follicles, free to the base or connate up to middle from base, excocarp coriaceous or subwoody, glabrous to shortly pubescent, glandular-punctate, endocarp cartilaginous to pergamentaceous; undeveloped carpels persistent in fruits; seeds persistent in dehisced follicle, ellipsoid or subtrigonal, shiny, smooth, black or brown, arillate, albuminous; embryo straight; cotyledons ellipsoid.

Subtropical and temperate regions of the Old World, E. Himalayas to Japan to Java and Sumbawa 9 species, 3 in India.

Literature. HARTLEY, T.G. (1981) A revision of the genus *Tetradium* (Rutaceae). Gard. Bull. Straits Settlements. 34: 91-131.

Notes. *Tetradium* has long been regarded as a synonym of *Euodia* J.R. & G. Forst. until Hartley (1981) reviewed and discussed taxonomic delimitations in *Tetradium* and related genera. He concluded that "those plants with opposite, pinnately compound leaves and follicular fruits with persistent seed form a natural group around the type species of *Tetradium* and stand well apart morphologically, from a group of species centered around the type species of *Euodia*". Sexual dimorphism observed in gynoecium of *Tetradium* spp. also substantiates the reason for separating it as a distinct genus from *Euodia* and *Melicope*.

KEY TO THE SPECIES

- 1a. Flowers predominantly 4-merous; anthers broadly oblong, shorter than filaments; follicles 2-seeded
 1. *T. fraxinifolium*
- b. Flowers predominantly 5-merous; anthers ovoid, longer than filaments; follicles 1-seeded 2
- 2a. Leaf rachis stout, velvety; leaflets velvety or woolly beneath with prominent oil dots 3. *T. ruticarpum*
- b. Leaf rachis slender, glabrous or with short soft white, spreading hairs; leaflets glabrous beneath with inconspicuous/diffuse oil dots 2. *T. glabrifolium*

1. *Tetradium fraxinifolium* (Hook.) T. G. Hartley in Gard. Bull. Straits Settlements, 34: 102. 1981. *Philagonia fraxinifolia* Hook., Ic. Pl. t. 710. 1848. *Evodia fraxinifolia* (Hook.) Benth., Fl. Hongkong 59. 1861; Hook. f., Fl. Brit. India 1: 490. 1875. Fig. 97.

Kh.: *Dieng-boraparam*, *Deing-Sngiyat*.

Trees, 5 - 16 m high; branchlets woody, terete, glabrous or nearly so; bark greyish-brown, lenticellate. Leaves 15 - 45 cm long; rachis stout, slightly ridged above, otherwise terete, glabrous or sometimes with scattered adpressed hairs; leaflets 6 - 12, opposite; base in lateral leaflets acute to rounded and more or less oblique, cuneate in terminal leaflets, acuminate at apex, acumen 1.5 - 2 cm long, margins glandular-crenulate with 5 - 7 crenations per centimeter or rarely entire, 5.5 - 20.5 x (2.5-)3.5 - 8.5 cm, chartaceous to coriaceous, glabrous or puberulent; leaflets ovate, oblong, oblong-lanceolate or elliptic-obovate; secondary nerves 10 to 20 pairs, spreading, reticulate, ultimate nervelets rather inconspicuous; petiolules of lateral leaflets 5 - 10 mm long. Inflorescences 7 - 16 (-23) cm long, rachis compressed, puberulent to pubescent; pedicels 2 - 4 mm long, slender, pubescent. Male flowers: Sepals 4, connate at base, valvate, ovate, obtuse, 0.5 - 1 mm long, green, pubescent. Petals 4, valvate, oblong, apex hooded, 3 - 4.5 mm long, white or yellowish, glabrous abaxially, villous adaxially along midnerve up to middle from base. Stamens 4; filaments 4 - 4.5 mm long, subulate above, sparsely hairy adaxially, hairs glandtipped; anthers broadly oblong, ca 1.5 mm long. Pistillodes 3 or 4, 2.5 - 3 mm long, connate at base, styles subulate, glabrous. Disk obscure. Female flowers: Sepals, petals and disk as in male flowers. Staminodes 4, shorter than petals, ligulate. Ovary 4-carpellate, subglobose or obovoid, 2 - 3 mm long, glandular-punctate, glabrous, ovule 2 per carpel; style very short; stigma capitate, 4-lobed. Follicles 2-seeded, connate towards base abaxially, 10 - 15 mm across; exocarp shortly pubescent to glabrous abaxially; endocarp glabrous to sparsely pubescent; seeds subcollateral, separate, equal or unequal in size, 3 - 5 mm long, reddish brown, shiny, arillate.

Fl. April-July; Fr. Aug.-Jan.

Distrib. India: Evergreen forests in E. Himalayas and N.E. India, between 900 - 2500 m altitude. W. Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland and Meghalaya. Cultivated in hill stations of Tamil Nadu.

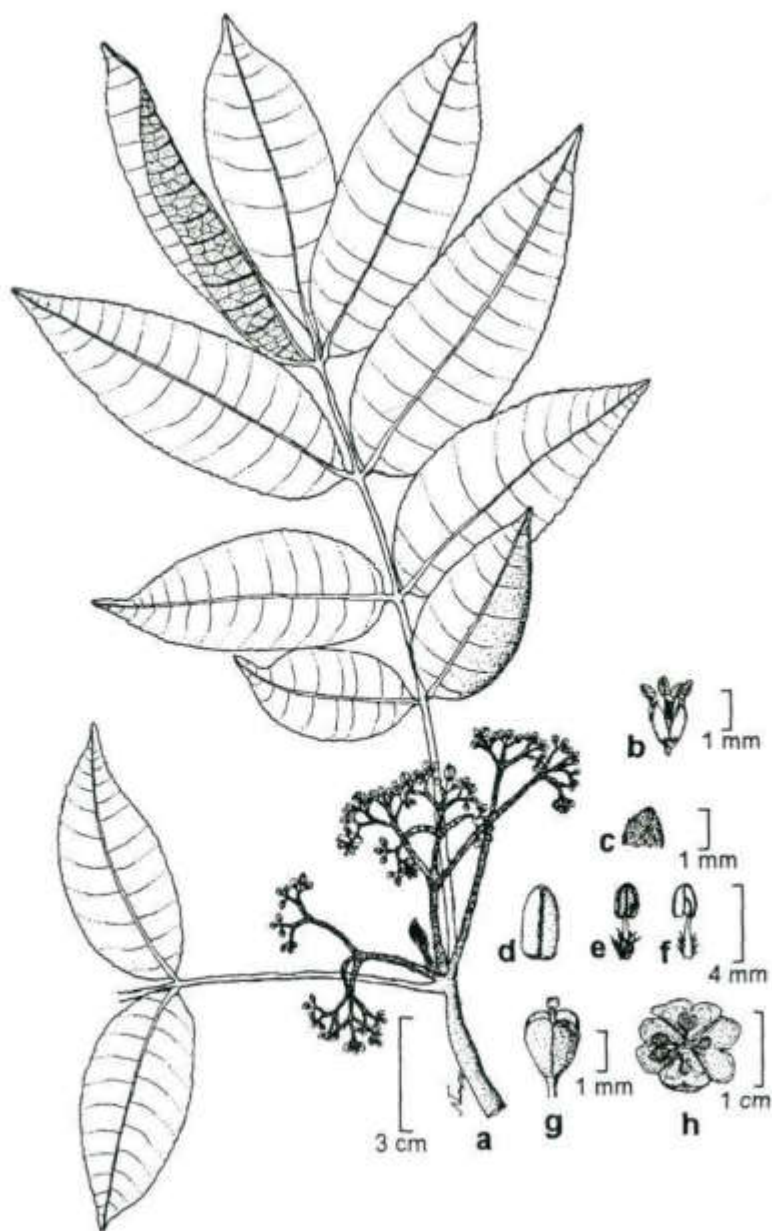


Fig. 97. *Tetradium fraxinifolium* (Hook.) T.G. Hartley: a. flowering twig; b. male flower (half-opened); c. sepal; d. petal; e. stamen (ventral view); f. stamen (dorsal view); g. pistil; h. fruit (dehiscent).

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

Notes. In North Bengal the plant is cultivated as a fodder. Wood is soft and white and is used for posts and making tea chests, ceiling boards, partitions and match splints. The plant is used as an antipyretic in Indo-China.

The under surface of leaflets in this species is often pale, reticulately nerved and prominently gland-dotted. However, a few specimens from Sikkim Himalayas show close similarity to *Tetradium glabrifolium* in having leaflets rather glaucous beneath, finely reticulate, subpapillate and inconspicuously gland-dotted.

2. *Tetradium glabrifolium* (Champ. ex Benth.) T. G. Hartley in Gard. Bull. Straits Settlement. 34: 109. 1981. *Boymia glabrifolia* Champ. ex Benth. in Hooker's J. Bot. Kew Gard. Misc. 3: 330. 1851. *Megabotrya meliaefolia* Hance ex Walpers in Ann. Bot. Syst. 2: 259. 1852. *Euodia meliaefolia* ('*Evodia*') (Hance ex Walpers) Benth., Fl. Hongkong 58. 1861; Hook.f., Fl. Brit. India 1: 490. 1875. *Euodia glabrifolia* (Champ. ex Benth.) Balakr., Fl. Jowai: 115. 1871, syn. nov.

Fig. 98.

Asm.: Maiphak, Namsingasing, Mukasing.

Trees up to 25 m high; branchlets generally slender, cylindrical, glabrous or glabrescent; bark greyish, lenticellate. Leaves 10 - 26 cm long; rachis slender, terete, slightly ridged above, glabrate to pilose; leaflets 6 - 12 pairs (or rarely if 3 then with 7 - 13-foliolate leaves on the same branchlets), opposite, subopposite and alternate, ovate, oblong-lanceolate or lanceolate, obtuse or acute at base, often oblique, acuminate at apex, acumen ca 15 mm long, entire or remotely to finely crenate along margins, 3.5 - 15 x (1.2-) 2.5 - 5.5 cm, thin, chartaceous, shiny above, glabrous, pale or glaucous beneath; secondary nerves 6 - 12 pairs, faint, spreading, tertiaries finely reticulate, nervelets conspicuous; petiolules of lateral leaflets 5 - 10 mm long, terminal leaflet on an extension of rachis 20 - 25 mm long. Panicles trichotomous, 10.5 - 17 cm long; peduncle brachiate, branches slender, compressed, pubescent. Flowers predominantly 5-merous or occasionally 4-merous; pedicels slender, 1 - 1.5 mm long, pubescent. Male flowers: Sepals connate, ca 0.5 mm long, ovate-orbicular, obtuse, pubescent abaxially, glabrous adaxially. Petals fleshy, oblong, obtuse, 2.5 - 3.5 mm long, hairy within along midnerve, glabrous abaxially. Stamens 5(4); filaments 1.5 - 2 mm long, subulate, hairy inside; anthers ca 2 mm long, ovoid. Pistillodes 3 to 5, 2 - 2.5 mm long, hairy. Disk ca 0.5 mm high, ca 1 mm broad, lobulate, punctate, glabrous. Female flowers: Sepals, petals and disk as in male flowers. Ovary 4-5-carpellate, united at base, 4 - 5-lobed, 4 - 4.5 mm across, punctate, glabrous or shortly pubescent, each with 2 collateral ovules; 4 - 5-locular; style short; stigma capitate. Follicles 4 or 5, sparsely to densely adpressed pubescent laterally, connate towards the base abaxially, 1-seeded, endocarp sparsely pubescent; seeds globose, 2 - 4 mm long, 1 - 2 mm across, black, hard, shiny.

Fl. April-July; Fr. Nov.-Jan.

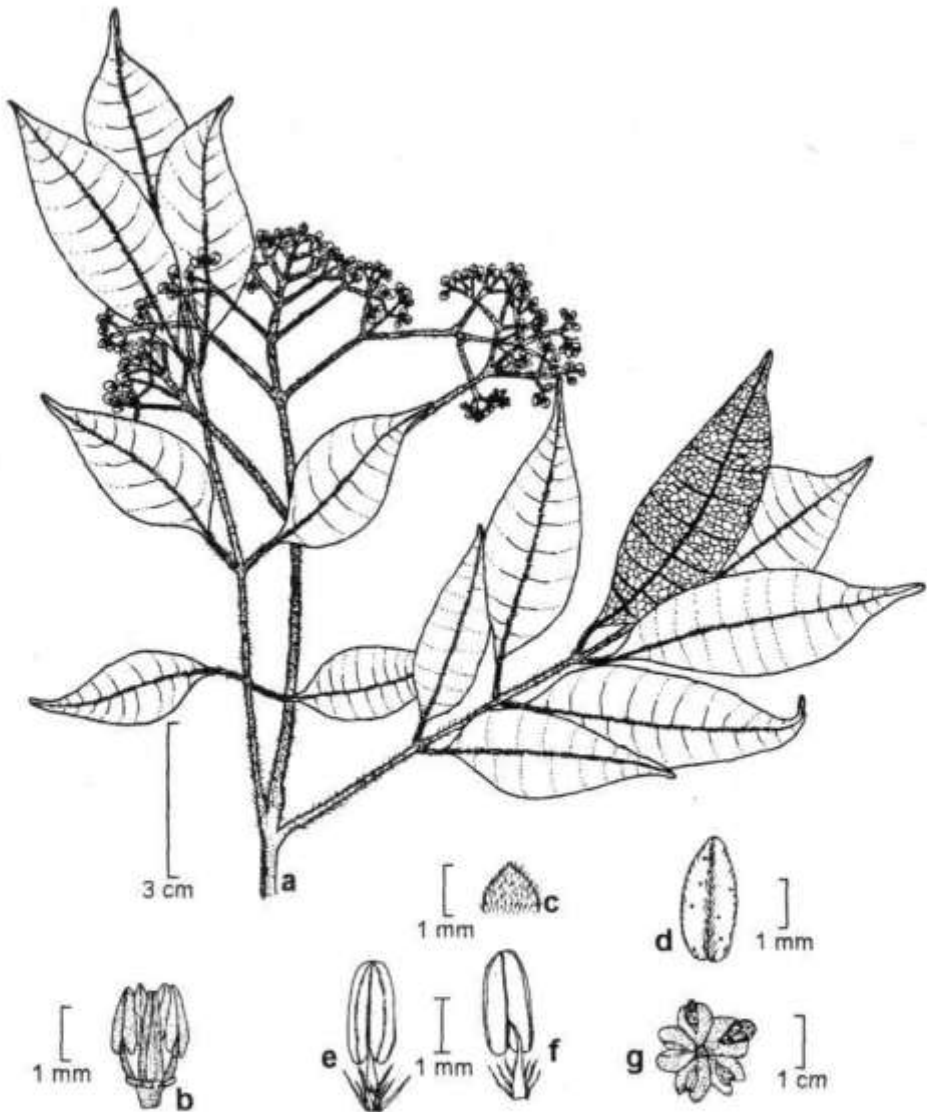


Fig. 98. *Tetradium glabrifolium* (Champ. ex Benth. Walp.) T. G. Hartley: a. flowering twig; b. male flower showing detached sepals & petals; c. sepal; d. petal; e. stamen (ventral view); f. stamen (dorsal view); g. fruit (dehiscent).

Distrib. India: Evergreen forests of E. Himalayas and N.E. India, between 600 - 1200 m altitude. Sikkim, Assam, Meghalaya, Bihar and Orissa.

Nepal, Bhutan, Myanmar, China and Japan.

Notes. In Assam, the plant is used for looms. Wood, which is yellowish-white when fresh then turning to reddish-brown, is used for making cigar boxes. Bark contains 'berberine'. An amber coloured exudation in the form of beads is obtained from incisions made in the bark. This exudate has medicinal value.

T. glabrifolium can be easily recognised from rest of the species of *Tetradium* by its leaflets with densely reticulate ultimate veinlets that are visible on undersurface.

3. *Tetradium ruticarpum* (A. Juss.) T. G. Hartley in Gard. Bull. Straits Settlements 34: 116. 1981. *Boymia rutaecarpa* A. Juss. in Mem. Mus. Hist. Nat. 12: 507, t. 25, f. 39. 1825 & Mem. Rutaceae 124. t. 25. f. 30, 1825. *Euodia rutaecarpa* (A. Juss.) Benth., Fl. Hongkong 59. 1861; Hook.f., Fl. Brit. India 1: 490. 1875.

Shrubs or moderate trees up to 10 m high; branchlets stout, glabrate to finely velvety; bark deep brown, lenticellate. Leaves 20 - 31 cm long; rachis strong, terete, velvety-pubescent; leaflets 6 - 12, rarely if 3, then 7 - 13-foliolate leaves on same branchlet, opposite or subopposite, ovate, oblong, oblong-lanceolate, base in lateral leaflets obtuse to rounded and oblique, cuneate in terminal ones, apex acute or shortly acuminate, margins entire, 5 - 17 x 2.5 - 5.8 cm, chartaceous, pale or brown beneath when dry, glaucous, velvety-pubescent or densely woolly beneath, shortly pubescent above; secondary nerves 10 - 16 pairs, faint, slightly arching; petiolules of lateral leaflets subsessile or up to 7 mm long, terminal leaflets on an extension of rachis 15 - 20 mm long. Panicles 6 - 12 cm long; peduncle and branches stout, velvety-pubescent; pedicels ca 2 mm long, pubescent. Flowers predominantly 5-merous, occasionally 4-merous, ca 5 mm long, ca 8 mm across. Male flowers: Sepals connate at base, ovate, obtusely acuminate, ca 1 mm long, pubescent. Petals oblong, obtuse, 3.5 - 4 mm long, glabrous abaxially, villous adaxially along midnerve. Stamens 5; filaments subulate, 1.5 - 2 mm long, hairy adaxially; anthers ca 2.5 mm long, ovoid. Pistillodes usually 5, connate at base, 3 - 3.5 mm long, glabrous or sometimes hairy. Disk obscure. Female flowers: Sepals, petals and disk as in male flowers. Ovary 4- or 5-carpellate, glabrous or sparsely hairy, punctate, 4- or 5-locular, ovules 2 per locule, collateral; style very short; stigma capitate. Follicles globose or subglobose, 4 - 6 mm long, ca 1 mm across, glabrous or sparsely pubescent, glandular-punctate or pustular, 1-seeded, paired with an aborted seed; seeds ellipsoid, 3 - 5 mm long, ca 4 mm across, brown, rugose.

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

Distrib. India: Temperate forests in Sikkim Himalayas and Khasi hills, 1750 - 2500 m. Sikkim and Meghalaya.

Bhutan, China and Japan.

Notes. The Chinese drug Wou-Tchou-Yer, which is used extensively as a stimulant, carminative and stomachic, is extracted from dried fruits of this plant.

T. nuticarpum can easily be distinguished from other species of the genus in having velvety-pubescence all over the plant, very stout branches of panicles, and pustular fruits.

23. *Zanthoxylum* L.

Shrubs, scandent, climbing, or erect or trees; evergreen or deciduous, dioecious or monoecious, aromatic, often armed with prickles which are borne on elevated, conical or pyramidal, corky protruberances. Leaves alternate, trifoliolate to imparipinnate or paripinnate; petiole and rachis winged or not; leaflets 3 - 33, subsessile to shortly petiolulate, opposite to alternate, often asymmetric, entire to glandular-serrate. Inflorescence terminal and/or axillary, racemose, cymose or paniculate. Flowers small, unisexual or rarely bisexual. Perianth of 4 to 8, irregularly uniseriate, undifferentiated segments or biseriate with 4 or 5 outer sepals and 4 or 5 inner petals. Stamens 3 - 5 (-8), free, alternate with petals, in carpellate flowers reduced to staminodes or absent. Disk flat to pulvinate or obscure. Gynoecium of 1 - 4, sessile or stipitate, distinct or only partially united carpels, in staminate flowers rudimentary or absent. Ovary 1-locular, each with 2 collateral pendulous ovules; styles coherent to divergent; stigma capitate, distinct or coherent. Fruits of 1 to 4, distinct or partially coherent 1-seeded 2-valved follicles, exocarp firm or fleshy, glandular-punctate, or pustular, red or black, endocarp cartilaginous, straw coloured, detached or adherent; seeds ovoid to subglobose, black or reddish, shiny, testa crustaceous, often hanging from opened follicle by a funiculus on maturity, endosperm fleshy.

Pantropical with some species rarely extending to temperate zones of E. Asia and one in N. America, ca 220 species, 12 in India.

Literature. BABU, C.R. (1974) 1977. The genus *Zanthoxylum* Linn. (Rutaceae) in India. *Bull. Bot. Surv. India* 16: 48-71. BRIZICKY, G.K. (1962). Taxonomic and Nomenclatural notes on *Zanthoxylum* and *Glycosmis* (Rutaceae). *J. Arn. Arb.* 43: 80-93. FOSBERG, F.R. (1958) "*Zanthoxylum*" L., "*Xanthoxylum*" Mill. and "*Thylax*" Raf. *Taxon* 7: 94-96. FOSBERG, F.R. (1959) Typification of *Zanthoxylum*. *Taxon* 8: 103-105. HARTLEY, T.G. (1966) A revision of the Malesian species of *Zanthoxylum* (Rutaceae). *J. Arn. Arb.* 47: 171-211.

Notes. The taxonomic delimitation and nomenclature of *Zanthoxylum* L., sensu stricto (with an undifferentiated uniseriate perianth) and its segregate *Fagara* L. (with biseriate, differentiated perianth) has been a subject of much controversy among earlier taxonomists. Brizicky (1962) based on his observations on species with perianth structure as transitional to *Fagara* type proposed that simple perianth of *Zanthoxylum* was

most likely a secondary condition derived by reduction from that of *Fagara* type due to abortion of some or all sepals. He considered *Fagara* as a subgenus under *Zanthoxylum*.

Hartley (1966) while revising Malasian species of *Zanthoxylum* demonstrated what was called 'a complete transition between *Fagara* and *Zanthoxylum* types of perianth' in three staminate specimens of *Zanthoxylum dimorphophyllum* from China. He, therefore, united both *Zanthoxylum* and *Fagara* under one genus. This view was endorsed by Babu (1974) who revised the genus in Indian region, with 13 species including 3 new species viz. *Z. burkillianum* (from Abor hills (Arunachal Pradesh), *Z. pseudoxyphyllum* (Manipur) and *Z. nepalensis* (Nepal).

KEY TO THE SPECIES

- 1a. Petiole and rachis narrow to broadly winged; perianth of uniseriate or irregularly biseriate 4 - 8, undifferentiated segments 2
- b. Petiole and rachis wingless; perianth of biseriate, 4 or 5 sepals and 4 or 5 petals 3
- 2a. Branchlets ferruginous-pubescent; inflorescence in leaf axils, short, glomerate, paniculate cymes; secondary nerves of leaflets up to 30 pairs, prominent 1. *Z. acanthopodium*
- b. Branchlets glabrous; inflorescence terminal on short, axillary branchlets, spreading, paniculate; secondary nerves of leaflets up to 20 pairs, more often indistinct 2. *Z. armatum*
- 3a. Plants erect shrubs or trees 4
- b. Plants scandent or climbing shrubs 7
- 4a. Plants often erect shrubs or small trees up to 10 m high; branchlets with small retrorse, simple prickles; leaves small to medium, up to 30 cm long 5
- b. Plants medium to large trees up to 25 or 30 m tall with a long bole and a terminal crown; main stem and older branches with prickles borne on corky conical protruberances; leaves larger, up to 45 (-60) cm long 6
- 5a. Leaves usually digitately 3-foliolate, seldom pinnately 4- or 5-foliolate; branchlets glabrous; gynoecium 1-carpellate 6. *Z. ovalifolium*
- b. Leaves imparipinnate with 13 - 17 leaflets; branchlets with soft velvety-tomentose indumentum; gynoecium 4-carpellate 12. *Z. tomentellum*
- 6a. Flowers 4-merous; gynoecium 1-carpellate 9. *Z. rhetsa*
- b. Flowers 5-merous; gynoecium 3 - 4-carpellate 4. *Z. myriacanthum*
- 7a. Leaflets fewer, 3 - 9, medium to large, up to 15 x 7.5 cm 8
- b. Leaflets many, 9 - 29, rarely less than 7 on same plant, small to medium, up to 10 x 4 cm 11
- 8a. Inflorescence single, axillary, racemose panicle; flowers solitary or 2 - 3-nate on peduncle 8. *Z. pseudoxyphyllum*
- b. Inflorescence fascicled, terminal and/or axillary, paniculate; flowers in dense cymose clusters 9
- 9a. Inflorescence terminal and axillary; leaflets with undulate, deeply sinuate, glandular-crenate margins 11. *Z. tetraspermum*
- b. Inflorescence often axillary; leaflets with entire to remotely glandular crenate margins 10
- 10a. Leaflets entire throughout, with a conspicuous cartilaginous margin, turning grey-brownish on drying; follicles up to 10 mm across 3. *Z. burkillianum*

- b. Leaflets with entire to glandular-crenate noncartilaginous margins, turning deep blackish on drying; foli-
cicles up to 7 mm across **5. *Z. nitidum***
- 11a. Branchlets, leaves and inflorescences with velvety-pubescent indumentum; leaflets caudate at apex, en-
tire up to middle and slightly crenate above along margins; flowers in lax cymes **10. *Z. scandens***
- b. Branchlets, leaves and inflorescences often glabrous, if pubescent indumentum not as above; leaflets
obtusely and shortly acuminate at apex, glandular-crenate to serrate along margins; flowers in dense
umbellate clusters **7. *Z. oxphyllum***

1. *Zanthoxylum acanthopodium* DC., Prodr. 1: 727. 1824; Hook.f., Fl. Brit. India 1:
493. 1875. *Z. acanthopodium* DC. var. *timbor* Hook.f., Fl. Brit. India 1: 493. 1875.

Beng.: *Tombul*; Hindi: *Damar*, *Nepalidhanya*, *Tejphal Timur*; Kh.: *Dieng-so-Khlam*.

Shrubs, erect or scandent or small trees up to ca 6 m high; branchlets cylindrical, armed with pseudostipular or rarely scattered, straight or incurved, compressed, reddish-brown prickles (25 mm long), ferruginous-pubescent; bark grey-brownish, lenticellate. Leaves 3-foliolate or imparipinnate, up to 25 cm long; petiole and rachis armed with compressed prickles on both sides, ferruginous-pubescent to glabrate, narrowly to broadly winged, wings 2.5-6 mm broad on either side; leaflets 3-15, opposite, subsessile, ovate-lanceolate to elliptic-lanceolate or oblong, obtuse to cuneate and slightly oblique at base, acute to acuminate or rarely obtuse at apex, subentire to glandular-serrate along margins, 1-11 x 0.5-3 cm, glossy green above, light greenish beneath, chartaceous, glabrous to ferruginous-pubescent especially on lower surface; midnerve armed with flattened prickles above and beneath; secondary nerves prominent, 5-30 pairs, reticulate. Inflorescences axillary, paniculate, up to 2 cm long, dense, ferruginous-pubescent. Male flowers ca 3 mm long; bracts minute, ca 0.5 mm long, hairy; pedicels slender, 1.5-3 mm long, pubescent. Perianth uni- or irregularly biseriate, the segments 5-8, lanceolate or ligulate, acute or obtuse, 1-1.5 mm long, green or yellowish, hairy. Stamens 4-6; filaments linear, ca 2 mm long; anthers ca 0.8 mm long, reddish-purple prior to anthesis. Disk pulvinate, ca 0.8 mm high. Pistillodes 2-3 (-5). Female flowers ca 2 mm long; pedicels ca 1.5 mm long, pubescent. Perianth and disk as in male flowers. Staminodes absent. Ovary 2-5-carpellate, each carpel ca 1.5 mm long, ovoid, glandular-punctate, hairy or glabrous; style divergent, articulated at about 3 mm below globose stigma, ca 0.5 mm long. Follicles 2-5, carpels 4-1 or 0, caducous, abortive, ovoid-subglobose, ca 4 mm across, reddish, pustular; seeds ca 3 mm across, black, shiny.

Fl. March-April; *Fr.* July-Sept.

Distrib. India: Evergreen forests of the Himalayas and N.E. India, up to 2000 m. Uttar Pradesh, W. Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Mizoram, Manipur and Meghalaya.

Nepal, Bhutan, Bangladesh, Myanmar, S.W. China, Thailand and Sumatra.

Notes. Fruit is used both as a medicine and a spice. An aromatic essential oil called 'Wartara oil' is extracted from fruits, which has properties similar to Coriander oil. Seeds are bitter, aromatic, subdorific and are used in preparation of tooth powder. In Assam, seeds are used as a fish poison. An insecticide which is used against house flies, is made from this plant. The plant has medicinal properties similar to *Z. armatum*.

Very similar to *Z. armatum* but can be recognised from it chiefly by its short, condensed, axillary panicles and ferruginous-pubescent branchlets. As has been noted by Babu (1974) "The frequent occurrence of reddish-purple anthers and prominent lateral nerves among the Indian material of *Z. armatum* brings the two species much closer than ever before. . . ." The indumentum pattern also varies considerably within the species in accordance with its geographical and altitudinal range.

2. *Zanthoxylum armatum* DC., Prodr. 1: 727. 1824; T.G. Hartley in J. Arn. Arb. 47: 211. 1966; Babu in Bull. Bot. Surv. India 16: 53. 1974 (1977). *Z. alatum* Roxb. (Hort. Bengal. 72. 1814, nom. nud.) Fl. Ind. ed. 2 (Carey) 3: 768. 1832; Hook.f., Fl. Brit. India 1: 493. 1875.

Beng.: *Gaira*, *Nepalithanya*, *Tambul*; Gar.: *Tezbal*, *Tezmal*; Hindi: *Nepali-dhaniya*, *Tejphal*, *Tamru*; Or.: *Tundopoda*; Punj.: *Timbar*, *Timal*, *Timru*; Sans.: *Tumburu*, *Dhiva*, *Gadhalu*.

Shrubs, erect or subscaudent or small trees up to ca 6 m high; branchlets usually armed with straight, compressed or slightly recurved, pseudostipular or scattered, reddish-brown prickles, rarely unarmed, glabrous; bark grey-brownish, scabrate. Leaves 3-foliolate to imparipinnate, up to 20 cm long; petiole and rachis occasionally with short, compressed prickles, narrowly to broadly winged, wings foliaceous, 2.5 - 5 mm broad on either side; leaflets 3 to 11, opposite, sessile, ovate-lanceolate or elliptic to oblong, acute to cuneate and more or less oblique at base, acute or acuminate at apex, entire or glandular-crenate along margins, 0.7 - 1.5 x 0.4 - 2.8 cm, glossy green above, chartaceous, glabrous; secondary nerves indistinct or rarely prominent, 5 - 20 pairs, inarching near margins. Inflorescences terminal on short lateral branchlets, ca 12 cm long, sparsely pubescent to glabrous. Flowers small in short cymes. Male flowers: Bracts minute, ca 0.5 mm long, pubescent or glabrous. Perianth uni- or irregularly biseriate, segments ovate-lanceolate, acute or acuminate, ca 1 mm long, yellowish, glabrous. Stamens 6 - 8, exserted; filaments 1.5 - 2.5 mm long; anthers ovoid-oblong, ca 1 mm long, yellowish or reddish-purple, with a dorsal gland on connective. Disk pulvinate, ca 0.5 mm high. Pistillodes usually absent or very rarely 1 or 2. Female flowers: Pedicels ca 2 mm long, perianth and disk as in male flowers. Ovary 1 - 3- or sometimes 4-carpellate, each carpel ovoid-subglobose, ca 1.5 mm long, glandular-punctate, unilocular with 2 ovules attached to inner angle of axis; style short, ca 0.5 mm long; stigma capitate. Fruiting pedicels 1 - 3 mm long. Follicles 1 - 3 with 2, 1, or 0 caducous abortive carpels, ovoid-subglobose, apiculate with persistent styler base, 3 - 4 mm, postular; seeds up to 3.5 mm across, ovoid, black, dull or shiny, smooth or wrinkled.

Fl. March-April; Fr. Aug.-Sept.

Distrib. India: In evergreen thickets throughout Himalayas up to 2000 m, and in Eastern Ghats of peninsular India between 90 - 1000 m. Occasionally cultivated. Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Nagaland, Manipur, Meghalaya, Orissa and Andhra Pradesh.

Pakistan, Nepal, Myanmar, China, Japan, N. & S. Korea, N. Vietnam, Taiwan, Lesser Sunda Islands, Philippines, Malaya peninsula and Sumatra.

Notes. Bark, fruit and seed are carminative, stomachic, anthelmintic and used in native medicine. The aromatic bark is used as a fish poison and insect repellent. Extract from fruits is used for dental troubles and scabies. An odoriferous oil known as 'Nartara oil', obtained on steam distillation of dried fruits, is used in perfume industry. In N.E. India leaves of this plant are used for making chutneys. The twigs are used as tooth brush and as a walking stick. The plant is very often grown as a hedge plant.

3. *Zanthoxylum burkillianum* Babu in Bull. Bot. Surv. India 16: 55. 1974 (1977). *Z. hamiltonianum* auct. non Wallich ex Hook.f. 1875; Burkill in Rec. Bot. Surv. India 10: 253. 1924. Fig. 99.

Shrubs, climbing or straggling; branchlets armed with scattered, retrorse, ca 3 mm long prickles. Leaves imparipinnate up to ca 30 cm long; petiole and rachis terete, glabrous, prickly; leaflets 7 - 9, alternate or subopposite, oblong or elliptic-oblong, acute to cuneate or obtuse at base, oblique or not, acuminate at apex, acumen 0.5 - 1 cm long, retuse at tip, margins entire, cartilaginous, 6 - 9 x 4 - 6 cm, chartaceous to coriaceous, glabrous, glossy above, pale beneath; secondary nerves 8 - 20 pairs, prominent, horizontally spreading. Inflorescences paniculate, axillary, ca 12 cm long. Male and female flowers not seen; fruiting pedicels stout, 4.5 mm long. Follicles 2 - 4 with 2, 1, or 0 persistent abortive carpels, globose, ca 1 cm across, pustular.

Distrib. India: Evergreen thickets of E. Himalayas. Arunachal Pradesh.

Endemic.

Notes. This species is so far known only from its type collection. It appears to be closely related to *Z. nitidum* especially in general appearance, but is different from that species in having alternate or subopposite leaflets with conspicuous cartilaginous margins and in its larger fruits. However, glabrous condition described by Babu (1974) as a delineating character does not hold good because of occasional occurrence of glabrous forms in *Z. nitidum*. Babu further observed that *Z. burkillianum* is also related to *Z. dissitum* Hemsl., a Chinese species but the latter is characterized by shorter inflorescences and follicles with winged suture.

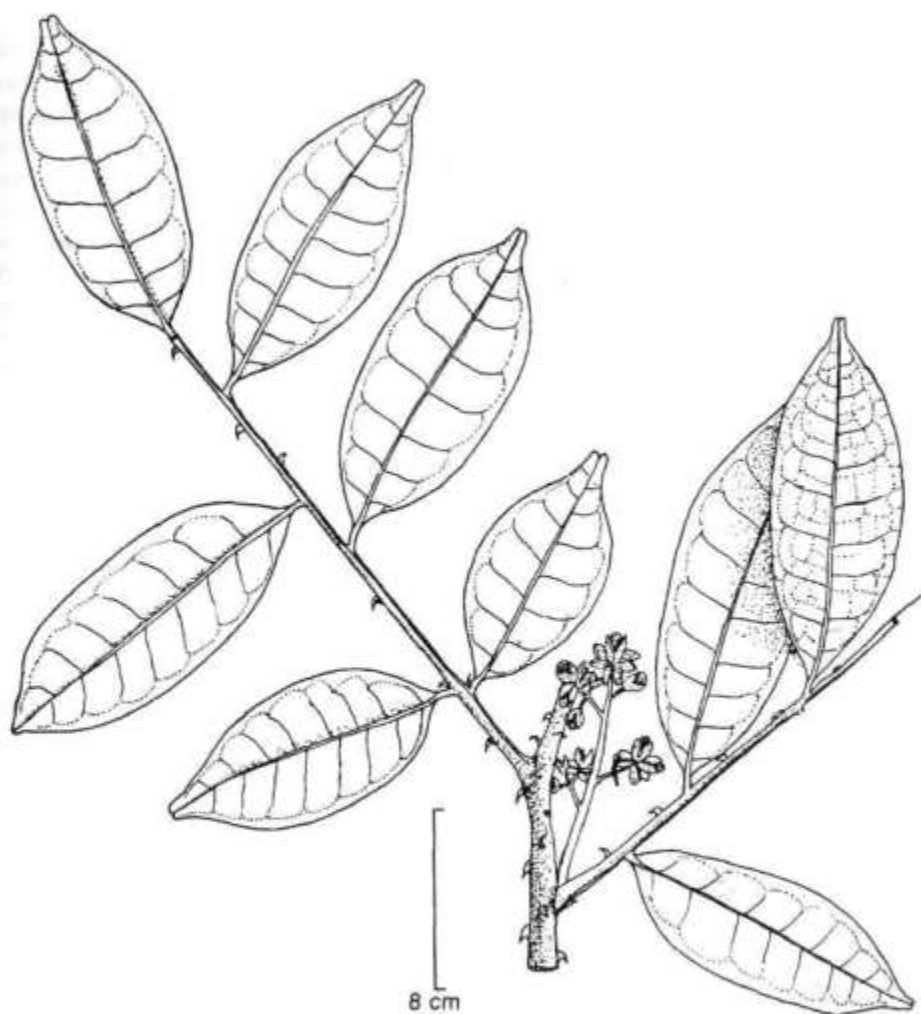


Fig. 99. *Zanthoxylum burkillianum* Babu : fruiting twig (from Holotype, Burkill 37598-A. CAL).

4. *Zanthoxylum myriacanthum* Wallich ex Hook.f., Fl. Brit. India 1: 496. 1875. *Fagara myriacantha* (Wallich ex Hook.f.) Engl. in Engl. & Prantl, Nat. Pflanzenfam. 3(4):118. 1896. **Fig. 100.**

Evergreen trees up to 25 m high; main trunk armed with scattered, straight, conical prickles up to 3 cm long; branchlets terete, swollen and hollow inside or with septate pith, densely prickly with straight or slightly curved, brownish, 2 - 5 mm long prickles. Leaves imparipinnate, 20 - 45(-60) cm long; petiole and rachis usually unarmed or rarely prickly beneath, glabrous or pubescent; leaflets 7 - 23, opposite or subopposite, elliptic-oblong or oblong-lanceolate, obliquely rounded or subcordate at base, abruptly short acuminate at apex, finely glandular crenate along margins, 8 - 20.5 x 2.5 - 8.5 cm, coriaceous, glabrous, dark brownish when dry; midrib adpressed above, raised beneath; secondary nerves 8 - 20 pairs, spreading, reticulate; petiolules up to 6 mm long. Inflorescences terminal and pseudoterminal, up to 33 cm long, glabrous to shortly pubescent; peduncle often minutely prickly. Male flowers 2 - 3.5 mm long; pedicels up to 2 mm long, glabrous or nearly so. Sepals 5, triangular, obtuse, ca 1 mm long, glabrous. Petals 5, elliptic, obtuse, 1.5 - 2.5 mm long, glabrous. Stamens 5, slightly exerted; filaments linear, ca 1.5 mm long; anthers ovoid, ca 1 mm long. Disk pulvinate, ca 0.5 mm high. Pistillodes 3, ovoid-globose ca 0.5 mm high. Female flowers 2 - 3 mm long; pedicels, sepals, petals and disk as in male flowers. Staminodes absent. Gynoecium 3 - 4-carpellate, carpels ovoid-subglobose; style and stigma cohering to form a combined peltate stigmatic structure; fruiting pedicels 2 mm long. Follicles 1 - 3 with 2, 1, or 0 persistent abortive carpels, subglobose, 4 - 5 mm across, pustular; seeds compressed, ca 2.5 mm across, shiny, black.

Fl. March-May; *Fr.* June-Aug.

Distrib. India: Evergreen forests of E. Himalayas and N. E. India, up to 600 m. Sikkim, Assam and Nagaland.

Bangladesh, China, Sumatra, Malay peninsula and Philippines.

Notes. Fruits are said to be used as a condiment in Assam. The wood, although brittle, seems to be suitable for tea boxes.

5. *Zanthoxylum nitidum* (Roxb.) DC., Prodr. 1: 727. 1824; Babu in Bull. Bot. Surv. India 16: 61. 1974 (1977). *Fagara nitida* Roxb., Fl. Ind. 1: 439. 1820. *Z. hamiltonianum* Wallich ex Hook.f., Fl. Brit. India 1: 494. 1875. *Z. hamiltonianum* Wallich ex Hook. f. var. *tomentosum* Hook.f., l.c.

Shrubs, scandent or climbing, evergreen; branchlets velvety-tomentose, usually armed with scattered, few, straight or retrorse, brownish, 3 - 5 mm long prickles, or sometimes unarmed. Leaves trifoliolate to imparipinnate, up to 40 cm long; petiole and rachis grooved above, prickly beneath or occasionally not, velvety-tomentose to

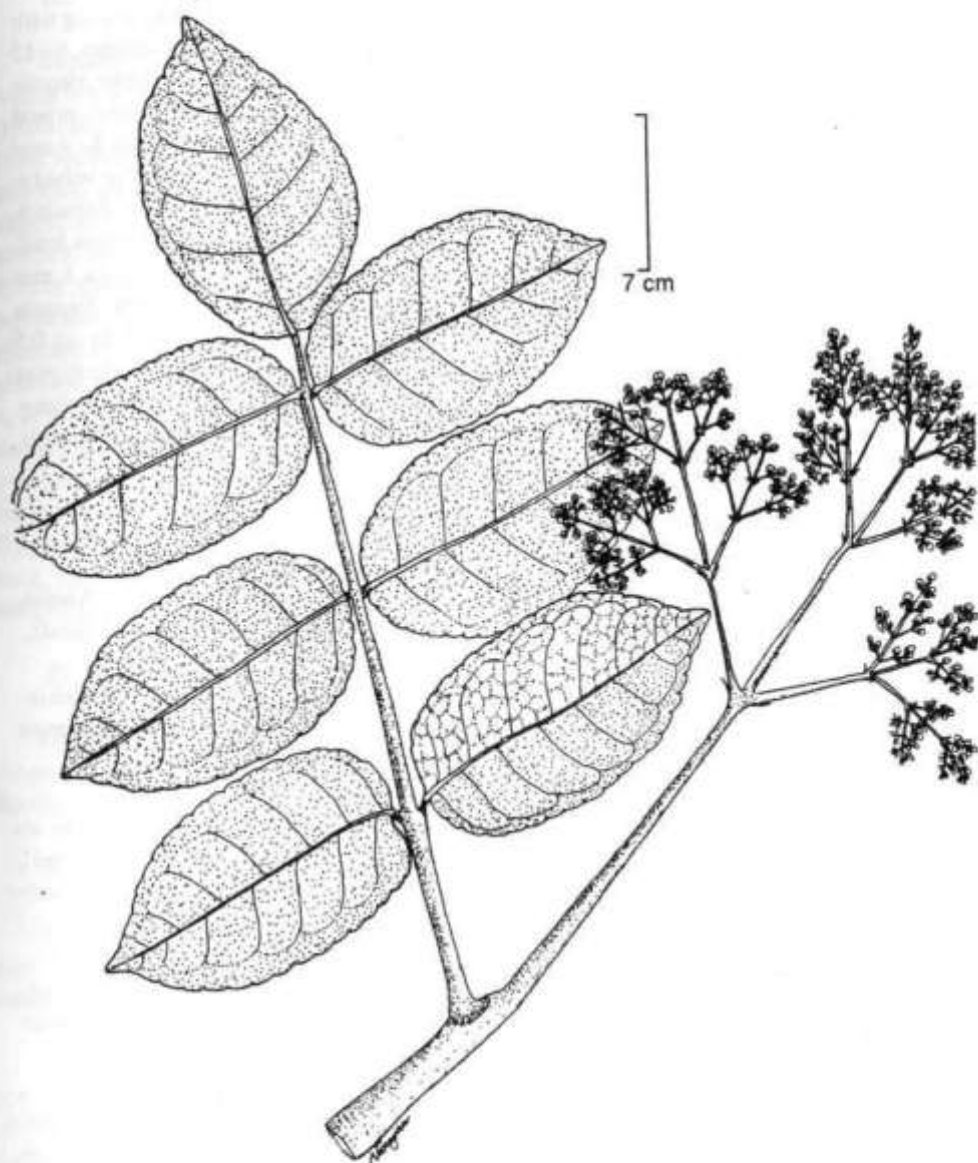


Fig. 100. *Zanthoxylum myriacanthum* Wallich ex Hook.f. : flowering twig.

glabrous; leaflets 3 - 9, lateral ones opposite, broadly ovate-elliptic or oblong, obtuse to cuneate at base, oblique or not, abruptly acuminate at apex, acumen 1 - 1.5 cm long with a retuse tip, often entire or sometimes remotely glandular-crenate along margins, 6 - 15 x 2.5 - 7.5 cm, chartaceous to coriaceous, glossy on both surfaces, glabrous above, shortly pubescent along midnerve and secondary nerves; midnerve depressed above, raised beneath; secondary nerves 5 - 15 pairs, spreading, depressed above; petiolules 2 - 4 mm long. Inflorescence axillary, paniculate, fascicled, 3 - 15 cm long, glabrous to velvety-tomentose. Male flowers 4 - 5 mm long; pedicels 1 - 1.5 cm long, pubescent. Sepals 4, broadly triangular, acute, 1 mm long. Petals 4, ovate-elliptic, obtuse, 2.5 - 3.5 mm long. Stamens 4, 4 - 4.5 mm long; filaments linear, 3 - 3.5 mm long; anthers ovoid, ca 1 mm long, gland tipped. Pistillodes 4, linear, ca 1 mm long. Disk flat, ca 0.5 mm high. Female flowers 2 - 3 mm long; pedicels, sepals, petals as in male flowers. Disk pulvinate, ca 0.5 mm high. Gynoecium 4-carpellate, carpels ovoid, 2 - 2.5 mm long; style short; stigma capitate, cohering into a peltate disk at anthesis. Fruiting pedicels 3 - 5 mm long. Follicles 1 - 4 with 3, 2, 1 or 0 abortive carpels respectively, globose, 5 - 7 mm across, exocarp pustular, apiculate; seeds rounded, ca 5 mm across, black, smooth.

Fl. Feb.-May; *Fr.* Aug.-Oct.

Distrib. India: Evergreen forests between 100 - 300 m. Bihar, W. Bengal, Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Meghalaya and Andaman Islands.

Thailand, N. & S. Vietnam, China, Taiwan, Ryuku Islands, Sumatra, Malay Peninsula, Java, Anabas Islands, Philippines, Celebes, Moluccas, New Guinea, Solomon Islands and Australia.

Notes. Root bark is used for treatment of tooth ache and boils. It is also used as an insecticide and fish poison. Stem and root bark contain an alkaloid known as 'nitidine'. Fruits are also used as fish poison. Seeds yield an essential oil containing high percentage of linalool.

Z. nitidum is closely related to *Z. tetraspermum* of peninsular India and Sri Lanka, but differs from latter by having predominantly axillary inflorescences and almost entire leaflets with less number of secondary nerves i.e. 5 - 15 pairs.

Although *Piper pinnatum* Lour. (1790) is the earliest name referred to this species, the epithet 'pinnatum', however, cannot be taken here because it is preoccupied in *Zanthoxylum* for a Norfolk Island species *Z. pinnatum* (J.R. & G. Forst.) Druce (based on *Blackburnia pinnata* J.R. & G. Forst.). The next available legitimate name is *Fagara nitida* Roxb. (1820) based on which De Candolle (1824) proposed the combinations *Z. nitidum* (Roxb.) DC. which is the correct name for this species (Babu 1974 (1977)).

6. *Zanthoxylum ovalifolium* Wight, Ill. Ind. Bot. 1: 169. 1839; Hook.f., Fl. Brit. India 1: 492. 1875. *Z. sepiarium* Wight, l.c. *Z. ovalifolium* var. *sepiarium* (Wight) Hook.f. l.c.

Kan.: *Amadalu*; Kh.: *Diang-sinulah, Tew Kalong, Diand-Shih*.

Shrubs or small trees up to 8 m high; branchlets glabrous, unarmed or occasionally with a few straight or incurved, reddish-brown, 3 - 6 mm long prickles. Leaves digitately trifoliolate or rarely uni- or bi- or very rarely 4 - 5-foliolate, up to 30 cm long; petioles (and rachis) slightly marginate, 5 - 10.5 cm long, unarmed or rarely armed with short prickles, glabrous; leaflets ovate to elliptic-oblong or obovate, acute to cuneate and slightly oblique at base, abruptly acuminate with a short, retuse acumen or rarely obtuse at apex, subentire or glandular-crenate to double crenate along margins, 4 - 22 x 2.0 - 7.5 cm, chartaceous to coriaceous, glabrous; secondary nerves 8 to 20 pairs, prominent; petiolules ca 5 mm long. Inflorescences axillary and terminal, paniculate, 3 - 13 cm long, glabrate or puberulous. Male flowers 2 - 3 mm long; pedicels slender, 1.5 - 3 mm long, glabrate, rarely glandular. Sepals 4, triangular, acute, ca 1 mm long, glandular. Petals 4, elliptic-oblong, obtuse, 2 - 3 mm long, white. Stamens 4, 2 - 3 mm long; filaments linear; anthers oblong, ca 1 mm long. Disk pulvinate, ca 0.8 mm high. Pistillodes single, conical, ca 1 mm high. Female flowers 3 - 4 mm long; pedicels, sepals and petals as in male flowers. Disk pulvinate, ca 0.5 mm high. Staminodes 4, filiform, ca 1 mm long. Gynoecium 1-carpellate, ca 2 mm long; ovary ovoid, glandular-punctate; style ca 0.5 mm long, eccentric; stigma globose. Fruiting pedicels 4 - 7 mm long. Follicle single, subglobose, apiculate, 6 - 9 mm across, pustular; seeds globose, 5 - 6 mm across, black.

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

Distrib. India: Evergreen forests up to 1500 m altitude. W. Bengal, Sikkim, Assam, Nagaland, Meghalaya, Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, Andaman & Nicobar Islands.

Myanmar, Java, Lesser Sunda Islands, Papua & New Guinea.

Notes. The hard, close grained and lustrous wood is used for making tool handles and in cabinet work. It is also used as walking stick. Seeds on distillation yield an essential oil, the chief content of it, 'saffrol' is poisonous and carcinogenic.

A variable species as regards its habit, armature and number, size, outline and texture of leaflets. The Andaman forms have unusually larger leaves than those occurring in the peninsular and north-eastern India. Although, leaves are generally digitately trifoliolate, a specimen collected in Attakati hills (Coimbatore, Tamil Nadu, S. India - *Joseph* 1273 (MH) shows imparipinnate leaves with 4 or 5 leaflets.

7. *Zanthoxylum oxyphyllum* Edgew. in *Trans. Linn. Soc. London* 20: 43. 1846; Hook.f., *Fl. Brit. India* 1: 494. 1875. *Fagara oxyphylla* (Edgew.) Reeder & Cheo in *J. Arn. Arb.* 32: 69. 1951.

Shrubs, climbing or scandent, up to 5 m high; branchlets terete, usually armed with scattered, retrorse or rarely pseudostipular straight, brownish prickles (1.5 cm long). Leaves imparipinnate up to 30 cm long; petiole and rachis grooved above; leaflets 5 - 29 or up to 25 (rarely 3-foliolate leaves occur on the same branchlet), alternate to opposite, ovate-lanceolate or oblong, younger ones linear-lanceolate, acute to cuneate or obtuse to rounded at base, acuminate at apex, acumen retuse at tip, crenate to glandular-serrate along margins, 2 - 10 x 1 - 4 cm, chartaceous or coriaceous, glabrous, glossy above; midnerve prickly beneath; secondary nerves 5 - 16 pairs, spreading; petiolules 3 - 7 mm long. Inflorescences terminal and axillary, 3 - 12 cm long, glabrous to puberulent; peduncle often prickly. Flowers in umbels or clusters of cymes, 5 - 7 mm long. Male flowers: Bracts linear-lanceolate, 1.5 - 2 mm long; pedicels glabrous to puberulent, 3 - 6 mm long. Sepals 4, ovate-triangular or rarely rounded, obtuse, 1 - 1.5 mm long, glabrous or ciliate with an apical gland. Petals 4, ovate-elliptic, 3 - 5 mm long, fleshy, obtuse, the midnerve prominent with spreading lateral veinlets. Stamens 4, 6 - 7 mm long; anthers oblong, 1 - 1.5 mm long, yellowish. Disk pulvinate, 1 - 1.5 mm high. Pistillodes 1 or 2 ca 1.5 mm high. Female flowers: Bracts, sepals, petals and disk as in male flowers. Staminodes absent. Gynoecium 4-carpellate, carpels ovoid, compressed, 4 - 5 mm long, glandular-punctate; styles coherent, ca 2 mm long; stigma cohering to a peltate disk, capitate; fruiting pedicel 5 - 10 mm long. Follicles 4 - 2, with 0, 1, 2, or 3 persistent abortive carpels, each follicle subglobose, apiculate, 5 - 6 mm across, pustular; seeds subglobose, ca 4 mm across, black.

Fl. Dec.-May; *Fr.* Aug.-Nov.

Distrib. India: Mostly in temperate forests at higher altitudes up to 2700 m; occasionally also found at lower elevations. Uttar Pradesh, W. Bengal, Sikkim, Manipur, Meghalaya and Arunachal Pradesh.

Nepal and Bhutan.

Notes. Fruits are medicinal and also used as condiment. Stem bark is stimulent, stomachic and digestive.

A characteristic species with large flowers arranged in dense umbellate clusters.

8. *Zanthoxylum pseudoxyphyllum* Babu in Bull. Bot. Surv. India 16: 66. 1974 (1977).

Shrubs, scandent or climbing, up to 6 m high; branchlets stout, terete, sparsely prickly or unarmed, glabrous. Leaves 3-foliolate to imparipinnate, 3 - 15.5 cm long; petiole and rachis grooved above, slightly prickly beneath, glabrous except the hairy groove; leaflets 3 - 7, opposite or subopposite, elliptic-oblong or obovate, cuneate and oblique or not at base, abruptly acuminate or acute to obtuse and retuse at apex, subtentire to glandular-crenate along margins, 1.5 - 8 x 0.7 - 5 cm, coriaceous, glabrous; secondary nerves 5 - 10 pairs, prominent; petiolules very short. Inflorescences terminal

and axillary, paniculate or racemose, up to 5 cm long, puberulent. Flowers often solitary or in 2 - 3-nate clustures. Male flowers ca 3.5 mm long; pedicels up to ca 1.5 mm long, puberulent; bracts ovate-rounded, less than 1 mm long. Sepals 4, triangular-rounded, 1 x 0.8 mm, with a prominent pellucid gland at tip, midnerve prominent up to the middle, sparsely branched, margins ciliate. Petals 4, imbricate, elliptic-oblong, obtuse, 2 - 3.5 mm long, penninerved. Stamens 4, up to 2 mm long; filaments linear, ca 0.5 mm long; anthers oblong, 1.5 mm long, gland tipped. Pistillodes of 2 or 3 rudimentary carpels, ca 1 mm long. Disk pulvinate, ca 0.5 mm high. Female flowers: Bracts linear-lanceolate, 1 - 1.5 mm long, ciliate. Petals elliptic-oblong, obtuse, ca 2 mm long. Staminodes absent. Gynoecium 4-carpellate; carpels ovoid, flattened-compressed, ca 1 mm long; style short; stigma capitate. Disk same as in male flowers. Fruits not seen.

Fl. April.

Distrib. India: Manipur and Arunachal Pradesh. So far known only from these two states, and report of this species from Arunachal Pradesh constitutes a new distributional record.

Notes. *Z. pseudoxyphyllum* is very closely allied to *Z. oxyphyllum* but differs from it in having fewer leaflets (3 - 7), shorter paniculate-racemose inflorescence with solitary or 2 - 3-nate flowers. Babu's (1974(1977): 66) description of this species was based on only two staminate collections from Manipur (*Watt* 6452 A & B in CAL). The description of female flowers added hitherto is from a pistillate flowering specimen from Manipur (*Watt* 6476 in CAL).

9. *Zanthoxylum rhetsa* (Roxb.) DC., *Prodr.* 1: 728. 1824; Hook.f., *Fl. Brit. India* 1: 495. 1875; Babu in *Bull. Bot. Surv. India* 16: 56. 1974 (1977). *Fagara rhetsa* Roxb., *Fl. Ind.* 1: 438. 1820. *Tipalia limonella* Dennst. in *Schluss., Hort. Malab.* 31. 1818, nom. nud. *Zanthoxylum limonella* (Dennst.) Alston in *Trimen, Handb. Fl. Ceylon Suppl.* 6: 37. 1931, nom. illegit. *Fagara budrunga* Roxb., *Fl. Ind. ed.* 1: 437. 1820. *Zanthoxylum budrunga* (Roxb.) DC., *Prodr.* 1: 728. 1824. *Z. budrunga* (Roxb.) DC. var. *rhetsa* (Roxb.) Haines, *Bot. Bihar Orissa* 1: 165. 1921.

Beng.: *Basinali, Kantahorina, Tambol*; *Guj.:* *Jejabala*; *Hindi:* *Badrang*; *Kan.:* *Jummina, Jimminra*; *Mal.:* *Mullilavu*; *Mar.:* *Tirphal, Chiphthal*; *Sans.:* *Ashvaghra, Mullilam*; *Tam.:* *Iratehi, Elarangam*; *Tel.:* *Rhetsamaram*.

Trees, up to 30 m high, with a long bole and spreading crown, evergreen or deciduous; main trunk with stout, broad, conical prickles of ca 5 mm long; branchlets woody, terete, sparsely prickly. Leaves paripinnate or imparipinnate, usually confined at tip of branchlets 30 - 45 cm long; petiole and rachis slightly grooved above when young, becoming cylindrical on maturity, usually prickly; leaflets 5 - 33, opposite and subopposite, ovate-oblong or lanceolate, acute to cuneate and oblique at base, caudate-acuminate at apex, acumen 1.5 - 3 cm long, entire to remotely crenate along margins with large glands

in sinuses of crenatures, 7 - 19 x 3 - 6.5 cm, chartaceous to coriaceous, glabrous; petioles 2 - 7 mm long. Panicles terminal or pseudoterminal (from uppermost leaf axil), 10 - 25 cm long, peduncle and axes glabrous to puberulent, sometimes prickly. Male flowers 1.5 - 2.5 mm long. Pedicels 1 - 2 mm long. Sepals 4, ovate-triangular, obtuse, subentire or fimbriate along margins, ca 0.5 mm long, green. Petals 4, valvate, elliptic-oblong, obtuse, 2 - 2.5 mm long, white or creamy yellow. Stamens 4, ca 2.5 mm long; anthers oblong, ca 1 mm long, yellow. Disk pulvinate, lobulate, ca 0.5 mm high. Pistillodes solitary, 0.5 mm high. Female flowers 1.5 - 2.5 mm long; pedicels, sepals, petals as in male flowers. Staminodes absent. Disk pulvinate, ca 0.3 mm high. Gynoecium 1-carpellate, 1 - 1.5 mm high; style eccentric; stigma truncate. Fruiting pedicels 1 - 4 mm long. Follicles single, globose, apiculate, 5 - 7 mm across, pustular; seeds globose, 4 - 6 mm across, bluish-black.

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

Distrib. India: Evergreen or moist deciduous forests up to 600 m. Bihar, W. Bengal, Sikkim, Assam, Meghalaya, Orissa, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Andaman Islands.

Bangladesh, Bhutan, Myanmar, Sri Lanka, Thailand, S. Vietnam, Malay peninsula, Java, Philippines, Celebes, Moluccas & Papua.

Notes. Root bark is diuretic and used in Ayurvedic medicines. Stem bark is bitter, aromatic. Pericarp of unripe fruits tastes like orange rind and is pickled. Dried fruits are used as a condiment especially to add taste to fish curries in western and southern India. Seeds are pungent and taste like black pepper. In Nagaland, powdered seeds are used for catching fish. An oil known as 'Mullilam oil' is extracted from dried mature fruits and is used as an antiseptic and disinfectant; it is also applied for treatment of cholera and inflammatory dermatosis. Wood is durable and is used as a substitute for sal and teak. It is also used in furniture. In Assam, it is occasionally used for making house posts.

10. *Zanthoxylum scandens* Blume, Bijdr. 249. 1825; Babu in Bull. Bot. Surv. India 16: 67. 1974(1977). *Z. cuspidatum* Cham. ex Benth. in Hooker's J. Bot. Kew Gard. Misc. 3: 329. 1851. *Z. khasianum* Hook.f., Fl. Brit. India 1: 494. 1875. *Fagara scandens* (Blume) Engl. in Engl. & Prantl, Nat. Pflanzenfam. 3(4): 118. 1896.

Shrubs, scandent or climbing; branches slender, terete, prickly or occasionally unarmed, velvety-pubescent. Leaves imparipinnate, up to 30 cm long; petiole and rachis slender, marginate and slightly grooved above, usually prickly, velvety-pubescent or glabrescent; leaflets 7 - 25, alternate or opposite, ovate to elliptic-lanceolate, acute to cuneate or rounded and oblique at base, caudate at apex, caudex up to ca 2 cm long with a retuse tip, along margins entire to glandular-crenate along margins, 2 - 6 x 1 - 3 cm, chartaceous, glabrous, glossy above; midnerve prominent beneath, slightly hairy; secon-

dary nerves 6 - 14 pairs, less prominent; petiolules short, ca 5 mm long. Inflorescences axillary and terminal, paniculate, up to 10 cm long, velvety-pubescent. Flowers sessile or shortly pedicellate. Male flowers: Sepals 4, ovate, acute, ca 1 mm long, usually ciliate. Petals 4, ca 3 mm long, ovate-oblong, obtuse. Stamens 4, slightly exerted; anthers oblong, ca 1 mm long, yellowish. Pistillodes 1 - 3, subulate. Female flowers: Sepals, petals as in male flowers. Stamines not seen. Gynoecium 2 - 4 carpellate; styles coherent or divergent at anthesis; stigma globose; fruiting pedicels up to 4 mm long. Follicles 1 - 4 with 3, 2, 1 or 0 persistent abortive carpels, subglobose, ca 5 mm across, pustular; seeds black, smooth, shiny.

Fl. April-May; *Fr.* Oct.-Dec.

Distrib. India: Moist evergreen forests up to 2000 m. Mizoram and Meghalaya.

China, Taiwan, Ryuku Islands, Sumatra, Java and N. Borneo.

Notes. Apparently related to *Z. oxyphyllum* but can be distinguished by velvety-pubescence on branchlets, petiole, rachis and inflorescence, and entire to glandular-crenate thin chartaceous caudate-acuminate leaflets.

11. *Zanthoxylum tetraspermum* Wight & Arn., Prodr. 1: 148. 1834; Hook.f., Fl. Brit. India 1: 495. 1875; Babu in Bull. Bot. Surv. India 16: 68. 1974 (1977). *Fagara tetrasperma* (Wight & Arn.) Engl. in Engl. & Prantl, Nat. Pflanzenfam. 3(4): 118. 1897.

Fig. 101.

Climbers, woody; branchlets cylindric, glabrous, very prickly; prickles scattered, hooked, sharp, 2 - 4 mm long, brownish. Leaves 3-foliolate, to imparipinnate, up to 20 cm long; petiole and rachis slightly grooved above, prickly, glabrous; leaflets (3) 5 or 7, opposite, ovate to elliptic-oblong or obovate, acute or obtuse to rounded and slightly oblique or not at base, abruptly acuminate at apex, acumen 0.5 - 1.5 cm long with a retuse tip, undulate or sinuate-crenate along margins with a prominent pellucid gland in each sinus, 3.5 - 9 x 1.5 - 4.5 cm, coriaceous, glabrous, glossy above, turning blackish or brownish on drying; secondary nerves 10 - 20 pairs, spreading; petiolules very short, 1 - 4 mm long. Panicles terminal and axillary, often fascicled, 3 - 15 cm long, pubescent to velvety-tomentose. Male flowers: 5 mm long; pedicels 1 - 2 mm long, pubescent. Sepals 4, ovate-triangular, acute, connate at base, subentire along margins 0.8 - 1 mm long. Petals 4, ovate-elliptic, obtuse, ca 2 mm long. Stamens 4; filaments linear, 3.5 mm long; anthers 0.5 - 1 mm long, connective often gland tipped. Disk pulvinate ca 1 mm high. Pistillodes 4, with subulate short (1 mm long) styles. Female flowers: Pedicels, sepals, petals and disk as in male flowers. Ovary 4-carpellate, ovoid-subglobose, 1.5 mm long; style very short; stigma peltate. Fruiting pedicels 1 - 4 mm long. Follicles 1 - 4 with 0, 1, 2 or 3 persistent abortive carpels. Seeds ca 5 mm across, black, smooth.

Fl. June-Sept.; *Fr.* Oct.-Dec.

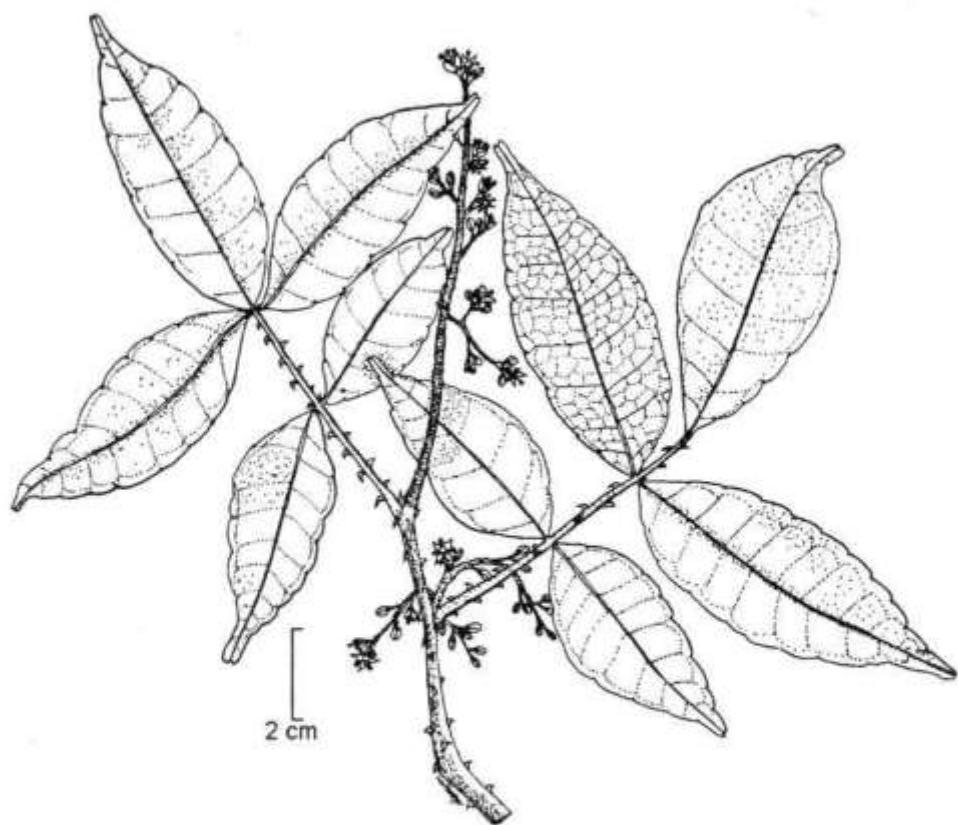


Fig. 101. *Zanthoxylum tetraspermum* Wight & Arn.: flowering twig.

Distrib. India: Evergreen or semievergreen forests of southern W. Ghats, up to 2000 m altitude. Tamil Nadu and Karnataka.

Sri Lanka.

12. *Zanthoxylum tomentellum* Hook.f., Fl. Brit. India 1: 493. 1875 emend. Babu in Bull. Bot. Surv. India 16: 69. 1974(1977).

Scandent shrubs or trees up to 10 m high; branchlets velvety-tomentose, armed with scattered, retrorse, brownish 5 mm long prickles. Leaves imparipinnate, up to 30 cm long; petiole and rachis cylindric, armed with retrorse prickles beneath, velvety-tomentose; leaflets 13 - 17, alternate or opposite, ovate to elliptic-oblong, 3 - 8 x 2 - 3.5 cm, coriaceous, glossy above, cuneate and oblique at base, obtuse or acuminate with retuse tip at apex, entire below and glandular-crenate above along margins; midnerve slightly hairy, depressed above, raised beneath; secondary nerves 6 - 14 pairs, horizontally spreading, pubescent beneath; petiolules up to 3 mm long. Inflorescences terminal and axillary, paniculate, up to 15 cm long, velvety-tomentose. Flowers in loose clusters of cymes. Male flowers: Pedicels 1 - 3 mm long, velvety-pubescent. Sepals 4, ovate-triangular, acute to obtuse, ca 2 mm long, puberulent abaxially, margins ciliate. Petals 4, oblong-elliptic, 2 - 4 mm long. Stamens 4, slightly exceeding petals; anthers oblong, ca 1 mm long, yellowish. Pistillodes solitary, ovoid with a subulate end, up to ca 2 mm long. Female flowers: Pedicels, sepals, petals as in male flowers. Staminodes absent. Gynoecium 4-carpellate, carpels ovoid, 2 mm long, glandular-punctate; style short, persistent in fruit as a beak; stigma capitate. Follicles 1 - 4 with 3, 2, 1 or 0 persistent abortive carpels, ca 5 mm across, pustular, beaked; endocarp slightly detachable; seeds globose, ca 4 mm across, black, smooth.

Distrib. India: In temperate forests of E. Himalayas at higher elevations. Sikkim and Meghalaya.

Bhutan.

Notes. Similar to *Z. oxyphyllum* but is distinct from it by having velvety-tomentose indumentum, smaller leaflets with entire or only distally glandular-crenate margins, smaller flowers, and fruits with a persistent beak.

Subfamily 4. TODDALIOIDEAE

Tribe 4.1. TODDALIEAE

24. *Acronychia* J.R. & G. Forst. nom. cons.

Trees or erect or scandent shrubs. Leaves opposite, uni- or trifoliolate; leaflets entire. Inflorescences axillary, corymbose, paniculate cymes. Flowers bisexual. Sepals free or connate basally, imbricate, persistent or caducous. Petals valvate, semipersistent

or caducous. Stamens double the number of petals, alternately long and short; filaments ciliate at base, pilose at about middle adaxially, gland-dotted; anthers ovoid or ellipsoid, obtuse or apiculate. Disk pulvinate, deeply 8-lobed, persistent or not in fruits. Ovary with or without septicial fissures, 4-carpellate, 4-locular, ovules 2 per locule, superposed; style terminal, twice as long as ovary; stigma 4-lobed. Fruit a 4-locular drupe or a 4-locular capsule, with or without septicial fissures, exocarp semifleshy, spongy, crustaceous or woody when dry, with or without mesocarp, endocarp cartilaginous to pergamentaceous. Seeds 2 or occasionally 1 per locule, ellipsoid to subpyriform, shiny or dull, smooth or finely tuberculate to rugose; embryo straight; cotyledons flat.

Tropics and subtropics of the Old World, Asia, Australia and New Caledonia, probably originated in eastern Australia - New Caledonia regions (Hartley, 1974a: 469); 42 species, one in India.

Literature. HARTLEY, T.G. (1974a) A revision of the genus *Acronychia* (Rutaceae). *J. Arn. Arb.* 55: 469-567. HARTLEY, T.G. (1974b) A proposal to conserve the generic name *Acronychia* (Rutaceae). *Taxon* 23: 435-437.

Acronychia pedunculata (L.) Miq., *Fl. Ind. Bat. Suppl.* 532. 1861. *Jambolifera pedunculata* L., *Sp. Pl.* 1: 349. 1753. *Clausena simplicifolia* Dalz. in Hooker's *J. Bot. Kew Gard. Misc.* 3: 180. 1851. *Acronychia laurifolia* Blume, *Cat. Gen. Buitnez.* 63. 1823; Hook.f., *Fl. Brit. India* 1: 498. 1875. *A. barberi* Gamble in *Bull. Misc. Inform.* 1915: 345. 1915.

Asm.: *Loajan*; Kan.: *Sonemau*; Mal.: *Vidu Kaneli*; Or.: *Madhugodiyamado*; Tam.: *Muttanari*.

Trees or shrubs, 5 - 15 m high, evergreen; branchlets woody, cylindrical to subquad-rangular with slightly flattened internodes, glabrous or with white, silvery pubescent hairs; bark grey, glossy, smooth or lenticellate. Leaves unifoliolate, opposite, 6.5 - 21 cm long; petioles (0.5-) 1 - 3 cm long, horizontally grooved above, swollen at both ends, glabrous or shortly pubescent; leaflet blades mostly elliptic or oblong or elliptic-oblong, grading to subobovate, acute to cuneate at base, acute or obtuse or obtusely acuminate at apex, entire along margins, (4.5-) 6 - 19 x (2-) 3 - 7.5 (-9) cm, glossy, chartaceous to coriaceous, glabrous; midnerve prominent on both sides; secondary nerves 12 to 15 (20) pairs, slender, prominent, spreading, anastomosing to fine reticulation. Inflorescences axillary, paniculate, corymbose cymes, 5 - 18 cm long; peduncle terete or slightly compressed, glabrous to finely pubescent; axes opposite. Flowers bisexual, 5 - 10 mm long, 8 - 12 mm across; bract and bracteoles minute, lanceolate, glabrate; pedicels slender, 5 - 10 mm long, glabrescent. Sepals 4, connate below, imbricate, persistent, suborbicular, obtuse, ca 1 mm long, ca 1.5 mm broad, pubescent. Petals 4, valvate, linear-oblong from a broader base, obtuse at apex, concave, 4 - 9 x 1.5 mm, glabrous abaxially, villous adaxially along midnerve, cream-yellowish. Stamens 8, inserted at base of disk; filaments 4 - 8 mm long, subulate, villous towards base on inner face; anthers

basifixed, ovoid or ellipsoid, ca 1 mm long. Disk 8-angled, 1 - 2 mm high, 2 - 3 mm broad, pubescent or villous. Ovary 3 - 4 mm high, ca 1.5 mm broad, glabrous to tomentose, 4-lobed, 4-locular, each with 2 superposed ovules; style ca 2 mm long, hairy at base, glabrous above, filiform; stigma capitate, 4-lobed. Drupe subglobose or ovoid or ellipsoid, septicial fissures apical or 0, apiculate or rarely grooved at apex, 1 - 1.5 cm long, ca 1.2 cm across, glabrate to finely adpressedly pubescent, green when ripe, dark-brownish turning to black on drying; seeds 2 to 4, ovoid, green.

Fl. Feb.-May; *Fr.* June-Dec.

Distrib. India: Evergreen or semievergreen forests at altitudes ranging from sea level to 2065 m. Uttar Pradesh, W. Bengal, Sikkim, Assam, Mizoram, Meghalaya, Tripura, Orissa, Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka, Kerala and Andaman & Nicobar Islands.

Bhutan, Myanmar, Sri Lanka, Thailand, Cambodia, Laos, N. Vietnam, S. Vietnam, China, Sumatra, Malay peninsula, Borneo, Philippines, Celebes and Papua.

Notes. The stem bark and wood are used for treatment of sores and ulcers. Root is used as a fish poison in Cochin-china. Leaves yield an aromatic essential oil. Stem bark is used as a tonic especially in scabies. Tender leaves are used as a condiment. Wood is used for poles and house constructions. It also gives good charcoal, preferred by goldsmiths. Fruits are edible.

When Linnaeus (1753) published *Jambolifera pedunculata*, he did not provide a phrase name but cited two synonyms : 'Jambolifera from Flora Zeylanica (Linnaeus, 1747), and 'Jambolens' from C. Bauhin (1623), followed by the statement 'Habitat in India'.

There are no specimens or illustrations associated with the Bauhin name. However, Trimen (in J. Linn. Soc. Bot. 24: 129-155. 1888) listed three specimens in Hermann's herbarium (BM) seen by Linnaeus and annotated by him as *Jambolifera pedunculata*. Trimen referred them to *Acronychia laurifolia* Blume (= *A. pedunculata* (L.) Miq.). There are three fertile specimens (with flowers), vol. 2. fol. 82 (upper left) and vol. 2. fol. 38 (lower left and upper right). These appeared as the only original material for the name *Jambolifera pedunculata*, of which the upper left flowering specimen in Herb. Hermann, vol. 2 : 82, No. 139 (BM) was designated as the lectotype for *Jambolifera pedunculata* Nair, K.N. (1993: 58), In: Jarvis, C.E. et al. (eds.). A list of Linnaean generic names and their types. IAPT, Koeltz, Germany).

25. *Skimmia* Thunb. nom. cons.

Erect shrubs or sometimes creeping low shrubs with adventitious roots or trees, evergreen, slightly to strongly aromatic; dioecious or monoecious. Stem of 1 to 3 year's

age green or blackish, later with pale creamy-grey or yellowish bark, inconspicuously lenticellate. Leaves alternate, simple, obovate to oblanceolate or narrowly elliptic, cuneate to rounded at base, acute or rounded or abruptly acuminate to attenuate-caudate at apex, entire or slightly crenulate near apex along margins, chartaceous or coriaceous, moderately to dark green above, pale to yellowish-green beneath; petioles green, brownish or reddish. Inflorescences terminal thyrsoid, paniculate cymes, globose to elongate-oblong or pyramidal, lax or dense, puberulent. Flowers functionally unisexual or bisexual, 4 - 5(-7)-merous, except in number of stamens which is as many as number of petals. Ovary 2 - 5 carpellate, 2 - 5-lobed, subglobose, vestigial in male flowers; style stout, shorter or equalling ovary, deciduous or persistent; stigma 2 - 5-lobed. Fruit a fleshy drupe, globose, rarely pyriform, red or black, with 1 - 5, 1-seeded, leathery, angular endocarps; seeds ovoid, albuminous, testa membranous; cotyledons rounded to oblong, yellowish-green.

Subtropical and temperate zones of Asia; throughout Himalayas (eastwards from E. Afghanistan through India), Myanmar, China, E. Asiatic Islands, Philippines, N. & S. Vietnam, Laos and Thailand; 4 species; 3 in India.

Literature. TAYLOR, N.P. (1987) A revision of the genus *Skimmia* (Rutaceae). *Kew Magazine* 4(4): 168-194.

KEY TO THE SPECIES

- 1a. Drupe red; erect or creeping low shrubs up to 1.5 m high 1. *S. anquetilia*
 b. Drupe black; small trees or erect shrubs up to 15 m tall or low creeping shrubs less than 1 m high 2
 2a. Leaves slightly aromatic when bruised, apex attenuate-caudate, caudex 10 - 15 mm long; petioles green or reddish 2. *S. arborescens*
 b. Leaves strongly aromatic when bruised, apex acute and shortly acuminate, acumen 5 - 10 mm long; petioles green or brownish 3. *S. laureola*

1. *Skimmia anquetilia* N.P. Taylor & Airy Shaw in *Bot. Mag.* 182: 170-171, t. 789. 1980; Palunin & Stainton, *Fl. Himalaya* 72, Pl. 22. 1984. *Limonia laureola* Wallich, *Pl. Asiat. Rar.* 3: 23. 1832, tantum quoad, specim. Sirmore (G. Govan) et Kumaon (Blinkworth), non DC. 1824. *Skimmia laureola* sensu Hook.f., *Fl. Brit. India* 1: 499. 1875, p.p., non (DC.) Sieb. et Zucc. ex Walpers 1846. Fig. 102.

Erect or creeping shrubs, up to ca 1.5 m high, densely branched, aromatic, bark yellowish, smooth or faintly fissured. Leaves often crowded at tips of branches, oblanceolate or elliptic-oblong, narrowly cuneate at base, acute or obtuse at apex, entire along margins, slightly revolute on drying 6.5 - 16.5 x 4.5 cm, coriaceous, finely granular when dry; midnerve prominent beneath; secondary nerves usually indistinct, rarely obsolete; petioles 5 - 15 mm long, marginate. Inflorescences terminal, paniculate, 2 - 4 cm long; peduncle corymbose, glabrous or minutely puberulent. Flowers in dense globose heads of cymes, 5-merous, abortively unisexual, 4 - 6 mm long, yellow, inodorous,

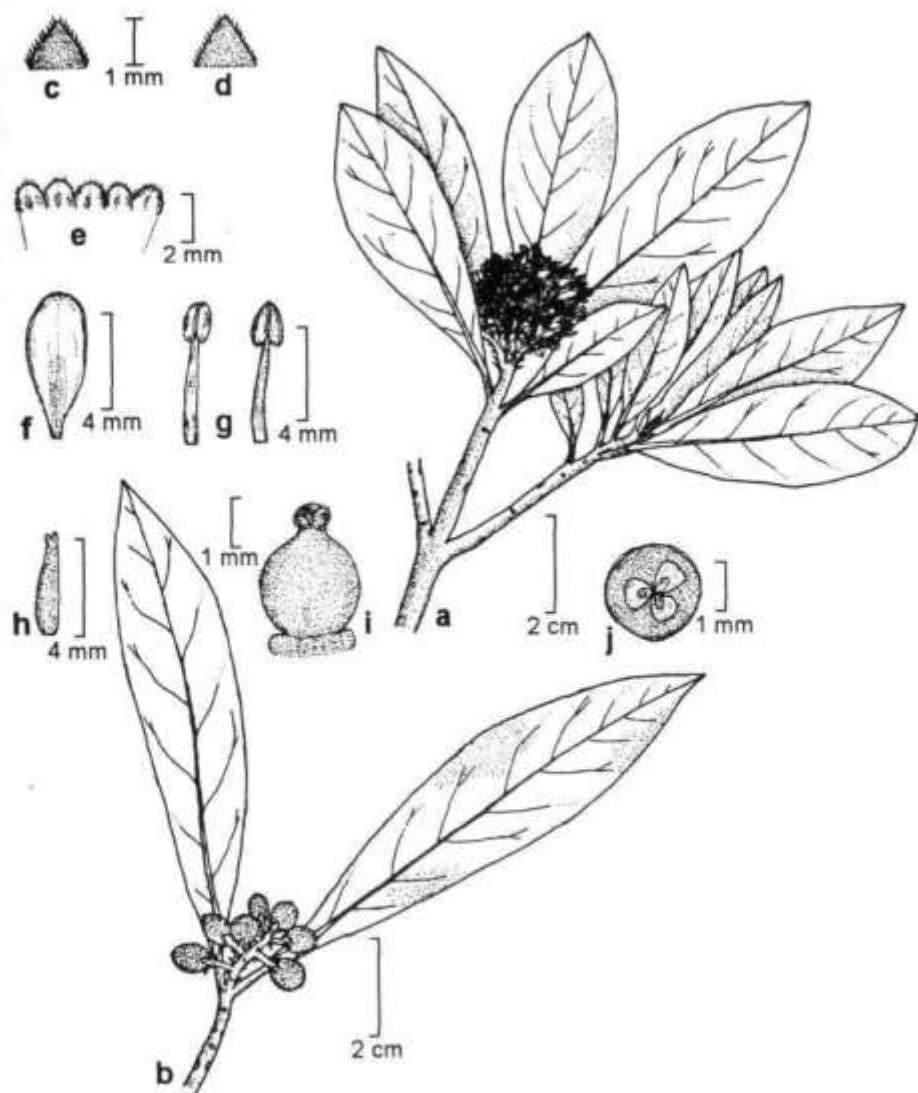


Fig. 102. *Skimmia anquetilia* N.P. Taylor & Airy Shaw: a. flowering twig; b. fruiting twig; c. bract; d. bracteole; e. sepals; f. petal; g. stamens; h. pistillode; i. pistil; j. c.s. of ovary.

half-opened; bracts 2 - 3 mm long, lanceolate, ciliate at margins, caducous or rarely persistent; bracteoles 2, ovate-triangular, ciliate; pedicels short, 1.5 - 2 mm long, puberulous. Male flowers: Sepals 5, connate below, imbricate, ovate or suborbicular, obtuse, ca 1 mm long, 1.2 - 1.5 mm broad, ciliate. Petals 5, valvate, semierect, oblong or oblanceolate, obtuse, clawed, 4 - 6 mm long, ca 2 mm broad, glabrous. Stamens 5, equal to petals in length; filaments subulate, glabrous; anthers ellipsoid, 1 - 1.5 mm long, orange-yellowish, dehiscing longitudinally on both sides. Disk lobulate, ca 0.5 mm high, ca 1 mm broad. Pistillodes solitary, arising at centre of disk, cylindrical, ca 2.5 mm long. Female flowers: sepals, petals and disk as in male flowers. Staminodes 5, filiform, ca 3 mm long with effete anthers. Ovary globose, ca 2 mm long and broad, punctate, glabrous, 2(-3) locular, ovule one in each locule; style short and stout; stigma 3-lobed, punctate. Fruiting pedicels ca 5 mm long. Drupes ovoid, 7 - 10 mm long, 4 - 5 mm across, red; stones 1 - 2, 1-seeded.

Fl. April-May; *Fr.* July-Nov.

Distrib. India: Open forests of W. Himalayas at 1830-3030 m, often found in Quercus-Rhododendron forests. Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.

Afghanistan, Pakistan and W. Nepal.

Notes. Unlike other species of *Skimmia*, *S. anquetilia* is not much valued in horticulture mainly due to its unexpanding flowers with an unpleasant odour. However, it is of botanical interest as one of the parents of the hybrid, *S. x confusa*. According to B.M. Lawrence (*Perfumer & Flavorist* 7: 38, 1982; cf. Taylor 1987), the plants have been accepted in perfume trade in India as their leaves yield essential oils similar to the well known perfume, French petit grain bigarade oil. Leaves have a pleasant smell, similar to musk or orange peel.

2. *Skimmia arborescens* T. Anderson ex Gamble in *J. Linn. Soc. Bot.* 43: 491. 1916; N.P. Taylor in *Kew Mag.* 4(4): 185. 1987.

Erect shrubs or small trees 3 - 15 m high; branchlets slender, cylindrical, glabrous; bark light to dark green, smooth or longitudinally striated. Leaves crowded at end of branchlets, cuneate to rounded at base, attenuate-caudate at apex, margins entire along margins, thin, chartaceous to coriaceous, plane or bullate between secondary nerves, smooth, wrinkled, not granulate when dry; midnerve prominently raised beneath; secondary nerves 6 to 10 pairs, slender, arching near margins to form an intramarginal loop, in smaller forms (subsp. *nitida*) secondary nerves often prominent; petioles green or occasionally reddish or purplish tinged, 1 - 2 cm long. Inflorescence subterminal, paniculate cymes; peduncle up to 6.5 cm long, often branched near base. Flowers functionally unisexual, sweet-scented; bracts persistent in fruits, ovate, 2 - 4 mm long, ciliate; bracteoles 2, opposite, subequal, suborbicular, obtuse, 1 cm long, ciliate; pedicels

3 - 5 mm long. Sepals 5, persistent, suborbicular, obtuse, ca 2 mm long, ciliate. Petals 5, oblanceolate or oblong, narrowed at base, obtuse to subrotund at apex, 3 - 6.5 mm long, white or greenish-yellow, prominently or sometimes indistinctly pinnately nerved. Stamens 5, exserted, linear, subulate above, ca 7 mm long; anthers dorsifixed, oblong or ellipsoid, in female flowers reduced to staminodes. Disk ca 0.8 mm high, pulvinate, persistent in fruits as a short stipe. Female flowers: Ovary globose, smooth, glandular-punctate, 3-locular, ovule one per each locule; style slender, up to 2 mm long; stigma capitate, 3-lobed. Drupes black, 5 - 50 per infructescence, each with 1 - 3 fertile endocarps.

KEY TO THE SUBSPECIES

- 1a. Leaves larger (12 - 20 x 4.5 - 5.5 cm), mostly oblong-elliptic, long caudate at apex, thin, papery when dry, bullate between lateral nerves 2.1. subsp. *arborescens*
- b. Leaves smaller (3 - 12 x 2 - 4 cm), obovate to oblanceolate, acuminate or short caudate, smooth or wrinkled but never bullate between lateral nerves 2.2. subsp. *nitida*

2.1. subsp. *arborescens*

Fig. 103.

Fl. April-May; *Fr.* Ripening in September.

Distrib. India: In dense, broad-leaved, semievergreen, temperate forests of Himalayas between 1500 - 2750 m; often growing in shade of large trees like *Quercus lamellos*. W. Bengal and Sikkim.

Central Nepal, Bhutan.

2.2. subsp. *nitida* N.P. Taylor & Airy Shaw in Kew Mag. 4(4): 185. 1987. *Skimmia laureola* (DC.) Sieb. & Zucc. ex Walpers var. *wattii* Narayanan & Nayar in J. Bombay Nat. Hist. Soc. 85: 653. 1988, syn. nov. *S. arunachalensis* Goel & Mehrotra in J. Bombay Nat. Hist. Soc. 86: 226. 1989, syn. nov. Fig. 104.

Fl. April-May; *Fr.* September.

Distrib. India: Temperate forests of E. Himalayas up to 2750 m. W. Bengal, Meghalaya, Manipur, Nagaland and Arunachal Pradesh.

Myanmar, China, Thailand, Laos and N. Vietnam.

3. *Skimmia laureola* (DC.) Sieb. & Zucc. ex Walpers, Reg. Bot. Syst. 5: 405. 1846; Hook.f., Fl. Brit. India 1: 499. 1875, p.p. *Limonia laureola* DC., Prodr. 1: 536. 1824.

Low scandent or erect shrubs or small trees, 0.5 - 13 m high, strongly aromatic; branches and branchlets terete, rather strong with green or brownish smooth or faintly

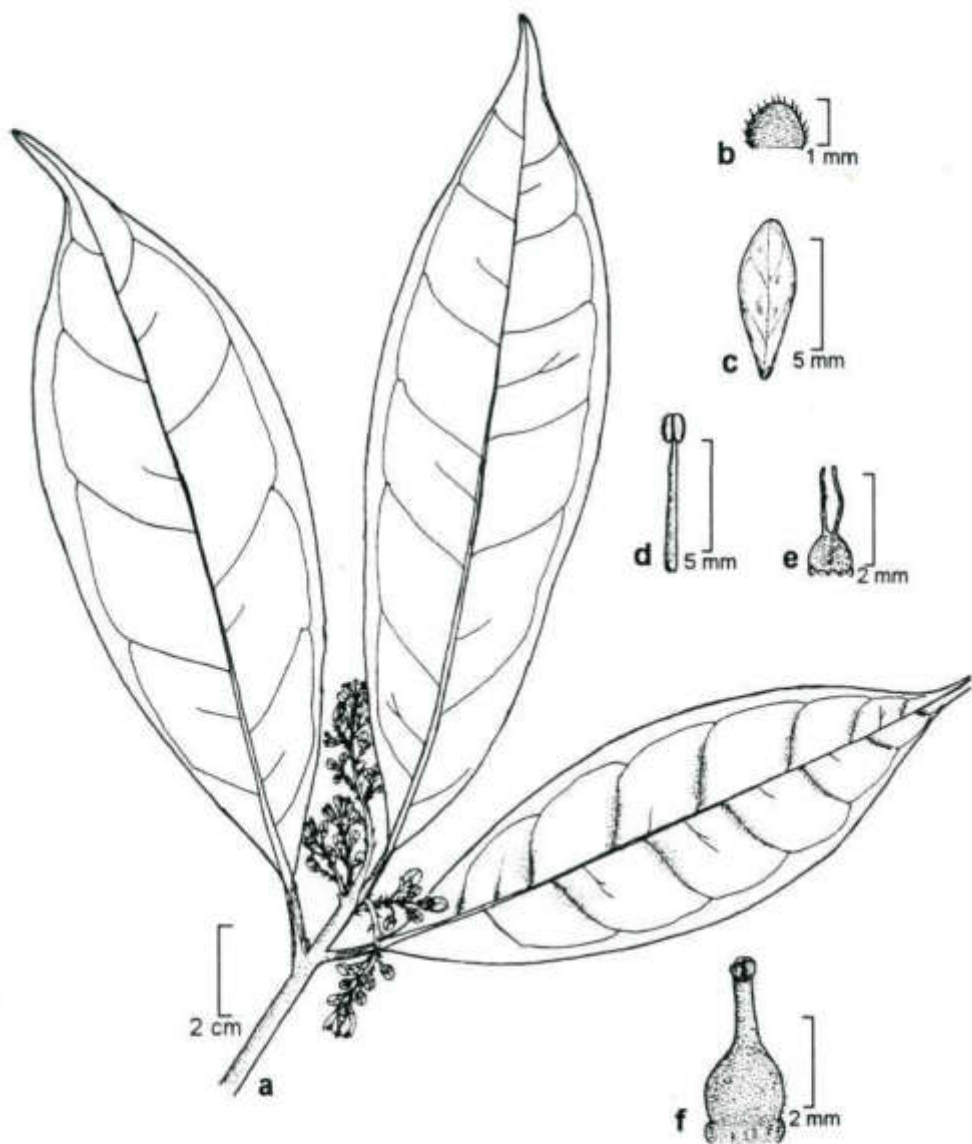


Fig. 103. *Skimmia arborescens* T. Anderson ex Gamble subsp. *arborescens*: a. flowering twig; b. sepal; c. petal; d. stamen; e. pistillodes; f. pistil.

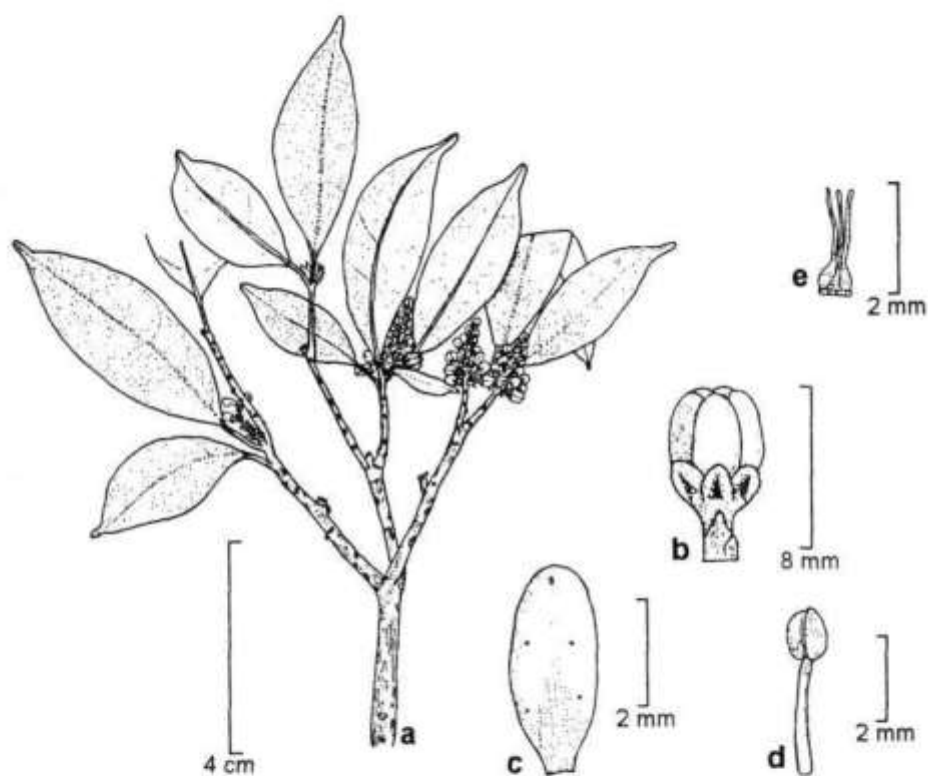


Fig. 104. *Skimmia arborescens* T. Anderson & Gamble subsp. *nitida* N.P. Taylor & Airy Shaw: a. flowering twig; b. flower (unopened); c. petal; d. stamen; e. pistil

fissured bark. Leaves oblanceolate or narrowly elliptic to elliptic-oblong, narrowly cuneate at base, acute or abruptly acuminate at apex, acumen 5 - 10 mm long, bluntish at tip, entire along margins, revolute when dry, variable in size, deep green, glabrous; midnerve keeled, rather prominently raised beneath, puberulent above, glabrous beneath; secondary nerves 7 - 20 pairs, conspicuous or obscure. Inflorescences terminal, paniculate, 2 - 4 cm long; peduncle branching at base or occasionally not, densely or few flowered. Flowers functionally unisexual or bisexual, cream or greenish-white, spreading, sweet-scented; bracts persistent, deltoid or suborbicular, subacute, ca 1 mm long, ciliate. Sepals 5, connate below, ovate or suborbicular, obtuse, ca 1 mm long, ciliate. Petals 5, oblong-lanceolate or oblong-ovate, obtuse at apex, clawed, 4 - 5 mm long, glabrous. Stamens 5; filaments subulate, 3 - 4 mm long; anthers ellipsoid, 0.8 - 1 mm long, reduced to staminodes in female flowers. Disk lobulate, ca 0.5 mm high, ca 1 mm broad, glabrous. Ovary subglobose, 2 mm long, 1.5 mm broad, glandular-punctate, glabrous, 3-5-locular, ovule 1 in each locule; style very short and thick; stigma capitate, 3 or more lobed, punctate. Drupes subglobose or oblong-elliptic, black, 5 - 50 per infructescence with usually 3, 1-seeded stones; endocarp adherent, cartilaginous, epicarp subwoody, reticulate, glabrous; seeds ovoid, ca 5 mm long, ca 3 mm across, cream-white.

KEY TO THE SUBSPECIES

- 1a. Low creeping shrubs less than a meter high, older stems with adventitious roots; leaves 4 - 10.5 x 1.5 - 3.5 cm, narrowly elliptic to elliptic-oblong; secondary nerves often indistinct 3.1. subsp. *laureola*
 b. Erect shrubs or small trees, 3 - 13 m high, older stems not rooting; leaves (8-) 15.5 - 24 x 4.5 - 6 cm, mostly oblanceolate; secondary nerves 10 - 20 pairs, prominent 3.2. subsp. *multinervia*

3.1. subsp. *laureola*

Fig. 105.

Fl. April-May; *Fr.* Aug.-Nov.

Distrib. India: Temperate forests of E. Himalayas at elevations 2125 - 3950 m. W. Bengal, Sikkim and Nagaland.

Nepal, Bhutan, Myanmar and China.

3.2. subsp. *multinervia* (Huang) N.P. Taylor & Airy Shaw in *Kew Mag.* 4(4): 189, t. 90. 1987. *Skimmia multinervia* Huang in *Acta Phytotax. Sinica* 7: 348, t. 67, f. 1-6. 1958. *S. kamengensis* Goel & Mehrotra in *J. Bombay Nat. Hist. Soc.* 86: 228. 1989. syn. nov.

Fig. 106.

Fl. April-May; *Fr.* Ripening in August.

Distrib. India: Temperate forests of E. Himalayas at altitude up to 4000 m. W. Bengal, Sikkim, Manipur, Nagaland, Arunachal Pradesh.

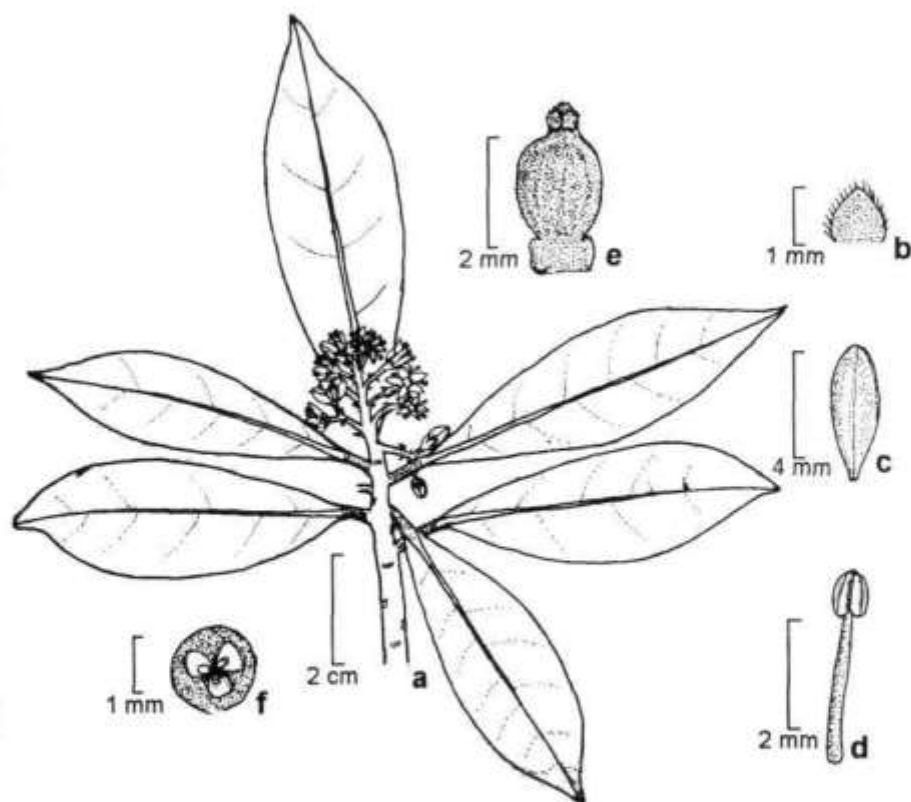


Fig. 105. *Skimmia laureola* (DC.) Sieb. & Zucc. ex Walpers subsp. *laureola*: a. flowering twig; b. sepal; c. petal; d. stamen; e. pistil; f. c.s. of ovary

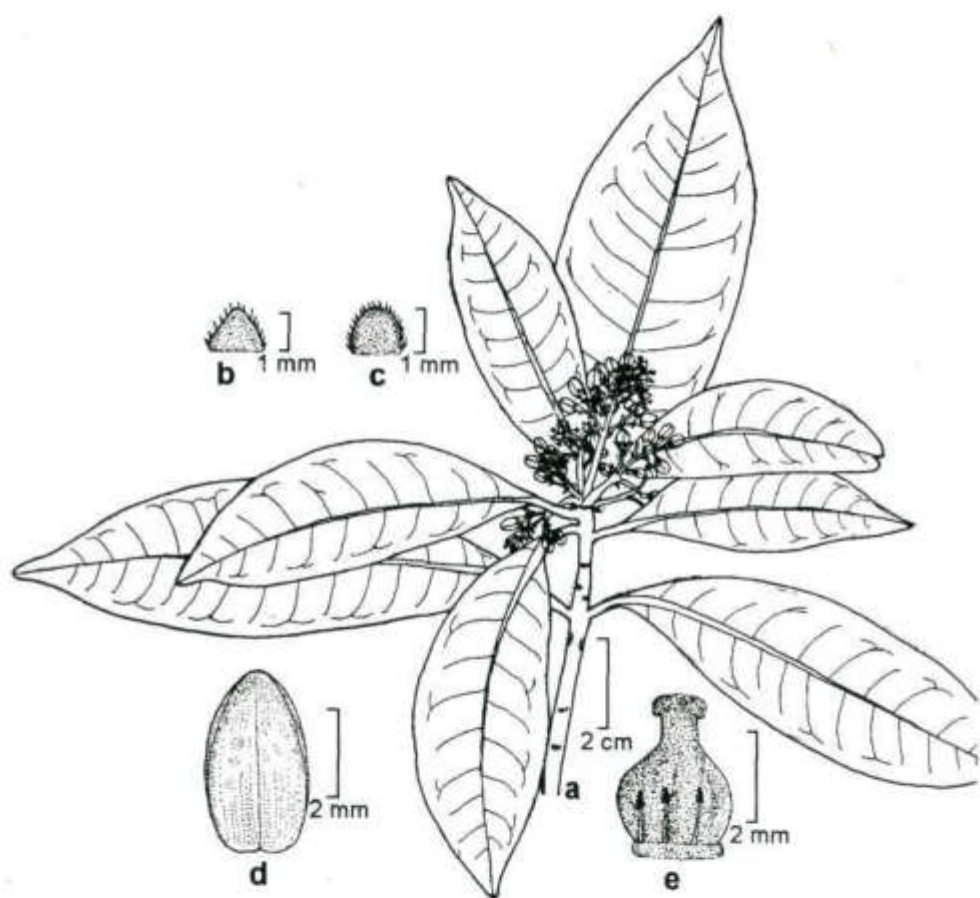


Fig. 106. *Skimmia laureola* (DC.) Sieb. & Zucc. ex Walpers subsp. *multinervia* (Huang) N.P. Taylor & Airy Shaw : a. flowering twig; b. bracteole; c. sepal; d. petal; e. pistil.

Bhutan, Myanmar, N. Vietnam and China.

Notes. The plants are valued as ornamentals and cultivated for their large attractive foliage and densely flowered panicle inflorescence.

26. *Toddalia* Juss.

Monospecific; description and distribution as for the species given below.

Toddalia asiatica (L.) Lam., Tab. Encycl. Meth. 2: 116. 1797. *Paullinia asiatica* L., Sp. Pl. 365. 1753, typ. cons. *Toddalia aculeata* (Smith) Pers., Syn. Pl. 1: 249. 1805, nom. superfl.; Hook.f., Fl. Brit. India 1: 497. 1875. *Scopalia aculeata* Smith, Pl. Ic. Hact. ed. 1, 2: t. 34. 1790. nom. superfl. *Toddalia floribunda* Wallich, Pl. As. Rar. 3: 17, t. 232. 1832. *T. asiatica* (L.) Lam. var. *floribunda* (Wallich) Kurz in J. Asiat. Soc. Bengal pt. 2, Nat. Hist. 44: 130. 1875; Gamble, Fl. Pres. Madras 1: 107. 1915. *T. asiatica* (L.) Lam. var. *gracilis* Gamble, l.c. *T. asiatica* (L.) Lam. var. *obtusifolia* Gamble, l.c.

Beng.: *Kada-tadali*; Hindi: *Jangli-Kalimirch*; Kan.: *Kadumenagu*; Kh.: *Siha-Sieng-ung*, *Sia-sohsar*; Mal.: *Kaka-toddali*; Sans.: *Dahna*, *Kanchano*; Tam.: *Milagamai*, *Kattumilagu*; Tel.: *Konda kashinda*.

Shrubs, scandent or sarmentose or straggling or rarely erect or subscaudent, 3 - 15 m high; stem and branchlets densely to sparingly prickly or occasionally also unarmed, young shoots rusty-tomentose; prickles scattered, recurved, sharp, 3 - 5 mm long (in larger forms raised on a conspicuous corky protruberance of bark). Leaves digitately trifoliolate, alternate; petioles (0.7-) 1 - 3.5 (-5) cm long, slender, obscurely marginate or horizontally grooved above, prickly or unarmed; leaflets sessile, variable, oblong-elliptic, elliptic-obovate, oblanceolate, narrow to cuneate or acute at base, often asymmetric, obtuse or obtusely acute or acuminate at apex, acumen 5 - 15 mm long, bluntish or notched at tip, entire to subentire or faintly to prominently crenulate or subserrate along margins, (1-) 2 - 9.5 x (0.5-) 1 - 4 cm, membranous to chartaceous or moderately to highly coriaceous, glabrous, dark green and often glossy above, light green beneath; secondary nerves 10 - 20(-30) pairs, slender, close, parallel, inarching near margins, in larger leaflets anastomosing. Panicle 1.5 - 10.5 cm long; peduncle slender or rather stout, sparsely branched or compounded as in larger forms. Flowers creamy-white, sweet-scented, 4 - 7 mm across, bracteate; pedicels slender, unequal in size, 1 - 6 mm long, puberulent or shortly pubescent. Male flowers: Calyx lobes deltoid, acute, ca 0.5 mm long, glandular, shortly pubescent externally, glabrous internally. Petals narrow to broadly oblong, hooded at apex, 1.5 - 6 x 0.8 - 1.5 mm, glandular-punctate, glabrous or thinly pubescent externally. Stamens slightly exerted, filaments 2 - 5 mm long, white; anthers broadly oblong, ca 1 mm long with a pellucid gland on dorsal side, yellow. Disk 5 or more lobed, 0.5 - 0.8 mm high, ca 1 mm broad. Pistillodes 1 - 2 mm high, glabrous. Female flowers: Sepals broadly triangular, otherwise same as in male flowers. Petals narrowly oblong. Staminodes ca 1.5 mm long, with minute, effete anthers. Disk broader than in male

flowers. Ovary subglobose or oblong, entire, 2 - 3 mm high, ca 1.5 mm broad, punctate, glabrous; style very short or 0; stigma 5-lobed, punctate. Drupes 4 - 5(-7)-grooved or lobed (sometimes hardly lobed in larger forms), orange or reddish when ripe, rind smooth with prominent, translucent glands; seed one in each locule, reniform, 2 - 3 mm long, ca 1 mm across, brownish, shiny.

Fl. Sept.-Jan.; *Fr.* Feb.-Aug., ripens during May-June.

Distrib. India: Common in dry, open, scrub jungles or evergreen forests or sholas from sea level to 2500 m. Widespread throughout India, except in the arid zones.

Nepal, Bhutan, Bangladesh, Myanmar, Sri Lanka, China, Malasia, Thailand, Sumatra, Philippines, Malagasy, Mascarene Islands, E. & S. Africa.

Notes. Root and root bark are aromatic, antiperiodic, antidiarrhoeic, astringent, stomachic and vulnerary. Infusion of fresh root bark and leaves is carminative. Fresh leaves are eaten for stomach pain. Ripe berries are pickled.

A highly polymorphic species adapted to varied climatic and edaphic conditons. According to habitat and altitudinal differentiation, three ecological forms are found in India, with frequent intermediates. (1) Plants growing in open, dry, coastal, scrub jungles (sometimes up to 500 m or above) which receive a low annual rainfall are slender, very prickly stragglers with narrow, obtusely acute leaflets, slender panicles and small, distinctly lobed drupes. (Common in peninsular India). (2) In evergreen forests (between 700 - 2000 m), the plants grow as gregarious, scandent shrubs or woody liana with larger, thick, coriaceous, obtuse or obtusely acuminate leaflets and short, condensed panicles - Peninsular India. (3) At higher elevation, the plant attains the form of a stunted, erect, usually unarmed shrub with spiralled leaves and smaller, thick, coriaceous, obtuse or obtusely acuminate leaflets, and shorter condensed panicles.

Barrie & Nair (in *Taxon* 40: 646-649, 1991) demonstrated that the specimen in Linnaean herbarium (Herb. Linn. 512.1 (LINN), designated as lectotype of *Paullinia asiatica* L. by Kokwaro (in Polhill, R.M. (ed.), *Fl. Trop. E. Africa* 1982), did not represent *Toddalia asiatica*, but a species of Rose, most probably *Rosa laevigata* Michaux. Kokwaro's lectotypification, however, could not be superceded as the specimen is original material and does not conflict with the protologue. Barrie & Nair, therefore, proposed to conserve the specimen in the Hermann herbarium, Vol. 3: 45, sub. No. 143 (BM) (which qualifies as one of the fine original materials associated with the name *Paullinia asiatica* L.) as the type of *P. asiatica* and to list it as such in the Appendix III A of the ICBN.

27. *Vepris* A. Juss.

Unarmed shrubs or trees. Leaves alternate, tri- or unifoliolate; leaflets many-nerved. Flowers functionally unisexual or bisexual, in terminal and/or axillary panicles, racemes or cymose clusters. Calyx saucer-shaped; sepals 3 or 4 or rarely 0. Petals 2 to 4, imbricate. Stamens 6 - 8, inserted at base of disk. Pistillodes rudimentary, 2-cleft above. Staminodes 6 - 8, with effete anthers. Ovary globose, 1 - 4-locular, ovule 1 or 2 in each locule; stigma capitate, sessile. Fruits drupaceous, 1 - 4-locular, 1 - 2-seeded.

Tropical Africa, Malagasy, Mascarene Islands and peninsular India; 15 species, one in India.

Vepris bilocularis (Wight & Arn.) Engl. in Engl. & Prantl, Nat. Pflanzenfam. 3(4): 178. 1896 et ed. 2. 19a: 306. 1931; Gamble in Fl. Pres. Madras 1: 151. 1915; Gandhi in C.J. Saldanha & Nicolson, Fl. Hassan Dist. 378. 1976. *Toddalia bilocularis* Wight & Arn., Prodr. 1: 149. 1834; Hook.f., Fl. Brit. India 1: 497. 1875. *Dipetalum biloculare* (Wight & Arn.) Dalz. in Hooker's J. Bot. Kew Gard. Misc. 2: 138. 1850.

Mal.: *Karagil*; Sans.: *Krishnaguru*; Tam.: *Devadarom*.

Trees, evergreen up to 30 m high; stem bark grey-brownish, lenticellate. Leaves digitately trifoliolate, 16.5 - 25 cm long; petioles (3-) 4 - 7.5 cm long, horizontally grooved almost up to middle from base adaxially, cylindric otherwise; leaflets elliptic-lanceolate, elliptic-oblong, acute, slightly oblique at base, shortly acuminate at apex, acumen blunt or sometimes notched at tip, entire along margins, 8.5 - 21 x 4 - 8 cm, coriaceous, glabrous; petiolules up to 10 mm long, glabrous; secondary nerves up to 40 pairs, close, parallel, inarching near margins forming an intramarginal nerve. Panicles terminal or from uppermost leaf axils, up to 10 cm long, puberulent, soon becoming glabrous. Flowers unisexual, borne in cymose clusters, yellowish; pedicels slender, 1 - 2 mm long, shortly pubescent. Calyx saucer-shaped, 2 - 3-lobed, rarely sepals 0. Petals 2 or 3, imbricate, orbicular, ca 2.5 mm long and broad, glandular, prominently nerved, glabrous. Stamens 6, exserted; filaments 2 - 3 mm long; anthers dorsifixed, oblong, ca 1 mm long. Pistillodes cylindric, 2-cleft above, glabrous. Ovary globose, 2 - 4-locular; style 0; stigma capitate. Staminodes rudimentary with effete anthers. Fruiting pedicels ca 1 cm long, glabrous. Drupes fleshy, subglobose or oblong, 2-locular, ca 1 x 2 cm, pustular, glabrous; seed 1 in each locule, oblong, flattened, brownish.

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

Distrib. India: Evergreen or semievergreen forests of southern W. Ghats from Mysore southwards up to altitude 1500 m; often reported as growing near river banks. Karnataka, Tamil Nadu and Kerala.

Endemic.

Notes. The plants are a good source of high quality timber used for making shelves, cart-wheels and spokes. Decoction of wood boiled in oil is used for the cure of rheumatism, asthma, leprosy, eye and ear-disorders. A decoction of root is given in biliousness. A number of alkaloids have been isolated from stem bark (e.g. Veprisone) and leaves.

SPECIES EXCLUSIVELY CULTIVATED IN INDIA

1. *Calodendrum capense* (L.f.) Thunb., Nov. Gen. Pl. 2: 43. 1782. *Dictamnus capense* L.f., Suppl. Pl. 232. 1781.

The Cape Chestnut.

Trees, up to 20 m high; branches opposite. Leaves simple, opposite, decussate, ovate, obtuse or retuse or acute at apex. Flowers in paniculate cymes, mauve. Petals linear-oblong with pinkish or purplish glands. Stamens 10, in two whorls, outer whorl sterile, petaloid. Fruit a 5-locular, 5-valved capsule, ca 3.5 cm across, epicarp rugose-warty; seeds subglobose or pyramidal, ca 1.5 cm across.

A native of tropical E. and S. Africa. Once reported as cultivated in gardens of Bombay and vicinity by graham (Cat. Pl. Bombay, 1839). The plant is of ornamental value.

2. *Casimiroa edulis* La Llave in La Llave & Lex., Nov. Veg. Descr. Fasc. 2: 2. 1825.

White sapote; Cochil Sapote, Mexican Apple.

Trees, up to 12 m high; main trunk ca 1 m across; branches spreading, scabrous; bark greyish. Leaves alternate, 3 - 5-foliolate; leaflets ovate or elliptic-oblong, acuminate at apex, cuneate at base, subentire along margins, 6 - 16.5 x 2.5 - 6.5 cm, dark green, coriaceous, inconspicuously gland-dotted, finely reticulate. Inflorescence axillary and pseudoterminal, paniculate. Flowers functionally unisexual, 5-merous, greenish-white. Fruit greenish-yellow when ripe, with a thin epicarp, up to ca 10 cm across; seeds plump, up to 20 x 10 mm.

A native of C. America, cultivated in N. India for its fruits.

3. *Choisya ternata* Kunth in H.B.K., Nov. Gen. Sp. Pl. 6: 6, t. 513. 1823; Matthew in Rec. Bot. Surv. India 20: 60. 1969.

Mexican Orange.

Shrub much branched, evergreen, ca 3 m high. Leaves opposite, digitately 3-foliolate; leaflets sessile, oblong or elliptic-lanceolate, coriaceous, pellucid-dotted. Flowers in racemes, 5-locular with 2 seeds in each locule.

Native of Mexico. In S. India it is occasionally grown in gardens as an ornamental plant.

4. *Flindersia australis* R. Br. in Flinder's Voyage 2: 595, t. 1. 1814; Hartley in J. Arn. Arb. 50: 520. 1969.

Trees up to 15 m high. Leaves alternate, subopposite, opposite or verticillate, usually crowded at tip of branchlets, imparipinnate or rarely paripinnate; leaflets oblong-lanceolate, crenulate along margins, profusely glandular-punctate, glossy above. Flowers functionally unisexual (staminate) and/or bisexual, in axillary and terminal panicles, creamy-white. Fruit 5-locular, septicidal capsule, ca 6 cm long, ca 5 cm broad, separating to one half or completely to its entire length, ellipsoid, star-shaped when open, exocarp muciculate, drying blackish or pale brown, endocarp horny, pale brownish; seeds 2 in each locule, winged.

Native of east central Queensland, south to north-eastern New South Wales. Occasionally cultivated in India. The star-shaped fruits are attractive.

5. *Fortunella japonica* (Thunb.) Swingle in J. Wash. Acad. Sci. 5: 171. 1915. *Citrus japonica* Thunb., Nov. Acta Regiae Soc. Sci. Upsal. 3: 199. 1780.

Round Kumquat.

Shrubs, profusely branched; spines short, axillary. Leaves alternate, 1-foliolate, ovate, obtuse or acute, crenate, pale green, gland-dotted; petiole narrowly winged. Flowers axillary, solitary or in pairs, 5-merous. Fruit a hesperidium, globose or oblate, 2.5 - 3 x 2 - 2.5 cm, with a thick, fleshy, sweet (edible) pericarp, golden-yellowish when ripe, segments 4 - 7, with scented acidic juice.

Native of South China; cultivated throughout the warmer parts of the World for its delicious fruits. One of the most handsome *Citrus* plants. Occasionally cultivated in N. India.

6. *Melicope denhamii* (Seem.) T. G. Hartley in Sandakania 4: 57. 1994. *Picrasma denhamii* Seem., Fl. Vit. 33. 1865.

Shrubs up to 2 m high. Leaves digitately 3-foliolate, on a long petiole (5 cm long); leaflets narrow, linear-oblong, sinuate along margins, ca 18 x 1.5 cm. Flowers in axillary panicles, bisexual, greenish-yellow, scented. Fruit capsular, with smooth, leathery pericarp; seeds bright, shiny, black.

Probably a native of Borneo east to the southern Philippines and Caroline Islands and southeast throughout Malesia to the Solomon Islands, New Hebrides and Fiji. In India, it is grown in botanic gardens and homestead gardens as an ornamental plant.

7. *Poncirus trifoliata* (L.) Raf., Sylv. Tellur. Mant. 143. 1838. *Citrus trifoliata* L., Sp. Pl. ed. 2. 1101. 1763.

Trifoliate orange.

Trees, small, much branched, deciduous tree with long and stout spines. Leaves alternate, digitately 3-foliolate; petiole narrowly winged. Flowers solitary, sessile, 4 - 6-merous, wide-opening. Fruits globose, ovoid or pyriform, very fragrant and dull lemon coloured when ripe, 3 - 5 cm across, finely downy-pubescent, rind thick, glandular, rough, segments 5 - 7, pulp-vesicles slender, stalked, linear, strongly acidic, with acrid oil droplets; seeds ovoid or oblong, numerous per fruit.

Native of C. and N. China and cultivated in many tropical and subtropical countries, including India. The plants are highly valued as rootstock for many *Citrus* species. Hybrids between *Poncirus trifoliata* and other *Citrus* spp. are vigorous and show high disease resistance. Dried fruits are medicinal and used for diarrhoea.

8. *Ravenia spectabilis* (Lindl.) Engl. in Martius, Fl. Bras. 12: 76. 1874. *Limonia spectabilis* Lindl., Bot. Reg. t. 59. 1840.

Shrubs small, handsome, up to 2 m high. Leaves 3-foliolate; leaflets subsessile, oblong, shiny above, thin, coriaceous. Flowers solitary or in axillary, few-flowered cymes, purplish-red, slightly zygomorphic, gamopetalous.

Native of West Indies and widely cultivated in many tropical countries. In India, it is often grown in gardens as an attractive ornamental plant.

SIMAROUBACEAE

(R.K. Basak)

Trees or shrubs, usually with bitter substances; twigs pithy, hairy or glandular. Leaves alternate to spiral, usually pinnate, rarely simple; stipules absent or caducous. Inflorescence axillary or rarely terminal, usually compound racemes or corymbose panicles, pubescent. Flowers 3 - 5-merous, usually small, regular, unisexual or bisexual, many or few. Calyx 3 - 5-lobed, partly connate or free. Petals 3 - 5, free, variously coloured. Disk annular or elongate, simple or lobed. Stamens as many as or twice the number of petals, rarely numerous, free; filaments slender, often with a scale at base; anthers oblong, dehiscent longitudinally. Carpels 1 - 5, free or connate, 2 - 5-lobed; ovules solitary in each locule; styles 1 - 5, distinct or connate; stigmas connate or free. Fruits drupes, samaras or schizocarps; seeds solitary with membranous or leathery testa.

Tropical and subtropical regions of both the hemispheres, particularly in tropical America (Mexico to Argentina, tropical west Africa and southeast Asia), 30 genera and ca 200 species; 5 genera and 11 species in India.

Literature. NOOTEBOOM, H.P. (1962). Simaroubaceae In: STEENIS, Fl. Males. ser. I. 6: 193-226; BASAK, R.K. (1980). Fasc. Fl. India 4: 1 - 24.

Notes. Genus *Balanites* Del. is treated under Zygophyllaceae.

KEY TO THE GENERA

- | | |
|--|----------------------|
| 1a. Leaves simple | 5. <i>Samadera</i> |
| b. Leaves compound | 2 |
| 2a. Branches unarmed; flowers bisexual | 3. <i>Harrisonia</i> |
| b. Branches armed; flowers unisexual, or both uni- and bisexual | 3 |
| 3a. Stipules present but caducous; sepals and petals persistent in fruit | 4. <i>Picrasma</i> |
| b. Stipules absent; sepals and petals not persistent | 4 |
| 4a. Stamens twice as many as petals; fruits winged | 1. <i>Ailanthus</i> |
| b. Stamens as many as petals; fruits not winged | 2. <i>Brucea</i> |

1. *Ailanthus* Desf., nom. cons.

Trees, tall, fast-growing, sometimes deciduous; young parts brownish-hairy; branches thick, pithy. Leaves large, long-petioled, imparipinnate, usually crowded at ends of branches; leaflets opposite to subopposite, petiolulate, oblique, entire or toothed, acuminate, usually glandular beneath. Flowers in axillary or terminal branched panicles, usually unisexual; male flowers foetid during anthesis. Calyx small, 5-lobed. Petals 5, oblong, concave, longer than calyx. Disk 10-lobed, thick, flat. Stamens 10 in male flowers; filaments subulate, reduced or absent in female flowers. Carpels 2 - 5,

free, flat, rudimentary or absent in male flowers; styles free or connate; stigma peltate. Fruits 1 - 5, linear or oblong-lanceolate samaras; wing membranous; seed, orbicular or obovate, flat.

Tropical and subtropical areas of Asia and Australia with 5 species; 4 species in India.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Leaflets usually entire | 2 |
| b. Leaflets usually toothed | 3 |
| 2a. Leaves with large glands on lower surface near base; petals puberulous | 3. <i>A. integrifolia</i> |
| b. Leaves with small hairy glands on lower surface near margins; petals glabrous | 4. <i>A. triphysa</i> |
| 3a. Petiolules less than 1 cm long; petals woolly | 1. <i>A. altissima</i> |
| b. Petiolules more than 1.5 cm long; petals glabrous | 2. <i>A. excelsa</i> |

1. *Ailanthus altissima* (Miller) Swingle in J. Wash. Acad. Sci. 6: 495. 1916. *Toxicodendron altissima* Miller, Gard. Dict. ed. 8, no. 10. 1768. *Ailanthus glandulosa* Desf. in Mem. Acad. Sci. (Paris) 1786: 265, t. 8. 1788; A.W. Bennett in Hook. f., Fl. Brit. India 1: 518. 1875.

Deciduous trees, 20 - 25 m high. Leaves 30 - 50 cm long, pubescent or glabrous; leaflets 4 - 10 pairs, lanceolate, obliquely divided by midnerve, base with 2 - 4 teeth; each with a large gland beneath, acuminate, 5 - 15 x 1.5 - 5 cm. Flowers greenish, small, in 10 - 20 cm long panicles. Calyx lobes ca 1 mm long. Petals 2 - 4 mm long. Filaments filiform. Ovary glabrous, ca 1.5 mm long; styles connate up to middle; stigma peltate, 5-lobed. Samaras reddish when young, linear-oblong, 3 - 5 x 0.6 - 1.2 cm, membranous, somewhat spirally twisted; seed single.

Fl. & Fr. April - Aug.

Distrib. India: Introduced tree but naturalised on hills in north-western India up to 1800 m. Haryana, Himachal Pradesh, Kashmir, Punjab and Uttar Pradesh.

China. Cultivated and naturalised in temperate and tropical regions.

Notes. In N. India it is often planted as an ornamental and avenue tree.

2. *Ailanthus excelsa* Roxb., Pl. Coromandel 1: 24, t. 23. 1795; A.W. Bennett in Hook. f., Fl. Brit. India 1: 518. 1875; *Pongelion wightii* Tieghem in Ann. Sci. Nat. Bot. I: 277. 1906.

Guj.: *Ardusi*; Hindi: *Anua*, *Maharukhi*, *Urrulo*; Kan.: *Doddamara*; Mal.: *Matti pongilyam*; Mar.: *Maharukh*; Or.: *Mahanim*; Sans.: *Madala*; Tam.: *Perumaram*, *Peru*; Tel.: *Peddamanu*; Urdu: *Mahanim*.

Deciduous trees with large leaf-scars, 15 - 25 m high. Leaves equally or unequally pinnate, usually 20 - 40 cm long, rarely up to 90 cm or more; petioles tomentose; leaflets 8 - 14 pairs, alternate or opposite, variable in shape, unequal at base, acute or acuminate at apex, coarsely and irregularly toothed or sublobate, 4 - 16 x 3 - 8 cm, tomentose when young; lateral nerves 12 - 20 pairs; petiolules with 2 hairy glands near base. Flowers greenish-yellow, large, lax, in much-branched panicles; pedicels slender. Calyx lobes ovate-triangular, ca 2 mm long. Petals ovate-lanceolate, 3 - 4 x ca 2 mm, reflexed. Filaments glabrous; anthers ca 1 mm long. Ovary sparsely hairy; styles free or connate; stigma curling. Samaras linear, oblong to lanceolate, acute at both ends, 4 - 7.5 x 1 - 1.5 cm, reddish-brown, strongly reticulate, once or twice twisted at base.

Fl. & Fr. Dec. - July.

Distrib. India: Punjab, Haryana, Uttar Pradesh, Bihar, W. Bengal, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands.

Pakistan and Sri Lanka.

Uses. The timber is used for making packing cases, boats, toys and other articles since it is light. The tree yields an inferior type of *bassora* or hog-gum. Bark used as a febrifuge and tonic.

3. *Ailanthus integrifolia* Lam. subsp. *calycina* (Pierre) Nootb. in Steenis Fl. Males. ser. 1. 6: 218. 1962. *Pongelion calycinum* Pierre, Fl. Forest Cochin. 4: t. 294 A (text). 1893. *Ailanthus calycina* Pierre l.c. (plate). *A. grandis* Prain in Indian Forester 28: 131, t. 210. 1902; Kanj. et al., Fl. Assam 1: 216. 1936. Fig. 107.

Asm.: *Actaluca*, *Borpat*, *Borkesutu*, *Saragphula*, *Koronga*, *Ring*; *Kh.*: *Diang-ehao*; *Lep.*: *Maldikung*.

Lofty trees, 30 - 50 m high; bark grey. Leaves alternate, 60 - 100 cm long, paripinnate; petioles 5 - 20 cm long; leaflets alternate, ovate-lanceolate or ovate, oblique, cuneate at base, acuminate at apex, entire or rarely sinuate along margins, 6 - 20 x 3 - 9.5 cm, glabrous; lateral nerves 10 - 12 pairs, 1 or 2 pairs with glands. Flowers in loosely branched, 30 - 40 cm long panicles; pedicels ca 5 mm long. Calyx irregularly lobed; lobes 3-angular, pubescent. Petals ca 4 mm long, densely hairy along margins and laxly hairy outside in male flowers. Anthers ca 2 mm long in male flowers. Ovary hairy; styles 5, connate; stigma spreading. Samaras apically twisted, rounded along outer margin, straight along inner margin, 10 - 13 x 3 - 4 cm, light brown; seeds flat, ca 1.5 cm across.

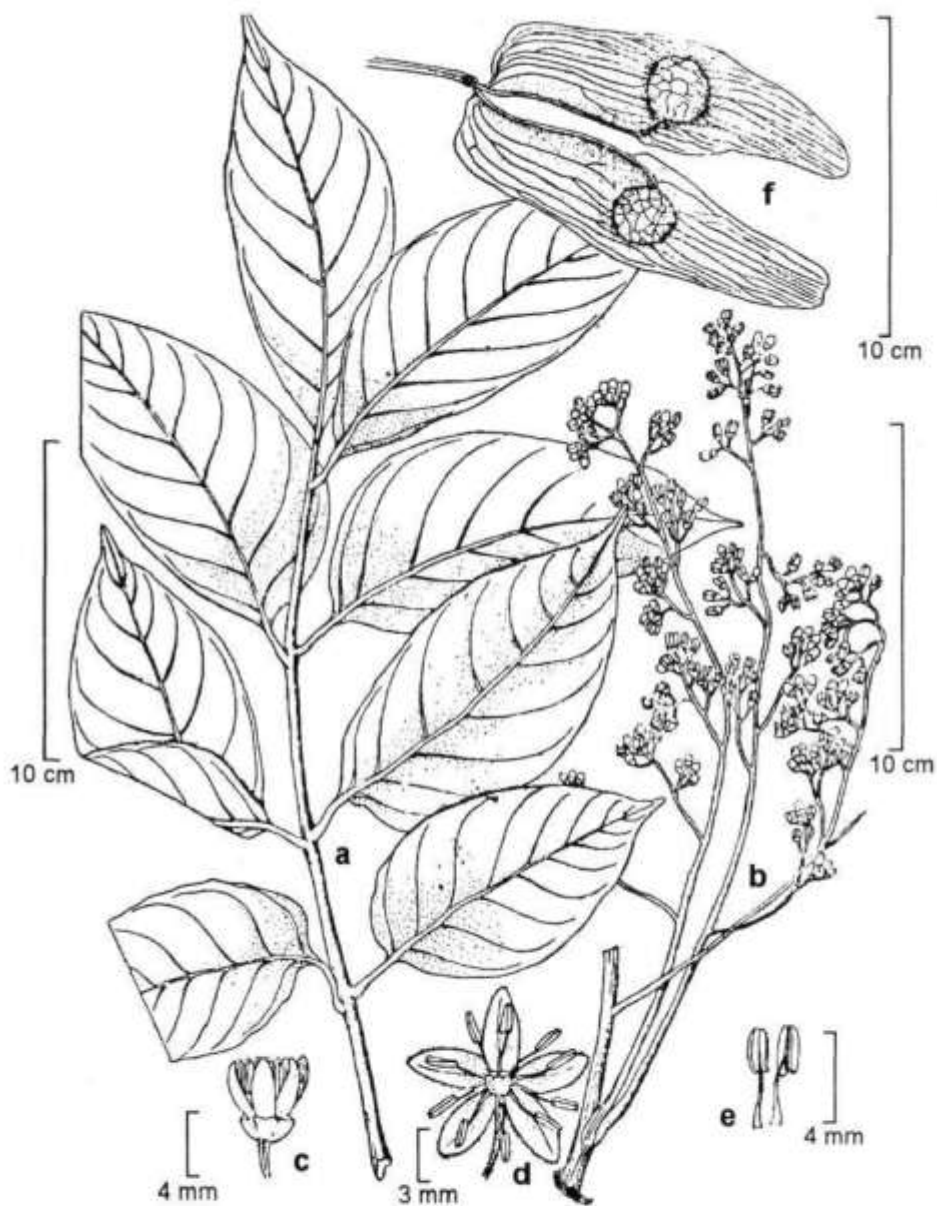


Fig. 107. *Ailanthus integrifolia* Lam. subsp. *calycina* (Pierre) Nootb.: a. leaf; b. inflorescence; c. male flower; d. male flower spread out; e. stamens; f. samaras.

Fl. & Fr. Jan. - April.

Distrib. India: W. Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Mizoram, Tripura, Meghalaya.

Cambodia, Laos, Thailand, Vietnam and Indonesia (Java).

Uses. Wood is used for making packing cases.

Notes. *A. integrifolia* subsp. *integrifolia* differs from subsp. *calycina* in having larger flowers, up to 15 mm long, pedicels 2 - 3 mm long, sepals 6 - 10 mm long and petals which are evenly hairy outside. However, they cannot be distinguished in vegetative or fruiting condition.

4. *Ailanthus triphysa* (Dennst.) Alston, Handb. Fl. Ceylon 6 (Suppl.): 41. 1931; Nootb. in Steenis, Fl. Males. ser. I. 6: 219. 1962. *Adenanthera triphysa* Dennst., Schluss. Hort. Malab. 32. 1818. *Ailanthus malabarica* DC., Prodr. 2: 89. 1825; A.W. Bennett in Hook. f., Fl. Brit. India 1: 518. 1875. *A. kurzii* Prain in Indian Forester 28: 133, t. 3B. 1902.

Kan.: *Dhup, Hal-maddi*; Mal.: *Pongiyam, Mattipal*; Tam.: *Peru, Perumaram*; Tel.: *Peddaman*.

Trees, large, deciduous, 30 - 40 m high; bark grey, rough. Leaves crowded, mostly paripinnate, 20 - 70 cm long; leaflets 6 - 10 pairs, opposite or alternate or subopposite, falcate, obliquely ovate-oblong or oblong-lanceolate, unequal at base, acute or acuminate at apex, entire or wavy along margins, 9 - 14 x 2.5 - 5.5 cm, glabrous, glaucous beneath; petiolules 5 - 10 mm long. Flowers in dense axillary branched pubescent 20 - 50 cm long panicles; bracts small, caducous; pedicels ca 3 mm long. Calyx lobes 3-angular, acute, ca 1 mm long, pubescent. Petals oblong-lanceolate, 3 - 5 x 1 - 1.5 mm, glabrous. Stamens 3 - 4 mm long in male flowers; filaments tortuous-folded in bud, filiform, with spreading hairs; anthers ovate-cordate. Ovary 2 - 2.5 x 1 - 1.5 mm, glabrous; styles free at base, connate above; stigma 3 - 4-lobed, peltate. Samaras linear-oblong, rounded at both ends, not twisted, 5 - 9.5 x 1.5 - 2.5 cm, reddish-brown.

Fl. & Fr. Jan. - May.

Distrib. India: Common in evergreen forests up to 1500 m. India: Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Andaman Islands.

Myanmar, Sri Lanka, China, Cambodia, Vietnam, Thailand, Malaysia and Australia.

Uses. Wood is used for making packing cases, boards and toys; a viscous aromatic resin is obtained from bark which is locally used for incense. Fruits edible.

2. *Brucea* J.F. Miller, nom. cons.

Shrubs or small trees, very bitter; young parts pubescent. Leaves imparipinnate, exstipulate, very large; leaflets 3 - 15, opposite, oblique, ovate to lanceolate, acuminate at apex, entire or toothed along margins, with flat spot-like glands along margins beneath. Flowers unisexual or bisexual, in long axillary panicles, 4-merous. Sepals 4, small, ovate-elongate or 3-angular, connate at base, pubescent, imbricate in bud. Petals 4, free, small, ovate-oblong, oblong or linear, pubescent outside. Disk 4-lobed, cupular, thick, glabrous. Stamens 4, inserted below disk; filaments short; anthers ovate-cordate. Carpels 4, free, ovoid; styles free or coherent at base, recurved outwards over ovary; stigma thick or club-shaped. Fruits of 1 - 4 free dry nuts, ovoid or ellipsoid, 2-ribbed; seeds ovoid, solitary.

Asia and N. Australia with 6 species; 2 in India.

KEY TO THE SPECIES

- 1a. Leaflets bluntly serrate or crenate; lateral nerves nearly parallel; nuts ca 5 mm long with stalks 2 - 4 mm long when dry **1. *B. javanica***
 b. Leaflets usually entire; lateral nerves not parallel; nuts 10 - 12 mm long with stalks 2 - 4 mm long when dry **2. *B. mollis***

1. *Brucea javanica* (L.) Merr. in J. Arn. Arb. 9:3. 1928; Nooteb. in Steenis, Fl. Males. ser. I. 6: 211. 1962. *Rhus javanica* L., Sp. Pl. 265. 1753. *Brucea sumatrana* Roxb., Hort. Beng. 12. 1814; A.W. Bennett in Hook. f., Fl. Brit. India 1: 521. 1875.

Evergreen, foetid shrubs or small trees, 1 - 6 m high, often epiphytic; branchlets stout, tomentose. Leaves 25 - 50 cm long; petioles 6 - 15 cm long; leaflets 3 - 15, ovate-oblong to ovate-lanceolate, acute or obtuse at base, acuminate at apex, 4 - 14 x 2 - 5.5 cm, densely yellowish-pubescent beneath, sparsely hairy above, sometimes glabrous; petiolules slender. Flowers (reddish or greenish-red or purple) in axillary pubescent panicle of cymes. Panicles, 15 - 30 cm long; bracts deltoid, minute. Male flowers with slender pedicels. Sepals 1 - 2 mm long, pubescent. Petals linear-spathulate, 1 - 2 mm long, sparsely pubescent or glabrous; filaments subulate. Female flowers with pedicels up to 2.5 mm long. Sepals and petals as in male flowers. Stigma free, ca 1 mm long. Nuts 1 - 4, ovoid, somewhat compressed, ridged, 4 - 5 x 2.5 - 3.5 mm, glabrous, black; stone reticulate.

Fl. Jan. - July; *Fr.* July - Nov.

Distrib. India: Arunachal Pradesh, Assam, Nagaland, Meghalaya, Kerala and Andaman Islands.

Asia and Australia.

Uses. Plant astringent; seeds used in amoebic dysentery.

2. *Brucea mollis* Wallich ex Kurz in J. Asiat. Soc. Bengal Pt., 2, Nat. Hist. 42: 64. 1873; A.W. Bennett in Hook. f., Fl. Brit. India 1: 521. 1875.

Shrubs or small trees, 1 - 4 m high; branches lenticellate; young parts tomentose; stems reddish-brown. Leaves alternate, 18 - 40 cm long; leaflets 3 - 9(-13), opposite, 5 - 15 x 2 - 6 cm; lowest pair smallest, becoming larger upwards, ovate or oblong-lanceolate, unequal at base, acute or acuminate at apex, entire along margins, rarely undulate, membranous, pubescent on both surfaces, rarely glabrous; petiolules 2 - 10 mm long, pubescent. Flowers minute, in axillary pubescent 10 - 25 cm long panicle of cymes, pubescent. Sepals 4, ca 1 mm long, imbricate. Petals 4, linear, minute, imbricate, green, white, creamy or red. Stamens 4, ca 1 mm long. Disk 4-lobed. Ovary deeply 4-lobed, glabrescent; styles linear, deflexed. Nuts 1 - 2, or 3 - 4, ovoid, pointed at apex, orange-red when ripe.

Fl. & Fr. Nov. - May.

Distrib. India: W. Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Manipur and Meghalaya.

Bhutan, Bangladesh, Myanmar, Sri Lanka, China, Thailanda, Cambodia, Vietnam, Malesia, Indonesia and Philippines.

3. *Harrisonia* R. Br. ex Adr. Juss., nom. cons.

Shrubs or rarely small trees, up to 12 m high or sprawling, spiny; branches pithy; branchlets pubescent when young, glabrous when mature, lenticellate; stipular spines accrescent, conical, slightly recurved, finally caducous. Leaves spiral, imparipinnate or 3-foliolate; rachis narrowly winged; leaflets rhomboid to ovate-lanceolate, subentire to coarsely crenate to serrate. Flowers bisexual, 4 - 5-merous, in bracteate axillary cymes or terminal thyrses. Calyx small, 4 - 5-lobed; lobes acute, 3-angular, persistent. Petals 4 - 5, longer than calyx, glabrous. Disk hemispherical. Stamens 8 - 10, attached at base of disk; filaments with small scales at base, glabrous. Ovary globose or lobed, seated on a thick disk, 4 - 5-celled; styles 4 - 5, free or connate at base; stigma 4 - 5-lobed, knob-shaped; ovule solitary, pendulous, amphitropous. Fruits globose, entire or lobed drupes; seeds with a thin testa, endospermous.

Tropics of Africa, Asia and Australia with 4 species; 2 species in India.

KEY TO THE SPECIES

- 1a. Leaves 3-foliolate; cymes 3 - 5-flowered; flowers usually 4-merous; petals whitish; drupes not lobed 1. *H. brownii*
- b. Leaves imparipinnate; cymes 8 - 30-flowered; flowers usually 5-merous; petals pinkish; drupes lobed 2. *H. perforata*

1. ***Harrisonia brownii*** Adr. Juss. in Mem. Mus. Hist. Nat. Paris 12: 540. t. 28, no. 47, 1825; A.W. Bennett in Hook. f., Fl. Brit. India 1: 519. 1875. Fig. 108.

Shrubs, deciduous, spreading, ca 3 m high; branches dark brown; spines in pairs, short, sharp, up to 5 mm long, dark. Leaves digitately 3-foliolate, 5 - 10 cm long; petioles 0.5 - 2.8 cm long; leaflets ovate to rhomboid, acuminate at apex, 2 - 8 x 0.5 - 4 cm; terminal one largest, narrowed at base; lateral ones usually oblique, cuneate at base, 1 - 5 x 0.5 - 2 cm; petiolules 0.5 - 10 mm long, slender, channelled. Flowers small; bracts persistent, 3-angular, pubescent; pedicels slender, up to 6 mm long. Calyx 4-lobed, ca 1 mm long, glabrous or sparsely hairy. Petals 4, lanceolate-oblong, acute, reflexed, 3 - 3.5 x ca 1 mm, white. Disk cylindrical, slightly 8-lobed, short. Stamens 8; filaments ca 2 mm long; anthers ca 1 mm long. Ovary rather deeply lobed, ca 1 mm long; styles 4, connate, ca 1.5 mm long, twisted, glabrous. Drupes globose, entire.

Fl. & Fr. June - Nov.

Distrib. India: Fairly common in deciduous forests and often forming small thickets. S. Andaman Islands.

Indonesia, Philippines, New Guinea and Australia.

Notes. Leaves all turn yellow before falling. New flush of leaves gives a very pretty appearance.

Uses. Shoots, barks, roots etc. are of medicinal value.

2. ***Harrisonia perforata*** (Blanco) Merr. in Philipp. J. Sci. 7: 236. 1912; Nooteb. in Steenis, Fl. Males. ser. 1. 6: 208. 1962. *Paliurus perforatus* Blanco, Fl. Filip. 174. 1837; *Harrisonia bennettii* (Planchon) A.W. Bennett in Hook. f., Fl. Brit. India 1: 519. 1875. *Lasirolepis bennettii* Planchon in Hooker's J. Bot. Kew Gard. Misc. 5: 570. 1846. *Limonia pubescens* Wallich ex Hook. f., Fl. Brit. India 1: 507. 1878.

Shrubs, scandent, ca 8 m high, with slightly recurved prickles. Leaves 8 - 16 cm long; rachis narrowly winged, pubescent; petioles 0.5 - 3 cm long; leaflets 5 - 13, 1 - 4 x 0.5 - 2 cm; odd ones ovate-rhomboid, crenate-serrate along margins, 2 - 5.5 x 1 - 2.5 cm, glabrous. Flowers rather large; pedicels pubescent. Calyx lobed, ca 1.5 mm long, persistent. Petals 5, lanceolate, rarely oblong, 6 - 8 x 1.5 - 2.5 mm, pale pinkish,

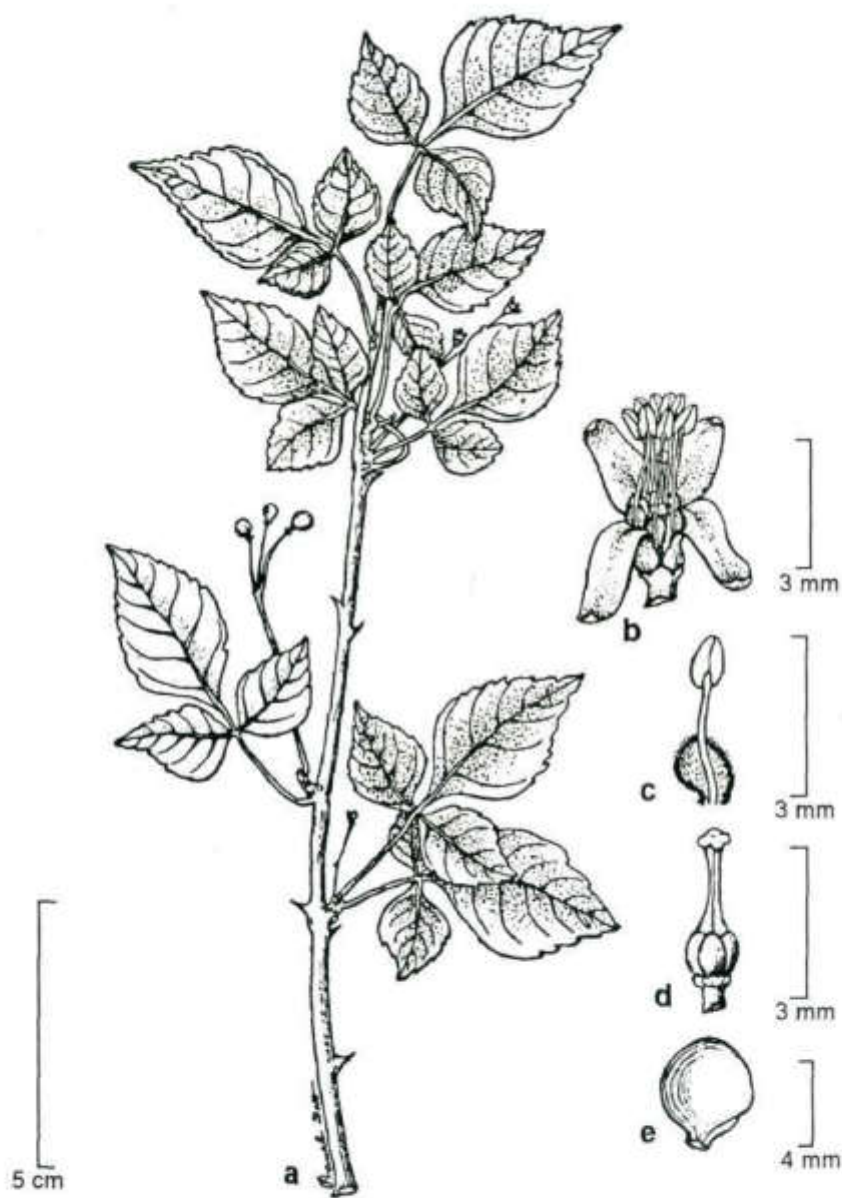


Fig. 108. *Harrisonia brownii* Adr. Juss. : a. branch with flowers and fruits; b. flower; c. stamen; d. gynoecium; e. drupe.

pubescent, inserted below disk. Stamens 10; filaments 7 - 10 mm long; ligules densely woolly along margins. Disk cup-shaped, 1 - 2 mm high, fleshy. Ovary 0.5 - 1.5 mm long, slightly lobed, glabrous; styles 6 - 8 mm long, connate, pubescent. Drupes slightly lobed.

Fl. Dec. - May; *Fr.* Feb. - Aug.

Distrib. India: Andaman Islands.

Myanmar, Thailand, Laos, Cambodia, Vietnam, Malesia, Indonesia and Philippines.

Uses. Shoot, bark, root etc. are of medicinal value.

4. *Picrasma* Blume

Trees or large shrubs, monoecious or dioecious; branches almost pithy, glabrous. Leaves imparipinnate; leaflets opposite or subopposite; stipules caducous, sometimes absent. Flowers 4 - 5-merous, in axillary long-peduncled compound cymes; bracts small, caducous; pedicels articulate. Sepals 4 - 5, free, persistent. Petals 4 - 5, longer than sepals, valvate, persistent. Stamens 4 - 5, hairy; anthers emarginate, versatile. Disk thick, pubescent, sometimes accrescent in fruit. Carpels 4 - 5, free, pubescent; styles connate above; stigma filiform. Ovules solitary, basal. Fruits 1 - 4, drupaceous, globose, wrinkled when dry; seeds with broad hilum and hard and thick testa.

Tropics of Asia and the New World with ca 8 species; 2 species in India.

KEY TO THE SPECIES

- | | |
|--|---------------------------------|
| 1a. Leaflets entire; flowers 4-merous | 1. <i>P. javanica</i> |
| b. Leaflets serrate or crenate; flowers 5-merous | 2. <i>P. quassioides</i> |

1. *Picrasma javanica* Blume, *Bijdr.* 5: 248. 1825; A.W. Bennett in Hook.f., *Fl. Brit. India* 1: 520. 1875, incl. var. *mishmiensis* A.W. Bennett. *P. nepalensis* J.J. Bennett, *Pl. Java Rar.* 201. 1844. *P. andamanica* Kurz ex A.W. Bennett, *l.c.* 520.

Asm.: *Bonposhla*, *Nimtitta*, *Tita-sasi*; *Nag.:* *Aeo*; *Nep.:* *Teju*.

Trees, 6 - 20 m high; bark thin, dark brown or black and more or less smooth, fissured, very bitter. Leaves 8 - 25 cm long; petioles 2 - 7 cm long; leaflets 3 - 7, opposite, oblong-ovate or elliptic or obovate-elong, cuneate at base, abruptly acuminate at apex, entire or wavy or wrinkled at margins, 5 - 15 x 1 - 6 cm; glabrous; lateral nerves 3 - 8 pairs; petiolules 1 - 5 mm long; stipules broadly ovate-orbicular, rounded at apex, acute at base, 1 - 1.5 cm long. Inflorescence axillary cymose panicles, 6 - 20 cm long; bracts obovate, caducous. Flowers 4-merous, dull-white; pedicels 8 - 13 mm long, villous, elongating in

fruits. Sepals ca 1 mm long, glabrous to puberulous, triangular to ovate, acute. Petals ovate-oblong, or oblong, 2-3 x 1-1.5 mm (male), 3-6 x 3-4 mm (female). Disk 4-lobed, hairy. Stamens 4, 2-5 mm long; filaments short, subulate, hairy. Carpels 4; styles ca 2 mm long. Drupes 1-4, ovoid-subglobose, shining, black when ripe, seated on cushion-like disk and supported by accrescent coriaceous petals and sepals.

Fl. & Fr. Throughout the year.

Distrib. India: Orissa, W. Bengal, Sikkim, Arunachal Pradesh, Assam, Manipur, Tripura and Meghalaya.

Nepal, Bangladesh.

Uses. Bark contains bitter principles allied to quassin and is used as febrifuge.

Notes. *P. nepalensis* Bennett differs from *P. javanica* Blume in being smaller trees with slender panicles and usually narrower leaflets having more elongated apices. But these characters are not constant and following King (in *J. Asiat. Soc. Bengal* pt. 2, Nat. Hist. 62: 228. 1893), the former is reduced to synonym of *P. javanica*. *P. andamanica* Kurz ex A. W. Bennett can hardly be distinguished from *P. javanica* (King l.c.).

2. *Picrasma quassioides* (D. Don) J.J. Bennett, *Pl. Java Rar.* 198. 1844; A.W. Bennett in Hook.f., *Fl. Brit. India* 1: 520. 1875. *Simaba quassioides* D. Don, *Prodr. Fl. Nepal.* 248. 1825.

Beng.: *Bhurungi*; Hindi: *Bharangi*, *Charangi*, *Kâshshing*; Kh.: *Dieng-khlang*; Nep.: *Shamabaringi*; Punj.: *Hala*, *Puthorin*, *tithu*.

Trees or large scrambling shrubs, up to 12 m high; branches stout, dotted with circular lenticels; bark more bitter, dark grey to black, smooth or slightly rough; young parts brown-tomentose. Leaves 30-35 cm long, lyrate imparipinnate; petioles 1.5-5 cm long, puberulous; leaflets 9-15, opposite, or sub-opposite, ovate to lanceolate or obovate, oblique at base, long acuminate at apex, serrate, 4-12 x 1.5-4(-6) cm, membranous, glabrous with age; lowest pair much smaller and stipuliform; lateral nerves 7-10 pairs, prominent beneath, pellucid, nervules finely reticulate; petiolules 1.5-3.5 mm long. Flowers pale greenish, in axillary corymbose puberulous panicles ca 15 cm long; pedicels 5-10 mm long, articulate below middle. Sepals small, ca 1 mm long, imbricate. Petals 3-2.5 x ca 2 mm, ovate or oblong-obovate, much enlarged and coriaceous in fruit. Stamens equalling petals; filaments strap-shaped, thick hairy at base. Drupelets 1-5 together, obovoid or globose, ca 5 mm, black when ripe; seed single, erect.

Fl. & Fr. Feb. - Sept.

Distrib. India: Subtropical Himalayas between 900 and 2500 m, Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh. Arunachal Pradesh, Assam, Nagaland, Meghalaya.

Nepal, Bhutan, S. China, Japan, Korea.

Uses. The bitter bark and wood are used as substitute for commercial *Quassia* bark. The bark and leaves are used as febrifuge and insecticide.

5. *Samadera* Gaertner

Small trees. Leaves alternate, simple, entire, petioled with scattered concave glands usually on lower surface. Flowers bisexual, in axillary or terminal umbels. Calyx small, 3-5-lobed, imbricate, glandular. Petals 3-5, coriaceous, free, elongate, imbricate. Disk large, obconic. Stamens 6-10, included, with basal scales and slender filaments; anthers lanceolate. Ovary of 4-5 free, distinct carpels; ovules solitary, pendulous; styles free at base, more or less united above; stigmas acute. Fruits of 1-5 large compressed drupes, rigid, winged; seeds solitary.

India, Tropical areas of Malesia, Sri Lanka, Myanmar, Cambodia, Thailand, Laos, Vietnam, Philippines, Indonesia, Bismarks & Solomon Islands; 2 species, 1 in India.

Notes. Nootboom in *Fl. Males.* ser. I. 6: 199. 1962 reduces this genus to a section under *Quassia*; but *Samadera* with simple leaves is treated here as a genus distinct from *Quassia* with compound leaves.

Samadera indica Gaertner, *Fruct.* 2: 352. t. 156. f. 3. 1791; A.W. Bennett in Hook.f., *Fl. Brit. India* 1: 519. 1875. *S. lucida* (Wallich) Planchon in Hooker's *J. Bot. Kew Gard.* Misc. 5: 562. 1846. *Quassia indica* (Gaertner) Nooteb. in Steenis, *Fl. Males.* ser. I. 6: 199. 1962; Nicolson et al. *Interpr. Hort. Malab.* 245. 1988.

Kan.: *Nipa*, *Samadera*; *Mal.:* *Karinjotta*; *Mar.:* *Kokhanji*; *Tam.:* *Nibam*, *Niepa*, *Karinjottei*.

Evergreen shrubs or low glabrous trees, 10-12 m high with stout branches. Leaves, elliptic-oblong, acute-acuminate at apex, sub-acute to rounded at base; 9-30 x 3.5-11 cm, coriaceous, glabrous, glossy, reticulately nerved. Petioles 1-2 cm long, stout. Flowers 20 or more in an umbelliform glabrous or puberulous inflorescence; peduncles 7-30 cm long, flattened, thickened at apex; pedicels 10-15 mm long, longer in fruits (up to 3 cm), articulate in lower half; bracts minute. Calyx 2-3 mm long, 4-lobed; lobes thick, about as long as tube or longer, semiorbicular, puberulous outside. Petals 4, free, oblong-oblancheolate, obtuse, 15-20 x 4 mm, dorsally pubescent, white or pale yellow or purplish. Stamens 8, 8-12 mm long, pubescent; anthers lanceolate-oblong, 2-3 mm; filaments puberulous. Ovary free, ca 2 x 2 mm, puberulous; styles glabrous, up to 2 mm

long. Drupes 1 - 4, 4 - 6 x 2.5 - 4 cm; flattened, with glands on pericarps, smooth, reticulate; seeds large.

Fl. & Fr. Almost throughout the year.

Distrib. India: Evergreen forests and along back-waters and sandy places in W. Ghats and Deccan plateau. Maharashtra, Goa, Karnataka, Kerala and Andaman Islands.

Myanmar, Sri Lanka.

Uses. It is the source of niepa bark of commerce; wood used for packing cases and cheap and light furniture and in match industry. Most parts are of medicinal value.

INTRODUCED SPECIES

Quassia amara L., Sp. Pl. (ed. 2) 553. 1762, app. 1679. 1763; Nooteb. in Steenis, Fl. Males. ser. I. 6: 199. 1962.

Fl.: July - March; *Fr.*: Aug. - April.

Native of tropical America from Brazil to Mexico and West Indies. Introduced and often naturalised in tropical countries of the Old World for medicinal and ornamental purposes; grown in gardens in India for the attractive foliage and red showy flowers.

EXCLUDED SPECIES

Eurycoma longifolia Jack. in Malayan Misc. 2: 45. 1822; A.W. Bennett in Hook.f. Fl. Brit. India 1: 521. 1875; Nooteb. in Steenis, Fl. Males. ser. I. 6: 205. 1962.

A.W. Bennett in Hook. f. (l.c.), Kurz (For. Fl. Burma 1: 202. 1877) and Nooteboom (l.c.) report occurrence of this species in the Andaman Islands, probably based on the specimen collected by Helfer. It may be noted that most of the collections of Helfer from Tenasserim (Myanmar) are mixed up with his collections from Andaman as is evidenced from the label "Tenasserim and Andamans". It is most likely that the specimen of above species of Helfer might be from Tenasserim. King (in J. Asiat. Soc. Bengal pt; 2. Nat. Hist. 62: 230. 1893) holds similar view. Further, inspite of intensive and extensive explorations, this species could not be collected from the Andaman and Nicobar Islands.

SURIANACEAE

(E. Vajravelu and R.K. Basak)

Shrubs or small trees; branches densely glandular-hairy. Leaves simple, sessile, hairy. Flowers 5-merous, bisexual, perfect, hidden by leaves, solitary, or 2 - 4 in axillary or terminal cymes; bracts foliaceous. Sepals lanceolate, imbricate. Petals obovate or elliptic. Stamens 10, obdiplostemonous; filaments subulate; disk inconspicuous. Carpels 5, free; styles filiform; stigma capitellate; ovules 2 in each locule. Fruits 5 or fewer, 1-seeded, pubescent, enclosed by calyx.

Pantropical, on sea shores; unigeneric.

Suriana L.

Pantropical, usually on small isolated islands or coral islets and atolls especially in the Pacific and Indian Oceans; unispecific.

Notes. Bentham & Hooker (Gen. Pl. 1: 303. 1862), Solereder (Syst. Anat. Dicot. 207 - 213. 1899 & in Loesener & Solereder in Verh. Bot. Vereins. Prov. Brandenburg 47: 35 - 62. 1905), Engler (in Engler & Prantl, Nat. Pflanzenfam. ed. 2, 19 a: 367. 1931), Cronquist (in Brittonia 5: 129. 1944), Brizicky (in J. Arn. Arb. 43: 176. 1962), Nooteboom (in Steenis, Fl. Males. ser. I, 6: 196. 1962) and Hutchinson (Fam. Fl. Pl. 440. 1973) keep *Suriana* in the family Simaroubaceae. But Arnott (in Wight & Arn., Prodr. 360. 1834), Jadin (in Ann. Sci. Nat. Bot. 8, 13: 224 - 226 & 303. 1901), Record & Hess (Timb. New World 521 - 522. 1949), Gutzwiller (in Bot. Jahrb. Syst. 8: 1 - 49. 1961) Nooteboom (in Blumea 14: 309-315. 1966) Cronquist (Evol. Class. Fl. Pl. 265. Integr. Syst. Class. Fl. Pl. 583. 1981; Takhtajan (Fl. Reg. World 333. 1986) and Heo & Tobe (in J. Pl. Res. 107: 29-37. 1994) consider the genus as a representative of a distinct unigeneric family Surianaceae which is followed here.

Suriana maritima L., Sp. Pl. 284. 1753; A.W. Bennett in Hook. f., Fl. Brit. India 1: 522. 1875.

Shrubs or small trees, 2 - 3 m high, littoral, without a bitter taste. Leaves crowded at ends of branchlets, exstipulate, linear-spathulate, entire, 15 - 30 x 2 - 3 mm, with dense simple, glandular hairs, nerves inconspicuous with tuberculate scars. Inflorescence 2 - 4-flowered; bracts lanceolate, 4 - 8 x 1 mm; pedicels ca 1 cm long, articulate. Sepals connate at base, ovate-lanceolate to ovate oblong, 5 - 10 x 2 - 3 mm. Petals obovate-oblong to orbicular, shortly clawed, as long as sepals, bright yellow. Stamens unequal; filaments hairy below; anthers emarginate, ca 1 mm long. Ovary obovoid, ca 1 mm long, hairy; styles ca 5 mm long, glabrous except at base; stigma free, small, inconspicuous. Fruits 2 - 3 mm long, consisting of 3 - 5 achene-like drupelets.

Fl. Sept. - Feb.; *Fr.* Nov. - May.

Distrib. India: Found along sea coast, usually rare but locally often very abundant in islands or small islets forming thickets along sandy beach and coral coasts. Tamil Nadu (Rameswaram & Krusadi Islands); Andaman & Nicobar islands; Lakshadweep (Minicoy, Kavarthi, Agathi, Betra Por).

Throughout tropics.

OCHNACEAE

(B. Safui and M.P. Nayar)

Undershrubs, shrubs, or trees with watery juice. Leaves simple, alternate, glabrous, coriaceous; stipules present. Inflorescence terminal, axillary, or on short racemose, cymose, compound or thyrsoid panicles, bracteate. Flowers one to many, regular, bisexual, conspicuous; pedicels articulate. Sepals 4-5, free, imbricate, persistent. Petals 4-10, free, deciduous, imbricate. Stamens 4 to many, inserted at base of or on disc; filaments usually persistent; anthers basifixed, dehiscing by apical pores or longitudinally. Ovary deeply lobed; carpels 2-10, superior, free with 1 ovule or fused with 2 to many ovules per carpel; styles simple, subulate, straight or incurved; stigma simple, terminal, free or fused. Fruits drupes, berries or septicidal capsules; seeds solitary to numerous with or without endosperm.

Tropics and subtropics, mostly in Africa and Asia, 40 genera and 600 species; 3 genera and 7 species in India.

Literature. KANIS(1968). A revision of the Ochnaceae of Indo-Pacific area. *Blumea* 16(1): 1-82.

KEY TO THE GENERA

- 1a. Flowers in conferted cymose clusters of umbelloid appearance; anthers opening with 2 longitudinal slits 1. *Brackenridgea*
- b. Flowers not in conferted clusters, usually thyrsoid or cymose 2
- 2a. Leaves with distinct intramarginal nerves; stamens 10 2. *Gomphia*
- b. Leaves without intramarginal nerves; stamens many 3. *Ochna*

1. *Brackenridgea* A. Gray

Trees with spreading branches. Stipules small, free, often lacinate, caducous. Leaves shining above, coriaceous; nerves strongly curved upwards, nervelets branching more or less transversely. Inflorescence thyrsoid or short cymes of umbelloid appearance; rachis often growing vegetatively after flowering; bracts many, small, caducous; pedicels filiform, caducous. Flowers with hemispherical turns which turns red in fruit. Sepals 5, fleshy, red in fruit. Petals 5 (-10) white or yellow. Stamens 10 or more with subterete filaments; anthers dehiscing from apex downwards by longitudinal slits. Ovary obovoid, carpels 5(-10); stigma small. Fruits 1-2(-5), reddish, turning black when ripe.

5 species in S. and S.E. Asia (Andamans, Kochang, Sumatra, Malesia, New Guinea, Queensland and Fiji.); 1 species in India.

Brackenridgea hookeri (Planchon) A. Gray, *New Gen. Pl.* 1853 & in *Proc. Amer. Acad. Arts & Sc.* 3: 51. 1857. *Gomphia hookeri* Planchon in *Hooker's London J. Bot.* 6:

3. 1847; A.W. Bennett in Hook.f., Fl. Brit. India 1: 525. 1875. *G. umbellata* Hook. f. ex A.W. Bennett, l.c. 526. J. Bot. Kew Gard. Misc. *Ochna hookeri* (Planchon) Kuntze, Rev. Gen. Pl. 1: 106. 1891. *Oouratia hookeri* (Planchon) Burkill in Bull. Misc. Inform. 1935: 318. 1935.

Trees, up to 30 m. Leaves oblong to lanceolate, obtuse or acute or acuminate at apex, tapering at base, margins entire, denticulate in young plants, 6 - 15 x 2 - 5 cm. Inflorescence terminal, many-flowered, sessile cymes; bracts small, ovate-lanceolate, entire or pectinate; pedicels 10 - 15 mm long, longer in fruits. Flowers 10 - 20. Sepals ovate to obovate, 4 - 5 x 1 - 2 mm. Petals 5, ovate to obovate, 3 - 5 x 1 - 2 mm. Torus ca 1 mm across, becomes larger in fruits. Stamens 10; filaments 1 - 1.5 mm, anthers 1.5 - 2 mm. Carpels usually 5; styles 1.5 - 3 mm long, longer in fruits. Fruits ovoid, ca 6 x 5 mm, smooth, turning black on maturity.

Fl. April.

Distrib. India: Andaman Islands.

Thailand, Malesia and Borneo.

2. *Gomphia* Schreber

Shrubs or small trees, with spreading branches. Leaves alternate, simple, coriaceous, shining; veins straight, parallel, curved upwards near margin, veinlets reticulate; stipules small, intrapetiolarly united, caducous. Inflorescence axillary or terminal thyrses; peduncles short, persistent, bracteate. Flowers with a short, 5-ribbed gynophore, enlarging in fruit; pedicels filiform, articulate. Sepals 5, tinged pinkish, enlarging in fruit. Petals 5, yellow creamy or white. Stamens 10; filaments terete, short; anthers opening with 2 apical pores. Ovary 5-lobed, obovoid; lobes unilocular; styles connate; stigma simple. Fruits 1 - 2(-5), yellowish, turning dark-purple or blue-black when ripe; seed single, exalbuminous.

30 - 35 species in Africa, Madagascar, S.E. Asia (S. China, India, Sri Lanka, Thailand, Vietnam, Sumatra and Malesia); 1 species in India.

Gomphia serrata (Gaertner) Kanis in Taxon 16: 422. 1967, in Blumea 16(1): 53. 1968 & in Steenis, Fl. Males. ser. I. 7: 105. 1972. *Meesia serrata* Gaertner, Fruct. 1: 344. t. 70. f. 6. 1788. *Gomphia angustifolia* Vahl, Symb. Bot. 2: 49. 1791; A.W. Bennett in Hook.f., Fl. Brit. India 1: 525. 1875. *G. malabarica* DC., Prodr. 1: 736. 1828. *Walkeria serrata* Willd. in DC., l.c. *Oouratia angustifolia* (Vahl) Baillon, ex Laness, Pl. Unit. Col. Fr. 607. 1886. *Ochna angustifolia* Kuntze, Rev. Gen. Pl. 1: 106. 1891. *O. zeylanica* Lam. Encycl. Meth. 4: 512. 1797.

Kan.: *Pundegida*; Mal.: *Chavakampu*, *Anai vilavu*, *Chokatti*, *Puachetti*; Tam.: *Gurunda Karpata*, *Ramanchi*.

Shrubs or small trees up to 25 m high. Leaves ovate to obovate-lanceolate, acute to acuminate at apex, tapering towards base, serrate along margins, 6 - 20 x 2 - 5 cm, glabrous; petioles 2 - 6 mm; stipules 3 - 6 mm. Inflorescences many-flowered terminal and axillary cymes; pedicels up to 1 cm long, longer in fruits. Flowers 0.8 - 1.6 cm across. Sepals free, ovate to elliptic, 4 - 6 x 2.5 - 3.5 mm, coriaceous, enlarged in fruit. Petals deciduous, obliquely obovate to broadly spatulate, 4.5 - 7 x 2.5 - 5 mm; yellow creamy or white. Torus ca 1 mm across, larger in fruiting. Stamens 10, subsessile. Ovary deeply 4 - 5-lobed, glabrous; style persistent, 3 - 5 mm, long in fruiting; stigma minute. Fruits ca 8 x 6 mm, smooth, shining.

Fl. & Fr. Almost throughout the year.

Distrib. India: W. Ghats from sea level to 1500 m. Karnataka, Tamil Nadu and Kerala.

Sri Lanka & S.E. Asia (Thailand, Cambodia, Sumatra, Malay Peninsula, Java, Philippines, Celebes).

Uses. Wood is used as poles or planks for construction of houses. Decoction of roots and leaves bitter, used as stomachic and anti-emetic tonic. Young branches are used against tooth-ache.

3. *Ochna* L.

Shrubs or small trees with spreading branches. Leaves alternate, shining, chartaceous, many-nerved; stipules 2, caducous. Inflorescence simple cymes, lateral or terminal thyrses or panicles; peduncles sometimes branching once or twice after flowering. Flowers conspicuous, bracteate; pedicels filiform. Sepals 5, imbricate, turning red in fruits. Petals 5(-10), in two whorls, yellow. Stamens many in 2 or more whorls; filaments subterete; anthers opening with 2 apical pores. Carpels 5 - 10(-15), lobed; lobes unilocular; styles connate or free; stigmas simple or capitate. Fruits 1 - 5, greenish, turning black when ripe.

About 85 species in tropics in Africa, C. America, S. and S.E. Asia (India, Nepal, Bangladesh, Myanmar, Sri Lanka, Malesia, Thailand, Cambodia, Vietnam, Borneo, Java, Sumatra, Philippines); 5 species in India.

Notes. Kanis (in *Blumea* 16(1): 1 - 82. 1968) reduced *O. pumila* and *O. gamblei* to varieties under *O. obtusata*. But there are remarkable differences in the structure of floral as well as vegetative parts in these species. Their distribution pattern is also characteristic. *O. pumila* is found mainly in the N.E. Himalayan states, whereas *O.*

gamblei is found mainly in the coastal states of S.E. parts of the country. Considering these points the above two species are maintained as such, without reducing to varieties.

KEY TO THE SPECIES

- | | |
|--|--------------------------|
| 1a. Petals 5 - 10 x 2 - 5 mm, as long as sepals | 3. <i>O. lanceolata</i> |
| b. Petals 15 - 25 x 7.5 - 15 mm, larger than sepals | 2 |
| 2a. Flowers 2 - 3; peduncles more than 2 cm | 5. <i>O. pumila</i> |
| b. Flowers many; peduncles less than 2 cm long | 3 |
| 3a. Sepals usually reflexed in fruits; anthers as long as or slightly shorter than filaments | 2. <i>O. integerrima</i> |
| b. Sepals spreading or inflexed in fruits; anthers longer than filaments | 4 |
| 4a. Leaves waxy, glaucous, obtuse or rounded at apex | 1. <i>O. gamblei</i> |
| b. Leaves not waxy or glaucous, acute or acuminate at apex | 4. <i>O. obtusata</i> |

1. *Ochna gamblei* King ex Brandis, Indian Trees 128. 1906; Gamble, Fl. Pres. Madras 1: 166. 1915. *O. obtusata* DC. var. *gamblei* (King ex Brandis) Kanis in Blumea 16(1): 1 - 82. 1968. *O. beddomei* Gamble, l.c. & in Bull. Misc. Inform. 1916: 34. 1916.

Hindi: *Rakat-rohan*; Mar.: *Sonari-chattu*; Tam.: *Koorykaly*; Tel.: *Kuka-moi*.

Large shrubs or small trees; branchlets stout; bark thick, whitish. Leaves crowded at ends of branchlets, almost sessile, obovate, oblong or broadly elliptic, obtuse or rounded at apex, crenate, serrate or subentire along margins, 6 - 14 x 3.5 - 7 cm, coriaceous, waxy, glaucous; stipules 3 - 4 mm. Inflorescence compound, many-flowered. Flowers 3 - 4.5 cm across; pedicels slender, 2 - 4 cm long, longer in fruiting. Sepals 5, ovate or ovate-oblong, 10 - 20 x 5 - 10 mm. Petals 5 - 8, obovate, yellow. Stamens 35 - 70; anthers 6 - 8 mm, more than twice the length of filaments. Ovaries 5 - 10, lobed; styles 8 - 12 mm, connate. Fruits 3 - 5.

Fl. & Fr. March - Oct.

Distrib. India: Orissa, Assam, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Endemic.

2. *Ochna integerrima* (Lour.) Merr. in Trans. Amer. Philos. Soc. n.s. 24(2): 265. 1935. Kanis in Blumea 16: 36. 1968 & in Steenis, Fl. Males. ser.1. 7: 199 1972. *Elaeocarpus integerrima* Lour., Fl. Cochinch, 338. 1790. *O. wallichii* Planchon, Fl. Cochinch. 338. 1790 et in Hooker's J. Bot. Kew Gard. Misc. 5: 650. 1846; A.W. Bennett in Hook.f., Fl. Brit. India 1: 524. 1875, incl. var. *parviflora* A.W. Bennett. *O. brevipes* Planchon, l.c. 652; A.W. Bennett in Hook.f., l.c. 525. *O. parviflora* Griffith, Not. Pl. Asiat. 4: 464. 1854. *O. squarrosa* Kurz, Rep. Andam. Isl. 74. 1870, non L. *O. andamanica* Kurz, l.c. 33. 1870 nom. nud.

Asm.: *Khindabeng*.

Undershrubs or small deciduous trees; branches slender. Leaves oblong-elliptic, lanceolate, or linear-lanceolate, usually chartaceous, acute or obtuse at both ends, serrate or rarely crenate along margins, 5 - 20 x 2 - 7 cm; petioles 2 - 5 mm long; stipules 5 - 8 mm long. Inflorescence many-flowered, monochasial; pedicels 2 - 4 cm long. Sepals 5, ovate to ovate-oblong, 10 - 16 x 5 - 9 mm, turning dark red, reflexed in fruit. Petals deciduous, 5 - 6, rarely more, obovate, tapering at base, 15 - 25 x 8 - 15 mm. Torus swollen, larger in fruit. Stamens 30 - 60(-75); filaments unequal, persistent, filiform, 3 - 6 mm long. Carpels 5 - 10; style 10 - 15 mm long; stigma branched. Fruits 2 - 3(-5).

Fl. & Fr. March - June.

Distrib. India: Assam, Meghalaya and Andaman & Nicobar Islands.

Bangladesh, Myanmar and S.E. Asia.

Uses. The wood is used for huts making. The bark being bitter in taste yields a digestive tonic.

3. *Ochna lanceolata* Sprengel, Syst. Veg. 2: 597. 1825. *O. wightiana* Wallich ex Wight & Arn., Prodr. 152. 1834; A.W. Bennett in Hook. f., Fl. Brit India 1: 524. 1875. *O. heyneana* Wight & Arn., Prodr. 1.c. *O. moonii* Thwaites, Enum. Pl. Zeyl. 70. 1858.

Tam.: *Katharai, Silimbi*.

Large shrubs or small trees, much branched; branchlets covered with lenticels. Leaves ovate, oblong, lanceolate or elliptic, acute to rounded at both ends, crenate or subentire along margins towards base, 1.5 - 7 x 1 - 2.5 cm, subcoriaceous or shining; petioles 1 - 3 mm; stipules slender, 3 - 6 mm. Inflorescence simple, 1 - 3 (rarely up to 5)-flowered; pedicels filiform, up to 2.5 cm long. Flowers 1 - 2 cm across. Sepals 5, ovate-oblong, 7 - 10 x 3 - 5 mm. Petals 5, deciduous, ovate-oblong. Stamens 25 - 50; filaments 2 - 4 mm; anthers 2 - 5 mm. Carpels 5 - 7; styles 5 - 7.5 mm, longer in fruits; stigmas shortly branched. Fruits 1 - 3, up to 8 mm long.

Fl. & Fr. March - July.

Distrib. South peninsular India (Andhra Pradesh, Karnataka, Tamil Nadu and Kerala).

Sri Lanka.

Uses: Walking sticks are made from the branches.

4. *Ochna obtusata* DC. in Ann. Mus. Natl. Hist. Nat. 17: 411. 1811, *O. squarrosa* auct. non L. 1753: A.W. Bennett in Hook.f., Fl. Brit. India 1: 523. 1875. *O. cordata* Thwaites, Enum. Pl. Zeyl. 1: 70, 409. 1858. *O. grandiflora* Moon, Cat. Pl. Zeyl. 1: 41. 1824. *O. lucida* Lam., Encycl. Meth. 1: 510. 1797. *O. moonii* Thwaites, Enum. Pl. Zeyl. 1: 70. 1858, p.p.

Bhoj.: *Champa-baha*, Kan.: *Mudah*, *Narole*, *Ramatana-champaka*; Mar.: *Kanaka champa*; Or.: *Buin-champa*, *Koniari*, *Nobiniseri*, *Pata-champa*; Tam.: *Chilanti*, *Padalak-onai*, *Panjaram*, *Shengodu*, *Sherundi*; Tel.: *Sunari*, *Tammichetta*, *Yera-jammi*, *Yera-juvi*.

Shrubs or small trees; branchlets slender. Leaves very variable, elliptic, ovate or oblong, lanceolate, mostly acute to acuminate at apex, acute at base, serrate or denticulate along margins, 5 - 16 x 3 - 7 cm, chartaceous; petioles up to 5 mm long; stipules 3 - 8 mm long. Inflorescence many-flowered thyrses or umbellate in nature; peduncles 0.5 - 3 cm long. Flowers 3 - 4.5 cm across, pedicellate. Sepals ovate or ovate-oblong, 10 - 18 x 5 - 10 mm. Petals 5 - 10, deciduous, obovate, 10 - 25 x 7 - 15 mm. Torus hemispherical. Stamens 30 - 75; filaments up to 4 mm long; anthers 4 - 10 mm long. Ovaries 5 - 10; styles twisted, 8 - 12 mm long, longer in fruits, persistent. Drupes 3 - 5 on swollen torus.

Fl. & Fr. March - Aug.

Distrib. India: Uttar Pradesh, Bihar, Orissa, W. Bengal, Assam, Tripura, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Nepal, Bangladesh and Sri Lanka.

Uses. Root used as an antidote for snake-bite; decoction of root is given for certain menstrual complaints, also for consumption and asthma. Bark is used as digestive tonic and boiled leaves are used as an emollient cataplasm.

Notes. Very much variable in size and shape of leaves due to its occurrence at different ecological habitats from sea level to hilly areas up to 1200 m especially in Western and Eastern Ghats and in southern foot hills of Central Himalayas.

5. *Ochna pumila* Buch.-Ham. ex DC. in D. Don, Prodr. Fl. Nepal. 1: 736. 1824; A.W. Bennett in Hook.f., Fl. Brit. India 1: 524. 1875. *O. obtusata* DC. var. *pumila* (Buch.-Ham. ex DC.) Kanis in Blumea 16(1): 1 - 82. 1968. *O. collina* Edgew. in Trans. Linn. Soc. London 20: 43. 1846.

Bhoj. & Or.: *Champa-baha*, *Buhin*, *Champa*, *Tindu*; Hindi: *Simalkata*.

Small shrubs up to 70 cm high, branching at base; roots woody, tuberous. Leaves oblanceolate, obovate-oblong, obtuse to acute at apex, cuneate at base, serrate along margins, 8 - 16 x 3 - 8 cm, coriaceous; petioles up to 7 mm; stipules 6 - 12 mm.

Inflorescence 2 - 3-flowered cymes; peduncles 3 - 8 cm long. Sepals ovate to ovate-oblong, 10 - 18 x 5 - 10 mm. Petals deciduous, obovate, 15 - 25 x 7 - 15 mm, bright yellow. Torus swollen, enlarged in fruits. Stamens many; anthers 3 - 4 mm, almost equal or slightly longer than filaments. Ovary 5 - 10-lobed; styles twisted, connate, 8 - 15 mm. Drupes 3 - 5, greenish, turning blackish-red to black on maturity.

Fl. & Fr. March - Aug.

Distrib. India: Mainly in North and North eastern parts and Himalayan states. viz. Uttar Pradesh, Bihar, Orissa, W. Bengal, Assam, Sikkim, Madhya Pradesh, Karnataka and Tamil Nadu.

Nepal.

Uses. Roots pounded and infusion used as medicine by Rabbahs and Mundas. Leaves are said to be used as poultice for lumbago and ulcers.

BURSERACEAE

(V. Chithra and A.N. Henry)

Trees or shrubs, secreting resin or oil. Leaves alternate, rarely opposite or spiral, usually more or less crowded at the ends of branchlets, imparipinnate, rarely unifoliate. Inflorescence racemose or paniculate, axillary or terminal, often crowded at the ends of branchlets. Flowers small, unisexual or bisexual, actinomorphic, 3 - 6-merous, greenish to creamy. Bracts and bracteoles usually deltoid to subulate. Sepals variously connate, imbricate or valvate. Petals free or variously connate, imbricate or valvate. Disk annular or cupular, free or adnate to calyx, intrastaminal, crenate, rarely pilose. Stamens usually twice as many as petals, obdiplostemonous when two whorls are present, only slightly reduced in female flowers; filaments free or more or less united, inserted below or on the disk, sometimes pubescent; anthers bilocular, dorsifixed, introrse, dehiscing longitudinally. Ovary superior, 2 - 5 locular, ovules 2 per locule on axile placenta, usually pendulous; style simple; stigma capitate or slightly lobed; gynoecium reduced to a pistillode, or absent in male flowers. Fruits drupaceous, indehiscent, with 2-5 pyrenes, or dehiscent and pseudocapsular; seeds solitary, pendulous, nonendospermous, contortuplicate; cotyledons fleshy, containing oil; testa membranous.

Throughout the tropics; ca 16 genera and 550 species, 7 genera and 19 species in India.

Literature. ENGLER, A. (1883). Burseraceae In: A. & C. DC., Monogr. Phan. 4: 1-169. ENGLER, A. (1931). Burseraceae In: ENGLER, A. & K. PRANTL, Nat. Pflanzenfam. ed. 2, 19a: 405-456. LEENHOUTS, P.W. (in collaboration with KALKMAN, C. & H.J. LAM 1956). Burseraceae. In: STEENIS, F. Males. I, 5: 209-296.

KEY TO THE GENERA

- | | |
|--|----------------------|
| 1a. Fruits capsular | 1. <i>Boswellia</i> |
| b. Fruits drupaceous | 2 |
| 2a. Flowers 3-merous | 3 |
| b. Flowers 4-6-merous | 4 |
| 3a. Stipule present; fruits ellipsoid; pyrene thick-walled, bony | 3. <i>Canarium</i> |
| b. Stipule absent; fruits ovoid, slightly oblique; pyrene thin-walled, papery to crustaceous | 5. <i>Dacryodes</i> |
| 4a. Leaf rachis winged | 2. <i>Bursera</i> |
| b. Leaf rachis not winged | 5 |
| 5a. Disk annular | 7. <i>Protium</i> |
| b. Disk cup-shaped | 6 |
| 6a. Disk adnate to calyx | 6. <i>Garuga</i> |
| b. Disk free | 4. <i>Commiphora</i> |

1. *Boswellia* Roxb. ex Colebr.

Trees; bark papery, greenish or ash-coloured, peeling off into thin flakes. Leaves alternate, ex-stipulate, imparipinnate; leaflets opposite or subopposite. Racemes axillary, usually paniced. Flowers bisexual, small, white or pink. Calyx 5-lobed, persistent. Petals 5, narrowed at base, imbricate. Disk annular, crenate. Stamens 10, alternately long and short, inserted on or at base of disk. Ovary sessile, 3-locular; ovules 2 in each locule, pendulous; style short, grooved; stigma 3-lobed. Fruits capsular, 3-gonous, septicidal; pyrenes 3, 1-seeded, bony, cordate with a long apex, surrounded by a broad membranous wing; seeds compressed, winged; cotyledons contortuplicate, multifid.

Africa, Asia, mostly in tropical regions; ca 24 species; 2 species in India.

KEY TO THE SPECIES

- 1a. Young shoots and leaf rachis pubescent or puberulous; panicles shorter than leaves; peduncles and pedicels pubescent; disk free from calyx; sepals and petals pubescent 2. *B. serrata*
 b. Young shoots and leaf rachis glabrous; panicles longer than leaves; peduncles and pedicels glabrous; disk adnate to calyx; sepals and petals glabrous 1. *B. ovalifoliolata*

1. *Boswellia ovalifoliolata* Balakr. & Henry in J. Bombay Nat. Hist. Soc. 58: 546. 1961; Ellis, Fl. Nallamalais 1: 86. 1987.

Trees 7 - 10 m high; bark papery, ash-coloured, peeling off in thin flakes. Leaves 9 - 25 cm long; leaflets 9 - 13, ovate-oblong, 1-7.4 x 0.7 - 5.2 cm, glabrous, glaucous beneath, inaequilateral and rounded at base, entire or slightly wavy along margins, retuse, obtuse or rounded at apex, nerves reddish. Panicles axillary, up to 32 cm long. Flowers pale rose, mildly fragrant. Calyx lobes broadly 3-angular, ca 1 x 2 mm, glabrous, persistent. Petals obovate, ovate-oblong to oblong, 4 - 5 x 2.5 - 3 mm, acute or obtuse at apex, papillose outside. Stamens 2.75 - 3 mm long, papillose; filaments subulate; anthers versatile. Disk annular, crenate, fleshy. Pistil ca 3 mm long. Capsules 1 - 1.5 x 0.5 - 0.8 cm.

Fl. & Fr. Feb. - April.

Distrib. India: Dry deciduous forests in Eastern Ghats up to 400 m. Andhra Pradesh.

Endemic.

2. *Boswellia serrata* Roxb. ex Colebr. in *Asiat. Res.* 9: 379. t. 5. 1807; A.W. Bennett in Hook. f., *Fl. Brit. India* 1: 528. 1875. *B. serrata* Roxb. ex Colebr. var. *glabra* (Roxb.) A.W. Bennett in Hook. f., *Fl. Brit. India* 1: 528. 1875. *B. glabra* Roxb., *Pl. Coromandel* 3: t. 207. 1811.

Beng.: *Kundro, Luban, Salai*; Guj.: *Mukul-salai*; Hindi: *Luban, Salai, Salhe, Salpe*; Kan.: *Chitta, Maddi*; Mal.: *Vella-kundurukkam*; Mar.: *Salai*; Sans.: *Kundurur, Sallaki*; Tam.: *Guggulumaram, Kundrikam, Kundurukkan-pishin, Kungiliam, Parangisambrani*; Tel.: *Andaka, Anduga-pisunu, Tellaguggilamu*; Eng.: Indian olibanum.

Trees; 6-20 m high; branchlets with annular swelling at intervals. Leaves 15.5-44 cm long; axis pubescent or puberulous; leaflets 8-23, variable in size, shape and degree of pubescence (sometimes the lowermost pair much smaller than the others, ovate-lanceolate, oblong-ovate or elliptic, 0.8 - 9.4 x 0.4 - 3.5 cm, coriaceous, oblique, cuneate, rounded at base, crenate-serrate, sometimes entire or repand along margins, acute, obtuse or retuse, mucronate at apex. Panicles axillary, up to 21 cm long; bracts subulate, pubescent, caducous. Flowers pink, or white with pinkish tinge, fragrant. Calyx tube broadly campanulate, 1.5 - 3 x 2.5 - 3 mm; calyx-lobes triangular-ovate, pubescent, persistent. Petals ovate-oblong, 5 - 7 x 2.5 - 4 mm, shortly clawed, obtuse, inflexed at apex, pubescent outside except margins. Stamens 2.5 - 5 mm long, glabrous, pubescent or puberulous; anther lobes oblong; connective produced beyond the anther lobes. Pistil ca 4 mm long; stigma capitate. Capsules 3-gonous, 1.2 - 2.4 x 1 - 1.4 cm.

Fl. Jan. - May, Sept. - Dec.; *Fr.* April - Aug., Nov. - March.

Distrib. India: On dry hills and slopes, on gravelly soils at altitudes 275 - 900 m.

Punjab, Uttar Pradesh, Madhya Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu.

Endemic.

2. *Bursera* Jacq. ex L.

Trees. Leaves uni- or bipinnate, rarely unifoliolate; leaflets petiolulate, obtuse or retuse, entire or serrate. Inflorescence a panicle. Flowers small, bisexual or unisexual. Sepals 3 - 6, connate at base, imbricate. Petals 3 - 6, oblong-ovate, often much longer than sepals, reflexed or spreading, valvate. Stamens 6 - 12, free; anthers oblong-ovate. Disk annular, crenate. Ovary sessile, ovoid-subglobose, 3 - 5-locular; ovules 2 in each locule; style short or absent; stigmas 3 - 5, obtuse. Drupes globose or slightly oblong, pyrenes 3 - 5, 1-seeded; cotyledons foliaceous.

Mostly in tropical America, ca 80 species; one species in India.

Literature. ENGLER, A. (1931). In: ENGLER, A. & K. PRANTL, Nat. Pflanzenfam. ed. 2, 19a: 423. BULLOCK, A.A. (1936). Contributions to the flora of Tropical America: XXVII. Notes on the Mexican species of the genus *Bursera*. Bull. Misc. Inform. 1936: 346-387.

Bursera penicillata (Sesse & Moc. ex DC.) Engl. in Bot. Jahrb. Syst. 1: 44. 1881 & in A. & C. DC., Monogr. Phan. 4: 52. 1883; Hussain et al. in Indian Forester 100(5): 315-319. 1974. *Elaphrium penicillatum* Sesse & Moc. ex DC., Prodr. 1: 724. 1824. *Bursera delpechiana* Poiss. ex Engl. in A. & C. DC., Monogr. Phan. 4: 53. 1883.

Eng.: *Linaloe* or *Lignaloe tree*, *Indian lavender tree*.

Small, deciduous trees or shrubs, 5-6 m high, dioecious; female trees slightly smaller than the male ones; bark brownish, smooth, lenticellate with resin ducts; vegetative and floral buds arise from axils of bud scales; bud scales in two rows. Leaves alternate, imparipinnate, (3-) 5-9-foliolate, up to 15 cm long, those of male trees bigger; rachis winged, sparsely pilose with mixed glandular hairs; leaflets sessile to shortly petiolulate, ovate or rhomboid-ovate, ca 5.5 x 2.2 cm, minutely pubescent above, villous beneath; rounded or abruptly attenuate at base, serrate-crenate in the upper region and entire below along margins, acute at apex; terminal leaflet larger than the lateral ones. Inflorescence a paniculate cyme, axillary or pseudo terminal; peduncles 8-10 cm long, branched, pubescent. Flowers unisexual or bisexual, actinomorphic, 4-merous, rarely 5-merous, creamy white, fragrant; male flowers larger than the female ones; bracts subtending branches linear-lanceolate, those subtending flowers minute, subulate, both glandular-hairy. Sepals 4, deltoid, ca 1 mm long, more or less connate at base, glandular hairy outside. Petals oblong, ca 3 mm long, acute, half deflexed, densely villous with mixed glandular hairs, smaller in size in female flowers. Stamens 8, 2-3 mm long; obdiplostemonous; filaments dilated at base; anthers dorsifixed. Staminodes 8 in female flowers, 1.5 mm long; filaments as long as anthers, dilated and attached to disk; anther lobes twisted. Disk annular, 8-lobed, crenate. Ovary superior, conical, laterally compressed, bilocular; ovules 2 in each locule in axile placentation; style simple; stigma bifid. Pistillode minute in male flowers. Fruits drupaceous, ovoid, sometimes 3-lobed, brown when mature, 1-seeded, one of the locules invariably suppressed; seeds nonendospermous.

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

Distrib. Native of Mexico. Established at Tatgunni near Bangalore. Cultivated at widely separated areas in S. India.

Uses. Oil obtained from the wood and fruits is a colourless to pale yellow liquid of pleasant odour, used in modern perfumery, for flavouring foods and beverages. It is chiefly used by the soap and cosmetics industry.

3. *Canarium* L.

Tall trees, rarely shrubs or (pseudo-) lianas. Leaves large, alternate, imparipinnate, rarely 1-3-foliolate; stipulate or ex-stipulate; leaflets opposite, slightly oblique at base, entire to dentate or serrate along margins, acuminate at apex; the lowest leaflets often

stipuliform. Inflorescence axillary or terminal, sometimes pseudoterminal, branched panicle, thyrsoid (sometimes reduced to racemes or spikes, especially the female ones). Flowers bracteate, 3-merous, unisexual, or bisexual. Calyx cupular or urceolate; lobes deltoid, valvate, persistent, more or less funnel-shaped or flat with undulate margins in fruit. Petals free, oblong or obovate with a small inflexed apiculum, valvate or imbricate, fleshy and thick except the base and margin, creamy white. Stamens 6, rarely 3; filaments free or connate at base, often adnate to disk; anthers oblong-lanceolate, dorsifixed, sterile in female flowers. Disk intrastaminal, 6-lobed; strongly developed in male flowers. Ovary in female flowers ovoid to ellipsoid, 3-locular; ovules 2 in each locule; style cylindrical; stigma capitate, faintly 3-lobed. Pistil in male flowers reduced to a pistillode or absent, sometimes united with the disk to an "ovariodisc". Drupes ovoid or ellipsoid, often 3-gonous, usually blue black when ripe, rarely ivory white or red; pericarp fleshy (rarely fibrous); pyrene stony, 3-locular, 1 or 2 sterile; seed one in each locule; testa brown; cotyledons palmatifid to 3-foliolate, oily.

SE. Asia (from S. Deccan to S. China and Hainan), Sri Lanka, the Mascarenes, Madagascar, Mauritius, W. and E. Africa, Malesia, N. E. Australia, Micronesia (Palau), Melanesia as far east as Samoa; ca 100 species, 6 species in India.

Literature. LEENHOUTS, P.W. (1956). Burseraceae - Canarium In: STEENIS, Fl. Males. 1, 5: 249-296; (1959). Revision of the Burseraceae of the Malaysian area in a wider sense Xa Canarium. Blumea 9: 275-471.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Leaves stipulate | 2 |
| b. Leaves exstipulate | 5 |
| 2a. Stipules deeply pectinate, persistent | 2. <i>C. denticulatum</i> |
| b. Stipules entire or slightly wavy, caducous | 3 |
| 3a. Stamens free | 6. <i>C. vulgare</i> |
| b. Stamens connate | 4 |
| 4a. Inflorescence terminal; fruits ovoid-ellipsoid | 4. <i>C. manii</i> |
| b. Inflorescence axillary; fruits spindle shaped | 1. <i>C. bengalense</i> |
| 5a. Leaflets rusty villous beneath; calyx tube glabrous inside; disk pilose above; ovary pilose | 5. <i>C. strictum</i> |
| b. Leaflets glabrous beneath; calyx tube densely pubescent inside; disk glabrous; ovary glabrous | 3. <i>C. euphyllum</i> |

1. *Canarium bengalense* Roxb., Fl. Ind. 3: 136. 1832; A.W. Bennett in Hook. f., Fl. Brit. India 1: 534. 1875; Leenh. in Blumea 9: 412. t. 27. 1959. Fig. 109.

Asm.: Bisjang, Dhuna; Asm. & Sylhet: Dhuna, Nerebi; Garo: Borsamphol, Tekreng; Lepcha: Narockpa; Nep.: Goguldhup.

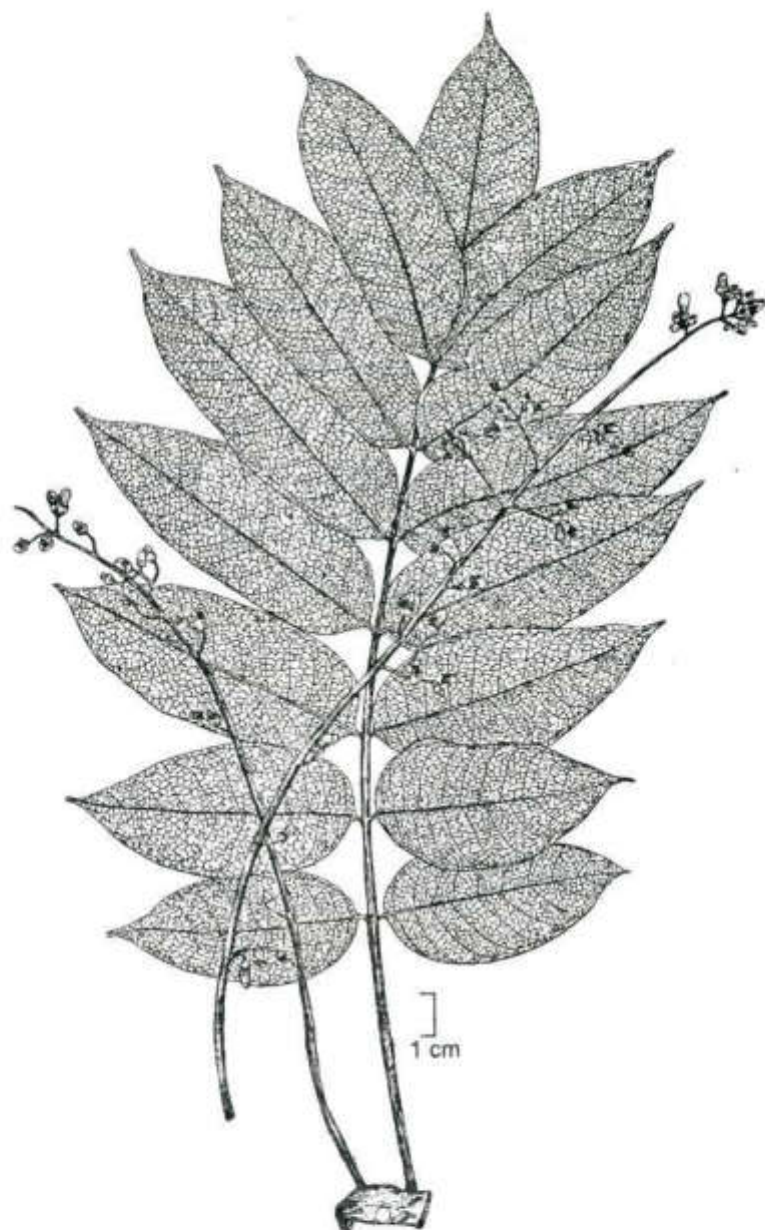


Fig. 109. *Canarium bengalense* Roxb. : habit.

Trees, 20 - 25 m high, buttressed; branchlets lenticellate, pubescent when young. Leaves 6 - 9-jugate, rarely 10-jugate; 30 - 75 cm long; stipules subulate, ca 8 mm long, pubescent, caducous, stipule-scars prominent; leaflets oblong-ovate, lanceolate, elliptic or oblanceolate, 6.3 - 23 x 3 - 8 cm, chartaceous, sometimes sparsely pubescent on the nerves beneath, oblique, rounded or acute at base, entire, slightly wavy, rarely irregularly crenate towards apex; acuminate or caudate at apex. Inflorescence axillary or supra-axillary, thyrsoïd; male ones 12 - 43 cm long; flowers 13 - 15 mm long. Calyx cupular, 2 - 3 mm long, shallowly 3-lobed; lobes deltoid, sparsely tomentose outside, rounded at apex. Petals oblanceolate-oblong, 9 - 11 x 3 - 4 mm, cucullate towards apex, pubescent outside. Stamens 6, 8 - 10 mm long, connate at base for about half the length of filaments. Disk tubular, hirsute. Pistillode in male flowers absent or minute, densely tomentose. Drupes 1 - 3, spindle-shaped, 4 - 5 x 1.5 - 2 cm, pruinose, dark purple; mesocarp fleshy, aromatic; calyx persistent, saucer-shaped, 3-lobed.

FL May - Sept.; Fr. July - Dec.

Distrib. India: Evergreen, moist and mixed forests from 370 - 1000 m. Assam, W. Bengal, E. Himalayas.

Bangladesh, Myanmar, Laos and Thailand.

Uses. Fruits with aromatic flesh are edible. The brittle, amber-coloured resin is burnt as incense. Wood is used for planks, shingles and tea-boxes. The leaves and bark are used externally for rheumatic swellings. Resin mixed with bees' wax is used as a substitute for shellac used in stiffening crepe.

Notes. Resembles *C. strictum* Roxb. but differs by the large number of leaflets and usually acutely 3-angular fruits.

2. *Canarium denticulatum* Blume, Bijdr. 1162. 1826; Leenh. in Steenis, Fl. Males. I, 5: 272. f. 21 j, 22 k, 37. 1956 excl. Syn. *C. manii* King. *C. coccineo-bracteatum* Kurz in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 41(2): 296. 1872; A.W. Bennett in Hook. f., Fl. Brit. India 1: 536. 1875; Parkinson, For. Fl. Andaman Isl. 116. 1923.

Trees, 12 - 30(-50) m tall, rarely a shrub; branchlets minutely tomentose or glabrescent, sometimes lenticellate. Leaves 2 - 6-jugate, aromatic when bruised; stipules pectinate to dendriform, 0.8 - 2.5 (-4) cm long, minutely tomentose, persistent; leaflets inaequilateral, ovate to lanceolate or oblong, 5 - 20 x 2 - 15 cm, stiff-herbaceous to coriaceous, glabrous, cuneate to rounded or cordate and slightly oblique at base; entire or slightly wavy, dentate or serrate along margins, acuminate at apex. Inflorescence axillary, together pseudoterminal, thyrsoïd, 12 - 35 cm long, lax, densely rusty-tomentose; bracts lanceolate. Flowers densely pubescent; male flowers 4 - 5 mm long, female 7 - 8 mm long. Calyx ca 4 x 3 mm; lobes ovate, obtuse, densely pubescent outside. Petals lanceolate, ca 5.5 x 2.5 mm, inflexed at apex, pubescent outside. Stamens ca 3.5 mm long,

more or less adnate to disk in male flowers, inserted on the disk in female flowers. Disk annular, lobed, in male flowers; adnate to the receptacle except a low rim in female flowers. Pistil more or less stalked, reduced to a pistillode in male flowers. Drupes up to 10, ellipsoid to ovoid or obovoid, ca 2.6 x 1.6 cm, rugose; seeds 3 - 1.

KEY TO THE FORMAS

- 1a. Habit coarse; leaves 4 - 6-jugate; nerves (14-) 16-17 (-21) pairs, not sunken; stipules pectinate; lobes broad and lacinate **2.1. f. denticulatum**
- b. Habit slender; leaves 2 - 4-jugate; nerves 9 - 14 pairs, slightly sunken above; stipules dendriform; lobes subulate **2.2. f. fissistipulum**

2.1. subsp. *denticulatum* f. *denticulatum*

Fl. Feb.

Distrib. India: S. Andamans.

Sumatra (also Simalur), Malay Peninsula (Perak), Java, Borneo (very rare) and Philippines (Basilan and Mindanao).

2.2. subsp. *denticulatum* f. *fissistipulum* (Miq.) Leenh. in *Blumea* 9: 368. 1959. *C. fissistipulum* Miq. *Sum.* 525. 1861.

Distrib. India: S. Andamans.

Indonesia, S. Myanmar, Malay Peninsula and Borneo.

3. *Canarium euphyllum* Kurz in *J. Asiat. Soc. Bengal*, Pt. 2, *Nat. Hist.* 41(2): 295. 1872; A.W. Bennett in *Hook. f., Fl. Brit. India* 1: 535. 1875; Parkinson, *For. Fl. Andaman Isl.* 115. 1923.

Hindi: *Dhup*

Evergreen or deciduous trees, up to 30 m high, with small buttresses and numerous small protuberances; bark whitish grey; terminal bud ferruginously shaggy-pilose. Leaves exstipulate, 4 - 6(-8) jugate, up to 47 cm long, leaf scars conspicuous, cordate; leaflets ovate-oblong, lanceolate or oblanceolate, 7.3 - 25 x 3.6 - 9 cm, chartaceous, oblique, coarsely serrate or dentate, rarely entire along margins, truncate or shortly acutely acuminate at apex. Inflorescence axillary, narrowly thyrsoid, 20 - 45 cm long; branches transverse with 4 - 6 flowers; bracts subulate, densely hairy, caducous. Male flowers ca 1 cm long, minutely tomentose. Calyx campanulate, broadly 3-lobed, 3 - 5 x 4 - 4.5 mm, sparsely pubescent outside, densely velutinous inside. Petals oblanceolate, 7.5 - 10 mm long, velutinous outside, glabrous inside. Stamens 6; filaments connate about

half-way. Disk annular, fleshy with a narrow central canal. Pistillode none or minute. Infructescences racemose, 10 - 20 cm long, with 3 - 5 fruits. Drupes ovoid-ellipsoid, bluish black; pyrene 1-seeded; calyx persistent with remains of fimbriate disk.

Fl. May - June.

Distrib. India: Andaman & Nicobar Islands.

Myanmar.

Uses. Wood with a smell reminiscent of vinegar when freshly cut, is used for aeroplanes and gliders particularly for spars and for making plywood. It is also used as a substitute for the common classes of mahogany, for joinery, decorative work, cabinets, packing cases, billiard tables and internal fittings in ships, in the manufacture of matches, boxes and indoor constructions. Logs are used as floats for rafting timber. Resin is used by the Andamanese for burning and for making a composition for covering the binding of their arrows.

4. *Canarium manii* King in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 62(2): 247. 1894; Parkinson, For. Fl. Andaman Isl. 116. 1923; Leenh. in Blumea 9: 372. f. 18. 1959.

Medium-sized to large deciduous trees; bark light grey, strongly aromatic; branchlets lenticellate, scabrous, minutely pubescent to glabrescent. Leaves 2-4-jugate; stipules orbicular, caducous, stipule scar drop-shaped; leaflets ovate-lanceolate, terminal ones often elliptic, aromatic when bruised; 6 - 16 x 3.5 - 7 cm, slightly oblique, cuneate-cordate at base, entire or slightly revolute along margins; abruptly acuminate at apex. Inflorescence terminal, minutely pubescent, male ones thyrsoïd, 10 - 12 cm long; female ones subracemose, ca 7 cm long. Flowers white, densely pubescent; male ones 4 - 5 mm long; female ones 7 - 8 mm long; flower 3 in each cyme; middle one pedicellate; lateral ones sessile; bracts foliaceous, orbicular, ovate-lanceolate, ca 8 x 4 mm, acute, tomentose; bracteoles ca 6 x 3 mm, at base of sessile flowers. Calyx cupular, in male flowers ca 1 mm long, in female ones 5 - 6 mm long; lobes ovate, obtuse, densely tomentose. Petals ovate, ca 5 x 2.5 mm, cucullate, thick, tomentose outside. Stamens 6, united at base to form a cup-like structure. Disk in male flowers variable, solid and conical or with a narrow central canal; in female flowers connate with receptacle except the margin. Pistil globose, stalked, ca 3.5 mm long; stigma subsessile. Pistillode in male flowers ca 1 mm long or absent. Drupes 1 - 2, ovoid-ellipsoid, ca 3 x 1.5 cm; pyrene 1-seeded.

Fl. & Fr. Feb. - July.

Distrib. India: Middle and S. Andamans.

Endemic.

Notes. Related to *C. denticulatum*, but differs by its entire (not incised) stipules and terminal inflorescence.

5. *Canarium strictum* Roxb., Fl. Ind. 3: 138. 1832; A.W. Bennett in Hook.f., Fl. Brit. India 1: 534. 1875; Leenh. in Blumea 9: 414. 1959. *C. sikkimense* King in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 62(2): 187. t. 11, 12. 1894; Brandis, Ind. Trees 1: 30. 1921. *C. reziniferum* Brace ex King in J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 62(2): 188. 1894; Kanj. et al., Fl. Assam 1: 224. 1936.

Beng., Guj. & Hindi: *Kala dammar*; Kan.: *Halemaddu*, *Karedupa*, *Mada dhup*, *Ral dhup*; Mal.: *Karuttukungiliyam*, *Kunthirikka-payin*, *Pantappayan*, *Thelli*, *Viraka*; Mar.: *Dhup*, *Raldhup*; Sans.: *Raladhupa*; Tam.: *Attam*, *Karunkungiliyam*, *Kundurukkam*, *Kungulu*; Tel.: *Nalla rojanamu*; Eng.: *Black damar*, *Black dhup*, *Indian white Mahogany*.

Large trees, 20 - 30(-50) m high tall, buttressed; young branchlets ferruginously woolly. Leaves exstipulate, 3 - 5 rarely, 7-jugate, variable in shape and degree of pubescence; 20 - 56 cm long; rachis tomentose; leaflets ovate-elliptic, oblong-obovate, lanceolate or oblanceolate, 7 - 22 x 4 - 10 cm, coriaceous, ferruginously tomentose beneath, oblique, obtuse or subcordate or rounded to broadlycuneate, slightly decurrent at base; serrulate, crenulate, irregularly obscurely crenate or finely undulate along margins, shortly acuminate at apex. Inflorescence axillary or pseudoterminal, thyrsoid, sometimes racemose, densely ferruginously woolly or minutely fulvous-tomentose; male ones 15 - 40 cm long; female ones 7 - 20 cm long. Flowers unisexual or bisexual, yellow, dull white or pale green with mangiferous odour; bracts caducous; pedicels short in male flowers, long in female flowers. Male flowers: Calyx tube campanulate, 5 - 5.5 x 3 - 4 mm; lobes 3-angular, ferruginously pubescent outside. Petals oblong-lanceolate, concave, 6.5 - 8.5 x 2.5 - 4.5 mm, subglabrous to densely pubescent. Stamens 6 - 8 mm long, connate into a tube, anthers acuminate. Disk apically pilose; pistillode absent. Female flowers: Calyx tube urceolate, 5 - 6 x 4 - 5 mm, pubescent outside. Petals oblong-oblanceolate, 7 - 8 x 3 - 4 mm, pubescent outside. Stamens 3.5 - 4.5 mm long; filaments broad, connate to form a cup; anthers reduced. Disk obscurely lobed, pilose. Pistil ca 6.5 mm long, flask-shaped; ovary and style hairy; style thick; stigma capitate. Drupes oblong-ellipsoid or obovoid, 3.5 - 4 x 1.5 - 2 cm, dark blue.

Fl. & Fr. Jan. - Dec.

Distrib. India: Moist evergreen forests. Sikkim, Assam, Meghalaya, Orissa, Karnataka, Tamil Nadu and Kerala.

Upper Myanmar.

Uses. The resin from the tree called the black dammar of commerce is used in the manufacture of varnishes, bottling wax and as a substitute for Burgundy pitch in plasters. It is used for caulking boats. Well-seasoned timber is used for making boards, for ceiling,

flooring and partitions. Decoction or powder of resin is given internally as a remedy in rheumatism, cough, fever, epilepsy, asthma, syphilis, blood impurities, various poisons, hernia, haemorrhage and to improve complexion.

6. *Canarium vulgare* Leenh. in Bernice P. Bishop Mus. Bull. 216: 31. f. 13. 1955; Leenh. in Steenis, Fl. Males. I, 5: 263. 1956. *C. commune* L., Mant. Pl. 127. 1767, p.p.; A.W. Bennett in Fl. Brit. India 1: 531. 1875.

Hindi: *Janqli badam*; Kan.: *Java badamiyanne*, *Kaglim ara*; Mal.: *Kanucicingari*; Eng.: *Java Almond*.

Trees, up to 45 m high, buttressed; branchlets smooth, glabrous. Leaves 2-5-jugate, 23-32 cm long; rachis swollen at nodes; stipules at junction of branchlet and rachis, oblong, elliptic or rotundate, auricled, 1-5 x 0.5-1.75 cm, glabrous or pulverulent, entire or slightly wavy, rounded at apex, caducous, stipule-scars linear; leaflets lanceolate, ovate-oblong, terminal leaflet often smaller and elliptic; 4.5-16 x 2-7 cm, chartaceous to subcoriaceous, slightly oblique at base, cuneate, dilated and articulate at the point where lamina and petiole join, entire or wavy along margins, long acuminate at apex. Inflorescence terminal, thyrsoid, branched; male ones up to 35 cm long, female ones up to 20 cm long; bracts ovate-orbicular, concave, ca 5 x 4 mm, densely pubescent, obtuse-rounded at apex. Flowers tomentose; male flowers sessile or subsessile, ca 5 mm long; female flowers stalked, 6-7(-12) mm long. Calyx cup-shaped, ca 3.5 x 4.5 mm, shallowly lobed; lobes ovate, obtuse, densely pubescent outside. Petals ovate, ca 4.5 x 3 mm, obtuse. Stamens 6, free, ca 3 mm long. Disk in male flowers solid, variable in form and shape, sometimes with a style-like appendix; in female flowers adnate to receptacle except the rim. Ovary glabrous. Pistillode absent in male flowers. Drupes up to 12, ovoid, calyx persistent, flat, lobes orbicular with undulate margin.

Fl. & Fr. March - June.

Distrib. India: Cultivated in Kerala.

Malesia. Also cultivated throughout the tropics.

Uses. Seeds from cultivated trees are used as a substitute for almonds. The oil from seeds is used as a substitute for coconut oil. The pressed cake is used as fertilizer and cattle feed. An emulsion of the seeds is used as baby food. Timber is used for canoe building; buttresses are used for making paddles. The oleo-resin called nauli gum is applied in the form of an ointment to indolent ulcers. Planted as a shade-tree in nutmeg plantations. Resin is used as an incense, and as a fixative in perfumery and for varnishes. Oil derived from resin is employed in varnish industry and for soaps and cosmetics.

Note. Closely related to *C. indicum* L. but differs in having more or less caducous, entire stipules.

4. *Commiphora* Jacq. nom. cons.

Shrubs or small trees, deciduous; branches and branchlets often spinescent. Leaves alternate or fascicled, exstipulate, 3 - 7-foliolate, imparipinnate, membranous or chartaceous; leaflets sessile or shortly petiolulate, entire, crenate or serrate; lateral ones often smaller than the terminal ones. Flowers sessile or subsessile, bisexual or unisexual, solitary or in fascicles or paniculate dichasial cymes, crowded at ends of the branches. Calyx campanulate, cupular or tubular, 4-lobed, rarely 5 - 6-lobed, persistent. Petals 4, valvate, rarely 5 - 6, inserted on margin of disk, linear-oblong or oblong or oblanceolate, reflexed and apiculate at apex. Disk cupular. Stamens usually 8, inserted on margin of disk, in 2 rows, alternately long and short; filaments flat or filiform, often dilated at base; anthers oblong, basifixed, dehiscing longitudinally. Ovary sessile, ovoid or oblong, 2 - 4 locular; ovules 2 in each locule; style short; stigma 2-lobed, rarely 3 - 4-lobed. Drupes ovoid, globose or subglobose, apiculate, crustaceous or woody, splits irregularly at maturity into 2 - 6 valves, leaving the pulp exposed; 1-seeded.

Arabia, Pakistan, India. Tropical and S. Africa; ca 185 species, 6 species in India.

Literature. ENGLER, A. (1931). In: ENGLER, A. & K. PRANTL, *Nat. Pflanzenfam.* ed. 2, 19a: 429. ABEDIN, S. & S.I. ALI (1972). *Burseraceae* In: NASIR, E. & S.I. ALI, *Fl.W. Pakistan* 26: 1 - 4.

KEY TO THE SPECIES

- | | |
|---|------------------------|
| 1a. Plants armed; leaves 3-foliolate; terminal leaflets larger than the laterals; flowers solitary or in fascicles | 2 |
| b. Plants unarmed; leaves imparipinnate with 2 - 3 pairs of leaflets; terminal leaflet not much larger than the laterals; flowers many, in panicles | 4 |
| 2a. Branches drooping; lateral leaflets minute, auriculiform | 1. <i>C. agallocha</i> |
| b. Branches erect; lateral leaflets not auriculiform | 3 |
| 3a. Calyx lobes as long as tube; glandular hairy outside | 5. <i>C. wightii</i> |
| b. Calyx lobes shorter than tube, glabrous outside | 2. <i>C. berryi</i> |
| 4a. Leaflets glabrous; terminal one long-petioluled, caudate acuminate; calyx tube glabrous outside | 3. <i>C. caudata</i> |
| b. Leaflets pubescent; terminal one subsessile, shortly acuminate; calyx tube pubescent outside | 4. <i>C. pubescens</i> |

1. *Commiphora agallocha* (Wight & Arn.) Engl. in A. & C. DC., *Monogr. Phan.* 4: 11. 1883. *Amyris agallocha* Roxb., *Hort. Beng.* 28. 1814, nom. nud. *A. commiphora* Roxb., *Fl. Ind.* 2: 244. 1824. *Balsamodendron agallocha* Wight & Arn. in *Ann. Nat. Hist.* 3: 86. 1839. *B. roxburghii* Arn. in *Ann. Nat. Hist.* 3: 86. 1839, non Stocks 1848; A.W. Bennett in Hook. f., *Fl. Brit. India* 1: 529. 1875.

Beng.: *Gugala*; Sans.: *Agaru*, *Googgula*; Tam.: *Kungulu*; Tel.: *Agaru*, *Bhurandi*.

Trees or shrubs, up to 4 m high; branches crooked, drooping, lateral branches often thorny; bark of young shoots green, smooth, that of the larger branches and trunk covered with a light-coloured pellicle which peels off from time to time. Leaves alternate; petioled; leaflets ovate, oblong-elliptic, 0.4 - 5 x 0.3 - 2.5 cm, chartaceous, glabrous, serrate or serrulate along margins, acute at apex; lateral leaflets minute, often auriculiform. "Flowers axillary, short-pedicelled, small, red, collected in little bundles in the small protuberances gems left by the former year's leaves, over the now leafless slender twigs. Berries drupeaceous, the size of a black current, red, smooth. Nut two-celled with a single seed in each".-Roxb. 1824.

Distrib. India: Assam, W. Bengal. Commonly cultivated in house premises in Srikakulam, Vizianagaram and Visakhapatnam districts of Andhra Pradesh.

Bangladesh.

2. *Commiphora berryi* (Arn.) Engl. in A. & C. DC., Monogr. Phan. 4: 17. 1883; T. Cooke, Fl. Pres. Bombay 1: 201. 1902. *Balsamodendron berryi* Arn. in Ann. Nat. Hist. 3: 86. 1839; A.W. Bennett in Hook. f., Fl. Brit. India 1: 529. 1875.

Tam.: *Mudgiluvai*, *Mulkiluvai*; Eng.: *Indian Balm of Gilead*.

Shrubs or small trees, 3 - 6 (-10) m tall, branchlets ending in sharp spines. Leaves alternate or fascicled, petiolate, 3-foliolate; leaflets sessile, obovate, ovate-suborbicular, 0.3 - 4.5 x 0.3 - 2.5 cm; terminal leaflets larger than the laterals; chartaceous, glabrous, glossy above, cuneate or subacute at base, entire to crenate along margins, obtuse or rotund at apex. Flowers solitary or fascicled, axillary, ca 8 mm long, deep red, pink or cream coloured. Calyx narrowly campanulate, 4-lobed; lobes 3-angular or deltoid. Petals 4, oblanceolate, apiculate. Stamens 8, free, alternately long and short; longer in male flowers than in female or bisexual flowers. Disk small, 6 - 8-lobed. Drupes oblong or ovoid-subglobose, 0.8 - 1.2 x 0.6 - 0.9 cm, beaked; seed solitary.

Fl. Feb. - March; *Fr.* April - Dec.

Distrib. India: In dry forests. Andhra Pradesh, Tamil Nadu, Karnataka.

Uses. Grown as a hedge plant throughout southern India. The plant yields a fragrant gum-resin.

3. *Commiphora caudata* (Wight & Arn.) Engl. in A. & C. DC., Monogr. Phan. 4: 27. 1883; Gamble, Fl. Pres. Madras 171.1915. *Protium caudatum* Wight & Arn., Prodr. 176. 1834; A.W. Bennett in Hook. f., Fl. Brit. India 1: 530. 1875. *P. caudatum* Wight & Arn. var. *roxburghianum* (Wight & Arn.) A.W. Bennett in Hook. f., Fl. Brit. India 1: 530. 1875. *P. roxburghiana* Wight & Arn., Prodr. 176. 1834.

Kan.: *Konda mavu*; Mal.: *Kilimaram*; Tam.: *Kiluvai*, *Pachaikiluvai*; Tel.: *Konda mamidi*, *Konda ragi*; Eng.: *Hill mango*.

Trees, 5-15 m high, unarmed, often with short thorns on old wood, glabrous. Leaves alternate; leaflets 3-7; terminal one larger, all petiolulate, ovate-oblong, lanceolate or elliptic, 2.7-10.5 x 1.3-5 cm, chartaceous, glossy above, cuneate to attenuate at base, entire along margins, acute to long acuminate or caudate at apex. Flowers unisexual or bisexual, in axillary or terminal panicles, pale green to red in colour, scented; bracts linear; bracteoles short. Calyx campanulate or cupular, 4-lobed, lobes ovate or deltoid, 2-4 mm long, as long as broad, acute, persistent. Petals 4, linear-oblong or oblanceolate, apiculate at apex, 4-6 mm long. Disk cupular, intrastaminal. Stamens 8, free, alternately long and short, 1-3.5 mm long, inserted on margins of disk, filaments dilated at base. Pistillode short in male flowers. Ovary in bisexual and female flowers ovoid or oblong, 2-locular; ovules 2 in each locule, pendulous; style very short; stigma 2-lobed. Drupes ellipsoid or globose, 0.7-1.7 x 0.8-1.5 cm, black; pyrenes 1 or 2; seed solitary, ca 2 mm long with four radiating wings.

Fl. & Fr. March - Oct.

Distrib. India: Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

Uses. Planted as an avenue tree. Oleo-gum-resin obtained from the bark and leaves is used in medicine, as incense and for embalming. Fruits are pickled and eaten.

4. *Commiphora pubescens* (Wight & Arn.) Engl. in A. & C. DC., Monogr. Phan. 4: 21. 1883; Gamble, Fl. Pres. Madras 171. 1915. *Protium pubescens* Wight & Arn., Prodr. 176. 1834; A.W. Bennett in Hook. f., Fl. Brit. India 1: 530. 1875.

Trees, up to 6 m high; branchlets pubescent. Leaves alternate; leaflets 3-7, ovate or obovate, ovate-lanceolate or ovate-elliptic, 1.8-13.5 x 1.4-6 cm, sparsely pubescent above, pubescent beneath, obtuse or cuneate at base, entire along margins, acute to acuminate at apex, terminal leaflet petiolulate, larger; the laterals sessile. Panicles cymose, axillary, bracteate, dichotomously branched, puberulous. Flowers yellowish-red. Calyx campanulate, ca 2 x 2 mm, 4-lobed; lobes ovate, obtuse or acute, pubescent outside, persistent. Petals 4, oblong to oblanceolate, 4-5.5 mm long, apiculate and reflexed at tip. Stamens 8, free, inserted on or along margins of disk, 2.5-4.5 mm long. Disk enclosed in calyx. Pistillode small in male flowers. Drupes ovoid to obovoid, 0.9-1.2 x 0.7-1.2 cm; pyrenes 1 or 2; seed solitary.

Fl. & Fr. April - Dec.

Distrib. India: Tamil Nadu. W. Peninsula.

Endemic.

5. *Commiphora wightii* (Arn.) Bhandari in Bull. Bot. Surv. India 6: 327. 1964 & Fl. Indian Desert 95. f. 34. 1978. *Balsamodendron wightii* Arn. in Ann. Nat. Hist. 3: 86. 1839. *Commiphora mukul* (Hook. ex Stocks) Engl. in A. & C. DC., Monogr. Phan. 4: 12. 1883. *Balsamodendron mukul* Hook. ex Stocks in Hooker's J. Bot. Kew Gard. Misc. 1: 259. t. 8. 1849; A.W. Bennett in Hook. f., Fl. Brit. India 1: 529. 1875.

Beng., Guj., Hindi: *Gugal*, *Guggul*; Mar. & Kan.: *Guggule*; San.: *Guggulu*, *Devadhupa*, *Koushikaha*; Tam.: *Marishakshi gukkal*; Tel.: *Guggul*; Eng.: *Indian bdellium*.

Shrubs, up to 4 m high; branches knotty and crooked, aromatic; young parts glandular-pubescent; branchlets thorny. Leaves 1 - 3-foliolate; leaflets sessile; terminal leaflets larger, often petiolulate; rhomboid-ovate or obovate, 0.8 - 3.8 x 0.5 - 2.6 cm, glaucous, cuneate at base, serrate or entire, sometimes serrate only towards the apex along margins; obtuse or acute at apex, laterals less than half the size of the terminal ones. Plants dimorphic: one with bisexual and male flowers and the other with female flowers with staminodes. Flowers solitary or in 2 - 3 flowered fascicles, red or pinkish white; bracts 2, opposite, glandular-hairy. Calyx campanulate or tubular, 1 - 2 mm long, fused with disk, glandular-hairy, 4 - 5-lobed; lobes 3-angular, as long as tube. Petals 4 - 5, broadly linear, 3 - 5 x 1 mm, reflexed at apex. Stamens 8, rarely 10, alternately long and short, 3 - 5 mm long; shorter ones inserted in deeper alternate sinuses of disk. Staminodes 1 - 1.5 mm long in female flowers. Disk 8 - 10 lobed. Ovary oblong-ovoid, attenuate into style; stigma obscurely 2-lobed. Drupes ovoid, red when ripe with two white longitudinal lines; mesocarp yellow, rarely orange, 4-lined; pyrenes ovoid, acute.

Fl. & Fr. Jan. - May, Sept. - Dec.

Distrib. India: On open dry hills and other rocky habitats. Rajasthan, Gujarat, Madhya Pradesh and Karnataka.

Arabia, Baluchistan and Pakistan(Sind).

Uses. The pale brown or dull green coloured gum-resin collected during the cold season is used as incense, as a fixative in perfumery and in medicine. It is used as an antiseptic on old wounds, as a uterine stimulant, as a gargle for weak and spongy gums and pyorrhoea. It stimulates appetite and improves digestion. It acts as a diaphoretic, diuretic and expectorant. In Iran, used as a stomachic and for muscular rheumatism.

CULTIVATED SPECIES

Commiphora myrrha (Nees) Engl. in A. & C. DC. Monogr. Phan. 4: 10.1883; S. Dutt in Indian Oil & Soap J. 26(10): 233. 1961. *Balsamodendron myrrha* Nees, Dusseld. 357. 1828.

Beng. & Hindi: *Bol* or *Heerabol*; Kan. & Mal.: *Bola*; Sans.: *Bola*, *Rasagandhi*, *Samudragala*; Tam. & Tel.: *Polam*.; Eng.: *Indian myrrha of commerce*.

Small deciduous trees, 3 - 4.5 m high with a thick trunk; branchlets spiny. Leaves with 5 - 7 leaflets; leaflets obovate-oblong or oblanceolate. Flowers small in numerous branching clusters, 7 - 20 cm long (3 - 8 inch) appear before the leaves. Fruits sessile, broadly ovoid or ellipsoid, 12 - 20 cm (5/8 inch) long, split when ripe. Whole plant strongly resinous with the aroma of green mangoes.- (Dutt 1961).

Distrib. Native of Arabia. It is often cultivated in W. & S. India, particularly in dry hilly regions of Karnataka and Kerala. In the latter place it is sometimes found as a roadside or avenue tree.

Uses. The gum obtained from tree is used in Ayurvedic and Unani medicines in cases of dyspepsia, dysentery, amenorrhoea and chlorosis and also as an astringent and an antiseptic drug in the form of tinctures in cases of ulcerations of the mouth and other affections of the mucous membrane. It is used occasionally as an incense in religious worship.

5. *Dacryodes* Vahl

Trees dioecious. Leaves exstipulate, rarely with pseudostipules; petioles usually flattened to canaliculate; leaflets entire. Panicles axillary or pseudoterminal. Flowers 3-merous. Sepals free or connate, caducous. Petals slightly thickened and inflexed at apex. Stamens 6, glabrous; filaments free or connate at base with disk to various degree. Disk intrastaminal, glabrous. Pistil 3(-2)-locular, glabrous, moderately reduced in male flowers; stigma sessile, apical or nearly so. Drupes oblong or ellipsoid, 1-seeded; pericarp fleshy, thick, coarsely wrinkled when dry; mesocarp membranous; endocarp cartilaginous; pyrene with 1 fertile and 2 reduced locules; cotyledons folded or contortuplicate, 3-partite, palmate or palmatifid.

Distrib. India: America, Africa and Asia; ca 40 species in tropical regions, one species in India.

Literature. KALKMAN, C. (1954). Revision of the Burseraceae of the Malaysian area in a wider sense-VIII. *Dacryodes* Vahl *Blumea* 7: 500-522. LEENHOUTS, P.W. (1956). *Burseraceae. Dacryodes* In: STEENIS, Fl. Males. 1, 5: 219-229.

Dacryodes rugosa (Blume) H.J. Lam in *Ann. Jard. Bot. Buitenzorg* 42: 203. t. 11. f. 64. 1932; P. Chakraborty in *Bull. Bot. Surv. India* 21: 6. 1979. *Santiria rugosa* Blume, *Mus. Bot.* 1: 212. 1850. *S. fasciculata* A.W. Bennett in *Hook.f., Fl. Brit. India* 1: 539. 1883.

Trees, 5 - 20 (-35) m high, sometimes large shrubs; branchlets pubescent. Leaves (0-) 2 - 4-jugate; petioles terete or more or less flattened at base, pubescent or puberulous to glabrous; bases of petioles, nodes of rachis and ends of petiolules distinctly swollen; leaflets variable in shape, elliptic or elliptic-oblong, obovate or ovate to oblong-lanceolate, (3.8-) 6 - 22(-24) x (1.8-) 2.5 - 11.3 cm, chartaceous, often bullate, oblique at base, cuneate to rounded or acute, more or less abruptly acuminate at apex. Panicles axillary or pseudoterminal, rarely terminal, densely, minutely pubescent. Flowers pale yellow or white, sparsely pubescent to glabrous. Male inflorescence slender, 15 - 60 cm long, laxly branched; flowers clustered. Female inflorescence pyramidal, lax, 2 - 25 (-40) cm long, few-flowered. Calyx in male flowers 0.75 - 1 mm long, in female ones 1 - 1.5 mm long. Calyx lobes ovate, acute. Stamens adnate to disk, episealous ones slightly longer. Disk cupular, thick. Pistil reduced to pistillode or absent in male flowers. Fruits ovoid, slightly oblique, rounded at both ends, 1.5 - 2.5 x 0.75 - 1.5 cm; in various shades between yellow and red; flower remains long-persistent.

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

Distrib. In primary forests up to 900 m; Andaman & Nicobar Islands (Katchal island).

Sumatra (south), Malay Peninsula, W. Java, Borneo.

Notes. Chakraborty In. Bull. Bot. Surv. India 21: 6. 1979 reports this species for the first time in Katchal Island of the Andaman.

6. *Garuga* Roxb.

Trees, deciduous; branchlets pubescent. Leaves alternate, imparipinnate, clustered at the ends of branchlets, deciduous; stipules deciduous; leaflets subsessile, opposite or subopposite, crenate-serrate; stipels often present. Panicles axillary, much-branched, crowded at ends of branchlets. Flowers bisexual or unisexual, 5-merous. Calyx tube broadly or narrowly campanulate, tomentose, lobes ovate. Petals inserted on calyx tube. Disk cupular, crenate, adnate to receptacle. Stamens 10, free, equal or alternately long and short, inserted on notches of disk; filaments subulate, pubescent; anthers oblong. Ovary ovoid, on short gynophore, pubescent or glabrous, 4 - 5-locular; ovules 2 in each locule; style grooved, pubescent; stigma capitate, 4 - 5 lobed. Drupes globose, pericarp fleshy, pyrenes 1 - 5, rugose, 1-seeded.

S.E. Asia, America, N. Borneo, N. Australia, S. China, E. Java, N. & E. Malesia, the Philippines, W. Pacific and Melanesia; ca 4 species, 2 species in India.

Literature. KALKMAN, C. (1953). Revision of the Burseraceae of the Malaysian area in a wider sense VI. Revision of the genus *Garuga* Roxburgh. *Blumea* 7: 459-470. LEENHOUTS P.W. (1956). *Burseraceae* - *Garuga* Roxb. In: STEENIS, Fl. Males. I, 5: 215-218.

KEY TO THE SPECIES

- 1a. Leaves pubescent; calyx tube more than 4 mm long, deciduous; drupes 15 - 20 mm across, apically horned 2. *G. pinnata*
- b. Leaves glabrous; calyx tube less than 2 mm long, persistent in fruit; drupes 8 - 10 mm across, apically obtuse 1. *G. floribunda* var. *gamblei*

1. *Garuga floribunda* Decne. in Nouv. Ann. Mus. Hist. Nat. 3: 477. 1834 var. *gamblei* (King ex W. Smith) Kalkman in Blumea 7: 466. 1953. *G. gamblei* King ex W. Smith in Rec. Bot. Surv. India 4: 262. 1911; Gamble, Fl. Pres. Madras 169. 1915. Fig. 110.

Asm.: *Bon-misri*, *Bonthai-phang*.

Trees, up to 15 m high, often buttressed at base; bark ashy-grey, smooth; young parts puberulous. Leaves up to 46 cm long; stipules oblong, caducous; leaflets 11 - 15, ovate-oblong, oblong-lanceolate, 3.6 - 15 x 1.5 - 4 cm, chartaceous, oblique and cuneate at base, crenate-serrate along margins, acuminate at apex. Panicles up to 20 cm long, pubescent or glabrescent; peduncle 4 - 9.5 cm long, slender; bracts linear. Flowers white or yellow, fragrant. Calyx tube narrowly campanulate, ca 1.5 mm long; lobes 3-angular, minutely tomentose or puberulous outside. Petals oblong or ovate, 3 - 4 x 1 - 1.5 mm, acuminate at apex, pubescent. Stamens ca 2 mm long; filaments puberulous. Disk ca 1.5 mm long, crenate. Ovary sparsely puberulous; style pubescent; stigma 4 - 5-lobed. Drupes 4-lobed, globose, 8 - 10 mm across; pyrenes 4, one-seeded.

Fl. & Fr. Feb. - June.

Distrib. India: At high altitudes. Assam, E. Himalayas, Sikkim, W. Ghats, Bangladesh, W. China, Hainan.

Uses. Used in the same way as *G. pinnata*. Wood is used for more expensive furniture (Kalkman, 1953).

2. *Garuga pinnata* Roxb., Pl. Coromandel 3: 5. t. 208. 1811; A.W. Bennett in Hook. f., Fl. Brit. India 1: 528. 1875.

Asm.: *Kechkechi*, *Pani-amora*; Beng.: *Joom*, *Jum*, *Kharpat*, *Tinn*; Guj.: *Khusimb*; Hindi: *Ghogar*, *Kaikar*, *Kharpat*; Kan.: *Aranelli*, *Biligadde*, *Dodda dumpli*, *Godda*, *Hala-balagi*, *Kater-Kalesjam*; Kh.: *Dieng-Sohpyjar-Synrang*, *Dieng-Soh-Khmut*; Mal.: *Karegam*, *Kattukalinjam*, *Kosramba*; Mar.: *Kudak*; Nep.: *Aule dabadabe*, *Dab dabi*, *Maldit*; Or.: *Arnu*, *Mohi*, *Sompotri*; Tam.: *Karre-vembu*, *Karuvilangam*; Tel.: *Garuga*, *Garogoo*, *Garugudu*, *Kondavepa*.

Trees, up to 30 m high; bark white, grey or brown; branchlets pubescent. Leaves up to 42 cm long; stipules falcate; leaflets 11 - 17, variable in size, ovate-obovate, elliptic or



Fig. 110. *Garuga floribunda* Decne. var. *gamblei* (King ex W. Smith) Kalkman : habit.

oblong-lanceolate, 2.8 - 14.2 x 1.5 - 5.9 cm, chartaceous, puberulous, oblique at base, subentire or serrate-crenate along margins, acute-acuminate at apex. Leaf-galls copious. Panicles up to 30 cm long, tomentose; peduncles 2 - 6 cm long, stout; bracts linear, ca 2 mm long, caducous. Flowers cream-coloured or pale yellow. Calyx tube broadly campanulate, 3 - 8 mm long; lobes ovate-oblong, densely tomentose. Petals oblong-lanceolate, 5 - 8 x 1.5 - 2 mm, tomentose, thickened and inflexed at apex. Stamens 3 - 3.5 mm long, inserted on calyx tube; filaments pubescent. Disk crenate, yellow. Ovary globose, pilose; style pilose; stigma 5-lobed. Drupes oblong or irregularly globose, 1.5 - 2 cm across, fleshy, pale yellow; pyrenes 2 or 3; 1-seeded; seed with a membranous wing.

Fl. Jan. - May; *Fr.* March - Aug., Oct. - Dec.

Distrib. India: throughout, in deciduous forests at altitudes 150-900 m.

Bangladesh, Myanmar, S. China, S.E. Continental Asia, Malesia, Philippines, Vietnam and Thailand.

Uses. Fruits are edible, used in preparing pickles. The bark and leaf galls are used for tanning. The juice of leaf is given for asthma. The timber is used for planking, canoes, boxes, drums, furniture, cabinet work, house building, for commercial and tea chest plywood, match splints and cheap pencils; also used for brown wrapping paper. Leaves and shoots are used as fodder. The tree is used in afforestation.

7. *Protium* Burm. f., nom. cons.

Trees, sometimes shrubs. Leaves alternate, exstipulate, imparipinnate, rarely unifoliolate, leaflets petiolulate; tips of leaflets usually distinctly mucronulate. Panicles axillary or pseudoterminal, branched. Flowers small, bisexual or unisexual, 4 - 6-merous. Calyx persistent. Disk annular, truncate-undulate or crenately lobed, fleshy, glabrous. Stamens twice as many as petals, free; sometimes slightly reduced in female flowers. Ovary ovoid or subglobose, 4 - 5-locular, glabrous or pubescent; ovules 2 in each locule; male flowers often with sterile ovules. Drupes globose or ovoid with 1 - 3 pyrenes; pulp fibrous, arilliform; pyrenes hard, bony; testa membranous; cotyledons plicate, lobed to palmatifid.

American tropics, Madagascar, Mascarenes, in S.E. Asia from India through Malesia as far as New Guinea; ca 90 species, one species in India.

Literature. LEENHOUTS, P.W. (1956). Burseraceae. *Protium* In: STEENIS, Fl. Males. I, 5: 213-215; 7: 820. 1976. ENGLER, A. (1931). *Protium* In: ENGLER, A. & K. PRANTL, Nat. Pflanzenfam. ed. 2. 19a: 411.

Protium serratum (Wallich ex Colebr.) Engl. in A. & C. DC., Monogr. Phan. 4: 88. 1883. *Bursera serrata* Wallich ex Colebr. in Trans. Linn. Soc. London 15: 361. t. 4. 1827; A.W. Bennett in Hook. f., Fl. Brit. India 1: 530. 1875. *B. serrata* Colebr. var. *serratissima* Haines, Bot. Bihar Orissa 171. 1921. **Fig. 111.**

Asm.: *Mirtenga, Najor, Neoli*; Beng.: *Gutgotya*; Or.: *Garur, Limbru, Nimbura moi, Ninbura, Sorupotrimoi*; Tel.: *Chitreka*; Eng.: *Murtenga, Indian red pear*.

Trees, up to 20 m high; bark brownish or light grey outside, pink or reddish brown inside; branchlets striate, pubescent or puberulous. Leaves 7.5 - 34 cm long; rachis pubescent or brown tomentose; leaflets 5 - 7(-11), ovate-oblong to elliptic-lanceolate, 5 - 17 x 2 - 6 cm, coriaceous, pubescent when young, oblique, narrowed or rounded at base, entire, crenate-serrate along margins, bluntly caudate or acuminate at apex; petiolules usually swollen at both ends. Panicles lax, axillary or in axils of fallen leaves, shorter than leaves, up to 15 cm long; bracts often foliaceous, linear-lanceolate, ca 1.5 cm long. Flowers bisexual, 5-merous, pale green or greenish white. Calyx saucer-shaped, ca 1.5 mm long; lobes rounded or 3-angular, pubescent. Petals oblong-lanceolate, acute, ca 2.5 x 1 mm, pubescent outside. Stamens 10, shorter than petals, ca 1.5 mm long, equal; filaments dilated at base. Disk annular, crenate. Ovary ovoid, densely pubescent; stigma sessile or subsessile, 5-lobed. Drupes ovoid to globose, 2 - 3-furrowed, 1.3 - 2 cm across, red, with 1-3 one-seeded nuts.

Fl. Feb. - April; Fr. May - June, Sept.

Distrib. India: Common along streams, in ravines or on rocky grounds; occasionally planted in gardens. Uttar Pradesh, Bihar, W. Bengal, Assam, Orissa, Madhya Pradesh, Andhra Pradesh and Karnataka.

Bangladesh, Myanmar, Thailand, Vietnam.

Uses. Timber is used for house construction, solid wheels, shafts of carts, ploughs and furniture. It is suitable for decorative work, turnery, carving and cabinet making and for plywood. Fruits are edible.

DOUBTFUL SPECIES

Canarium subulatum Guillaumin

P.W. Leenhouts in Blumea 9: 411. 1959 reports, "a dubious specimen (Parkinson 224) from Mid-Andaman".

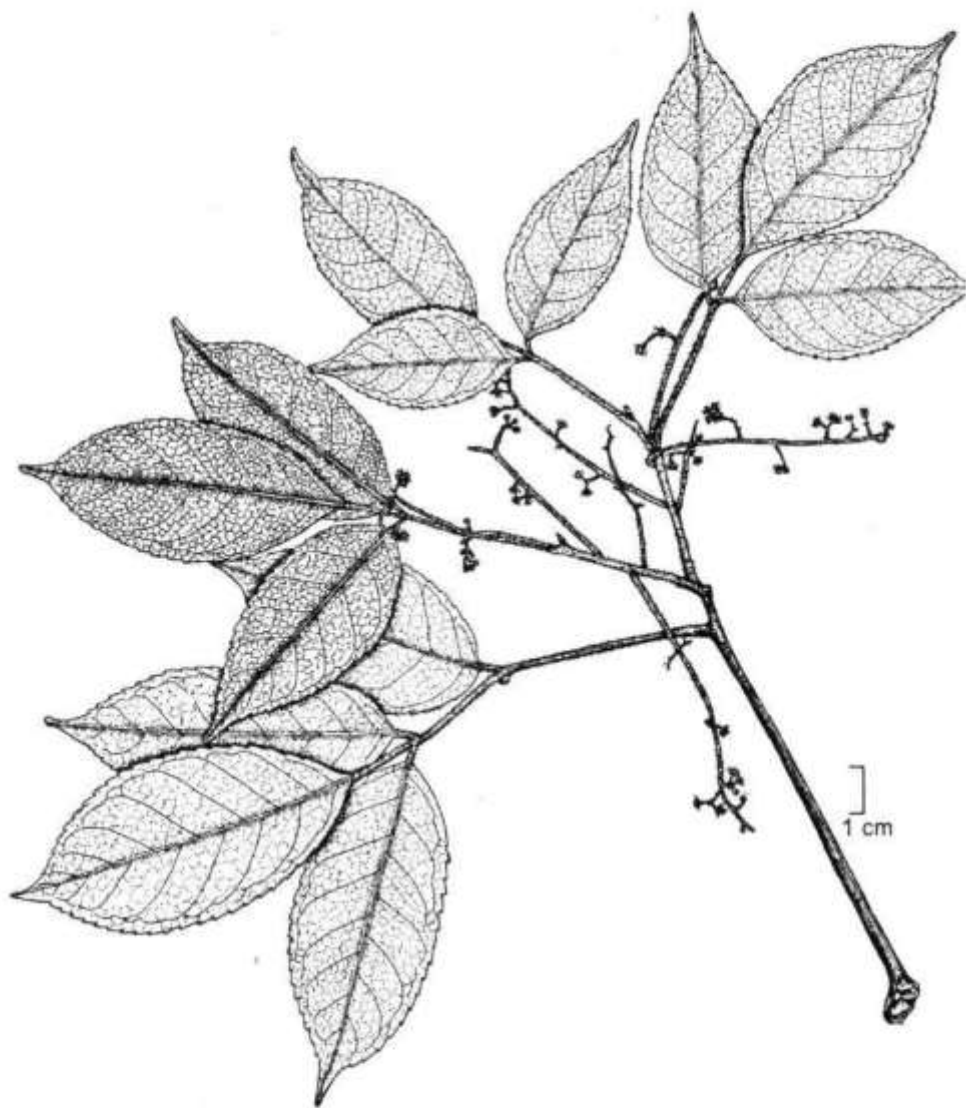


Fig. 111. *Protium serratum* (Wallich ex Colebr.) Engl. : habit.

MELIACEAE

S.S. Jain and S.S.R. Bennet

Trees or shrubs, rarely undershrubs. Leaves exstipulate, spiral, rarely decussate, usually pinnate rarely simple or 2-pinnate; leaflets opposite or alternate, more or less oblique at base, usually with an indumentum of simple hairs, less frequently of 2-fid or stellate hairs or peltate scales. Inflorescence axillary panicular cymes (thyrses), sometimes racemose, fasciculate or spicate or flowers in pairs, or solitary. Flowers regular, bisexual or unisexual, plants monoecious, dioecious or polygamous; rudiments of opposite sex usually well-developed in unisexual flowers. Calyx usually 3 - 6-lobed, rarely entire or of free imbricate sepals. Petals generally 3 - 6, free or rarely united at base, sometimes partly fused with staminal tube, imbricate, sometimes valvate or contorted. Stamens generally 4 - 12, inserted outside base of disk or androgynophore; filaments usually connate to form a staminal tube with or without appendages, rarely free; anthers usually sessile, erect, included or exerted, 2-loculed, longitudinally dehiscent. Antherodes in female flowers small, without pollen. Disk or androgynophore intrastaminal, tubular, annular, or obsolete, free or partly adnate to ovary and staminal tube. Ovary generally 2 - 5-locular; locules 2- or many-ovuled; placenta axile, rarely parietal; ovules collateral, superposed or 2-seriate; style single; stigma capitate or discoid. Pistillode in male flowers with a shruken ovary with abortive ovules, long, slender style and less glandular stigma. Fruit a capsule, berry, drupe or rarely a nut; seeds if winged usually attached to a woody columella and if unwinged with a fleshy arillode or sarcotesta, rarely with corky or woody sarcotesta or not, usually nonendospermous, sometimes with fleshy endosperm. Embryo with 2 plano-convex, flat, collateral, superimposed or rarely oblique cotyledons; cotyledons completely fused in *Sphaerosacme*; radicle usually superior, included or extending to surface.

A medium-sized family of woody plants comprising 51 genera and ca 575 species, distributed in the tropics and subtropics; 19 genera and 70 species in India.

Literature. BAHADUR, K.N. (1988). Monograph on the genus *Toona* (Meliaceae).

KEY TO THE GENERA

- | | |
|---|----|
| 1a. Plants dioecious; buds naked; locules usually 1 - 2-ovuled; seeds not winged; sarcotesta fleshy | 2 |
| b. Plants monoecious; buds protected by scale leaves; locules 3- or more-ovuled; seeds winged or not; sarcotesta corky or woody | 16 |
| 2a. Staminal tube appendaged | 3 |
| b. Staminal tube not appendaged | 13 |
| 3a. Fruit a dehiscent capsule | 4 |
| b. Fruit an indehiscent berry or drupe | 9 |
| 4a. Stamens inserted on rim of staminal tube | 5 |
| b. Stamens almost always inserted within throat of staminal tube | 8 |

- 5a. Capsules usually 2-valved 16. *Trichilia*
 b. Capsules 3 - 10-valved 6
- 6a. Indumentum with a mixture of simple, 2-fid as well as stellate hairs; petals adnate to staminal tube below 9. *Munronia*
 b. Indumentum with simple hairs only; petals free from staminal tube 7
- 7a. Leaves 3-foliolate; rachis winged 10. *Naregamia*
 b. Leaves simple; petioles not winged 17. *Turraea*
- 8a. Flowers linear or oblong; disk annular, rarely patelliform, or absent; anthers locellate; locules 1-seeded 4. *Chisocheton*
 b. Flowers oblong; disk cup-shaped or tubular; anthers not locellate; locules usually 2-seeded 7. *Dysoxylum*
- 9a. Fruit a berry 19. *Walsura*
 b. Fruits drupaceous 10
- 10a. Petioles without glands 6. *Cipadessa*
 b. Petioles with a pair of sunken glands at base 11
- 11a. Leaves 3-foliolate; flowers bisexual 12. *Sandoricum*
 b. Leaves uni-, 2- or 3-pinnate; flowers bisexual and male 12
- 12a. Leaves unipinnate with an indumentum of simple hairs; stigma 3-lobed; drupes 1-seeded; endocarp thin 3. *Azadirachta*
 b. Leaves 2 - 3-pinnate with an indumentum of stellate hairs; stigma 4 - 8-lobed; drupes 3 - 8-seeded; endocarp stony 8. *Melia*
- 13a. Indumentum with a mixture of simple and stellate hairs and peltate scales; anthers in one whorl 14
 b. Indumentum of simple hairs only; anthers in 2 whorls of 5 each 15
- 14a. Indumentum with stellate hairs and peltate scales; inflorescence usually an axillary panicle; fruit a berry, rarely a nut or capsule 1. *Aglaia*
 b. Indumentum with simple, rarely 2-fid or stellate hairs; inflorescence a spike or spicate panicle; fruit a capsule 2. *Aphanamixis*
- 15a. Petals adnate to staminal tube below; anthers of lower whorl appendaged; fruit a berry 11. *Reinwardtiodendron*
 b. Petals free from staminal tube; anthers not appendaged; fruit a capsule 14. *Sphaerosacme*
- 16a. Stamens completely free 15. *Toona*
 b. Stamens completely or partly adnate to staminal tube 17
- 17a. Mangrove plants; seeds not winged 18. *Xylocarpus*
 b. Non-mangrove plants; seeds winged 18
- 18a. Locules less than 12-seeded; seeds attached to the top of 5-ridged columella, without seed scars, winged at both ends 13. *Soymida*
 b. Locules many-seeded; seeds attached laterally in tiers on 3 - 5-angled and ridged columella, with seed scars, with a terminal wing 5. *Chukrassia*

1. *Aglaia* Lour.

Trees or shrubs with indumentum of stellate hairs or peltate scales. Leaves usually pinnate, rarely 3-foliolate or unifoliolate. Inflorescence usually an axillary panicle, rarely cauliflorous; the males large, many-flowered; females small, few-flowered. Flowers

unisexual, male and female flowers found on different individuals (dioecious); female flowers larger than the males. Calyx 3 - 5-lobed, valvate or imbricate. Petals 3 - 6, free or united at base, free from staminal tube or partly united with it, imbricate. Staminal tube globose, cup-shaped or cylindrical, entire or crenate at margin, rarely lobed, 0.5 - 5.5 mm long; anthers generally 5 - 10, glabrous, rarely hairy, inserted in a single whorl, included or partly exerted. Antherodes similar but without pollen. Disk absent. Ovary usually 1 - 3-locular; locules 1- or 2-ovuled; style short or absent; stigma small, capitate, conical or lobed. Pistillode with or without rudimentary ovules. Fruit a berry, nut or sometimes a capsule; seeds arillate, sometimes with a fleshy sarcotesta.

Indo-Malesian region, Australia, Melanesia and Polynesia with ca 100 species; 23 in India.

KEY TO THE SPECIES

- | | |
|--|-----------------------------|
| 1a. Anthers exerted; seeds angular | 2 |
| b. Anthers included in staminal tube or nearly so; seeds not angular | 3 |
| 2a. Leaves simple | 21. <i>A. simplicifolia</i> |
| b. Leaves compound; leaflets 3 or 5 | 15. <i>A. indica</i> |
| 3a. Fruit a capsule | 4 |
| b. Fruit a berry | 8 |
| 4a. Petals 4; anthers 8; ovary 3-locular; locules 1-ovuled | 18. <i>A. lawii</i> |
| b. Petals 6; anthers 6 - 10; ovary 2 - 3-locular; locules 2-ovuled | 5 |
| 5a. Leaflets (2-) 7, alternate or subalternate | 6 |
| b. Leaflets 3 - 13, opposite or subopposite | 7 |
| 6a. Calyx 3-lobed; ovary 2-locular | 6. <i>A. chittagonga</i> |
| b. Calyx 5-lobed; ovary 3-locular | 16. <i>A. jainii</i> |
| 7a. Leaflets obtuse at apex; anthers 6 | 7. <i>A. cucullata</i> |
| b. Leaflets abruptly acuminate at apex; anthers 8(-10) | 22. <i>A. spectabilis</i> |
| 8a. Flowers 4-merous | 11. <i>A. fusca</i> |
| b. Flowers 5-merous | 9 |
| 9a. Leaflets glabrous or with very minute pustulate scales | 10 |
| b. Leaflets with lepidote scales or stellate-tomentose | 12 |
| 10a. Leaflets glabrous | 11 |
| b. Leaflets minutely pustulate on both surfaces | 12. <i>A. ganggo</i> |
| 11a. Leaflets 5 - 8, alternate | 13. <i>A. glaucescens</i> |
| b. Leaflets 9 - 13, alternate or opposite | 19. <i>A. maiae</i> |
| 12a. Leaflets with lepidote scales at least when young | 13 |
| b. Leaflets with lepidote scales mixed with stellate hairs | 21 |
| 13a. Panicles shorter than leaves | 14 |
| b. Panicles as long as or longer than leaves | 18 |
| 14a. Anthers 10 | 14. <i>A. haslettiana</i> |
| b. Anthers less than 10 | 15 |
| 15a. Leaflets 3 - 5 | 17. <i>A. khasiana</i> |

- | | |
|---|---------------------------|
| b. Leaflets 5 - 7 | 16 |
| 16a. Shrub or small tree | 2. <i>A. apiocarpa</i> |
| b. Medium-sized or large trees | 17 |
| 17a. Leaves to 45 cm long; leaflets 5 - 7, lepidote beneath | 1. <i>A. andamanica</i> |
| b. Leaves to 15 cm long; leaflets 7, lepidote along main nerves | 4. <i>A. barberi</i> |
| 18a. Leaves 5-foliolate; panicles longer than leaves | 23. <i>A. talbotii</i> |
| b. Leaves pinnate; panicles not longer than leaves | 19 |
| 19a. Leaflets usually 5, rarely 3 or 7 | 9. <i>A. elaeagnoidea</i> |
| b. Leaflets 9 or more | 20 |
| 20a. Leaflets 13, glabrous except main nerves beneath; flowers sessile | 5. <i>A. canarensis</i> |
| b. Leaflets 9 - 18, lepidote when young, almost glabrous when mature; flowers short-pedicellate | 20. <i>A. perviridis</i> |
| 21a. Leaflets with silvery white indumentum beneath | 3. <i>A. argentea</i> |
| b. Leaflets with reddish or brownish indumentum | 22 |
| 22a. Leaflets 9 - 13, with lepidote scales and stellate hairs on nerves beneath; stamens included; berries pulpy. | 8. <i>A. edulis</i> |
| b. Leaflets 7 - 15, glabrous above except nerves, densely lepidote-tomentose beneath; stamens exserted; berries not pulpy | 10. <i>A. exstipulata</i> |

1. *Aglaia andamanica* Hiern in Hook. f., Fl. Brit. India 1: 555. 1875; C.E. Parkinson, Forest Fl. Andaman Isl. 121. 1923.

Tree, to 25 m tall; young parts with deciduous lepidote scales. Leaves to 45 cm long; leaflets 5 - 7, ovate-elliptic to elliptic, 10 - 15 x 5 - 8 cm, membranous, glabrous and shining above, sparsely lepidote beneath; secondary nerves 13 - 16 on each side; petiolules 6 - 8 mm long. Panicles crowded at ends of branches, 5 - 8 cm long, covered with lepidote scales. Flowers ca 3 mm long; pedicels short. Calyx cup-shaped, 5-toothed, lepidote outside, yellowish-white. Petals 5, elliptic-obovate, larger than calyx, puberulous outside. Staminal tube obovoid-globose with 4 obscure broad teeth at apex; anthers 8 - 9, included. Ovary small, depressed, 3-angled, densely hairy; stigma fleshy, subcapitate, 3-angled, glabrous. Fruits narrowly ellipsoid, ca 4 cm long, pale, lepidote.

Fl. & Fr. Nov. - July.

Distrib. India: Andaman & Nicobar Islands. In deciduous and semideciduous forests.

Myanmar.

2. *Aglaia apiocarpa* (Thwaites) Hiern in Hook. f., Fl. Brit. India 1: 555. 1875; Nair & Rajan in Nair & A.N. Henry, Fl. Tamil Nadu 1: 65. 1983. *Milnea apiocarpa* Thwaites, Enum. Pl. Zeyl. 60. 1858.

Shrub or small tree, to 5 m high; branchlets with a dense coat of ferruginous fimbriate scales towards tip. Leaves 15 - 40 cm long, imparipinnate; rachis to 20 cm long; rachis and leaflets minutely lepidote when young; leaflets 7, opposite or subopposite, elliptic to oblong, inequilateral at base, entire along margins, acuminate at apex, 10 - 20 x 3 - 15 cm, thinly coriaceous, almost glabrous except along midnerve beneath; secondary nerves 6 - 10 on each side; venation more or less obscure; petiolules slender, 5 - 20 mm long. Panicles shorter than leaves, lax, axillary, racemosely branched, densely rusty-lepidote; peduncles to 20 cm long. Flowers small; pedicels 1 - 2 mm long, stout, lepidote. Calyx ca 1.5 mm long, thick, 5-lobed, densely lepidote. Petals 5, oblong, thick, to 2.5 mm long, lepidote. Anthers slightly exerted. Ovary globose, lepidote. Fruits subglobose, 2 - 4 x 1.5 - 3.5 cm, rusty-lepidote.

Fl. & Fr. Mar. - Nov.

Distrib. India: Tamil Nadu.

Sri Lanka.

3. *Aglaia argentea* Blume, Bijdr. 170. 1825; C.E. Parkinson, Forest Fl. Andaman Isl. 121. 1923.

Tree, to 10 m tall; young parts covered with dense stellate hairs intermixed with lepidote scales. Leaves imparipinnate, 60 - 70 cm long; leaflets 7 - 11; upper leaflets 30 - 40 cm long, oblong-lanceolate to elliptic, silvery white beneath; secondary nerves 12 - 24 on each side, prominent beneath; lower leaflets 12 - 24 cm long; petiolules short, to 5 mm long. Panicles 7 - 15 cm long. Flowers sessile, subglobose, minute. Calyx deeply 5-lobed, lepidote outside, glabrous inside. Petals 5, twice as long as calyx, glabrous. Staminal tube globose, shorter than petals; mouth subentire; anthers 5, included. Ovary depressed; stigma truncate, glabrous. Fruits ovoid, 2 - 3 cm across, minutely rusty-pubescent, lepidote.

Fl. & Fr. Mar. - Sept.

Distrib. India: Nicobar Islands.

Myanmar, Java, Sumatra and New Guinea.

4. *Aglaia barberi* Gamble in Bull. Misc. Inform. 1915: 346. 1915 & Fl. Pres. Madras 180. 1915.

Fig. 112.

Tree, to 15 m tall; branchlets with an indumentum of reddish-brown lepidote scales. Leaves 10 - 15 cm long; leaflets 7, subopposite, lanceolate or elliptic-lanceolate, inequilateral at base, entire along margins, acuminate at apex, 6 - 12 x 2 - 4 cm, glabrous on both surfaces, lepidote on main nerves; secondary nerves ca 12 on each side, more



Fig. 112. *Aglaia barberi* Gamble : habit.

or less at right angles with midnerve; venation obscure; petiolules 3 - 7 mm long. Panicles ca 8 cm long, lepidote; bracts minute, caducous. Flowers pedicellate. Calyx saucer-shaped; lobes short, acute, ciliate. Petals oblong-ovate, glabrous. Staminal tube globose, not contracted at base, undulate along margins; stamens almost as long as staminal tube; anthers included. Ovary hairy; style short; stigma capitate. Berries obovoid, depressed at apex, to 1.5 cm across, reddish-brown when dry.

Fl. & Fr. Dec. - July

Distrib. India: W. Ghats, to 900 m. Kerala and Tamil Nadu.

Endemic.

Note. A rare and threatened species (Ahmedullah & Nayar, *Endemic Plants of the Indian Region* 1: 187, 1987).

5. *Aglaia canarensis* Gamble in *Bull. Misc. Inform.* 1915: 346. 1915 & *Fl. Pres. Madras* 180. 1915.

Tree, to 20 m tall; young parts lepidote. Leaves imparipinnate, to 40 cm long with a long rachis; leaflets ca 13, alternate or subopposite, lanceolate, obtusely acute or even rounded at base, entire along margins, acute at apex, 13 - 17 x 5 cm, glabrous on both surfaces except on nerves beneath, olive-brown when dry; secondary nerves 12 - 15 on each side; venation obscure; petiolules ca 1 cm long, that of terminal leaflet longer. Panicles axillary, lax, ca 40 cm long, lepidote; peduncle to 15 cm long, ultimate branches spicate. Flowers sessile, small, lepidote, with ovate bracts and 3 - 5 acute bracteoles. Calyx campanulate; lobes obtuse, ciliate. Petals oblong, to 2 mm long, glabrous. Staminal tube subglobose, glabrous; anthers acute, included. Ovary conical; style short.

Fl. & Fr. Jan. - May.

Distrib. India: W. Ghats of Karnataka (S. Kanara).

Endemic.

6. *Aglaia chittagonga* Miq. in *Ann. Mus. Bot. Lugduno-Batavum* 4: 44. 1868. *Amoora chittagonga* (Miq.) Hiern in *Hook. f., Fl. Brit. India* 1: 559. 1875; Kanj. et al., *Fl. Assam* 1: 237. 1937. *Aphanamixis chittagonga* (Miq.) Haridasan & R.R. Rao, *Forest Fl. Meghalaya* 1: 204. 1985.

Tree, to 15 m tall; bark blackish-brown, exuding milky juice; young parts covered with thin, silvery lepidote scales. Leaves to 30 cm long; rachis lepidote; leaflets 2 - 6, alternate or subalternate, elliptic, oblong-elliptic or oblong-lanceolate, slightly oblique or acute at base, entire along margins, acuminate at apex, 6 - 12 x 3 - 6 cm, membranous,

lepidote along midnerve and main nerves beneath especially when young; secondary nerves 12 - 16 on each side; petiolules to 3 mm long, stout. Male panicles clustered in axils of leaves, 10 - 15 cm long, lax; branches and pedicels slender; female panicles shorter, few-flowered, with shorter and stouter pedicels. Flowers to 3 mm long. Calyx cup-shaped, usually 3-lobed. Petals 3 - 4, ca 3 mm long. Staminal tube urceolate; anthers 6, included. Ovary 2 - 3-locular. Fruits indehiscent, obovoid, 2 - 3 cm long, 2 - 3-locular, 2-seeded.

Fl. & Fr. Aug. - Mar.

Distrib. India: Dense tropical evergreen forests in N.E. India; Arunachal Pradesh, Assam and Meghalaya.

Bhutan, Bangladesh, Myanmar and Malesia.

Note. According to Kanjilal *et al.* (1937) it is a very precocious tree, and saplings not more than 3 or 3.5 m high are found in flowers or fruits.

7. *Aglaia cucullata* (Roxb.) Pellegrin in Lecomte, Fl. Indo-Chine 1: 171. 1911. *Amoora cucullata* Roxb., Pl. Coromandel 3: 54. t. 258. 1819; Hiern in Hook. f., Fl. Brit. India 1: 560. 1875; Kanj. *et al.*, Fl. Assam 1: 236. 1937.

Tree, to 25 m tall, with grey bark and numerous blind root suckers. Leaves imparipinnate, to 80 cm long; leaflets 3 - 13, opposite or subopposite, ovate or oblong-elliptic, obtuse at both ends or sometimes oblique at base, 7 - 20 x 4 - 6.5 cm, glabrous, subcoriaceous; secondary nerves ca 16 on each side; terminal leaflet falcate; petiolules ca 1.25 cm long. Inflorescence densely lepidote; male panicles drooping, almost as long as leaves, with many diverging branches; female racemes much shorter, few-flowered. Flowers bracteate, 3 - 4 mm long, yellow; female and bisexual flowers larger than male flowers. Calyx 3-lobed. Petals 3. Staminal tube turbinate, scarcely shorter than petals; anthers 6, sessile, included. Ovary 3-locular; locules 2-ovuled; style absent; stigma 3-lobed, large. Pistillode similar but slender and stipitate. Capsules pyriform-globose, ca 6 cm across, obtusely 3-lobed, 3-valved, 3-seeded; seeds rounded with an orange-coloured fleshy aril.

Fl. & Fr. Oct. - May.

Distrib. India: W. Bengal, Assam, Maharashtra, Goa, Karnataka and the Andaman & Nicobar Islands.

Nepal and Myanmar.

Note. Reported by Hiern (1875) to occur on the Andaman Islands but King (1895) and Parkinson (1923) did not include it. Almeida (Flora of Savantwadi 1: 86. 1990)

included it on the authority of Dalgado. Kanjilal et al. (1937) stated that it was very rare, only once found in the Diagurung Reserve, Sibsagar Division, Assam.

8. *Aglaia edulis* (Roxb.) A. Gray, U.S. Expl. Exped. Phan. 1: 237. 1854; Hiern in Hook. f., Fl. Brit. India 1: 556. 1875; Kanj. et al., Fl. Assam 1: 239. 1937. *Milnea edulis* Roxb. [Hort. Beng. 18. 1814, nom.], Fl. Ind. 1: 637. 1832.

Tree, to 25 m tall with a dense crown; bark greyish-brown, exuding milky juice; young parts with an indumentum of stellate hairs and peltate scales. Leaves to 60 cm long, imparipinnate; leaflets 9 - 13, opposite or subopposite, elliptic-lanceolate or oblong, acute or rounded at base, entire along margins, acute at apex, 7 - 25 x 2.5 - 8 cm, chartaceous with stellate hairs mixed with lepidote scales on nerves beneath or glabrescent; secondary nerves 12 - 16 on each side; nerves obscure above; petiolules 4 - 6 mm long, stout. Panicles 10 - 20 cm long, rusty-tomentose. Flowers pedicellate, 1 - 2 mm across, yellow. Calyx 5-lobed. Petals ovate-oblong. Staminal tube globose; anthers 5, included. Ovary 1 - 3-locular. Berries subglobose, ca 2.5 cm across, yellowish, covered with lepidote scales, pulpy, usually 2-seeded.

Fl. & Fr. Apr. - Nov.

Distrib. India: Arunachal Pradesh, Assam, Tripura and Meghalaya.

Bangladesh and Indo-Malesian region.

Use. Fruit edible.

Note. According to Deb (Flora of Tripura State 1: 446. 1981) who has followed C. De Candolle (Monographiae Phanerogamarum 1: 609. 1878) the correct name and citation of this species is *A. edulis* (Roxb.) Miq. in Ann. Mus. Bot. Lugduno-Batavum 4: 49. 1868.

9. *Aglaia elaeagnoidea* (A. Juss.) Benth., Fl. Austral. 1: 383. 1863; Ramamoorthy in C.J. Saldanha & Nicolson, Fl. Hassan 392. 1976. *Nemadra elaeagnoidea* A. Juss. in Mem. Mus. Hist. Nat. 19: 259. t. 14. 1830. *Aglaia roxburghiana* (Wight & Arn.) Miq. in Ann. Mus. Bot. Lugduno-Batavum 4: 41. 1868; Beddome, Fl. Sylv. S. India t. 130. 1871; Hiern in Hook. f., Fl. Brit. India 1: 555. 1875. *A. odoratissima* auct. non Blume 1825: T. Cooke, Fl. Pres. Bombay 1: 209. 1902; Talbot, Forest Fl. Bombay 1: 234. 1909. *Milnea roxburghiana* Wight & Arn., Prodr. 119. 1834; Wight, Icon. Pl. Ind. Orient. t. 166. 1839.

Tree, 15 - 20 m tall; young parts and inflorescence covered with brown lepidote scales. Leaves imparipinnate, 7 - 25 cm long; leaflets (3-) 5 (-9), opposite, petiolulate or sometimes almost sessile, elliptic, lanceolate, oblanceolate, elliptic-oblong or ovate, 5 - 15 x 2.5 - 8 cm, thinly coriaceous, glabrous above, sparsely lepidote beneath and densely so on nerves; secondary nerves 12 - 20 on each side; petiolules to 1.25 cm long,

that of terminal leaflet longer. Panicles 7 - 25 cm long, densely flowered. Flowers shortly-pedicellate, globose, yellow. Calyx cup-shaped, 5-lobed, ciliate along margins, lepidote outside. Petals 5, elliptic-oblong, longer than calyx, often scaly outside when young. Staminal tube shorter than petals, urceolate, somewhat contracted at base; mouth obscurely 5-lobed; stamens 5, small, inserted in middle of staminal tube; anthers included or exerted. Ovary small, depressed, stellately lepidote; style half as long as staminal tube or almost absent; stigma ovoid or obscurely lobed. Berries subglobose or pyriform, ca 2 cm across, velvety-lepidote-tomentose, buff coloured, 1-seeded.

KEY TO THE VARIETIES

- | | |
|---|--------------------------------|
| 1a. Leaflets distinctly petiolulate, usually oblanceolate; anthers exerted | 9.2. var. <i>bourdillonii</i> |
| b. Leaflets almost sessile, usually elliptic or lanceolate; anthers included | 2 |
| 2a. Leaflets 7 - 9, usually oblanceolate, less than 7.5 cm long; style almost absent; stigma broad, obscurely lobed | 9.3. var. <i>courtallensis</i> |
| b. Leaflets 5 - 7, usually lanceolate, more than 10 cm long; style almost half as long as staminal tube; stigma ovoid | 3 |
| 3a. Leaflets to 15 x 5 cm | 9.4. var. <i>elaegnoidea</i> |
| b. Leaflets ca 10 x 2.5 cm | 9.1. var. <i>beddomei</i> |

9.1. var. *beddomei* (Gamble) K.K.N. Nair in J. Bombay Nat. Hist. Soc. 78: 426. 1981. *A. roxburghiana* (Wight & Arn.) Miq. var. *beddomei* Gamble, Fl. Pres. Madras 180. 1915. *A. roxburghiana* sensu Beddome, Fl. Sylv.S. India. t. 130A. 1871, non (Wight & Arn.) Miq. 1868. Fig. 113.

Fl. & Fr. Dec. - Feb.

Distrib. India: Bihar, Orissa, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu (E. Ghats; hills of Deccan; Travancore, to 900 m).

9.2. var. *bourdillonii* (Gamble) K.K.N. Nair in J. Bombay Nat. Hist. Soc. 78: 426. 1981. *A. bourdillonii* Gamble in Bull. Misc. Inform. 1915: 346. 1915 & Fl. Pres. Madras 180. 1915. *A. roxburghiana* sensu Beddome, Fl. Sylv. S. India t. 130B. 1871, non (Wight & Arn.) Miq. 1868. Fig. 114.

Fl. & Fr. Dec. - Feb.

Distrib. India: Tamil Nadu (Tirunelveli Hills); Kerala (Attramallay ghats), above 1200 m.

Endemic.



Fig. 113. *Aglaia elaeagnoidea* (A. Juss.) Benth. var. *beddomei* (Gamble) K.K.N. Nair : habit.



Fig. 114. *Aglaia elaeagnoidea* (Juss.) Benth. var. *bourdillonii* (Gamble) K.K.N. Nair : habit.

9.3. var. *courtallensis* (Gamble) K.K.N. Nair in J. Bombay Nat. Hist. Soc. 78: 426. 1981. *A. roxburghiana* (Wight & Arn.) Miq. var. *courtallensis* Gamble, Fl. Madras 180. 1915.

Fl. Nov. - Feb.; *Fr.* Jan. - Dec.

Distrib. India: Tamil Nadu (Tirunelveli Hills), 950 - 100 m, common. Endemic.

9.4. var. *elaegnoidea*

Fl. & Fr. Nov. - Aug.

Distrib. India: Bihar, Orissa, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu.

Malesia and Indonesia (Java and Sumatra).

10. *Aglaia extipulata* (Griffith) Balakr. in J. Bombay Nat. Hist. Soc. 67: 57. 1970. *Euphora extipulata* Griffith, Not. Pl. Asiat. 4: 547. 1851. *Aglaia polyantha* Beddome, Icon. Pl. Ind. Orient. 44. 1868 - 1874. *A. minutiflora* Beddome, Icon. Pl. Ind. Orient. t. 193. 1868 - 1874; Gamble, Fl. Pres. Madras 181. 1915. *A. minutiflora* Beddome var. *travancorica* Hiern in Hook. f., Fl. Brit. India 1: 557. 1875. *A. travancorica* auct. non Hiern 1875: Bourd., Forest Fl. Travancore 85. 1908. **Fig. 115.**

Tree, to 20 m tall, with reddish-pink fragrant wood; young parts with a dense indumentum of reddish-brown lacerated lepidote scales and stellate hairs. Leaves usually imparipinnate, ca 60 cm long; leaflets to 15, opposite or subopposite, narrowly elliptic or oblong-lanceolate, subcordate, rounded or cuneate at base, entire or irregularly toothed along margins, acuminate at apex, 7 - 15 x 2.5 - 5 cm long, glabrous above except on nerves when mature, densely covered with lepidote scales mixed with stellate hairs beneath; secondary nerves 10 - 14 on each side, conspicuous; rachis and petiolules densely stellate-lepidote. Panicles to 45 cm long. Flowers globose, minute, fragrant; pedicels slender. Calyx subglobose, 5-toothed, stellate-tomentose outside. Petals 5, glabrous. Staminal tube nearly entire at mouth, glabrous; anthers 5, exerted. Ovary lepidote-pubescent; style short; stigma conoid. Berries subglobose, to 2.5 cm long, densely stellate-lepidote.

Fl. & Fr. Oct. - May.

Distrib. India: Restricted to the W. Ghats of Kerala and Tamil Nadu (Travancore and Anamalai hills), 450 - 900 m, not uncommon.

Myanmar.



Fig. 115. *Aglaia exstipulata* (Griffith) Balakr.: habit.

11. *Aglaia fusca* King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 62. 1895; C.E. Parkinson, Forest Fl. Andaman Isl. 121. 1923.

Tree, to 10 m high; young branches ash-coloured, with a thin layer of pale-rusty scurfy tomentum becoming glabrous later. Leaves 15-25 cm long; leaflets 5-7, alternate or subopposite, the upper pair usually opposite, oblong-lanceolate to ovate-lanceolate, cuneate or rounded at base, entire along margins, acute or acuminate at apex, 6.5-12 x 2.5-4 cm, coriaceous, glabrous above, shining, minutely punctulate and rusty-puberulous on midnerve; secondary nerves 7-9 on each side, ascending; petiolules to 8 mm long, that of terminal leaflet longer. Panicles shorter than leaves. Flowers globose, ca 2 mm; pedicels shorter than flowers. Sepals 4, rounded, unequal, lepidote outside. Petals 4, oblong-ovate, concave, larger than sepals, glabrous. Staminal tube globose-obovoid, glabrous; mouth subentire; anthers 4, ovate, short, inserted near mouth. Ovary pubescent; style long, cylindric, glabrous. Immature berries globose, ca 1.5 cm with a small apiculus, rusty-tomentose, 1-locular, 1-seeded.

Fl. & Fr. Nov. - June.

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

Note. Parkinson (*l.c.*) included this species on the authority of King (*l.c.*). According to Balakrishnan & Vasudeva Rao (in Jain & Rao, An Assessment of Threatened Plants of India 191. 1983) this species has been collected only in the type locality.

12. *Aglaia ganggo* Miq., Fl. Ned. Ind., Eerste Bijv. 3: 506. 1861. & in Ann. Mus. Bot. Lugduno-Batavum 4: 46. 1868; C.E. Parkinson, Forest Fl. Andaman Isl. 121. 1923.

Tree, to 15 m tall; bark greyish, smooth; young branches, petioles, midnerve and inflorescence lepidote-tomentose. Leaves pari- or imparipinnate, to 60 cm long; leaflets 10-17, opposite or alternate, oblong or oblong-lanceolate, somewhat unequal at base, entire along margins, acute or shortly acuminate at apex, 7-18 x 2.5-4 cm, minutely pustulate on both surfaces, subcoriaceous; secondary nerves 12-18 on each side; petiolules 3-8 mm long. Panicles as long as leaves, rusty. Flowers subsessile, 2-3 mm long. Calyx cupular, 5-toothed, lepidote outside. Petals 5, elliptic, concave, larger than calyx, glabrous. Staminal tube ovoid, shorter than petals; mouth entire; anthers 5, included. Ovary depressed, 3-angled, small, densely hairy; stigma grooved, glabrous. Fruits compressed, reniform, almost 2-lobed, ca 2 cm across, lepidote, coppery-brown.

Fl. & Fr. Rainy season, Jan. - Mar.

Distrib. India: Andaman & Nicobar Islands. Evergreen or semievergreen forests of Middle and S. Andamans, Long and Havelock Islands.

13. *Aglaia glaucescens* King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 64. 1875; C.E. Parkinson, Forest Fl. Andaman Isl. 121. 1923.

Small tree, ca 8 m tall; bark covered with rust-coloured, scurfy tomentum when young, becomes cinereous-lenticellate when mature; branchlets slender. Leaves pari- or imparipinnate, 20-30 cm long; leaflets 5-8, oblong-lanceolate to ovate-oblong, entire along margins, subacute at apex, 6-14 x 3.5-5 cm, thinly coriaceous, dull and subglaucous beneath; secondary nerves 7-10 on each side, ascending or straight, slightly prominent beneath; petiolules 7-12 mm long. Panicles as long as leaves, lax, few-flowered. Flowers globose, 2-3 mm, yellowish-orange; pedicels ca 2 mm long. Sepals 4-5, ovate, concave, erect. Petals 4-5, elliptic, obtuse, longer than sepals, coriaceous, glabrous. Staminal tube cylindrical, as long as petals, widening at the subtenture mouth; anthers 4-5, shortly and broadly ovate, included. Ovary pubescent; stigma glabrous.

Fl. & Fr. Dec. - Feb.

Distrib. India: Andaman Islands.

14. *Aglaia haslettiana* Haines in J. & Proc. Asiat. Soc. Bengal 15: 312. 1919 & Bot. Bihar Orissa 180. 1921.

Tree, to 15 m high; branchlets, rachises and petiolules densely lepidote. Leaves usually imparipinnate, to 50 cm long; leaflets 5-7, subopposite or alternate, oblong or elliptic-oblong, tapering and oblique at base, entire along margins, acuminate at apex, 15-23 x 3.5-7.5 cm, densely lepidote beneath when young, glabrescent except on midnerve when mature; secondary nerves 10-15 on each side; venation obscure; petiolules 3-10 mm long. Panicles 5-10 cm long, densely lepidote, shortly pedunculate. Flowers globose, small, ca 2 mm, fragrant; pedicels 1-1.5 mm long. Calyx campanulate, shallowly 5-toothed, lepidote outside. Petals 5, elliptic-oblong, obtuse. Staminal tube globose, as long as petals; mouth crenulate; anthers 10, sessile, 1-seriate, equal, included. Ovary short, obscurely 3-angled; stigma sessile, 3-lobed. Fruits not seen.

Fl. April - May

Distrib. India: Orissa.

Endemic.

Note. Haines considered it to be a connecting link between *Amoora* Roxb. and *Aglaia* Lour.

15. *Aglaia indica* (Hook. f.) Harms in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 19b1: 146. 1940; Nair & Rajan in Nair & A.N. Henry, Fl. Tamil Nadu 1: 66. 1983. *Beddomea*

indica Hook. f. in Benth. & Hook.f., Gen. Pl. 1: 336. 1862; Beddome, Fl. Sylv. S. India t. 135. 1871 (smaller fig.); Hiern in Hook. f., Fl. Brit. India 1: 566. 1875. **Fig. 116.**

Large shrub or small tree; young parts lepidote. Leaves 15 - 30 cm long; rachis terete, to 7 cm long; leaflets 1 - 2 pairs with a terminal one, opposite, elliptic, more or less cuneate at base, entire along margins, acuminate at apex, 7 - 18 x 4 - 8 cm, almost glabrous when mature; secondary nerves ca 7 on each side; petiolules 0.8 - 2.5 cm long, that of terminal leaflet longer. Inflorescence a simple raceme, or paniculate, 7 - 15 cm long, few- or many-flowered. Flowers ca 5 mm across; pedicels 2.5 - 6 mm long with a small bract at base. Calyx small, 5-lobed; lobes spreading, imbricate, rusty-lepidote outside. Petals 5, free, orbicular, concave, equal or the 2 inner ones smaller, imbricate, glabrous. Staminal tube short, thick, crenate at mouth; anthers 5, sessile, large, with thick connectives attached broadly to the tube on back, included. Ovary conical, depressed, 3-locular; locules 2-ovuled; stigma sessile, capitate, 5-angled. Capsules obovoid or oblong, 2.5 - 4 cm long, furrowed, rough, stellate-lepidote.

Distrib. India: Western Ghats, undergrowth in evergreen forests, on slopes, to 1200 m. Karnataka, Tamil Nadu and Kerala.

Endemic.

16. *Aglaia jainii* Viswanathan & K. Ramachandran in Bull. Bot. Surv. India 24: 212. (Nov.) 1983. *Amoora canarana* (Turcz.) Hiern in Hook. f., Fl. Brit. India 1: 560. 1875, non *Aglaia canarensis* Gamble 1915. *Oraoma canarana* Turcz. in Bull. Soc. Imp. Naturalistes Moscou 1: 411. 1858. *Aglaia tamilnadensis* Nair & Rajan in Nair & A.N. Henry, Fl. Tamil Nadu 1: 66. (Dec.) 1983.

Tree, to 15 m tall, with milky juice; young parts, inflorescence, calyx and fruit rusty-lepidote. Leaves imparipinnate, to 30 cm long; rachis to 10 cm long. Leaflets 3 - 7, opposite or alternate, elliptic to ovate-oblong, narrowed at base, entire along margins, acuminate at apex, 8.5 - 13 x 3.5 - 4.5 cm, thinly coriaceous, more or less glabrous above, usually punctate-lepidote beneath; petiolules to 1 cm long. Panicles to 20 cm long. Flowers ca 5 mm across, greenish yellow, fragrant, polygamodioecious; pedicels to 2 mm long. Calyx cupular, 5-lobed, ca 1.5 mm long. Petals 5, free, obovate, ca 2.5 mm long, thick, glabrous, imbricate. Staminal tube subglobose, ca 1.5 mm long; mouth crenate; anthers 10, included. Ovary ovoid, ribbed, pubescent, 3-locular; style short; stigma discoid, 3-lobed. Capsules subglobose, 3-valved, ca 1.5 x 1 cm, greenish or greyish, 1 - 2-seeded.

Fl. & Fr. Apr. - May and July - Sept.

Distrib. India: Tamil Nadu and Kerala. Evergreen forests on the Anamalai and Travancore Hills of W. Ghats, to 1100 m.



Fig. 116. *Aglaia indica* (Hook. f.) Harms : habit.

Endemic.

17. *Aglaia khasiana* Hiern in Hook. f., Fl. Brit. India 1: 554. 1875; Kanj. et al., Fl. Assam 1: 238. 1937.

Tree, to 15 m tall; young parts ferruginous-lepidote. Leaves imparipinnate, 15 - 30 cm long; leaflets 3 - 5, opposite or alternate, narrowly elliptic, narrowed at both ends, entire along margins, 10 - 20 x 2.5 - 5 cm, glabrescent; secondary nerves 12 - 14 on each side; petiolules 0.8 - 2.5 cm long. Panicles much shorter than leaves, densely branched, ferruginous-lepidote. Flowers almost sessile, 4 - 6 mm across. Calyx 4 - 5-toothed; teeth obtuse, rusty-tomentose. Petals 4 - 5, stellate-lepidote, imbricate. Staminal tube urceolate, glabrous; anthers 4 - 5, elliptic-oblong, ca 2 mm long. Ovary depressed, hirsute in upper half. Berriers ca 2.5 cm across, glabrous.

Distrib. India: Arunachal Pradesh, Assam and Meghalaya.

Endemic.

Note. Hiern (*l.c.*) reported the distribution of this species in Sikkim also on the basis of J.D. Hooker's collection but with some doubt. Neither Grierson and Long (Flora of Bhutan 1991) nor Haridasan and Rao (Forest Flora of Meghalaya 1985) recorded it.

18. *Aglaia lawii* (Wight) C.J. Saldanha in C.J. Saldanha & Nicolson, Fl. Hassan 392. 1976. *Nimmoa lawii* Wight in Calcutta J. Nat. Hist. 7: 113. 1847. *Epicharis exarillata* Nimmo ex J. Graham, Cat. Pl. Bombay 31. 1839, non Arn. 1834. *Nemedra nimmonii* Dalz. & Gibs., Bombay Fl. 37. 1861. *Amoora lawii* (Wight) Beddome, Fl. Sylv. S. India t. 133. 1871; Hiern in Hook.f., Fl. Brit. India 1: 561.1875. Fig. 117.

Tree, to 15 m tall; young parts, inflorescence, calyx and fruits covered by yellowish-brown lepidote scales. Leaves to 40 cm long; leaflets 1 - 2 pairs with a terminal one, opposite, sometimes alternate, ovate-lanceolate or elliptic, oblique at base, entire along margins, acute at apex, 12 - 16 x 5 - 6 cm, thin, glabrous on both surfaces or nearly so, sometimes hairy, gland-like excrescences present in axils of secondary nerves; secondary nerves to 10 on each side; petiolules ca 1 cm long. Inflorescences axillary, shorter than leaves; male flowers in panicles; females and bisexual ones in short spikes. Flowers 3 - 5 mm long, white; pedicels tetragonous, short. Calyx truncate, short, 4-toothed. Petals 4, oblong, ca 4 x 3 mm. Staminal tube globose, subentire at apex, glabrous; anthers usually 8, attached near base of staminal tube. Ovary lepidote, 3-locular; locules 1-ovuled; stigma 3-lobed. Capsules pyriform, ca 2.5 cm long, 3-locular with white resinous juice, buff-coloured, 2 - 3-seeded.

Fl. & Fr. Dec. - Feb.



Fig. 117. *Aglaia lawii* (Wight) Saldanha : habit.

Distrib. India: Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala. Occasional in semievergreen forests.

Bhutan.

19. *Aglaia maiiae* Bourd. in J. Bombay Nat. Hist. Soc. 12: 350. t. 11. 1899; Gamble, Fl. Pres. Madras 180. 1915.

Tree, to 25 m tall; wood sweet-scented; bark smooth, mottled brown and white. Leaves 30-60 cm long; leaflets 9-13, opposite or alternate, oblong-elliptic to lanceolate, unequally acute at base, entire along margins, acute or acuminate at apex, 12-16 x 5.5-6 cm, glossy and dark-green, coriaceous; secondary nerves ca 15 on each side; petiolules 8-12 mm long. Panicles 20-40 cm long, lax, drying black. Flowers globose, ca 4 mm, glabrous, yellowish, fragrant; pedicels ca 2 mm long. Calyx 5-lobed; lobes acute, imbricate. Petals 5, free, concave, imbricate. Staminal tube subglobose; mouth obscurely 5-toothed or entire; anthers 5, included. Ovary hairy, 2-locular; style short; stigma discoid. Berries fleshy, globose, ca 2 cm, buff-coloured, downy, 1-seeded.

Fl. & Fr. Mar. - Sept.

Distrib. India: Karnataka, Tamil Nadu and Kerala. Common in moist and semievergreen forests.

Endemic.

20. *Aglaia perviridis* Hiern in Hook. f., Fl. Brit. India 1: 556. 1875; Kanj. et al., Fl. Assam 1: 239. 1937. *A. perviridis* Hiern var. *sikkimiana* C.DC. in A. DC. & C. DC., Monogr. Phan. 1: 610. 1878.

Tree, to 15 m tall; bark greyish brown, rough with an aromatic smell; young parts rusty-lepidote. Leaves 30-50 cm long; leaflets 9-15, opposite or subopposite, lanceolate or ovate-lanceolate to ovate-oblong, obtuse or tapering at base, entire along margins, acuminate at apex, 17-20 x 1.5-6 cm, coriaceous, lepidote when young, almost glabrous afterwards; secondary nerves 14-18 on each side; petiolules 6-12 mm long, that of the odd leaflet the longest. Panicles about as long as leaves, lepidote when young; bracts and bracteoles lanceolate, small. Flowers minute, white; pedicels short, glabrous. Calyx 5-toothed, glabrous, ciliate along edges. Petals 5, free, imbricate. Staminal tube subglobose, glabrous; anthers 5, ovate, acute. Ovary glabrous, 1-locular, 2-ovuled. Berries asymmetrically ellipsoid, ca 2.5 cm long, covered with dense ferruginous scales, 1-seeded.

Fl. & Fr. May - Dec.

Distrib. India: W. Bengal, Sikkim, Assam and Meghalaya.

Endemic.

Note. Jain & Sastry (Threatened plants of India : A State-of-the-Art-Report 12, 1980) stated that this species occurs on the Khasi Hills, Meghalaya. Haridasan and Rao (Forest Flora of Meghalaya 1985), however, did not enumerate it.

21. *Aglaia simplicifolia* (Beddome) Harms in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 19b1: 146. 1940; Nair & Rajan in Nair & A.N. Henry, Fl. Tamil Nadu 1: 66. 1983. *Beddomea simplicifolia* Beddome, Fl. Sylv. S. India t. 135. 1871; Hiern in Hook. f., Fl. Brit. India 1: 566. 1875, incl. vars.; Gamble, Fl. Pres. Madras 184. 1915.

Small tree, to 8 m high; young parts scurfy-lepidote or stellate. Leaves unifoliolate, elliptic or lanceolate, obtuse or somewhat cuneate at base, entire along margins, acuminate at apex, 7 - 15 x 3 - 10 cm; secondary nerves ca 12 on each side, prominent beneath; petioles 1.5 - 2 cm long. Inflorescence a panicle or raceme, variable in length and texture, sometimes flowers solitary. Flowers 5 - 6-merous, 2.5 - 6 mm long. Calyx of 5 obtuse lobes, densely stellate-lepidote, large, enclosing petals. Petals 5, free, orbicular, ca 4 mm long, glabrous, imbricate. Staminal tube thin, large and globose or smaller, corrugated or plain, shortly 5-toothed or lobed at mouth; anthers 5, partly exserted. Ovary stellate-hirsute, 3-locular, 2-ovuled; style short, thick; stigma 3-lobed. Capsules oblong or obovoid, beaked, 2.5 - 4 cm long, densely rusty-tomentose.

Distrib. India: Karnataka and Kerala. Forests of the W. Ghats, 600 - 1200 m.

Endemic.

Note. On the basis of variations in inflorescence type and length and flower size 3 varieties, viz., *genuina*, *parviflora* and *racemosa* were recognised by earlier authors. These were distinguished by (a) large flowers in long, stout racemes, (b) small flowers in short panicles and (c) medium-sized flowers in long slender racemes, respectively. However, as foliage of these forms is similar they are not recognized as distinct taxonomic entities.

22. *Aglaia spectabilis* (Miq.) S.S. Jain & Bennet in Indian J. For. 9: 271. 1986; Grierson & Long, Fl. Bhutan 2: 35. 1991. *Amoom spectabilis* Miq. in Ann. Mus. Bot. Lugduno-Batavum 4: 37. 1868; Hiern in Hook. f., Fl. Brit. India 1: 561. 1875. *A. wallichii* King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 56. 1895. *Aglaia hiemii* Viswanathan & K. Ramachandran in Bull. Bot. Surv. India 24: 212. 1983, non King 1895 nec Koord. & Valetton ex Koord. 1898. *Aphanamixis wallichii* (King) Haridasan & R.R. Rao, Forest Fl. Meghalaya 1: 206. 1985.

Tree, to 25 m tall, buttressed; young parts with milky sap; bark grey, nearly smooth; young shoots and inflorescence covered with rusty-brown fimbriated scales and stellate hairs. Leaves 30 - 85 cm long; rachis greyish or rusty, with lepidote scales and stellate

hairs. Leaflets 9 - 19, rarely 3 - 7, close to panicles, opposite or alternate, elliptic or ovate-oblong, rounded or slightly cuneate at base, entire along margins, acuminate at apex, 15 - 25(-30) x 7 - 9(-15) cm, almost glabrous except on nerves beneath when mature, subcoriaceous; secondary nerves 12 - 20 on each side; petiolules 1 - 2 cm long, that of the odd leaflet the longest, to 3 cm long. Male panicles much-branched and many-flowered, 30 - 45 cm long; female panicles 7 - 10 cm long. Male flowers smaller than female flowers. Calyx minute, obtusely 3-lobed, lepidote-stellate. Petals 3, free, orbicular, concave, ca 2 mm long, tomentose. Staminal tube urceolate, glabrous; mouth 8 - 10-lobed or toothed; anthers usually 8, rarely 10, slightly exerted. Ovary in female flowers depressed, pyramidal, prominently 3-angled, yellow-brown-tomentose, 3 - 4-locular; style short or absent; stigma 3 - 4-lobed, large, purple. Pistillode in male flowers similar but slender and with depressed, tawny-pubescent ovary and thick, fleshy, 3-grooved stigma. Capsules subglobose or broadly pyriform, 3 - 5 x 3 - 4 cm, orange-yellow-tomentose, 2 - 3-seeded.

Fl. & Fr. June - Mar.

Distrib. India: W. Bengal, Sikkim, Assam, Tripura, Meghalaya, Orissa and the Andaman & Nicobar Islands. Plains and low hills.

Bangladesh, Myanmar, Malesia and the Fiji Islands.

Note. Yields a timber of superior quality which is red in colour and used for planks and furniture.

23. *Aglaia talbotii* Sund. in Bull. Bot. Surv. India 10: 184. 1969. *A. littoralis* Talbot, Syst. List Trees Bombay ed. 2, 76. 1902 & Forest Fl. Bombay 1: 235. 1909, non Miq. & Zipp. 1868.

Shrub or small tree, to 4 m high. Leaves 5-foliolate, 8 - 25 cm long; leaflets obovate or elliptic, 4 - 12 x 0.8 - 1.3 cm, thinly subcoriaceous, glabrous, dark-green, shining above, pale-green beneath; secondary nerves 8 - 10 on each side; nerves prominent beneath; petiolules 2.5 - 3.5 mm long. Panicles much longer than leaves, densely flowered. Flowers polygamodioecious, subglobose, minute, yellowish; pedicels short. Calyx 5-lobed, lobes imbricate. Petals 5, free, concave, imbricate. Staminal tube subglobose, glabrous; mouth obscurely 5-lobed; anthers 5, included. Ovary small, stellate-lepidote, 1 - 2-locular, 1 - 2-ovuled; style short; stigma ovoid. Berries somewhat obovoid, subacute, 1 - 2 cm long, leathery, bright-yellow, lepidote, 1 - 2-seeded.

Fl. & Fr. June - Feb.

Distrib. India: Goa and Karnataka.

Notes. According to Raghavan and Sharma (in Nayar & Sastry (ed.), Red Data Book of Indian Plants 1: 202. 1982) it is endemic to the Western Ghats and confined to the coastal belt from North Kanara southwards but does not extend into Kerala. It was initially collected by Talbot during 1882 - 1896 as a very common plant but after that it was rediscovered only in 1964. Its rarity can be attributed to disturbance in its habitat.

CULTIVATED SPECIES

Aglaia odorata Lour., Fl. Cochinch. 173. 1790; Wight, Icon. Pl. Ind. Orient. t. 511. 1841; Hiern in Hook. f., Fl. Brit. India 1: 554. 1875; Gamble, Fl. Pres. Madras 181. 1915.

Shrub or small tree; young shoots rusty stellate-lepidote. Leaves 3-foliolate, 5 - 15 cm long; leaflets ovate or ovate-oblong, obtuse or tapering at both ends, entire along margins, 2.5 - 8 x 0.8 - 4 cm, thinly coriaceous, glabrous on both surfaces; secondary nerves 8 on each side; venation indistinct; terminal leaflet the largest; petiolules short. Panicles lax, longer than leaves. Flowers ca 2.5 mm long, yellow, fragrant; pedicels almost as long as flower. Calyx 5-lobed; lobes elliptic. Petals 5, orbicular or suborbicular, unequal. Staminal tube campanulate with 5 broad, truncate teeth; anthers 5, elliptic, included.

Cultivated in gardens in south India for its sweet-scented flowers.

Also cultivated in Sri Lanka, Malaysia and Singapore. Distributed in Thailand, Java and China.

IMPERFECTLY KNOWN SPECIES

Aglaia mannii (King ex Brandis) S.S. Jain & Gaur in J. Econ. Tax. Bot. 7: 466. 1985. *Amoora mannii* King ex Brandis, Indian Trees 142. 1906; C.E. Parkinson, Forest Fl. Andaman Isl. 121. 1923.

Leaflets 11 - 15. Fertile flowers in long axillary panicles.

Distrib. India: S. Andamans.

Notes. According to Balakrishnan and Rao (in Jain & Rao (ed.), An Assessment of Threatened Plants of India 191. 1983) material of this species has not been collected after the type. It was included by Parkinson (*l.c.*) without having seen any specimen.

EXCLUDED SPECIES

Aglaia pedicellaris C.DC. in A. DC. & C.DC., Monogr. Phan. 1: 607. 1878.

This species was described based of *Helper* 1046 (collected in Tenasserim and Andaman(K). Parkinson (1923) did not include it. However, in the Introduction he stated that Dr. Helfer, a Russian Scientist, visited the islands in 1839 to ascertain the mineral wealth but he was murdered by the aborigines on the North Andaman Island. His botanical collections from Andaman were, therefore, after his death, got mixed up with those from Tenasserim, so all specimens were then together labelled as "Tenasserim and Andaman" which has resulted in great confusion as plants of one region have been ascribed wrongly to the other. This may, perhaps, be the reason, why Parkinson did not include this in his flora.

2. *Aphanamixis* Blume

Trees with an indumentum of simple, very rarely 2-fid or stellate hairs. Leaves pinnate; leaflets opposite. Flowers unisexual(then plants dioecious) or bisexual, in axillary or supraaxillary inflorescence; male flowers small, in panicles; female and bisexual flowers larger, in long spikes, racemes or rarely panicles. Calyx deeply 5-lobed; lobes imbricate. Petals 3, united below with base of staminal tube, imbricate. Staminal tube globose or deeply cyathiform, entire or lobed at margins; anthers 3 - 8, inserted within staminal tube, included or partly exerted, glabrous, sometimes appendaged. Staminodes indehiscent, without pollen. Disk absent. Ovary usually 3-locular; locules usually 2-ovuled; style stout; stigma conical or truncate, 3-angled or with impression of anthers. Pistillode with or without vestigial ovules. Fruit a loculicidal capsule; valves 1- or 2-seeded; seeds arillate.

Indo-China and Indo-Malesia to the Solomon Islands, with 3 species; one in India.

Aphanamixis polystachya (Wallich) R. Parker in Indian Forester 57: 486. 1931. *Aglaia polystachya* Wallich in Roxb., Fl. Ind. 2: 429. 1824. *Andersonia rohituka* Roxb., Fl. Ind. 2: 213. 1832. *Amoora rohituka* (Roxb.) Wight & Arn. in Wight, Cat. Indian Pl. 24. 1833 & Prodr. 119. 1834; Beddome, Fl. Sylv. S. India t. 132. 1871; Hiern in Hook. f., Fl. Brit. India 1: 559. 1875.

Tree, evergreen, 5 - 20 m tall with a dense spreading, umbrella-shaped crown. Leaves alternate, crowded at ends of branchlets, 20 - 70 cm long; rachis to 12 cm long; leaflets 9 - 19, opposite or subalternate, oblong-ovate or oblanceolate, obliquely acute or caudate at base, entire along margins, abruptly acuminate at apex, 8 - 25 x 4 - 10 cm; secondary nerves 12 - 15 on each side; petiolules 3 - 5 mm long, that of terminal leaflet to 2 cm long. Flowers bracteate, sessile, rarely shortly pedicellate, dull-white. Male spikes paniced, as long as leaves; female spikes much shorter. Female flowers larger than male flowers. Calyx 5-lobed with ciliolate margins. Petals 3, broadly elliptic to orbicular, concave, ca 5 x 4 mm, glabrous or puberulous outside, sparsely hairy inside. Staminal tube nearly as long as petals, with a small opening at apex showing protruded apices of anthers; anthers 6, subsessile. Antherodes narrower, without pollen. Disk broadly conical, tawny-pubescent. Ovary subglobose or ellipsoid; stigma 3-lobed. Pis-

tillode with rudimentary ovules. Capsules obovoid, 2.5 - 4 cm across, 3-valved, coriaceous, smooth, yellow or purplish, soft, fleshy; seeds oblong with a scarlet aril.

Fl. & Fr.: Jan. - Dec.

Distrib. India: Uttar Pradesh, Bihar, West Bengal, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, Orissa, Madhya Pradesh, Maharashtra, Goa, Daman & Diu, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and the Andaman & Nicobar Islands.

Occurs almost throughout India except the north and northwestern parts.

Pakistan, Nepal, Bhutan, Bangladesh, Myanmar and Sri Lanka.

Uses. Oil obtained from the seeds is used for illumination and as a liniment in rheumatism; also applied in sores.

Notes. *Amoora beddomei* Kosterm. (in Acta Bot. Neerl. 31: 113. 1982) was synonymized under *Aphanamixis polystachya* by Mabberley (in Blumea 31: 133 - 138. 1985). With the distinctly pedicellate flowers and the much thinner inner 3 sepals *Amoora beddomei* can be a variety of *Aphanamixis polystachya*.

3. *Azadirachta* A. Juss.

Trees with an indumentum of simple hairs. Leaves pinnate; leaflets opposite or subopposite. Flowers in many-flowered, axillary panicles, bisexual and male on the same tree. Calyx 5-lobed. Petals 5, free, imbricate, much longer than calyx. Staminal tube cylindrical; mouth expanded with 10 simple or 2-lobed appendages; anthers 10, glabrous, inserted at base of and opposite appendages, included. Disk annular, adnate to base of ovary. Ovary 3-locular; locules with 2 collateral ovules; style elongate, slender; style head ring-shaped with 3 acute partially fused stigmatic lobes. Fruit usually a 1-seeded drupe; seeds ovoid, pointed.

Indo-Malesian region, with 2 species; one in India.

Azadirachta indica A. Juss. in Mem. Mus. Hist. Nat. 19: 221. t. 13. f. 5. 1830; Wight, Icon. Pl. Ind. Orient. t. 17. 1838. *Melia azadirachta* L., Sp. Pl. 385. 1753; Hiern in Hook. f., Fl. Brit. India 1: 544. 1875. *Melia indica* Brandis, Forest Fl. N. W. India 67. 1874.

Tree, to 20 m high. Leaves pari- or imparipinnate, 10 - 45 cm long; rachis 2.5 - 8 cm long, glabrous; leaflets 9 - 18, opposite, subopposite or alternate, ovate-lanceolate, lanceolate or falcate, prominently oblique at base, coarsely crenate-serrate along margins, acuminate at apex, 4 - 6 x 1 - 1.5 cm, glabrous; terminal leaflet often aborted; secondary nerves 12 - 18 on each side; petiolules 2 - 3 mm long, that of terminal leaflet

1 - 1.5 cm long. Panicles as long as or shorter than leaves. Flowers white, scented. Sepals 5, free, broad, rounded, united at base. Petals 5, free, oblong-spathulate, ca 5 mm long, spreading, ciliate, imbricate, pubescent inside along middle. Mouth of staminal tube pubescent inside. Ovary globose; style terete; stigma with a light-coloured rim at base. Drupes 1.5 - 2 cm long, smooth, yellow; seed surrounded by a sweet pulp when ripe.

Fl. & Fr. Feb. - Sept.

Distrib. India: Common throughout the country, also widely cultivated.

Pakistan, Nepal, Bhutan, Bangladesh, Myanmar and Sri Lanka.

Uses. A very useful tree. Wood hard and close-grained and resembles that of Mahogany (*Swietenia mahagoni* (L.) Jacq.). Good for furniture and sonorous drums. Bark, leaves, flowers, fruits and seeds are used medicinally.

4. *Chisocheton* Blume

Trees, with an indumentum of simple, or rarely stellate hairs. Leaves pinnate, pseudogemmate, sometimes imparipinnate, rarely paripinnate; leaflets 2 - 28 pairs, usually opposite. Flowers in axillary or supraaxillary panicles, rarely cauliflorous or epiphyllous, generally bracteolate, unisexual. Calyx cup-shaped, entire along margins or 3 - 6-lobed, sometimes splitting irregularly. Petals usually 4 - 5, free, linear, elongate, imbricate or valvate, rarely united below or adnate to base of staminal tube. Staminal tube cylindrical, sometimes expanded at mouth, entire or crenate at margin or with 4 - 10(-30) simple or 2-lobed appendages; anthers 4 - 10(-30)-locellate, inserted in throat, included or partly exerted, rarely attached to margin. Antherodes very slender, without pollen. Disk usually absent, if present, stipitate, annular or patelliform. Ovary 2 - 8-locular; locules usually 1-, rarely 2-ovuled; style filiform; stigma small, capitate, clavate or discoid. Pistillode slender, with or without vestigial ovules. Fruit usually a 2 - 5-valved loculicidal capsule; valves 1(-2)-seeded; pericarp leathery or woody; seeds obovoid-globose, with red or orange aril.

Indo-Malesian region to Vanuatu and Tropical China with ca 50 species; 2 in India.

KEY TO THE SPECIES

- 1a. Leaves 30 - 100 cm long; leaflets 12(-15) pairs; panicles to 1 m long; flowers pale yellow; capsules pyriform, 4 - 9 cm across
1. *C. cumingianus* var. *balansae*
- b. Leaves 20 - 60 cm long; leaflets to 8 pairs; panicles to 60 cm long; flowers white; capsules globose, ca 3.5 cm
2. *C. nicobarianus*

1. *Chisocheton cumingianus* (C.DC.) Harms var. *balansae* (C.DC.) Mabb. in *Taxon* 26: 528. 1977 & *Bull. Brit. Mus. (Nat. Hist.)*, Bot. 6: 347. 1979. *C. balansae* C.DC. in *Bull.*

Herb. Boissier 2: 578. 1894. *Guarea paniculata* Roxb., Fl. Ind. 1: 242. 1832. *Chisocheton paniculatus* (Roxb.) Hiern in Hook. f., Fl. Brit. India 1: 552. 1875.

Tree, 10 - 15 m tall; young parts rusty-pubescent. Leaves to 1 m long; leaflets 7 - 24(-30), oblong-ovate or lanceolate, unequally acute at base, entire along margins, acuminate at apex, glabrescent above, thinly pubescent along nerves beneath; secondary nerves 7 - 15 on each side, arcuating, ending parallel to margins; petiolules usually 6 - 12 mm long. Panicles to 1 m long, drooping with elongated lax branches. Flowers bracteate, ca 2 cm long, pale yellow, faintly scented; pedicels 3 - 5 mm long. Calyx cup-shaped, subtruncate, small. Petals ligulate, puberulous, imbricate. Staminal tube to 18 x 3 mm, with 6 - 8 obscure 2-fid pubescent appendages; anthers 8, sessile, linear, locellate, included. Disk annular. Ovary 4-locular; locules 1 - 2-ovuled; style slender, pubescent below, slightly exceeding staminal tube; stigma disciform or capitate. Capsules 4 - 9 cm across, dark orange or red; seeds black, shining; aril white or yellow.

Fl. & Fr. July - April.

Distrib. India: W. Bengal, Arunachal Pradesh, Assam, Tripura and Meghalaya.

Bangladesh and Myanmar.

2. *Chisocheton nicobarianus* Debnath & Sreekumar in J. Econ. Tax. Bot. 16: 553. 1992.

Tree, 15 - 30 m tall; bark lenticellate. Leaves 20 - 60 cm long, pseudogemmate; leaflets 6 - 16, opposite or subopposite, ovate-oblong or elliptic, acuminate at apex, 4 - 20 x 1.5 - 8 cm, subcoriaceous, glaucous and sparsely pubescent beneath; secondary nerves 8 - 14 on each side; petiolules 4 - 8 mm long, hispid. Flowers in axillary or supraaxillary 30 - 60 cm long loose panicles with clustered side branches. Flowers oblong, 8 - 14 mm long, white, fragrant; pedicels 1 - 1.5 cm long, hispid. Calyx cupular, 1.5 - 2.5 mm long, obscurely 4-lobed, coriaceous, hispid. Petals 4, spatulate, 8 - 12 mm long, leathery, sparsely hirtellus, imbricate. Disk absent. Staminal tube 6 - 10 mm long with 2-lobed appendages at apex, villous on both sides except at apex; stamens 8; anthers 1 - 2 mm long, hirsute on dorsal side. Ovary oblong, to 1.5 mm long, hirsute; style 6 - 6.5 mm long, hirsute; stigma capitate with an annular rim, truncate at apex. Capsules globose, ca 3.5 cm; seeds 2, discoid.

Fl. & Fr. May - June.

Distrib. India: Andaman & Nicobar Islands, S. Nicobar.

Note. The inclusion of *C. grandiflorus* Kurz in the flora of British India by Hiern (1875: 552) seems to be an error. For details *vide* Parkinson (1923: 119).

5. *Chukrassia* A. Juss.

Deciduous trees with an indumentum of simple hairs. Leaves usually paripinnate; leaflets alternate, subopposite or opposite, acuminate, entire, unequally sized. Panicles axillary or terminal, usually shorter than leaves. Flowers 4-5-merous, unisexual but with well-developed vestiges of opposite sex. Calyx short, dentate. Petals 4-5, free, oblong, contorted, much longer than calyx, erecto-patent. Staminal tube broadly cylindrical, narrowing towards apex, entire or 10-crenate; anthers or antherodes inserted within crenatures. Disk obsolete, in male flowers stipitate, more or less indistinguishable from base of pistillode, narrowly cushion-shaped in female flowers. Ovary flask-shaped, shortly stipitate, 3-5-locular; locules with numerous, 2-seriate ovules; style slender; stigma 3-5-lobed or capitate. Pistillode similar to pistil but more slender with vestigial ovules in well-developed locules. Fruit a septifragal capsule, ovoid, woody, 3-valved; valves 2-lamellate; columella with 3-5 sharply angled ridges at apex with conspicuous seed scars; seeds 80-100 per locule, arranged in tiers, terminally winged, endospermous.

One to 2 species from India eastwards to Malesia and S. China; one in India.

Chukrassia tabularis A. Juss. in Mem. Mus. Hist. Nat. 19: 251. t. 22. 1830; Beddome, Fl. Sylv. S. India t. 9. 1869; Hiern in Hook. f., Fl. Brit. India 1: 568. 1875 (as "*Chikrassia*")
C. velutina M. Roemer, Fam. Nat. Syn. Monogr. 1: 135. 1846.

Handsome tree, to 40 m tall with reddish brown bark. Leaves to 50 cm long; rachis 6-10 cm long; leaflets 10-20, subopposite or alternate, ovate-oblong to elliptic-lanceolate, inequilateral at base, entire along margins, acuminate at apex, 4-15 x 2.5-8 cm; secondary nerves 8-15 on each side; petiolules 2-8 mm long; upper leaflets larger than the lower, sometimes distal leaflets pinnatifid with petiolules to 3 cm long. Flowers ca 1.8 cm long, yellowish-white. Calyx small, obtusely 5-lobed, puberulous. Petals linear-oblong or spatulate, ca 1.5 x 0.4 cm, imbricate, puberulous outside, pubescent inside. Staminal tube dark purple, more or less glabrous; anthers 10. Ovary hairy; stigma about on the level of anthers. Capsules 4-5 x 2-2.5 cm, speckled with lenticels, brown.

KEY TO THE VARIETIES

- | | |
|--|--------------------------|
| 1a. Leaflets not velvety beneath; branchlets, rachis, petiolules and panicles glabrous | 1. var. <i>tabularis</i> |
| b. Leaflets velvety beneath; branchlets, rachis, petiolules and panicles hairy | 2. var. <i>velutina</i> |

1. var. *tabularis*

Fl. & Fr.: May - Mar.

Distrib. India: Bihar(?), W. Bengal, Sikkim, Arunachal Pradesh, Assam, Tripura, Meghalaya, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and the Andaman & Nicobar Islands.

Also cultivated elsewhere in the country.

Nepal, Bhutan, Bangladesh, Myanmar and Sri Lanka.

2. var. *velutina* (M. Roemer) King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 88. 1895; S. Almeida, Fl. Savantwadi 1: 87. 1990. *Chukrassia velutina* M. Roemer, Fam. Nat. Syn. Monogr. 1: 135. 1846. *C. nimmonii* J. Graham in Wight, Ill. Indian Bot. 1: 148. 1840.

Fl. & Fr.: May - Mar.

Distrib. India: Maharashtra, Karnataka and Andaman & Nicobar Islands.

Myanmar and Sri Lanka.

6. *Cipadessa* Blume

Shrubs or small trees with an indumentum of simple hairs. Leaves imparipinnate; leaflets opposite or nearly so. Flowers in axillary, peduncled, corymbose panicles, bi- and unisexual on the same individual (polygamous). Calyx 5-toothed. Petals 5, free, valvate. Stamens 5 - 10; filaments connate near base into a short staminal tube, terminating in a pair of narrowly lanceolate or filiform appendages; anthers acute or apiculate, short, hairy, inserted between appendages. Disk cup-shaped, adnate to base of staminal tube. Ovary 5(-6)-locular; locules with 1 or 2 collateral ovules; style short, stout, columnar; stigma swollen, capitate, 5-lobed. Fruit a small, globular drupe with 5 pyrenes; each pyrene with 1 or 2 seeds; seeds resemble flakes of an orange, exarillate.

Indo-Malesian region, with 3 species; one in India.

Cipadessa baccifera (Roth) Miq. in Ann. Mus. Bot. Lugduno-Batavum 4: 6. 1868. *Melia baccifera* Roth, Nov. Pl. Sp. 215. 1821. *Cipadessa fruticosa* Blume, Bijdr. 162. 1825; Hiern in Hook. f., Fl. Brit. India 1: 545. 1875.

A much-branched shrub or small tree, sometimes scandent; young parts silky. Leaves 8 - 30 cm long; rachis 3 - 6 cm long; leaflets 7 - 13, opposite, elliptic-lanceolate, acute at both ends, entire or coarsely serrate along margins, 2.5 - 12 x 1.5 - 5 cm, glabrous, sometimes hairy especially on nerves; petiolules short. Panicles shorter than leaves; peduncles slender, 3 - 10 cm long. Flowers small, white; pedicels ca 2 mm long. Calyx with 5, short, 3-angular teeth, pubescent outside. Petals oblong, acute, 2 - 4 x 1 - 1.5 mm, membranous, pubescent outside. Stamens slightly shorter than petals; filaments hairy; appendages sharp, as long as anthers. Ovary glabrous; style short; stigma 5-lobed. Drupes globose, 5-lobed, 5 - 8 mm, red when ripe.

Fl. & Fr. Almost throughout the year. Occurs in two peaks during March - April and July - August.

Distrib. India: Peninsular India, in dry forests and hilly areas, to 1800 m.

7. *Dysoxylum* Blume

Trees, usually glabrous or with an indumentum of simple hairs. Leaves pinnate; leaflets opposite, subopposite or alternate, elliptic, oblique at base, acuminate at apex, coriaceous. Flowers bisexual or unisexual (trees dioecious), in axillary panicles, racemes or spikes, occasionally rami- or cauliflorous, sometimes subtended by several imbricate bracts. Calyx usually shallowly or deeply 4 - 5-lobed or sepals free, spreading, valvate or imbricate. Petals 4 - 5, spreading, valvate or imbricate, free but sometimes fused to lower or upper half of staminal tube. Staminal tube cylindric, entire at margin, crenate, irregularly toothed or terminated by 6 - 10 simple or 2-lobed appendages; anthers 6, 8 or 10, short, included or half-exserted, glabrous, rarely hairy, alternating with appendages. Disk tubular or cup-shaped, crenulate along margin or lobed, free. Ovary 2 - 5-locular; locules 1 - 2-ovuled; style about as long as staminal tube; stigma discoid or capitate. Fruit a loculicidal capsule, 2 - 5-valved; locules 1 - 2-seeded; seeds arillate or not, nonendospermous.

Indo-Malesian region eastwards to Australia, New Guinea, Polynesia and New Zealand with ca 60 species; 16 in India.

KEY TO THE SPECIES

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|--|--|
| 1a. Flowers 5-merous | 3. <i>D. arborescens</i> |
| b. Flowers 4-merous | 2 |
| 2a. Calyx cup-shaped, about half as long as flower | 3 |
| b. Calyx 4 - 5 partite or sepalous, usually less than half as long as flower | 4 |
| 3a. Venation in leaflets prominent; calyx almost entire or obscurely 4-lobed; capsules reddish | 5. <i>D. binectariferum</i> |
| b. Venation in leaflets not prominent; calyx shallowly 4-lobed; capsules purple | 7. <i>D. ficiforme</i> |
| 4a. Flowers in panicles | 5 |
| b. Flowers in racemes or spikes | 9 |
| 5a. Disk densely hairy at mouth | 6 |
| b. Disk glabrous at mouth or nearly so | 7 |
| 6a. Flowers creamy white, fragrant, 1 cm or longer; pedicels short | 8. <i>D. gobarum</i> |
| b. Flowers white tinged with purple, foetid, less than 8 mm long; pedicels to 6 mm long | 16. <i>D. thyrsoides</i> var. <i>andamanicum</i> |
| 7a. Disk shorter than ovary | 10. <i>D. malabaricum</i> |
| b. Disk as long as or twice as long as ovary | 8 |
| 8a. Leaflets opposite, glabrescent beneath; capsules less than 2.5 cm long | 1. <i>D. alliarium</i> |
| b. Leaflets alternate, velvety beneath; capsules more than 5 cm long | 9. <i>D. grande</i> |
| 9a. Disk shorter than ovary | 10 |
| b. Disk as long as or longer than ovary | 11 |

- 10a. Tertiary nerves in leaflets prominent; racemes to 25 cm long; flowers to 7 mm long; capsules 5 - 6.5 cm across, verrucose with longitudinal ridges 14. *D. reticulatum*
- b. Tertiary nerves in leaflets not prominent; spikes to 5 cm long; flowers 2 - 5 mm long; capsules 3 - 5 cm across, 3-grooved 2. *D. andamanicum*
- 11a. Staminal tube glabrous; disk scarcely longer than ovary 12
- b. Staminal tube hairy; disk clearly longer than ovary 13
- 12a. Leaves 20 - 30 cm long; leaflets 2 pairs, opposite; inflorescence to 2.5 cm long 15. *D. rugulosum*
- b. Leaves 30 - 60 cm long; leaflets 3 - 5 pairs, alternate; inflorescence 2.5 - 25 cm long 12. *D. pallens*
- 13a. Shrub or small tree 13. *D. racemosum*
- b. Medium-sized to tall trees 14
- 14a. Staminal tube pubescent on both sides; ovary 2-locular 4. *D. beddomei*
- b. Staminal tube puberulous inside only; ovary 4-locular 15
- 15a. Leaves imparipinnate; leaflets 11 - 13; spikes clustered, 3 - 9 cm long 6. *D. densiflorum*
- b. Leaves paripinnate; leaflets 6; spikes solitary, 10 - 20 cm long 11. *D. microbotrys*

1. *Dysoxylum alliarium* (Buch.-Ham.) Balakr. in J. Bombay Nat. Hist. Soc. 67: 57. 1970. *Guarea alliarica* Buch.-Ham. in Mem. Wern. Nat. Hist. Soc. 6: 305. 1832, excl. Syn. Rumph. *Dysoxylum hamiltonii* Hiern in Hook. f., Fl. Brit. India 1: 548. 1875.

Evergreen tree, to 25 m tall; bark dark brown outside, smooth, scaly with age, reddish-brown, streaked inside, with a smell reminiscent of garlic. Leaves 30 - 70 cm long; leaflets to 17, on young poles to 42, opposite or subopposite, drooping, oblong-lanceolate, oblique at base, entire or slightly undulate along margins, acute or acuminate at apex, 8 - 16 x 5 - 9 cm, glabrous or hairy beneath, membranous, smell reminiscent garlic when bruised; secondary nerves ca 12 on each side. Panicles 15 - 25 cm long, puberulous; bracts and bracteoles minute. Flowers 4-merous, ca 6 mm long, greenish-white; pedicels slender, to 3 mm long. Calyx small, indistinctly 4-partite, pubescent. Petals 4, glabrous. Staminal tube pubescent; anthers 8. Disk glabrous, twice as long as ovary. Ovary pubescent, 3 - 4-locular; style slender, pubescent below, glabrous above. Capsules ca 2.5 cm across, pale yellow or white, 4-loculed; seeds with a red aril.

Fl. & Fr. June - Feb.

Distrib. India: N.E. region; Sikkim, Assam and Meghalaya.

Note. Grierson and Long (Flora of Bhutan 2(1): 37. 1991) recorded *D. mollissimum* Blume for Bhutan and Darjeeling (West Bengal) and synonymized *D. hamiltonii* Hiern thereunder.

2. *Dysoxylum andamanicum* King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 49. 1895; C.E. Parkinson, Forest Fl. Andaman. Isl. 120. 1923.

Tree, to 10 m tall. Leaves 15 - 25 cm long; leaflets 5 - 9, alternate, oblong to ovate, 7.5 - 12.5 x 4 - 5 cm, membranous, glabrous; secondary nerves 6 - 10 on each side;

petiolules ca 7 mm long. Spikes 2.5 - 5 cm long, few-flowered, puberulous. Flowers pale yellow or cream-coloured; pedicels ca 7 mm long, puberulous. Calyx shallow, glabrous, minutely 4-toothed. Petals 4, oblong, subacute, convex at apex, much longer than calyx, reflexed, puberulous outside, imbricate. Staminal tube cylindric, slightly inflated near base, shorter than petals, terminated by 9 - 10 teeth, slightly puberulous; anthers 8 - 10, alternate with teeth, ovate, partly exerted. Disk annular, shorter than and connate with ovary at its base, fleshy. Ovary conical, crenulate, densely white-pubescent; style stout; stigma with an annulus at base, discoid, included. Capsules globose, depressed, obscurely 3-grooved, ca 3.5 cm; seeds 2 or 3, elliptic.

Fl. & Fr. Jan.

Distrib. India: Andaman Islands.

3. *Dysoxylum arborescens* (Blume) Miq. in Ann. Mus. Bot. Lugduno-Batavum 4: 24. 1869; C.E. Parkinson, Forest Fl. Andaman Isl. 120. 1923. *Goniocheton arborescens* Blume, Bijdr. 177. 1825.

Tree, to 10 m tall. Leaves imparipinnate, 15 - 25 cm long; leaflets 2 - 3 pairs, opposite or subopposite, elliptic-obovate, cuneate at base, entire along margins, abruptly acuminate at apex, 6 - 13 x 3.5 - 6 cm, glabrous, membranous; terminal leaflet the largest; secondary nerves 6 - 8 on each side, not prominent; petiolules slender, 5 - 8 mm long, that of terminal leaflet to 2.5 cm long. Panicles 4 - 12 cm long. Flowers ca 7 mm long; pedicels slender, as long as flower. Calyx shallow with obscurely toothed cup. Petals 5, linear, somewhat thickened and narrowed towards apex, glabrous, longer than staminal tube. Staminal tube cylindric, glabrous, terminating in 10 broad shallow subcrenate teeth, inflated or not at base; anthers ovate, small, included or the tips exerted. Disk broad, thick, tubular, subcrenulate along margin, longer than ovary. Ovary ovoid, depressed, pubescent, 4-locular; style cylindric, minutely pubescent below, glabrous above; stigma discoid with an annulus at base. Capsules turbinate with 3 - 4 vertical grooves, ca 3 cm across, glabrous; seeds 2 - 4, ovoid, exarillate.

Fl. & Fr. Dec. - Feb.

Distrib. India: Andaman Islands.

Malesia.

4. *Dysoxylum beddomei* Hiern in Fl. Brit. India 1: 548. 1875.

Medium-sized to large tree; young parts puberulent. Leaves 30 - 40 cm long; leaflets 5 - 9, alternate, lanceolate, ovate to elliptic-oblong, inequilateral or cuneate at base, entire along margins, obtusely acuminate at apex, 10 - 15 x 4 - 5 cm, glabrous, pale green, submembranous; midnerve and secondary nerves pale beneath; petiolules to 1 cm long.

Inflorescence 7 - 15 cm long. Flowers greenish-yellow, to 8 mm long; pedicels short or flowers subsessile. Calyx with short teeth, puberulous. Petals imbricate. Staminal tube shortly toothed, puberulent on both sides. Disk glabrous, exceeding ovary. Ovary hirsute, 2-locular. Capsules ribbed, purple or yellow.

Fl. & Fr. Nov. - Mar.

Distrib. India: Kerala, in evergreen forests of Peermad and the Cardamom hills.

5. *Dysoxylum binectariferum* (Roxb.) Hook. f. ex Beddome in Trans. Linn. Soc. London 25: 212. 1866; Hiern in Hook. f., Fl. Brit. India 1: 546. 1875. *Guarea binectarifera* Roxb., Fl. Ind. 2: 240. 1830 (as "*binectarifera*"). *Dysoxylum macrocarpum* Beddome, Fl. Sylv. S. India t. 150. 1871.

Evergreen tree, to 30 m tall; young parts and inflorescences minutely pubescent. Leaves 30 - 75 cm long; leaflets 6 - 8, cuneate at base, entire or obscurely dentate along margins, acuminate at apex, 7 - 17 x 3 - 8 cm, thinly coriaceous, glabrous, dark green above, pale beneath; petiolules to 1 cm long. Panicles 20 - 30 cm long. Flowers shortly pedicellate, 4-merous, 3 - 5 mm long, pale-white. Calyx cup-shaped, entire or obscurely 5-lobed, about half as long as petals. Petals 4, velvety. Staminal tube mealy, 4-angled, terminating in 8 obscurely 2-fid teeth; anthers 8, included. Disk exceeding ovary, glabrous inside, puberulous outside, 8-toothed. Ovary hairy; style 4-angled; stigma capitate. Capsules obovoid, 2.5 - 3 cm across, 4-locular, 4-seeded, pale-yellow turning orange; seeds shining, purple with a large yellow hilum and white aril.

Fl. & Fr. Mar. - Jan.

Distrib. India: Sikkim, Arunachal Pradesh, Assam, Tripura, Meghalaya, Maharashtra, Goa, Daman & Diu, Karnataka, Tamil Nadu, Kerala and the Andaman & Nicobar Islands.

Sri Lanka.

6. *Dysoxylum densiflorum* Miq. in Ann. Mus. Bot. Lugduno - Batavum 4: 9. 1868; Balakr. in Bull. Bot. Surv. India 25: 59. 1982.

Tree, 15 - 30 m tall. Leaves 30 - 40 cm long; leaflet 13 - 19, alternate, elliptic-oblong, ovate or obovate, rounded or subcuneate at base, entire along margins, acute or acuminate at apex, 5 - 25 x 0.3 - 1 cm, glabrous or shortly puberulous on nerves beneath; secondary nerves 10 - 15 on each side, prominent beneath; petiolules 2 - 8 mm long, puberulous. Racemose spikes 3 - 9 cm long, fascicled. Flowers bracteate, ca 1.5 cm long, scented, white; pedicels to 2 mm long, pubescent. Calyx cup-shaped, 3 - 4 mm long, hairy with 4 rounded lobes. Petals 4, linear-oblong, obtuse, recurved and curled back in upper half, 10 - 12 x 2 - 3 mm, pubescent outside. Staminal tube cylindrical, shorter

than petals, glabrous outside, puberulous inside, 8-toothed at apex; anthers 7-8, included or partly exerted. Disk glabrous, cylindrical, silky-hairy, 4-locular; style hairy; stigma capitate, subpelate. Capsules obovoid-ellipsoid, 4 - 6 cm long, minutely pubescent.

Fl. & Fr. Nov. - Mar.

Distrib. India: Andaman & Nicobar Islands; Great Nicobar.

Malesia.

7. *Dysoxylum ficiforme* (Wight) Gamble, *Fl. Pres. Madras* 178. 1915. *Amoora ficiformis* Wight, *Ill. Indian Bot.* 1: 47. 1840. *Dysoxylum pupureum* Bourd. in *J. Bombay Nat. Hist. Soc.* 12:349, t. 2.1899. **Fig. 118.**

Evergreen tree, to 30 m tall; bark smooth, pale. Leaves ca 45 cm long; leaflets 7 - 11, subopposite or alternate, elliptic-lanceolate, oblique at base, entire along margins, acute at apex, 12 - 20 x 4 - 8 cm, glossy; secondary nerves 9 - 10 on each side, conspicuous beneath; petiolules to 6 mm long. Flowers in axillary or terminal panicles, or spikes, ca 8 mm long, buff-coloured; pedicels 2 - 4 mm long. Calyx 4-lobed, fleshy. Petals 4, fleshy. Staminal tube with crenulate mouth; anthers 8, included. Disk cup-shaped, with toothed-margin. Ovary hairy, 4-locular; style stout, almost as long as staminal tube; stigma capitate with a ring at base, slightly exerted. Capsules rounded, 5 - 7.5 cm, smooth, purple, 3 - 4-seeded.

Fl. & Fr. Feb. - Oct.

Distrib. India: Tamil Nadu and Kerala. W. Ghats. Endemic.

8. *Dysoxylum goharum* (Buch.-Ham.) Merr. in *J. Arn. Arb.* 23: 173. 1942; Balakr., *Fl. Jowai* 1: 123. 1981. *Guarea goharu* Buch.-Ham. in *Mem. Wern. Nat. Hist. Soc.* 6: 306, f. 1. 1832. *Dysoxylum procerum* Hiern in *Hook. f., Fl. Brit. India* 1: 547. 1875.

Tree, to 25 m tall; bark smooth, grey, scaly when mature, pink or reddish brown with white streaks inside, exuding milky resin; young shoots and inflorescence pubescent. Leaves 30 - 60 cm long; leaflets 7 - 13, opposite or alternate, ovate, ovate-oblong or oblong-elliptic, cuneate, rounded or obtuse at base, entire along margins, acute at apex, 10 - 25 x 7 - 10 cm, thinly coriaceous, glabrous; secondary nerves 12 - 16 on each side; petiolules stout, 5 - 12 mm long. Panicles 30 - 50 cm long. Flowers bracteate, 7 - 10 mm across, creamy white, fragrant; pedicels short. Calyx cup-shaped, 4 - 5-toothed. Petals 4, oblong, appressed-pubescent, valvate or slightly imbricate. Staminal tube glabrous; anthers 8 - 10. Disk elongate, to 2/3 as long as staminal tube; mouth hairy. Ovary hairy, 2 - 3-locular; style slightly exceeding staminal tube. Capsules pyriform-globose, 5 - 6 cm across, 3 - 4-locular; pericarp thick; seeds black with orange aril.



Fig. 118. *Dysoxylum ficiforme* (Wight) Gamble : habit.

Fl. & Fr. Dec. - Aug.

Distrib. India: Evergreen forests; Sikkim, Assam, Tripura and Meghalaya.

Myanmar.

Note. Grierson and Long (Flora of Bhutan 2(1): 37. 1991) reported the presence of *D. excelsum* Blume in Darjeeling (West Bengal) and synonymized *D. procerum* Hiern thereunder.

9. *Dysoxylum grande* Hiern in Hook. f., Fl. Brit. India 1: 547. 1875.

Tree, to 15 m tall; bark smooth, dark-grey; young parts velvety-tomentose. Leaves 40 - 60 cm long; rachis flat or slightly grooved near base; leaflets 12, alternate, oblong-caudate, rounded at base, entire along margins, acuminate at apex, 12 - 20 x 5 - 8 cm, more or less glabrous, grey-velvety beneath along main nerves; secondary nerves 20 - 25 on each side; petiolules 6 - 8 mm long. Panicles as long as leaves, velvety-tomentose. Flowers clustered, 5 - 7 mm long; pedicels slender, very short. Calyx small, pubescent; lobes acute, short. Petals grey-pubescent outside. Staminal tube glabrous or nearly so outside, terminating in 8 bifid teeth. Disk tubular, exceeding ovary, glabrous. Ovary hairy, 4-locular. Capsules pyriform, more than 5 cm long, glabrous, generally 1-seeded; seeds ellipsoid, ca 2.5 cm long, dark brown, shining.

Fl. & Fr. May - Jan.

Distrib. India: Assam.

Bhutan.

10. *Dysoxylum malabaricum* Beddome ex Hiern in Hook. f., Fl. Brit. India 1: 548. 1875. *D. glandulosum* Talb. Syst. List Trees Bombay 39. 1894. Fig. 119.

Tree, 30 - 40 m tall, ca 1.5 m in girth; bark grey with white warts. Leaves 30 - 35 cm long; leaflets 4 - 5 pairs, elliptic-oblong, 5 - 23 x 4 - 8 cm, pale-green, puberulous when young; secondary nerves 10 - 20 on each side, prominent beneath; petiolules 6 - 12 mm long. Panicles axillary, 10 - 20 cm long, crowded near ends of branches. Flowers ca 6 mm long, fragrant, white; pedicels 3 - 6 mm long. Calyx deeply 4-lobed; lobes more or less obtuse. Petals 4, linear-oblong, subacute, pubescent outside, imbricate. Staminal tube tubular or urceolate, more or less 4-angled, with 8 deep emarginate crenatures; anthers 8, included. Disk cup-shaped, truncate, equalling or half as long as ovary, crenulate and ciliate on margin, pubescent inside. Ovary white-tomentose, 4-locular with 2 collateral ovules in each; style as long as staminal tube; stigma capitate. Capsules pyriform, 5 - 6.5 cm across, verrucose, bright yellow, with 4-longitudinal furrows; seeds 3 - 4, bluntly 3-gonous; testa reddish-brown.

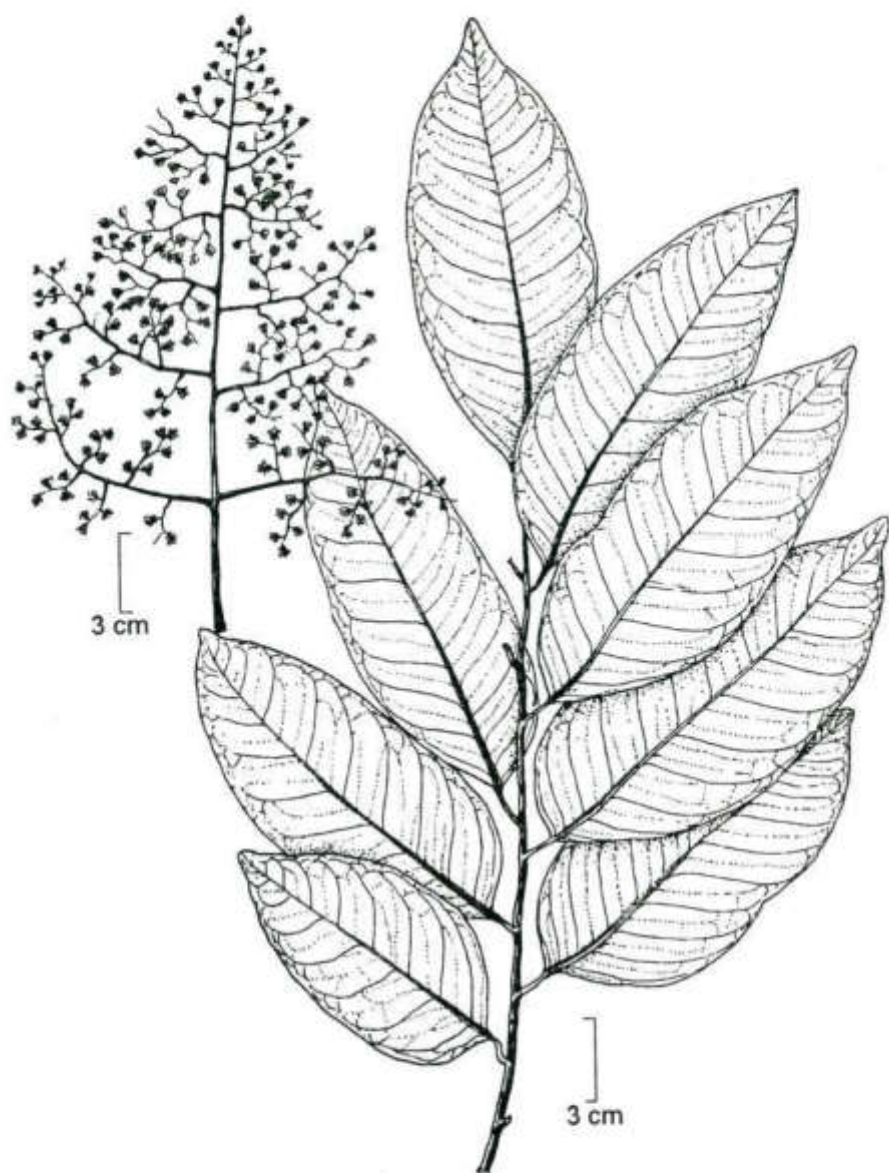


Fig. 119. *Dysoxylum malabaricum* Beddome ex Hiern : habit.

Fl. & Fr. Feb. - June.

Distrib. India: Karnataka, Tamil Nadu and Kerala.

Endemic.

11. *Dysoxylum microbotrys* King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 48. 1895; Deb & Datta in J. Econ. Tax. Bot. 10: 31. 1987.

Tree, 12 - 18 m tall. Leaves paripinnate, 30 - 50 cm long; rachises and petiolules almost glabrous; leaflets ca 3 pairs, opposite, elliptic or elliptic-oblong, cuneate at base, cuspidate at apex, 15 - 25 x 6.5 - 9 cm, thinly coriaceous, glabrous on both surfaces; secondary nerves 9 - 11 on each side; petiolules 5 - 8 mm long. Flowers in extraaxillary few-flowered spike-like 10 - 20 cm long cymes, or solitary, ca 1.25 cm long; pedicels ca 3 mm long, bracteolate. Calyx a shallow, slightly 4-toothed cup. Petals 4, oblong, slightly widened at base, subacute at apex, thickened and incurved, puberulous. Staminal tube slightly shorter than petals and style, puberulous; anthers 8, narrowly elliptic, included. Disk tubular, longer than ovary, puberulous; mouth thickened, rugulose, pilose. Ovary ovoid-conic, pubescent, 4-locular; locules 2-ovuled; style 4-angled, pubescent in lower half, glabrous in upper half; stigma discoid with a narrow annular band at base. Fruits pyriform, 4 - 6 x 3 - 3.7 cm, subglabrous; pericarp thick; seeds plano-convex, ca 1.8 cm long.

Distrib. India: Mizoram.

Malesia.

12. *Dysoxylum pallens* Hiern in Hook. f., Fl. Brit. India 1: 548. 1875; Kanj. et al., Fl. Assam 1: 233. 1937; Grierson & Long, Fl. Bhutan 2: 38. 1991.

Small tree with a spreading crown; bark dark-brown and plain outside, reddish-brown with streaks of lighter colour inside. Leaves 22 - 80 cm long; leaflets 2 - 5 pairs, alternate, oblong or elliptic, oblique at base, entire along margins, acuminate at apex, 7 - 25 x 3 - 10 cm, glabrous; secondary nerves 15 - 20 on each side, arched, slender and prominent; petiolules 5 - 7 mm long, stout. Racemes spicate, 2 - 25 cm long, puberulous. Flowers ca 8 mm long, greenish white, fragrant; pedicels ca 2.5 mm long, stout. Calyx cup-shaped, deeply 4-, rarely 5-lobed, 1 - 2 mm long, puberulous. Petals generally 4, ca 8 mm long, thick, pubescent outside, valvate. Staminal tube glabrous, unevenly 8-toothed; anthers 8, exerted. Disk glabrous, obscurely toothed at apex, scarcely exceeding ovary. Ovary hairy; style columnar, shortly hairy below. Capsules 2.5 - 4 cm across, pubescent.

Fl. & Fr. Feb.

Distrib. India: Sikkim, Assam, Arunachal Pradesh and Meghalaya.

Note. Haridasan & Rao (Forest Flora of Meghalaya 1985) did not include this species. According to Grierson and Long (*l.c.*) it is a poorly known species and may not be distinct from *D. cyrtobotryum* Miq.

13. *Dysoxylum racemosum* King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 47. 1895; Deb & Datta in J. Econ. Tax. Bot. 10: 31. 1987.

Small tree; young shoots and inflorescences puberulous or hairy. Leaves 30 - 50 cm long; leaflets alternate, 12.5 - 20 x 5.5 - 7.5 cm, membranous; secondary nerves 8 - 10 or more on each side, more or less prominent beneath; petiolules to 8 mm long. Inflorescence a raceme or spike, 10 - 30 cm long. Flowers ca 5 mm long, scattered; pedicels short, thick. Calyx shallow with obscurely 4-toothed cup, puberulous. Petals 4, elliptic, concave, much longer than calyx, thickened at apex, puberulous on both sides. Staminal tube slightly shorter than petals, cylindrical, puberulous with 8, 3-lobed teeth at tip; anthers 8, slightly exerted. Disk tubular, crenulate at margin, a little longer than ovary, glabrous, fleshy. Ovary densely hairy; style thick; stigma with a basal annulus. Capsules ovoid, 4 - 5 cm long, deciduously rusty-puberulous with rounded smooth pits.

KEY TO THE VARIETIES

- 1a. Plant more than 6 m high; leaves to 50 cm long; secondary nerves more than 10 pairs; inflorescence a spike, to 30 cm long 13.1. var. **arboreum**
- b. Plant less than 5 m high; leaves to 40 cm long; secondary nerves less than 10 pairs; inflorescence a raceme, to 12.5 cm long 13.2. var. **racemosum**

13.1. var. arboreum King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 48. 1895.

13.2. var. racemosum

Fl. & Fr. Dec.

Distrib. India: Mizoram and Andaman & Nicobar Islands.

14. *Dysoxylum reticulatum* King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 65: 114. 1897; Kanj. et al., Fl. Assam 1: 233. 1937.

Tree, to 20 m tall, with a straight trunk; bark grey and warty outside, hard, fibrous, pale yellow inside with golden brown streaks. Leaves 30 - 50 cm long; rachis flat above; leaflets ca 14, usually alternate or subopposite, ovate or ovate-lanceolate, oblique at base, entire along margins, acuminate at apex, 7 - 20 x 4 - 7 cm, chartaceous, glabrous, pale green; secondary nerves ca 15 on each side; venation prominent; petiolules 2 - 4 mm long. Racemes to 25 cm long. Flowers 5 - 6.5 mm long. Calyx cupular, 4-toothed,

fleshy, glabrous. Petals 4, elliptic, concave, 3 - 4 times as long as calyx, puberulous on both sides. Staminal tube shorter than petals, slightly bulged in middle, with 8 shallow emarginate teeth; anthers 8, included. Disk tubular, short, irregularly toothed at mouth, fleshy, glandular-pubescent. Ovary depressed, 3-angled, pubescent, 3-locular; style stout, subglabrous; stigma exserted, with an annulus at base. Capsules pyriform, depressed at apex, 6.5 - 7.5 x 5 - 6.5 cm, verrucose with longitudinal ridges, yellow or dark-brown; seeds 3-angular.

Fl. & Fr. Apr. - Mar.

Distrib. India: Assam, Meghalaya, Arunachal Pradesh; N. Bengal and Sikkim.

Note. Haridasan & Rao (Forest Flora of Meghalaya 1985) did not include this species.

15. *Dysoxylum rugulosum* King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 49. 1895; Deb & Datta in J. Econ. Tax. Bot. 10: 31. 1987.

Tree, 4 - 7 m high; young branches with striate pale brown bark. Leaves 20 - 30 cm long, paripinnate; rachis shorter than upper pair of leaflets; leaflets 2 pairs, opposite, oblong-oblancheolate, narrowed at base, shortly and abruptly acuminate at apex, thickly membranous, pale and minutely rugulose when dry; secondary nerves 8 - 14 on each side, faint above, prominent and almost winged beneath; lower pair 8.5 - 12 x 3.8 cm; upper pair 15 - 20 x 5.6 cm; petiolules ca 3 mm long, stout. Racemes supraaxillary, 3 - 4-flowered, puberulous. Flowers ca 5 mm long, shortly pedicellate. Calyx almost flat, 4-cornered, rugulose outside, glabrous inside. Petals 4, elliptic, truncate at base, subacute at apex. much longer than calyx, glabrous inside, puberulous outside, Staminal tube cylindric, shorter than petals, slightly ridged, puberulous outside, glabrous inside; mouth with 8 - 9 broad, shallow, emarginate teeth; anthers elliptic, not exserted. Disk shortly cylindric, slightly exceeding ovary, fleshy, glabrous, 8 - 9-toothed. Ovary hemispheric, ridged, puberulous, tapering into a long puberulous style; stigma discoid with a broad annulus at base, exserted. Fruits pyriform, apiculate, ca 3 x 1.8 cm.

Distrib. India: Mizoram.

Malesia.

16. *Dysoxylum thyrsoideum* Griffith ex Hiern var. *andamanicum* King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 43. 1895; C.E. Parkinson, Forest Fl. Andaman Isl. 120. 1923.

Medium-sized tree; bark dark brownish green with an offensive smell when cut. Leaves 30 - 40 cm long; leaflets 5 - 9, generally alternate, elliptic-ovate to ovate-oblong, 15 - 25 x 2 - 15 cm; petiolules to 1 cm long. Panicles as long as leaves, lax. Flowers ca 8

mm long, white tinged with pink, with an unpleasant smell; pedicels to 5 mm long. Calyx cup-shaped, short, coarsely 4-toothed, glabrous. Petals 4, oblong, obtuse, reflexed, pubescent inside, glabrous outside. Staminal tube toothed at apex; anthers included. Disk tubular, slightly longer than ovary, fleshy, hairy. Ovary hairy; style cylindrical, as long as staminal tube, thick, hairy; stigma discoid, with a basal annulus, exerted. Capsules obovoid, 2 - 3-lobed, ca 2.5 cm long.

Fl. & Fr. Dec. - Feb.

Distrib. India: Andaman Islands.

8. *Melia* L.

Trees, small to large-sized, deciduous, with an indumentum of simple and tufted, stellate hairs. Leaves alternate, 2 - 3-pinnate; leaflets serrate or entire. Flowers in large, many-flowered, axillary panicles, bisexual and male on the same plant. Calyx generally 5-lobed to near base; lobes sometimes imbricate. Petals generally 5, free, much longer than calyx lobes, imbricate. Staminal tube a little shorter than petals, cylindrical, dilated at mouth, 10- or 12-ribbed, terminating in as many as or twice as many as anthers; sometimes appendages 2 - 4-lobed; anthers hairy or glabrous, apiculate or acute, inserted on margin or just below within staminal tube, alternate with or opposite appendages. Disk small, annular or cup-shaped, free around base of ovary. Ovary 4 - 8-locular; locules with 2 superposed ovules; style cylindrical, elongate; stigma capitate or sometimes 3 - 8-lobed. Fruit a 3 - 8-locular drupe; locules 1 - 2-seeded; seeds oblong, laterally compressed, nonendospermous.

Old World tropics, with 3 species, elsewhere cultivated; 2 in India.

KEY TO THE SPECIES

- | | |
|---|-------------------------------|
| 1a. Branchlets slender; flowers lilac, honey-scented; drupes to 2 cm long | 1. <i>M. azedarach</i> |
| b. Branchlets stout; flowers white, inodorous; drupes 2.5 - 4 cm long | 2. <i>M. dubia</i> |

1. *Melia azedarach* L., Sp. Pl. 384. 1753; Wight, Icon. Pl. Ind. Orient. t. 160. 1839; Hiern in Hook. f., Fl. Brit. India 1: 544. 1875.

Tree, small or medium-sized; young parts scurfy-tomentose, glabrous when mature. Leaves 2-pinnate, rarely 3-pinnate, 30 - 90 cm long; pinnae 5 - 9, usually opposite; leaflets 3 - 7 on each pinna, opposite or subopposite, lanceolate, oblanceolate, ovate-lanceolate or elliptic-lanceolate, oblique at base, toothed or lobed along margins, acuminate at apex, 2.5 - 5 x 1 - 2.5 cm; secondary nerves 8 - 15 on each side; petiolules to 5 mm long. Panicles lax. Pedicels slender, to 7 mm long. Calyx 5-lobed to base, pubescent outside. Petals 5, linear-oblong or oblanceolate, deflexed, ca 7 mm long, pubescent outside when young. Staminal tube 0.5 - 1 cm long, cylindrical, 20 - 30-toothed, purple; anthers at mouth

of tube, apiculate. Ovary glabrous; style clavate at apex; stigma 10-lobed. Drupes ellipsoid or globose, fleshy, yellow when ripe.

Fl. & Fr. May - Dec.

Distrib. India: Cultivated almost throughout.

2. *Melia dubia* Cav., Diss. 7: 364. 1789; Hiern in Hook. f., Fl. Brit. India 1: 545. 1875. *Melia composita* Willd., Sp. Pl. 2: 559. 1799; Beddome, Fl. Sylv. S. India t. 12. 1869. **Fig. 120.**

Tree, to 25 m tall; young parts scurfy-tomentose, glabrous when mature. Leaves to 1 m long; pinnae 3 - 8 pairs; rachis terete, to 20 cm long; leaflets 3 - 13, ovate-lanceolate to ovate-rotund, more or less oblique at base, serrulate or entire along margins, acuminate at apex, 3 - 12 x 1.5 - 4 cm; secondary nerves 6 - 16 on each side; petiolules to 5 mm long, longer in terminal leaflet. Panicles 12 - 20 cm long. Calyx 5-lobed; lobes ovate-oblong, tomentose. Petals linear-spathulate, concave, ca 5 mm long, pubescent outside, puberulous inside. Staminal tube white, gibbous at base, slightly expanded at apex with 10, 2-fid appendages, nearly glabrous or puberulous inside; anthers exerted, pubescent. Ovary glabrous; style a little longer than staminal tube; stigma cylindrical, 5-toothed. Drupes ovoid or ellipsoid, 2.5 - 4 x 2 - 2.5 cm, pulpy, yellowish, 1 - 6-seeded.

Fl. & Fr. Mar. - Feb.

Distrib. India: Throughout.

Pakistan, Nepal, Bhutan, Bangladesh, Myanmar and Sri Lanka.

Note. *Melia superba* Roxb. (= *M. bumanica* Kurz) is very similar to *M. dubia* Cav. King (in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 18 - 19. 1895) treated it as a distinct species but examination of Indian material reveals that *M. superba* Roxb. is indistinguishable from *M. dubia* Cav.

9. *Munronia* Wight

Shrubs or herbs, to 1 m high, with woody rootstock. Leaves crowded at ends of branchlets, 3-foliolate or imparipinnate; leaflets entire or coarsely crenate or serrate with an indumentum of simple 2-fid or stellate hairs. Flowers solitary or in a few-flowered axillary panicles, bisexual. Calyx 5-partite, somewhat foliaceous, persistent. Petals 5, spathulate, elongate, connate in lower half and adnate to staminal tube below. Staminal tube narrowly cylindrical, 10-toothed or -appendaged at apex, to 5.5 cm long; anthers 10, terminal, alternating with teeth, setaceous, apiculate, hairy. Disk tubular, entire, membranous, sheathing, glabrous. Ovary 5-loculed; locules with 2 superposed ovules; style slender, exceeding staminal tube; stigma capitate. Fruit a loculicidal



Fig. 120. *Melia dubia* Cav. : habit.

capsule, 5-valved; locules 1- or 2-seeded; seeds plano-convex, shining, not winged, with pergamentaceous testa and a large membranous sarcotesta on the adaxial surface and around hilum; endosperm thin.

From India eastwards to Malesia, with ca 10 species; one in India.

Munronia pinnata (Wallich) Harms in Ber. Deutsch. Bot. Ges. 35: 78. 1917; A.S. Rao in Bull. Bot. Surv. India 5: 255. 1964. *Turraea pinnata* Wallich, Pl. Asiat. Rar. 2: 119, t. 21. 1829. *Munronia wallichii* Wight, Ill. Indian Bot. 1: t. 54. 1840; Hiern in Hook. f., Fl. Brit. India 1: 543. 1875.

Shrub or undershrub, to 1 m high; young parts hirsute with simple hairs. Leaves alternate, crowded at apex of shoot, imparipinnate; leaflets 7 - 9, opposite or subopposite, subsessile, lanceolate, ovate or oblong-lanceolate, rounded or tapering and usually oblique at base, entire or undulate along margins, acuminate at apex with 5 - 7 faint reticulately arcuating nerves on each side of midnerve, pubescent along main nerves beneath; petiolule of terminal leaflet to 1 cm long. Flowers clustered on axillary peduncles, bracteate, ca 5 cm long, white or pink; pedicels to 1.5 cm long. Calyx 5-partite almost to base, 0.3 - 1 x 0.1 - 0.3 cm; lobes oblong-spathulate, persistent, hirsute outside. Petals 5, narrow, spathulate, 2.5 - 4.5 x 0.5 - 1 cm, clawed, connate in lower half and also fused with staminal tube, spreading, imbricate, sparsely hairy in distal half. Staminal tube cylindrical, 2 - 2.5 cm long, mouth expanded with 10 appendages, glabrous; anthers 10, slightly hairy, exserted, alternating with appendages, pilose on back along connective. Disk tubular, entire, enclosing ovary and base of style, membranous. Ovary 5-locular; locules with 2 superposed ovules; style slender, exceeding staminal tube, pilose in lower half; style head capitate. Fruit a loculicidal capsule, depressed-globose, 5-valved, ca 2 cm across with uneven surface, red; valves 1- or 2-seeded; seeds plano-convex, with pergamentaceous testa, not winged, black, shining, endospermous.

Fl. & Fr. Sept. - May.

Distrib. India: W. Bengal, Sikkim, Assam, Nagaland, Tripura, Meghalaya, Andhra Pradesh, Karnataka and Tamil Nadu.

Bhutan.

10. *Naregamia* Wight & Arn.

Undershrubs, branched with a woody rootstock and indumentum of simple hairs. Leaves 3-foliolate; rachis winged. Flowers bisexual, solitary, axillary, paired or few, in clusters. Calyx 4 - 5-lobed, deciduous, imbricate. Petals 4 - 5, free, spathulate, elongate, at length spreading above, imbricate. Staminal tube 2 - 3.5 cm long, narrowly cylindrical, sometimes inflated at apex, 10-crenate at mouth; anthers 10, exserted, apiculate, setaceous, glabrous, inserted at crenatures. Disk obsolete, or annular. Ovary 3- or

4-locular; locules with 2 collateral ovules; style slender; stigma thinly discoid, or modified to form an obconical to ovoid cylindrical structure called receptaculum pollinis. Fruit a 3 - 4-valved loculicidal capsule; locules 1 - 2-seeded; seeds curved, truncate at both ends; testa thick and bony with irregular transverse ridges, arillate; endosperm thick.

Africa and India with 2 species; one in India.

Naregamia alata Wight & Arn., Prodr. 117. 1834; Wight, Icon. Pl. Ind. Orient. t. 90. 1838; Hiern in Hook. f., Fl. Brit. India 1: 542. 1875.

Small shrub, to 50 cm high; young parts covered with an indumentum of golden brown, simple hairs, almost glabrous when old. Leaves alternate, 3-foliate, to 10 cm long; rachis winged, to 2 cm long; leaflets sessile, cuneate-obovate or spatulate, tapering into a narrow base, entire or coarsely sinuate along margins or deeply lobed in distal half, broadly obtuse or notched at apex, 0.8 - 3 x 0.3 - 2 cm; leaflets and wing of rachis glabrous but pilose along margins. Flowers solitary, or few in axillary clusters, bisexual, 2.5 - 3 cm long, white; pedicels to 1.5 cm long. Calyx of 5, oblong, lanceolate sepals with fused lower parts, hairy outside. Petals 5, distinct, linear-spatulate, ca 2.2 x 0.8 cm, free from staminal tube; staminal tube 1.8 - 2 cm long, expanded at apex with 10 crenatures; anthers 10, apiculate, spreading. Ovary 3-locular; locules with 2 collateral, pendulous ovules; style filiform, slender, slightly longer than staminal tube; style head small, discoid. Capsules membranous, 3-lobed, 3-valved; valves 2-seeded; seeds terete, curved, truncate at both ends, muricate, unwinged, brownish black, arillodate.

Fl. & Fr. Aug. - Dec.

Distrib. India: Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

11. Reinwardti dendron Koord.

Trees, with an indumentum of simple hairs. Leaves unifoliate to pinnate; leaflets alternate or opposite, petiolulate. Flowers bisexual, in axillary spikes or panicles. Calyx deeply 3 - 5-lobed; lobes rounded, imbricate. Petals 5, concave, connivent, imbricate. Disk absent. Staminal tube globose, cyathiform or ovoid with undulate or lobed margin; anthers 10, in 2 whorls of 5 each, glabrous, the upper partly exerted, the lower alternating with anthers of upper whorl and completely included, apiculate. Ovary usually 5-locular; 1- or 2-ovuled; style short; stigma obscurely 3 - 5-lobed. Fruit a 1- or 2-seeded berry; seeds exarillate with a sarcotesta.

Indo-Malesian region with ca 7 species; one in India.

Reinwardti dendron anomalaiense (Beddome) Mabb. in Malayan Forester 45: 452. 1982. *Lansium anomalaiense* Beddome in Madras J. Lit. Sci. 3, 1: 40. 1864. *L. anamallayanum* Beddome, Fl. Sylv. S. India t. 131. 1871; Hiern in Hook. f., Fl. Brit. India

1: 553. 1875. *Aglaia anamallayana* (Beddome) Kosterm. in *Reinwardtia* 7: 257, f. 10. 1966. *Reinwardtiadendron anamallayanum* (Beddome) C.J. Saldanha in C.J. Saldanha & Nicolson, *Fl. Hassan* 392. 1976. **Fig. 121.**

Tree, to 20 m tall. Leaves 10 - 30 cm long; rachis to 5 cm long; leaflets 4 - 6, alternate, elliptic-lanceolate, acute or subequilateral at base, entire along margins, acute at apex, ca 16 x 2 - 6 cm, leathery, glaucous; secondary nerves many, 8 - 15 dominant with domatia at axils beneath; petiolules to 5 mm long. Inflorescences shorter than leaves. Flowers more or less sessile. Calyx ciliate, fused in lower half. Petals white. Stamens 9 - 10, in 2 whorls. Ovary globose, 3-lobed, densely hairy, 3-locular; locules 2-ovuled. Berries oblong, to 3 x 1.5 cm with dry greyish-tawny rind, 2-seeded.

Fl. & Fr.: Mar. - Nov.

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

12. *Sandoricum* Cav.

Trees, with an indumentum of simple hairs. Leaves 3-foliolate; leaflets coriaceous; lateral ones short-petiolulate; terminal one long-petiolulate. Flowers in axillary panicles, yellow or whitish. Calyx cup-shaped, almost truncate or shallowly 4 - 5-lobed. Petals 4 - 5, free, spreading, imbricate. Staminal tube almost as long as petals, terminating in 10 short 2-lobed appendages; anthers 10, glabrous, inserted opposite appendages, included. Disk cup-shaped, free, coarsely toothed along margin, sheathing ovary and style base. Ovary adnate to calyx below, 4 - 5-locular; locules with 2 collateral ovules; style columnar, nearly as long as staminal tube; stigma 4 - 5-lobed, on a thick cylindrical base. Fruits 1 - 5-locular; pyrenes 1(-2)-seeded; seeds reniform, laterally compressed; sarcotesta small and confined to apex of seed or completely surrounding it.

Indo-Malesian region to New Guinea, with ca 5 species; one in India.

Sandoricum koetjape (Burm.f.) Merr. in *Philipp. J. Sci.* 7: 237. 1912. *Melia koetjape* Burm.f., *Fl. Ind.* 101. 1768. *Sandoricum indicum* Cav., *Diss.* 7: 359, tt. 202 & 203. 1789; Hiern in *Hook. f., Fl. Brit. India* 1: 553. 1875; Balakr. & M.K.V. Rao in *Jain & R.R. Rao, Assess. Threat. Pl. India* 196. 1983.

Tree, evergreen, to 15 m tall. Leaves 3-foliolate; rachis 5 - 15 cm long, softly pubescent; leaflets broadly ovate to orbicular, rounded or subcuneate, slightly unequal at base, entire along margins, acuminate at apex, 10 - 20 x 4 - 12 cm, glabrous above, puberulous beneath especially along nerves; petiolules of lateral leaflets 2 - 5 cm long, that of terminal leaflet 3 - 9 cm long. Flowers clustered, to 5 mm long, fragrant. Calyx cup-shaped, shallowly 5-lobed; lobes obscurely 2-lobed or orbicular, pubescent. Petals 5, free, linear-elliptic, obtuse, fleshy, glabrous. Staminal tube narrow, fleshy, striate, glabrescent outside, puberulous inside; anthers 10. Stigma with 5 thick finger-like



Fig. 121. *Reinwardtiidendron anamalaiense* (Beddome) Mabb. : a. habit.

projections. Fruits subglobose, obtusely 5-angled, to 5 cm across, densely but minutely pubescent, yellow with an acidic pulp of peculiar smell.

Fl. & Fr.: Dec. - May.

Distrib. India: Andaman Islands.

Myanmar and Malesia.

13. *Soymida* A. Juss.

Trees, deciduous, lofty, glabrous. Leaves paripinnate; leaflets opposite, glabrous. Flowers unisexual, in axillary or terminal panicles. Sepals 5, more or less free, imbricate. Petals 5, free, spreading, with a short claw, imbricate. Staminal tube cup-shaped, short; margin entire or lobed with 10 anthers or antherodes with short filaments; appendages absent. Disk in male flowers shallowly cup-shaped, adnate to base of pistillode, reduced to indistinct swelling below ovary in female flowers. Ovary 5-locular; locules 12 - 16-ovuled; style absent; stigma discoid, 5-angled, thick, completely blocking mouth of staminal tube. Pistillode slender with rudimentary ovules. Fruit a septifragal capsule, 5-angled, 5-valved, woody; valves with 2 plates which separate from the 5-winged axis; seeds numerous, flat, winged at both ends, endospermous.

India and Sri Lanka. Unispecific.

Soymida febrifuga (Roxb.) A. Juss. in Mem. Mus. Hist. Nat. 19: 251. 1830; Beddome, Fl. Sylv. S. India t. 8. 1869; Hiern in Hook. f., Fl. Brit. India 1: 567. 1875. *Swietenia febrifuga* Roxb., Pl. Coromandel t. 17. 1795.

Large tree with tall, straight trunk and thick bluish grey or brown bark; branches with leaf scars. Leaves paripinnate, 25 - 50 cm long; rachis 6 - 12 cm long; leaflets 3 - 6 pairs, subopposite or alternate, ovate-oblong, rounded, inequilateral at base, entire or coarsely crenate-serrate along margins, obtuse at apex, 6 - 20 x 4 - 12 cm, coriaceous; secondary nerves 8 - 20 on each side; petiolules to 1 cm long, sometimes leaflets almost sessile. Flowers ca 1 cm across, greenish white. Calyx 5-lobed; lobes ovate, pubescent, imbricate. Petals 5, obovate, notched at apex, ca 5 mm long, pubescent outside. Staminal tube cup-shaped, less than half as long as petals; anthers 10. Ovary glabrous. Capsules smooth, 2.5 - 6.5 cm long, black when ripe; seeds to 5 cm long including wings.

Fl. & Fr. Feb. - July.

Distrib. India: Uttar Pradesh, Bihar, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Sri Lanka.

Uses. Medicinal. Bark yields a fibre and tannin. Timber used for building.

14. *Sphaerosacme* Wallich ex Royle

Trees, with an indumentum of simple hairs. Leaves imparipinnate; leaflets usually opposite, oblong, acuminate. Flowers unisexual, male and female flowers on different individuals (dioecious), in axillary or supraxillary panicles. Calyx deeply 4 - 5-lobed; lobes valvate or imbricate. Petals 5, free, conniving over staminal tube, imbricate. Staminal tube globose, undulate at margin; anthers 10, glabrous, in 2 whorls of 5 each, the upper partly exerted, the lower alternating with anthers of upper whorl and completely included. Disk absent. Ovary 5-locular; locules 1-ovuled; style absent; stigma pileate, broad, 5-lobed. Fruit a 2 - 5-valved loculicidal capsule; seeds arillate; cotyledons fused.

Himalayas. Unispecific.

Sphaerosacme decandra (Wallich) Penn. in *Blumea* 22:489. 1975. *Aglaia decandra* Wallich in *Roxb., Fl. Ind.* 2: 427. 1824. *Amoora decandra* (Wallich) Hiern in *Hook. f., Fl. Brit. India* 1: 562. 1875.

Tree, large, spreading with thick trunk; young parts hairy. Leaves alternate, crowded at ends of branchlets, imparipinnate, rarely paripinnate, 20 - 50 cm long; rachis 3 - 15 cm long; leaflets 7 - 13, opposite or subopposite, oblong, obovate-lanceolate or elliptic-lanceolate, cuneate at base, entire or undulate along margins, acuminate at apex, 3 - 20 x 1.5 - 5 cm, membranous; secondary nerves 12 - 18 on each side; petiolules 2 - 4 mm long. Panicles as long as leaves. Flowers bracteate, globose, yellow, fragrant; pedicels ca 3 mm long, slender. Calyx small, 5-lobed. Petals 5, rounded, concave, imbricate. Staminal tube globose, ca 2 mm, slightly shorter than petals, 5-lobed at apex, fleshy, yellow; anthers sessile, in 2 whorls of 5 each. Ovary small, fleshy, 3 - 5-locular; locules 1-ovuled; style absent; stigma 3 - 5-angled, fleshy. Capsules globose-ovoid, 5-angled, ca 4 cm across, 5-valved; valves 1-seeded.

Fl. & Fr.: May - Dec.

Distrib. India: W. Bengal and Sikkim.

Nepal and Bhutan.

* 15. *Toona* (Endl.) M. Roemer

Trees, deciduous or semievergreen, with an indumentum of simple hairs. Leaves paripinnate, sometimes imparipinnate; leaflets entire, serrate or dentate, glabrous or hairy. Flowers in terminal or subterminal panicles, 5-merous, unisexual but with well-developed vestiges of opposite sex. Calyx of free sepals, or 5-lobed. Petals 5, free, imbricate, longer than calyx in bud, attached at base by carina to cushion-shaped disk (androgynophore). Stamens 5, free, arising from disk, yellow, dehiscent. Antherodes brown, shrivelled, without pollen, sometimes with 1 - 5 thread-like staminodes alternating with stamens. Ovary at apex of disk, 5-locular; locules 6 - 10-ovuled; style short; stigma discoid, glandular. Pistillode slender with well-developed locules and small vestigial ovules. Fruit an ellipsoid or obovoid sepifragal capsule; seeds winged at both ends or with a single wing, with residual endosperm.

Old World from Pakistan eastwards to Australia with 7 species; 7 in India.

KEY TO THE SPECIES

- | | |
|--|--------------------------|
| 1a. Stamens 5; staminodes 5 | 2 |
| b. Stamens 5; staminodes absent | 3 |
| 2a. Leaflets serrate or dentate along margins; calyx cup-shaped; disk and ovary glabrous | 5. <i>T. sinoensis</i> |
| b. Leaflets entire along margins; sepals free; disk and ovary hirsute | 3. <i>T. hainesianii</i> |
| 3a. Bracts prominent, persistent | 7. <i>T. ternatensis</i> |
| b. Bracts absent or inconspicuous, or early caducous | 4 |
| 4a. Leaflets membranous; sepals free | 5 |
| b. Leaflets more or less coriaceous; calyx cup-shaped | 6 |
| 5a. Leaflets short-petiolate; pedicels and sepals densely hairy; capsules verruculose | 4. <i>T. microcarpa</i> |
| b. Leaflets long-petiolate; pedicels and sepals more or less glabrous; capsules glabrous or lenticellate | 1. <i>T. ciliata</i> |

* Almeida and Almeida (J. Bombay Nat. Hist. Soc. 91: 473 - 474. 1994) made 13 new combinations at varietal level in *T. hexandra*. They argued that because Bahadur (Monogr. Gen. Toona 1988) cited the earlier legitimate name, *T. hexandra* (Wallich) M. Roemer (= *Cedrela hexandra* Wallich 1824) in the synonymy of *T. ciliata* M. Roemer, *T. hexandra* should be the correct name for *T. ciliata*.

Wallich (in Roxb., Fl. Ind. 2: 425. 1824 under Obs.) certainly provided a few-line description for *C. hexandra*. But at the end he stated, "This may perhaps prove a distinct species, though I doubt it; in that case it might be called *C. hexandra*." This clearly is a provisional name and was not validly published under Art. 34.1(b). However, Aitkin (in Trans. Soc. Arts 48: 448. 1833) seems to have accepted Wallich's *C. hexandra*. This epithet would have seniority against that of *Toona ciliata* M. Roemer had Aitkin accepted and thereby validated *C. hexandra*. Nevertheless, as *T. ciliata* being an important timber tree, considering the overwhelming usage and the need to save the botheration of name change, the authors have accepted the frequently used name and decided to propose the same (*T. ciliata*) for conservation.

- 6a. Flower buds globose; calyx covering 3/4 of bud
 b. Flower buds conical; calyx covering 1/4 of bud

6. *T. sureni*2. *T. fargesii*

1. *Toona ciliata* M. Roemer, *Fam. Nat. Syn. Monogr.* 1: 139. 1846; Bahadur, *Monogr. Gen. Toona* 64. 1988. *Cedrela toona* Roxb. ex Rottler in *Ges. Naturf. Freunde Berlin Neue Schriften* 4: 198. 1803; Hiern in *Fl. Brit. India* 1: 568. 1875, p.p. *C. hexandra* Wallich in Roxb., *Fl. Ind.* 2: 425. 1824. *C. velutina* DC., *Prodr.* 1: 625. 1824. *Toona hexandra* (Wallich) M. Roemer, l.c. 139. *T. velutina* (DC.) M. Roemer, l.c. 139. *Cedrela australis* F. Muell., *Fragm. Phytogr. Austral.* 1: 4. 1858. *C. toona* Roxb. ex Rottler var. *parviflora* Benth., *Fl. Austral.* 1: 387. 1863. *C. microcarpa* C.DC. var. *grandifoliola* C.DC. in *Rec. Bot. Surv. India* 3: 371. 1908. *C. toona* Roxb. ex Rottler var. *listeri* C.DC., l.c. 370. *C. toona* Roxb. ex Rottler var. *pilistila* C.DC., l.c. 365. *C. toona* Roxb. ex Rottler var. *pubinervis* C.DC., l.c. 368. *C. toona* Roxb. ex Rottler var. *haslettii* Haines, *Forest Fl. Chota Nagpur* 250. 1910.

Tree, to 27 m tall; bark thin, dark-grey or reddish brown, smooth when young, rough afterwards, exfoliating in irregular scales; blaze deep pink with white streaks with a typical toon or garlic-like smell. Leaves generally paripinnate, to 70 cm long; leaflets 3 - 10 pairs. Panicles 10 - 45 cm long, shortly pedunculate. Flowers greenish or creamish yellow, unisexual with rudiments of opposite sex. Sepals 5, free, connate at base. Petals 5, free. Disk lobed, fleshy, hairy. Stamens 5, without staminodes in male flowers, with rudimentary stamens in female flowers, slender, about half the size of fertile stamens. Ovary brown or black, hairy or glabrous, partly sunk in disk, 5-locular; locules 6 - 10-ovuled; style short, thickened, generally glabrous but often hirsute; stigma capitate. Pistillode in male flowers with partly developed ovary having well-formed locules but with rudimentary ovules; style longer than that of fertile pistil and with a non-glandular stigma. Capsules ovate-oblong, 1.5 - 3 x 0.8 - 1.5 cm, lenticellate or not, blackish when dry; seeds ca 1.5 cm long, winged at both ends and upper wing a little shorter.

KEY TO THE SUBSPECIES

- 1a. Leaflets quite glabrous, or puberulous only on nerves and in axis of secondary nerves when mature
 1.1. subsp. *ciliata*
 b. Leaflets pubescent, more densely so beneath when mature
 1.2. subsp. *velutina*

1.1. *Toona ciliata* M. Roemer subsp. *ciliata*: Bahadur, *Monogr. Gen. Toona* 64. 1988.

KEY TO THE VARIETIES

- 1a. Filaments glabrous
 2
 b. Filaments pilose
 6
 2a. Leaflets puberulous on nerves
 1.1.9. var. *pubinervis*
 b. Leaflets glabrous
 3

- | | |
|---|----------------------------------|
| 3a. Style hirsute | 1.1.8. var. <i>pilistila</i> |
| b. Style glabrous | 4 |
| 4a. Stamens 6 | 1.1.5. var. <i>hexandra</i> |
| b. Stamens 5 | 5 |
| 5a. Leaflets entire along margins | 1.1.2. var. <i>ciliata</i> |
| b. Leaflets acutely dentate along margins | 1.1.6. var. <i>listeri</i> |
| 6a. Style hirsute | 7 |
| b. Style glabrous | 8 |
| 7a. Leaflets less than 16 x 5 cm; capsules ca 2 x 0.9 cm | 1.1.1. var. <i>australis</i> |
| b. Leaflets more than 18 x 7 cm; capsules ca 2.5 x 1.2 cm | 1.1.3. var. <i>grandifoliola</i> |
| 8a. Anthers appendaged at apex | 1.1.4. var. <i>haslettii</i> |
| b. Anthers not appendaged | 1.1.7. var. <i>parviflora</i> |

1.1.1. var. *australis* (F. Muell.) Bahadur, Monogr. Gen. Toona 78. 1988. *Cedrela australis* F. Muell., Fragm. Phytogr. Austral. 1: 4. 1858. *Toona australis* (F. Muell.) Harms in Engl. & Prantl, Nat. Pflanzenfam. 4: 270. 1896. *Cedrela toona* Roxb. ex Rottler var. *australis* (F. Muell.) C.DC. in Rec. Bot. Surv. India 3: 368. 1908. *C. toona* Roxb. ex Rottler var. *cuspidata* C.DC., l.c. 366. *C. toona* Roxb. ex Rottler var. *deccana* C.DC., l.c. 366. *C. toona* Roxb. ex Rottler var. *pilistaminea* C.DC., l.c. 366. *C. toona* Roxb. ex Rottler var. *puberula* C.DC., l.c. 369. *C. toona* Roxb. ex Rottler var. *stracheyi* C.DC., l.c. 367. *C. toona* Roxb. ex Rottler var. *talbotii* C.DC., l.c. 367.

Fl. & Fr.: Feb. - July.

Distrib. India: Almost throughout.

Nepal, China, Bangladesh and Myanmar.

Cultivated in Africa and sometimes in the United Kingdom.

1.1.2. var. *ciliata*: Bahadur, Monogr. Gen. Toona 64. 1988. *C. toona* Roxb. ex Rottler var. *gamblei* C.DC. in Rec. Bot. Surv. India 3: 367. 1908.

Fl. & Fr.: Feb. - May.

Distrib. India: Almost throughout the country.

Pakistan, Bangladesh, Nepal, Bhutan and China.

Extending southeastwards up to Australia. Cultivated in Sri Lanka, Afghanistan, Africa and the Hawaiian Islands.

1.1.3. var. *grandifoliola* (C.DC.) Bahadur, Monogr. Gen. Toona 91. 1988. *Cedrela microcarpa* C.DC. var. *grandifoliola* C.DC. in Rec. Bot. Surv. India 3: 371. 1908.

Fl. & Fr.: Oct. - Jan.

Distrib. India: Uttar Pradesh, W. Bengal, Sikkim, Assam, Mizoram and Meghalaya.

Bangladesh, Bhutan, China, Indonesia and New Guinea.

1.1.4. var. *haslettii* (Haines) Bahadur, Monogr. Gen. Toona 92. 1988. *Cedrela toona* Roxb. ex Rottler var. *haslettii* Haines, Forest Fl. Chota Nagpur 250. 1910.

Fl. & Fr.: Mar. - July.

Distrib. India: Bihar and Tripura.

Note. According to Bahadur (*l.c.*) this variety is extremely rare and is known only by 2 collections, one each from Santal Pargana (Bihar) and Agartala (Tripura).

1.1.5. var. *hexandra* (Wallich) Bahadur, Monogr. Gen. Toona 93. 1988. *Cedrela hexandra* Wallich in Roxb., Fl. Ind. 2: 425. 1824. *Toona hexandra* (Wallich) M. Roemer, Fam. Nat. Syn. Monogr. 1: 139. 1846. *Cedrela toona* Roxb. ex Rottler var. *nepalensis* C.D.C. in Rec. Bot. Surv. India 3: 365. 1908. *Toona ciliata* M. Roemer subsp. *nepalensis* (C. DC.) Panigr. in Bangladesh J. Bot. 3:54. 1974.

Fl. & Fr.: Mar. - Aug.

Distrib. India: Himachal Pradesh and Uttar Pradesh.

Nepal.

1.1.6. var. *listeri* (C.D.C.) Bahadur, Monogr. Gen. Toona 94. 1988. *Cedrela toona* Roxb. ex Rottler var. *listeri* C.D.C. in Rec. Bot. Surv. India 3: 370. 1908.

Fl. & Fr.: Mar. - Aug.

Distrib. India: W. Bengal.

Bangladesh.

1.1.7. var. *parviflora* (Benth.) Bahadur, Monogr. Gen. Toona 94. 1988. *Cedrela toona* Roxb. ex Rottler var. *parviflora* Benth., Fl. Austral. 1: 387. 1863.

Fl. & Fr.: Mar. - July.

Distrib. India: Assam and Uttar Pradesh.

Bangladesh and Australia.

1.1.8. var. pilistila (C.DC.) Nair & Kumari in Nair & A.N. Henry, Fl. Tamil Nadu 1: 69. 1983; Bahadur, Monogr. Gen. Toona 95. 1988. *Cedrela toona* Roxb. ex Rottler var. *pilistila* C.DC. in Rec. Bot. Surv. India 3: 365. 1908.

Fl. & Fr.: Mar. - June.

Distrib. India: W. Bengal and Tamil Nadu.

Bangladesh.

1.1.9. var. pubinervis (C.DC.) Bahadur, Monogr. Gen. Toona 96. 1988. *Cedrela toona* Roxb. ex Rottler var. *pubinervis* C.DC. in Rec. Bot. Surv. India 3: 368. 1908. *C. toona* Roxb. ex Rottler var. *multijuga* Haines, Bot. Bihar Orissa 2: 174. 1921.

Fl. & Fr.: Mar. - June.

Distrib. India: Sikkim and Bihar.

Nepal, China, Myanmar and Malesia.

1.2. Toona ciliata subsp. **velutina** (DC.) Bahadur, Monogr. Gen. Toona 97. 1988. *Cedrela velutina* DC., Prodr. 1: 625. 1824. *Toona velutina* (DC.) M. Roemer, Fam. Nat. Syn. Monogr. 1: 139. 1846. *Cedrela toona* Roxb. ex Rottler var. *pubescens* Fr., Pl. Delav. 126. 1889. *C. toona* Roxb. ex Rottler var. *henryi* C. DC. in Rec. Bot. Surv. India 3: 369. 1908. *C. toona* Roxb. ex Rottler var. *sublaxiflora* C.DC., l.c. 369. *C. kingii* C.DC., l.c. 371 incl. var. *bimanica*. *C. mollis* Hand.-Mazz. in Anzeig. Acad. Wissenschaft. Wien 24: 266. 1920.

KEY TO THE VARIETIES

- | | |
|---|------------------------------|
| 1a. Leaflets velvety beneath | 2 |
| b. Leaflets pubescent but not velvety | 3 |
| 2a. Leaflets drab-tomentose with tufts of white hairs in axils of secondary nerves beneath; panicles much shorter than leaves | 1.2.3. var. mollis |
| b. Leaflets rusty-tomentose without such axillary tufts of hairs but main nerves densely hairy beneath; panicles as long as or longer than leaves | 1.2.2. var. kingii |
| 3a. Leaflets strap-shaped, to 16 x 4 cm, papery; petiolules to 5 mm long | 1.2.1. var. candollei |
| b. Leaflets ovate-lanceolate, to 12 x 3.5 cm, leathery; petiolules to 1 cm long | 1.2.4. var. velutina |

1.2.1. var. candollei Bahadur, Monogr. Gen. Toona 99. 1988.

Distrib. India: W. Bengal.

China.

1.2.2. var. kingii (C.DC.) Bahadur, Monogr. Gen. Toona 100. 1988. *Cedrela kingii* C.DC. in Rec. Bot. Surv. India 3: 371. 1908, incl. var. *bimbanica*. *Toona kingii* (C.DC.) Harms in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 19b1: 46. 1940.

Fl. & Fr.: Mar. - June.

Distrib. India: Uttar Pradesh, W. Bengal, Sikkim, Assam and Tamil Nadu.

Pakistan, Myanmar and China.

1.2.3. var. mollis (Hand.-Mazz.) Bahadur, Monogr. Gen. Toona 101. 1988. *Cedrela mollis* Hand.-Mazz. in Anzeig. Acad. Wissenschaft. Wien 24: 266. 1920. *Toona mollis* (Hand.-Mazz.) A. Chev. in Rev. Int. Bot. Appl. Agric. Trop. 24: 157. 1944.

Fl. & Fr.: Mar. - June.

Distrib. India: Assam and Uttar Pradesh.

Nepal, Myanmar, China, Indonesia and New Guinea.

1.2.4. var. velutina: Bahadur, Monogr. Gen. Toona 104. 1988. *Fl. & Fr.*: Mar. - June.

Distrib. India: Uttar Pradesh, Bihar, W. Bengal, Assam, Meghalaya and Tamil Nadu.

Nepal, China and New Guinea.

2. Toona fargesii A. Chev. in Rev. Int. Bot. Appl. Agric. Trop. 24: 158. 1944; Bahadur, Monogr. Gen. Toona 107. 1988.

Tree, shortly branched, to 30 m tall; bark purplish brown; young parts pubescent. Leaves often imparipinnate, 30 - 50 cm long; rachis 8 - 10 cm long; leaflets 10 - 12 pairs, subopposite or alternate, ovate-lanceolate, unequally rounded at base, entire along margins, acuminate or cuspidate at apex, 11 - 14 x 3 - 5.5 cm, glabrescent above, hirtellous on mid- and secondary nerves beneath; secondary nerves 11 - 12 on each side. Panicles erect, pyramidal, lax, 20 - 30 cm long, puberulous. Flower buds conical; bracts caducous; pedicels 2 - 4 mm long. Sepals ca 1 mm long, 1/4 as long as bud, united to 1/3 below, ciliate along edges, hairy outside, glabrous inside. Petals 4 - 5 mm long, tinged with purple, glabrous. Filaments glabrous. Disk 5-lobed, hairy. Ovary conical, glabrous; style glabrous.

Fl. & Fr.: May - July.

Distrib. India: Assam.

China and New Guinea.

3. *Toona hainesii* (C.DC.) Harms in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 19bl: 47. 1940; Bahadur, Monogr. Gen. Toona 108. 1988. *Cedrela hainesii* C.DC. in Rec. Bot. Surv. Ind. 3: 363. 1908. *C. toona* Roxb. ex Rottler var. *hainesii* (C.DC.) Haines, Forest Fl. Chota Nagpur 250. 1910 & Bot. Bihar Orissa 174. 1921.

Moderate to large tree with a spreading crown; young parts hairy. Leaves to 50 cm long; rachis to 12 cm long; leaflets 11 pairs, opposite or subopposite, lanceolate, slightly oblique at base, entire along margins, acuminate at apex, ca 10 x 3 cm, puberulous especially along midnerve when young; secondary nerves to 15 on each side, hairy in axils beneath; petiolules to 7 mm long. Panicle 20 - 30 cm long, lax. Flowers small; pedicels ca 1 mm long. Sepals 5, rounded, puberulous outside, ciliate along margins, ca 1.25 mm long. Petals oblong-elliptic, obtuse at both ends, 4 - 4.5 x ca 2.5 mm. Stamens 5, alternating with 5 thread-like staminodes; anthers cordate at base, shortly appendaged. Disk and ovary hirsute; style glabrous.

Fl. & Fr.: May - Nov.

Distrib. India: Restricted to Singhbhum in Orissa.

China and Australia.

4. *Toona microcarpa* (C.DC.) Harms in Engl. & Prantl, Nat. Pflanzenfam. 3: 270. 1896; Bahadur, Monogr. Gen. Toona 109. 1988. *Cedrela microcarpa* C.DC. in A. DC. & C.DC., Monogr. Phan. 1: 745. 1878. *C. febrifuga* Blume var. *verrucosa* C.DC. in Rec. Bot. Surv. India 3: 374. 1908. *C. toona* Roxb. ex Rottler var. *pilipetala* C.DC., l.c. 367.

Large evergreen or deciduous tree; branchlets with verrucose lenticels, puberulous and brown when young dark-rubescens and glabrous when mature; bark with characteristic garlic odour. Leaves abruptly pinnate, to 50 cm long; rachis to 15 cm long; leaflets 8 - 10 pairs, opposite, oblong-ovate, obliquely round at base, entire along margins, acuminate at apex, 10 - 14 x 4 - 6 cm; secondary nerves 8 - 12 on each side; petiolules ca 5 mm long. Panicles shortly branched, shorter than leaves, hairy. Flowers small, bracteate; pedicels ca 1 mm long. Sepals 5, free, rounded, densely hairy, ciliate along margins. Petals 5, oblong-ovate, subacute at base, rounded at apex, ca 6 x 3 mm, ciliate along margins, glabrous or sometimes pilose. Filaments pilose; anthers apiculate. Disk and ovary densely hirsute; style glabrous or hirsute. Capsules ovoid or spindle-shaped, 1.5 - 4 cm long, warty, prominently verruculose, dark brown.

KEY TO THE VARIETIES

1a. Leaflets to 10 x 4 cm; panicles puberulous; petals pilose inside; style hirsute

42. var. *pilipetala*

- b. Leaflets to 14 x 6 cm; panicles hirtellous; petals and style glabrous 2
 2a. Capsules obovoid, to 2 cm long, thin-walled, dehiscence irregular 4.1. var. *microcarpa*
 b. Capsules fusiform, to 4 cm long, woody, dehiscence valvular 4.3. var. *sahnii*

4.1. var. *microcarpa*: Bahadur, Monogr. Gen. Toona 109. 1988. *Fl. & Fr.*: June - Jan.

Distrib. India: W. Bengal, Sikkim and Nagaland.

Nepal, China, Myanmar, Thailand and Indonesia.

4.2. var. *pilipetala* (C.DC.) Bahadur, Monogr. Gen. Toona 113. 1988. *Cedrela toona* Roxb. ex Rottler var. *pilipetala* C.DC. in Rec. Bot. Surv. India 3: 367. 1908. *Toona ciliata* M. Roemer var. *pilipetala* (C. DC.) Nair & Kumari in Nair & A.N. Henry, Fl. Tamil Nadu 1: 69. 1983.

Fl. & Fr.: Apr. - July.

Distrib. India: Maharashtra, Tamil Nadu and Kerala.

4.3. var. *sahnii* Bahadur, Monogr. Gen. Toona 114. 1988.

Fr.: Nov. - Feb.

Distrib. India: W. Bengal (Darjeeling).

Bhutan.

Notes. Flowers of this variety are not known but according to Bahadur (*l.c.*) they may not to be different from var. *microcarpa*.

5. *Toona sinensis* (A. Juss.) M. Roemer, Fam. Nat. Syn. Monogr. 1: 138. 1846; Bahadur, Monogr. Gen. Toona 115. 1988. *Cedrela sinensis* A. Juss. in Mem. Mus. Hist. Nat. 19: 294. 1830. *C. serrata* Royle, Ill. Bot. Himal. Mts. 144, t. 28. 1839. *Cedrela serrulata* Miq., Fl. Ind. Bat. Suppl. 508. 1859. *Toona serrata* (Royle) M. Roemer, l.c. 139. *Cedrela glabra* C. DC. in A. DC. & C. DC., Monogr. Phan. 1: 742. 1878. *C. sinensis* A. Juss. var. *hupehaha* C. DC. in Rec. Bot. Surv. India 3: 361. 1908. *C. serrata* Royle var. *pubenula* C. DC., l.c. 363. *Toona sinensis* (A. Juss.) M. Roemer var. *grandis* Pampan. in Nouvo Giorn. Bot. Ital. 17: 171. 1911. *T. serrulata* (Miq.) Harms in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 19b1: 47. 1940. *T. sinensis* (A. Juss.) M. Roemer var. *hupehaha* (C. DC.) A. Chev. in Rev. Int. Bot. Appl. Agric. Trop. 24: 156. 1944 & var. *incarvellei* A. Chev., l.c. 156. *T. microcarpa* (C. DC.) Harms var. *grandifolia* A. Chev., l.c. 158.

Tree, to 30 m tall; bark greyish brown, rough with vertical fissures. Leaves paripinnate but often with a terminal leaflet, to 70 cm long; rachis to 9 cm long; leaflets 5 - 14

pairs, opposite or alternate, upper and lower ones generally smaller, ovate-oblong, inequilateral at base, remotely serrate or dentate along margins, acuminate at apex, 5 - 25 x 3 - 7 cm, glabrous or slightly hairy along main nerves; secondary nerves to 30 on each side; petiolules 5 - 10 mm long. Panicles as long as or longer than leaves. Pedicels to 1 mm long. Calyx cup-shaped, ca 1 mm long; lobes rounded or obtuse. Petals 5, free, ovate or elliptic-oblong, 4 - 5.5 x 1.5 - 2.5 mm. Stamens 5, sometimes 6, alternating with an equal number of filamentous staminodes. Disk, ovary and style glabrous. Capsules obovate or fusiform, 2 - 3 cm long, glabrous, reddish-brown or black, often with a few minute lenticels; seeds with a wing at upper end only.

KEY TO THE VARIETIES

- | | |
|--|------------------------------|
| 1a. Leaflets 15 - 25 cm long | 5.1. var. <i>grandifolia</i> |
| b. Leaflets 5 - 13 cm long | 2 |
| 2a. Leaflets sessile or nearly so; axils of secondary nerves with a tuft of hairs beneath | 5.2. var. <i>longifolia</i> |
| b. Leaflets petiolulate, glabrous or hairy along nerves beneath; petiolules 5 - 10 mm long | 3 |
| 3a. Leaflets glabrous when mature | 5.4. var. <i>sinensis</i> |
| b. Leaflets puberulous on main nerves beneath when mature | 5.3. var. <i>puberula</i> |

5.1. var. *grandifolia* (A. Chev.) Bahadur, Monogr. Gen. Toona 121. 1988. *T. microcarpa* (C.DC.) Harms var. *grandifolia* A. Chev. in Rev. Int. Bot. Appl. Agric. Trop. 24: 158. 1944.

Fl. & Fr.: Sept. - Feb.

Distrib. India: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and all along the Himalayas.

Pakistan, Nepal and China. Cultivated in Europe and Japan.

5.2. var. *longifolia* (Wallich ex C. DC.) S. Almeida & Almeida in J. Bombay Nat. Hist. Soc. 91: 474. 1994. *Cedrela longifolia* Wallich ex C. DC. in Rec. Bot. Surv. India 3: 375. 1908, includ. var. *kumaona* C.DC., l.c. 376. *Cedrela glabra* C.DC. in A. DC. & C. DC., Monogr. Phan. 1: 742. 1878. *Toona glabra* (C.DC.) Harms in Engl. & Prantl, Nat. Pflanzenfam. 3: 269. 1896. *Toona longifolia* (Wallich ex C.DC.) M. Roemer ex Harms in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 19b1: 46. 1940. *Cedrela sinensis* A. Juss. var. *schensiana* C.DC., l.c. 361. *Toona sinensis* (A. Juss) M. Roemer var. *glabra* (C. DC.) Bahadur, Monogr. Gen. Toona 120. 1988.

Fl. & Fr.: May - Oct.

Distrib. India: Himachal Pradesh and Uttar Pradesh.

Nepal, China and Myanmar.

5.3. var. *puberula* (C.DC.) Bahadur, Monogr. Gen. Toona 122. 1988. *Cedrela serrata* Royle var. *puberula* C.DC. in Rec. Bot. Surv. India 3: 363. 1908.

Fl. & Fr.: Apr. - Sept.

Distrib. India: Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and all along the Himalayas.

Pakistan, Nepal and China. Cultivated in Europe and Japan.

5.4. var. *sinensis*: Bahadur, Monogr. Gen. Toona 115. 1988. *Fl. & Fr.*: May - Oct.

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

Widely distributed from Pakistan through India and China to Indonesia. Cultivated in Africa and Europe.

6. *Toona sureni* (Blume) Merr., Interpr. Herb. Amboin. 305. 1917; Bahadur, Monogr. Gen. Toona 129. 1988. *Swietenia sureni* Blume, Cat. Hort. Buitenzorg 27. 1823. *Cedrela febrifuga* Blume in Verh. Batav. Genootsch. Kunsten 9: 135. 1823 & Bijdr. 180. 1825. *Cedrela inodora* Hassk., Hort. Bogor. 131. 1844. *Toona febrifuga* (Blume) M. Roemer, Fam. Nat. Syn. Monogr. 1: 139. 1846. *T. febrifuga* (Blume) M. Roemer var. *cochinchinensis* Pierre, Fl. For. Cochinch. t. 358. 1897. *Cedrela celebica* Koord. in Meded. Pl. 19: 384. 1898. *C. toona* Roxb. ex Rottler var. *latifolia* C. DC. in Rec. Bot. Surv. India 3: 365. 1908. *C. febrifuga* Blume var. *assamensis* C.DC., l.c. 373. *C. sureni* (Blume) Burkill in Gard. Bull. Straits Settlements. 5: 120. 1930. *Toona ciliata* M. Roemer var. *latifolia* (C. DC.) Chandrab. in Biol. Mem. 2: 28. 1977.

Tree, 50 - 60 m tall; branchlets rather thick, densely pubescent when young, glabrous afterwards, often dark-reddish with pale lenticels; bark ca 1 cm thick, rough with vertical cracks, peeling off in oval flakes, red inside. Leaves 30 - 50 cm long; leaflets usually 6 - 15 pairs, opposite or subopposite, ovate-oblong, unequally oblique at base, entire along margin, subobliquely acuminate at apex, 8 - 20 x 4.5 - 7.5 cm, coriaceous, glabrous or nearly so above, sparingly pilose in axils of secondary nerves beneath, sometimes both surfaces pubescent; secondary nerves 10 - 20 on each side; petiolules to 6 mm long. Panicles as long as leaves, puberulous. Flower buds globose, covered 3/4 by calyx. Calyx cupulate, ca 1 mm long, 3-lobed; lobes rounded, glabrous or nearly so inside, ciliate along margins. Petals 5, free, oblong-ovate, 4.5 - 5 x 1.5 - 2.5 mm, glabrous or puberulous, ciliate along margins. Filaments pilose; anthers shortly apiculate. Disk and ovary densely hairy; style glabrous, occasionally curved in male flowers. Capsules obovate-fusiform, 2.5 - 4.5 cm long, often lenticellate, thin or woody; seeds winged at both ends.

KEY TO THE VARIETIES

1a. Leaflets glabrous

6.3. var. *glabrior*

- b. Leaflets puberulous especially on mid- and secondary nerves 2
 2a. Capsules more than 3.5 cm long; valves thick 6.1. var. *celebica*
 b. Capsule less than 3 cm long; valves thin 3
 3a. Leaflets 11.5 - 20 x 4.5 - 7.5 cm; calyx densely puberulous outside 6.4. var. *sureni*
 b. Leaflets ca 10.5 x 5 cm; calyx glabrous outside 6.2. var. *cochinchinensis*

6.1. var. *celebica* (Koord.) Bahadur, Monogr. Gen. Toona 133. 1988. *Cedrela odorata* Blanco, Fl. Filip. 184. 1837, non L. 1753. *C. celebica* Koord. in Meded. Pl. 19: 384. 1898. *C. brevipetiolulata* Haines, Bot. Bihar Orissa 2: 174. 1921.

Fl. & Fr.: July - Jan.

Distrib. India: Arunachal Pradesh, Assam, Meghalaya and Orissa. Its largest concentration is in the Philippines from where it extends westwards to northeast India through China and southwards to Indonesia (Bahadur, l.c.)

6.2. var. *cochinchinensis* (Pierre) Bahadur, Monogr. Gen. Toona 135. 1988. *Toona febrifuga* (Blume) M. Roemer var. *cochinchinensis* Pierre, Fl. For. Cochinch. t. 358. 1897. *Cedrela febrifuga* Blume var. *cochinchinensis* (Pierre) C.DC. in Rec. Bot. Surv. India 3: 374. 1908 & var. *pealii* C.DC., l.c. 374.

Fl. & Fr.: Sep*. - Jar.

Distrib. India: Assam.

Cambodia.

6.3. var. *glabrior* (C. DC.) S. Almeida & Almeida in J. Bombay Nat. Hist. Soc. 91: 474. 1994. *C. febrifuga* Blume var. *glabrior* C.DC. in A. DC. & C. DC., Monogr. Phan. 1: 744. 1878. *Cedrela inodora* Hassk., Hort. Bogor. 131. 1844. *C. febrifuga* Blume var. *inodora* (Hassk.) C.DC. in Rec. Bot. Surv. India 3: 373. 1908. *Toona febrifuga* (Blume) M. Roemer var. *glabrior* (C.DC.) Harms in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 19b1: 46. 1940 (as "*glabra*"). *T. inodora* (Hassk.) Hochr. ex Harms in Engl. & Prantl, Nat. Pflanzenfam. ed. 2, 19b1: 46. 1940. *T. sureni* (Blume) Merr. var. *inodora* (Hassk.) Bahadur, Monogr. Gen. Toona 136. 1988.

Fl. & Fr.: July - Jan.

Distrib. India: Meghalaya (Khasi Hills).

China, Myanmar, Australia through Southeast Asia. Widely distributed in Indonesia from where it extends northwestwards up to the Khasi Hills (Meghalaya), India and southeastwards through Malaysia, the Philippines, Thailand, Vietnam and up to Queensland in Australia.

6.4. var. *sureni* : Bahadur, Monogr. Gen. Toona 139. 1988.

Fl. & Fr.: July - Jan.

Distrib. India: W. Bengal, Sikkim, Assam, Meghalaya, Kerala and Tamil Nadu.

Bangladesh, Nepal and China. Chiefly concentrated in and around Indonesia and extending northwestwards into India and southeastwards as far as Australia (Bahadur, l.c.).

7. *Toona ternatensis* (Miq.) Bahadur, Monogr. Gen. Toona 144. 1988. *Cedrela febrifuga* Blume forma *ternatensis* Miq. in Ann. Mus. Bot. Lugduno-Batavum 4: 63. 1869. *Toona febrifuga* (Blume) M. Roemer var. *ternatensis* (Miq.) Pierre, Fl. For. Cochinch. t. 358. 1897.

Tree, 30 - 40 m tall; branchlets lenticellate with scars of fallen leaves. Leaves usually paripinnate, sometimes with a terminal leaflet, to 40 cm long; rachis 6 - 9 cm long; leaflets 10 - 20, usually opposite, or subopposite, sometimes alternate, ovate or oblong-lanceolate, oblique at base, entire along margins, acute at apex, 7 - 12 x 3 - 6 cm, glabrous except in axils of secondary nerves beneath; secondary nerves 10 - 15 on each side; petiolules to 1 cm long. Panicles lax, shorter than or as long as leaves. Flowers small; bracts persistent; pedicels to 1 mm long. Calyx shallowly 5-lobed, hardly 0.5 mm long, ciliate along edges. Petals 5, elliptic, obtuse, apiculate, 1 - 1.5 x ca 0.5 mm, ciliate. Disk and ovary hirtellous; style glabrous; stigma 5-lobed. Capsules elliptic-oblong, ca 2.5 cm long, thin-walled, sparingly lenticellate, black when dry; seeds winged at both ends; wing at upper end shorter.

Fl. & Fr.: Apr. - July.

Distrib. India: Uttar Pradesh (Dehra Dun) and Meghalaya (Garo hills). Rare.

16. *Trichilia* P. Browne

Trees or shrubs, with an indumentum of simple or rarely stellate hairs. Leaves imparipinnate, rarely 3-foliolate or unifoliolate; leaflets opposite, entire. Flowers unisexual, male and female flowers on different individuals, on long-peduncled axillary or terminal panicles, rarely fasciculate or cymose. Calyx short, 4 - 5-lobed, imbricate. Petals 4 - 5, oblong, suberect, free or connate below, imbricate or valvate. Staminal tube 8 - 10-fid about to middle with free part of filaments 2-appendaged at apex; anthers inserted between appendages, mucronate. Antherodes slender, not dehiscing. Disk fleshy, annular around ovary base. Ovary 2 - 3-locular; locules 1 - 2-ovuled; style elongate; stigma 2 - 3-lobed or -toothed with a rim at base. Pistillode smaller, with rudimentary ovules. Capsules loculicidal, 2-valved, 1-seeded; seeds covered by a white aril, nonendospermous.

Tropical America, Africa and Asia with 86 species; one in India.

Trichilia connaroides (Wight & Arn.) Benthelzen in Acta Bot. Neerl. 11: 13. 1962. *Zanthoxylum connaroides* Wight & Arn., Prodr. 148. 1834 (as "*Zanthoxylon*"). *Heynea trijuga* Roxb. ex Sims in Bot. Mag. 41: t. 1738. 1815 non *Trichilia trijuga* Vell. 1825; Hiern in Hook.f., Fl. Brit. India 1: 565. 1875. Fig. 122.

Shrub or small tree, to 5 m high, glabrous. Leaves crowded at ends of branchlets, alternate, 12 - 40 cm long; leaflets 5 - 7, ovate-oblong, oblique at base, entire along margins, acuminate at apex, 4 - 18 x 1.5 - 9 cm, pale beneath; petiolules to 2.5 cm long, that of terminal leaflet the longest. Panicles to 30 cm long. Flowers 4 - 5-merous, ca 8 mm across, cream-coloured; pedicels short. Calyx 5-lobed, short, pubescent. Petals 5, free, oblong, ca 4 mm long, ciliolate, subimbricate. Disk thick. Staminal tube wide, pubescent; anthers 10. Ovary globose, glabrescent; style ca 1 mm long; stigma capitate, 2-toothed. Capsules globose, beaked, ca 8 mm, red, splitting by 2 or rarely 3 valves.

Fl. & Fr. Mar. - Sept.

Distrib. Peninsular and N.E. India: Uttar Pradesh, Bihar, W. Bengal, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Orissa, Maharashtra, Goa, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala.

Nepal, Myanmar and Bhutan.

17. *Turraea* L.

Small trees or shrubs, with an indumentum of simple hairs. Leaves simple, entire or sometimes with repand-sinuate or crenate margins. Flowers solitary or in axillary or terminal clusters, bisexual; peduncles short with many small bracts. Calyx campanulate, 4 - 5-toothed. Petals 4 - 5, free, spatulate, elongate, reflexed, imbricate. Staminal tube cylindrical, elongate with short appendages at apex; anthers usually 10, sometimes 8, inserted near mouth, alternating with appendages, exserted. Disk annular, or obsolete. Ovary 5- or more-locular; locules 2-ovuled; style elongate, exserted; stigma capitate. Fruit a loculicidal capsule; valves 1- or 2-seeded; seeds oblong with a broad ventral hilum, hard, shining, arillate, endospermous.

Tropical and S. Africa, Madagascar, Mascarenes and tropical Asia to Australia with ca 60 species; one in India.

Turraea villosa Bennett, Fl. Jav. Rar. 182. 1840; Wight, Icon. Pl. Ind. Orient. t. 1593. 1850; Hiern in Fl. Brit. India 1: 542. 1875. *T. virens* auct. non L. 1771; Hiern in Hook. f., Fl. Brit. India 1: 541. 1875.



Fig. 122. *Trichilia connaroides* (Wight & Arn.) Bentvelzen. : habit.

Large shrub or small tree; young parts villous with golden brown simple hairs. Leaves crowded at end of branches, alternate, simple, elliptic or ovate, acute or rounded at base, entire along margins, acuminate at apex, 2 - 5 x 2 - 4 cm, membranous, softly villous when young, glabrous with age; petioles 2 - 5 mm long. Flowers axillary, solitary or in fascicles of 2 - 6, white or yellow, fragrant; peduncles to 2.5 cm long. Flowers bracteate, to 4 cm long; pedicels to 1.5 cm long. Calyx campanulate, 5-toothed. Petals 5, free, spatulate, to 4 cm long, spreading, imbricate. Staminal tube cylindrical, to 3 cm long, with short appendages at apex; anthers 8 - 10, short but longer than appendages and alternating with them, inserted at mouth. Ovary 5-locular; locules 2-ovuled; style linear, produced beyond staminal tube, ca 4 cm long, glabrous; style head ovoid, large. Fruit a subglobose capsule, ca 1.5 cm across; seeds oblong.

Fl. & Fr. Apr. - June.

Distrib. India: Gujarat, Maharashtra, Karnataka, Tamil Nadu and Kerala.

Note. Cooke (Flora of Presidency of Bombay 204. 1904) who doubtfully enumerated *T. virens* L. discussed at length how it was continued to be included in Indian floras following Graham (Catalogue of Plants of Bombay 31. 1839) and later Dalzell and Gibson (Bombay Flora 36. 1861).

18. *Xylocarpus* Koenig

Semievergreen, glabrous, littoral or mangrove trees or shrubs. Leaves alternate, paripinnate; leaflets opposite, generally 2 - 6, entire, faintly nerved. Panicles lax, axillary. Flowers unisexual but with well-developed rudiments of opposite sex. Calyx short, 4-fid to about middle, valvate. Petals 4, free, reflexed, much longer than calyx, contorted in bud. Staminal tube urceolate or globose, 8-dentate at apex; anthers 8, included, alternating with appendages. Antherodes in female flowers similar but non-dehiscing and without pollen. Disk cup-shaped, fleshy, red, adnate to base of ovary but free from staminal tube. Ovary 4-sulcate, 4-locular; locules 3 - 6-ovuled; style short; stigma discoid, almost blocking mouth of staminal tube, crenulate at margin; upper surface with 4 radiating grooves. Pistillode in male flowers similar but more slender and with rudimentary ovules. Fruit a septifragal capsule, irregularly globose, large, pendulous, leathery, 8 - 20-seeded, dehiscing tardily by 4-valves from base and apex; columella thin, rudimentary; seeds large, angular, thick, attached by apex to columella, exarillate, nonendospermous; testa corky; hilum prominent.

Mangrove swamps or coastal habitats of the Old World with about 5 species; 3 in India.

KEY TO THE SPECIES

1a. Leaflets ovate-oblong, acuminate at apex

3. *X. moluccensis*

- b. Leaflets obovate to elliptic-oblong, obtuse or rounded at apex 2
- 2a. Stems with smooth bark and long, branched snake-like buttresses, without pneumatophores; capsules 6 - 25 cm across 2. *X. granatum*
- b. Stems with rough longitudinally fissured bark and short buttresses, with erect pointed pneumatophores; capsules 8 - 13 cm across 1. *X. gangeticus*

1. *Xylocarpus gangeticus* (Prain) C.E. Parkinson in Indian Forester 60: 140. 1934. *Carapa moluccensis* Lam. var. *gangeticus* Prain in Rec. Bot. Surv. India 2: 292. 1903. *Carapa moluccensis* sensu Watson in Malayan Forest Rec. 6: 70 & 75, tt. 34 & 35. 1928, non Lam. *Carapa* sp. No. 116. C.E. Parkinson, Forest Fl. Andaman Isl. 118. 1923.

Moderate-sized, elegant tree, to 15 m tall; bark dark-coloured, peeling off in oblong flakes. Leaves 10 - 20 cm long; rachis to 8 cm long; leaflets usually 2 pairs, opposite, sometimes 1, rarely 3 pairs, 7 - 18 x 3 - 10 cm, subcoriaceous, similar to those of *X. granatum* but larger; secondary nerves 8 - 12 on each side; leaflets more or less sessile; petiolules to 8 mm long. Panicles 5 - 15 cm long, lax. Flowers pinkish white; pedicels 2 - 5 mm long. Calyx lobes rounded, somewhat obtusely acuminate, ca 2 mm long. Petals broadly elliptic-oblong, 4 - 7 mm long. Staminal tube 2.5 - 3 mm long; appendages irregularly lobed; anthers included. Ovary broadly ovoid; style conical, short; stigma discoid. Capsules obscurely 4-lobed, reddish-brown when mature.

Fl. & Fr.: Feb. - Dec.

Distrib. India: W. Bengal, Orissa and Andaman & Nicobar Islands.

Myanmar.

2. *Xylocarpus granatum* Koenig in Naturforscher 20: 2. 1784; C.E. Parkinson in Indian Forester 60: 138. 1934. *X. obovatus* (Blume) A. Juss. in Mem. Mus. Hist. Nat. 19: 244. 1830; Gamble, Fl. Pres. Madras 188. 1915. *Carapa obovata* Blume, Bijdr. 179. 1825. *C. moluccensis* auct. non Lam. 1784; Beddome, Fl. Sylv. S. India. t. 136. 1871; Hiern in Hook. f., Fl. Brit. India 1: 567. 1875.

Moderate-sized tree; stem usually crooked and often with knotty excrescences with thin, smooth, grey bark, peeling off in irregular flakes. Leaves 8 - 20 cm long; rachis 2 - 8 cm long; leaflets usually 4, opposite, narrowed, subequilateral or rounded at base, entire along margins, 5 - 20 x 2 - 9 cm; secondary nerves 6 - 10 on each side; petiolules to 1 cm long. Flowers small, yellowish; pedicels 4 - 8 mm long. Calyx lobes rounded, slightly obtusely acuminate, ca 2 mm long. Petals broadly elliptic-oblong, rounded at apex, 4 - 7 mm long. Staminal tube 3 - 5 mm long; appendages irregularly dentate-undulate; anthers included. Ovary broadly ovoid; style conical; stigma discoid, large. Capsules ovoid, eseptate, fleshy; valves thick, woody, smooth, brownish.

Fl. & Fr.: Feb. - Dec.

Distrib. India: W. Bengal, Orissa, Gujarat, Maharashtra, Goa, Daman & Diu, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Andaman & Nicobar Islands. Occurs along muddy seacoasts.

Bangladesh, Myanmar and Sri Lanka.

3. *Xylocarpus moluccensis* (Lam.) M. Roemer, *Fam. Nat. Syn. Monogr.* 1: 124. 1846; C.E. Parkinson in *India Forester* 60: 143. 1934; Mabb. in *Malayan Forester* 45: 450. 1982. *Carapa moluccensis* Lam., *Encycl.* 1: 621. 1785 quoad descr. excl. cit. Rumph.; Hiern in *Hook. f., Fl. Brit. India* 1: 567. 1875, p.p.; C.E. Parkinson, *Forest Fl. Andaman Isl.* 118. 1923. *Xylocarpus mekongensis* Pierre, *Fl. For. Cochinch. t.* 359B. 1897; Krishnam. et al. in *Bull. Bot. Surv. India* 23: 117. 1981.

Tree, to 10 m high, often crooked and low-branching; bark grey, rough with longitudinal fissures, peeling off in flakes; pneumatophores conical, geniculate. Leaves 10-25 cm long; rachis 3-5 cm long; leaflets 1-3 pairs, opposite, ovate-oblong, rounded, acuminate or cordate, subequilateral at base, entire along margins, acuminate at apex, 5-15 x 3-10 cm, thinly coriaceous; secondary nerves to 10 on each side; petiolules 1-3 mm long. Panicles 6-18 cm long. Flowers pinkish yellow; pedicels 2-10 mm long. Calyx lobes ovate, ca 1.5 mm long. Petals ovate-oblong, 4-7 mm long. Staminal tube ca 4 mm long; appendages 2-fid; stamens included. Ovary broadly ovoid; style conical, short; stigma discoid. Capsules broadly ellipsoid, obscurely 4-grooved, 8-15 cm across, brown.

Fl. & Fr.: Nov. - Oct.

Distrib. India: Andaman Islands.

Myanmar.

Note. Krishnamurthy et al. (*l.c.*) reported the occurrence of *X. mekongensis* in the Pichavaram mangroves on the East Coast in Tamil Nadu. Mabberley (*l.c.*) found *X. mekongensis* conspecific with *X. moluccensis* (Lam.) M. Roemer.

19. *Walsura* Roxb.

Trees, with an indumentum of simple hairs. Leaves imparipinnate, 3- or unifoliate; leaflets quite entire, usually papillose beneath; petiolules usually pulvinate. Panicles axillary and terminal. Flowers bisexual and male, or unisexual (individuals dioecious). Calyx short, deeply 5-lobed, or sepals free, imbricate or valvate. Petals usually 5, free, imbricate or valvate, rarely twisted. Stamens 10 or 8; filaments usually fused in lower half, rarely free, terminating in a pair of appendages; anthers inserted apically between appendages. Antherodes in female flowers smaller, without pollen. Disk annular in male and bisexual flowers and represented by a small swelling at base

of ovary in female flowers. Ovary short, ovoid and swollen in female and bisexual flowers, 2 - 3-locular; locules with 2 collateral ovules, or incompletely 4-loculed with 1 ovule; style short or absent; stigma capitate or stout, truncate or pileate. Pistillode in male flowers with a small ovary sunken in disk, with rudimentary ovules; style present; stigma broad. Berries 1 - 2-seeded; seeds arillate or not, nonendospermous.

Indo-Malesia, with 10 species; 7 in India.

KEY TO THE SPECIES

1a. Filaments subulate, free	5. <i>W. robusta</i>
b. Filaments linear, connate to various degrees to form a staminal tube	2
2a. Filaments connate for 1/2 to 2/3 of staminal tube	7. <i>W. tubulata</i>
b. Filaments connate to 1/3 of staminal tube	3
3a. Leaves less than 25 cm long	4
b. Leaves more than 30 cm long	5
4a. Leaflets 5	1. <i>W. candollei</i>
b. Leaflets 7	4. <i>W. perrottetii</i>
5a. Leaflets 3; flowers yellowish	6. <i>W. trifolia</i>
b. Leaflets 5; flowers white	6
6a. Leaflets more than 12 cm long, coriaceous; venation conspicuous	2. <i>W. hypoleuca</i>
b. Leaflets less than 12 cm long, chartaceous; venation inconspicuous	3. <i>W. oxycarpa</i>

1. *Walsura candollei* King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 84. 1895.

Moderate-sized tree; young branchlets glabrous, lenticellate. Leaves imparipinnate, 10 - 20 cm long; leaflets usually 5, rounded at base, entire along margins, subacute at apex, 5 - 10 x 2 - 3 cm, membranous, glabrous on both surfaces, pale and subglaucous beneath; secondary nerves 7 - 11 on each side; petiolules to 1 cm long. Panicles axillary, crowded at ends of branches, corymbosely cymose, puberulous. Flowers subglobose, 2 - 3 mm long, white; pedicels as long as flower. Sepals 5, free, ovate, concave, spreading, pubescent outside. Petals 4, elliptic-ovate, subacute, longer than sepals, puberulous. Stamens 10; filaments united into a tube in lower 1/3, pubescent, alternate ones shorter; anthers yellow, sparsely pubescent. Ovary conical, pubescent, surrounded by disk; style obconical, short; stigma conical with a fleshy annulus. Fruits ovoid to globose, ca 2 cm long, minutely rusty-puberulous with a slightly curved conical apiculus.

Fl. & Fr. Mar. - Aug.

Distrib. India: Andaman Islands.

2. *Walsura hypoleuca* Kurz, Rep. Veg. Andaman Isl. 33. 1870 & in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 41: 296. 1872; Hiern in Hook. f., Fl. Brit. India 1: 564. 1875.

Tree, 12 - 15 m tall; young branches stout, puberulous, lenticellate. Leaves 30 - 40 cm long; leaflets 5, elliptic-oblong, inequilateral at base, entire along margins, subacute at apex, 12 - 18 x 5 - 8 cm, thinly coriaceous, glabrous; secondary nerves 7 - 10 on each side; terminal leaflet larger and with more nerves; petiolules to 2 cm long, that of terminal leaflet longer. Panicles several from an axil, 10 - 15 cm long, pubescent. Flowers ca 3 mm long, white; pedicels short, puberulous. Calyx 5- or 6-toothed, puberulous. Petals 5, elliptic, obtuse, erect, longer than calyx, puberulous. Stamens 10, distinct, shorter than petals, inserted outside disk; filaments flat, hairy on both sides, slightly connate at base; anthers ovate, sparsely villous. Disk annular, cushion-like, entire, glabrous, surrounding ovary. Ovary obconic, villous; style cylindric, thickened upwards, glabrous; stigma discoid. Unripe fruits oblong, pointed, greyish-velvety.

Fl. & Fr.: March onwards.

Distrib. India: Andaman Islands.

3. *Walsura oxycarpa* Kurz in *J. Asiat. Soc. Bengal Pt.2, Nat. Hist.* 44: 200. 1875 & *Forest Fl. Burma* 1: 224. 1877.

Tree, evergreen, shade-loving, to 15 m tall; leaf buds tawny-puberulous. Leaves imparipinnate; rachis thin, lenticellate, glabrous; leaflets 7, lanceolate to oblong-lanceolate, long-acuminate at apex, 8 - 12 cm long, thin, papery, glaucescent beneath. Fruiting panicles long-peduncled with thin branches, lax, glabrous, shorter than leaves. Unripe fruits ovate-oblong, acuminate, ca 1.2 cm long, greyish-velvety.

Distrib. India: Andaman Islands. Not common.

Note. According to King (in *J. Asiat. Soc. Bengal Pt. 2, Nat. Hist.* 64: 85. 1895) material of this species was collected only by Kurz. King who had not seen its fruits opined that it is merely a small-leaved form of *W. hypoleucea* Kurz. Parkinson (*Forest Flora of Andaman Islands* 1923) did not include this species.

4. *Walsura perrottetii* C.DC. in *Annuaire Conserv. Jard. Bot. Geneve* 10: 152. 1907.

Tree; branchlets glabrous, lenticellate. Leaves alternate, imparipinnate, ca 23 cm long; rachis terete, to 6 cm long; leaflets 3-jugate, opposite, elliptic-ovate, acute at base, entire along margins, long-acuminate at apex, to 9 x 4 cm; secondary nerves 8 - 9 on each side; petiolules to 1 cm long. Panicles subcorymbose; branches to 12 cm long. Flowers shortly pedicellate. Calyx 5-toothed, densely hairy outside. Petals 5, oblong-subovate, truncate at base, acute at apex, ca 3 x 1 - 1.25 mm, hairy on both sides, valvate. Stamens 10; filaments fused in lower 1/3 of their length, glabrous, upper free part hairy, 2-appendaged at apex; anthers inserted between notches, mucronate, glabrous. Disk and ovary glabrous; style glabrous; stigma discoid.

Distrib. India: Nilgiri Hills in Tamil Nadu.

Note. It is apparently an overlooked species as may be evident from its absence from any of the south Indian floras. Further studies are necessary to understand this species.

5. *Walsura robusta* Roxb., Fl. Ind. 2: 386. 1832; Hiern in Hook. f., Fl. Brit. India 1: 565. 1875. *Surwala robusta* (Roxb.) M. Roemer, Fam. Nat. Syn. Monogr. 1: 108. 1846.

Tree, to 25 m tall; branchlets markedly lenticellate; young parts pubescent. Leaves to 30 cm long; rachis slightly flat; leaflets 3 - 5, elliptic or oblong-lanceolate, rounded or acute at base, entire along margins, long-acuminate or rounded at apex, 5 - 18 x 3 - 9 cm, chartaceous, glabrous, shining above, pale beneath; secondary nerves 5 - 10 on each side; venation somewhat indistinct; petiolules of lateral leaflets 5 - 10 mm long, that of terminal leaflet 5 - 35 mm long. Panicles usually terminal, 10 - 12 cm long, with a somewhat flat axis; bracts caducous, lanceolate, acute. Flowers shortly pedicellate, yellowish or white. Calyx minutely 5-toothed, ferruginous-pubescent. Petals 5, oblong-lanceolate, elliptic or elliptic-oblong, acute, spreading, 3 - 5 x 1 - 2 mm, thinly puberulous outside. Stamens 10; filaments almost free, subulate, subconnivent over stigma, white. Disk fleshy, annular or slightly lobed. Ovary 2-loculed; style short; stigma capitate. Berries subglobose, ca 1.5 cm across, pubescent.

Fl. Mar. - May; *Fr.* Dec. - Mar.

Distrib. India: Arunachal Pradesh, Assam, Tripura, Meghalaya and Andaman & Nicobar Islands.

Bangladesh and Myanmar.

6. *Walsura trifolia* (A. Juss.) Harms in Engl. & Prantl, Nat. Pflanzenfam. ed 2, 19b1: 119, 177. 1940. *Heynea trifolia* A. Juss. in Mem. Mus. Hist. Nat. 19: 235. 1830. *Walsura piscidia* Roxb., Fl. Ind. 2: 387. 1832; Wight, Ill. Indian Bot. 1: t. 55. 1840; Hiern in Hook. f., Fl. Brit. India 1: 564. 1875.

Small to moderate-sized tree. Leaves 3-foliolate; rachis to 5 cm long; leaflets oblong-elliptic, tapering at base, entire along margins, acuminate, or rounded at apex, 5 - 18 x 2 - 8 cm, glabrous on both surfaces, shining above, pale beneath; petiolules of lateral leaflets 3 - 5 mm long, that of terminal leaflet 1 - 3 cm long. Panicles corymbosely branched, almost as long as leaves; bracts minute, caducous; pedicels to 3 mm long. Calyx 5-toothed; teeth, ovate, acute, pubescent. Petals 5, oblong-lanceolate or oblong-elliptic, acute, 3.5 - 4 mm long, minutely ciliate, imbricate. Staminal tube half as long as petals, hairy inside; filaments fused about half their length below, upper free half 2-fid at apex; anthers 10, slightly hairy, inserted between appendages. Disk annular, large. Ovary sunk in disk, 2- or rarely 3-locular; stigma 2-dentate. Berries ovoid, ca 1.8 x 1.5 cm, tomentose, bright orange-yellow when ripe.

KEY TO THE VARIETIES

- 1a. Leaflets acuminate at apex; peduncles usually less than 3 cm long; calyx teeth 1/3 the length of petals; petals elliptic or elliptic-oblong, white 6.1. var. *ternata*
- b. Leaflets rounded at apex; peduncles 4 - 7 cm long; calyx teeth scarcely 1/4 the length of petals; petals oblong-lanceolate, yellowish 6.2. var. *trifolia*

6.1. var. *ternata* (Roxb.) Haines, Bot. Bihar Orissa 2: 178. 1921. *Walsura ternata* Roxb., Fl. Ind. 2: 389. 1832. *Heynea trifolia* A. Juss. var. *ternata* Panigr. & Mishra in Indian J. For. 11: 137. 1988.

Fl. & Fr. Nov. - April.

Distrib. India: Bihar, Orissa, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Goa, Daman & Diu.

Pakistan.

6.2. var. *trifolia*

Fl. & Fr. Nov. - June.

Distrib. India: Bihar, Orissa, Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu, Kerala and Goa, Daman & Diu.

Sri Lanka.

7. *Walsura tubulata* Hiern in Hook. f., Fl. Brit. India 1: 563. 1875.

Tree, to 12 m tall; branchlets with specks of raised lenticels; young parts brown-pubescent. Leaves pinnately 3-foliolate; rachis flat above; leaflets lanceolate, ovate or elliptic-oblong, tapering at base, inequilateral, entire along margins, acuminate at apex, 3 - 23 x 2.5 - 8 cm, subcoriaceous, glabrous and shining above, glaucous beneath; secondary nerves 10 - 12 on each side; petiolules swollen at both ends; petiolules of lateral leaflets 5 - 20 mm long, that of terminal leaflet 1 - 4 cm long. Panicles shorter than leaves. Flowers to 6 mm long with small boat-shaped bracts, yellowish. Calyx 5-partite, pubescent. Petals 5, ovate-lanceolate, 5 - 6 x 2 - 3 mm, glabrous or sparsely pubescent outside, imbricate. Staminal tube glabrous outside, pubescent inside; filaments connate in lower half or more, free part notched at apex; anthers inserted within notches.

Distrib. India: Sikkim, Assam and Meghalaya.

Note. Haridasan & Rao (Forest Flora of Meghalaya 1985) did not include this species.

CULTIVATED SPECIES

1. *Cedrela odorata* L., Sp. Pl. 289. 1753.

Medium-sized to large tree. Leaves paripinnate, ca 40 cm long; rachis to 6 cm long; leaflets to 8 pairs, entire, ca 15 x 4 cm, glabrous or with simple hairs; secondary nerves ca 12 on each side; lower leaflets smaller; petiolules to 6 mm long. Flowers in panicles. Calyx 5-lobed more or less to base. Petals 5, free, ovate-oblong, acute, longer than calyx in bud, imbricate, lower 1/3 adnate to enlarged disk (androgynophore). Stamens 5, free; anthers in male flowers dehiscent, yellow with pollen grains. Antherodes in female flowers shrivelled, brownish, without pollen. Staminodes absent. Ovary 5-loculed; locules 6 - 12-ovuled; style short; stigma discoid with glandular papillae. Pistillode in male flowers slender with vestigial ovules, a longer style and discoid stigma. Capsules pendulous, woody; seeds with a terminal wing.

Native of Tropical America. Cultivated in Tamil Nadu.

2. *Khaya grandifoliola* C.DC. in Bull. Soc. Bot. France 8: 10. 1907; B. Sharma et al., Fl. Karnataka 46. 1984 (as "*grandiflora*").

Tree; bark scaly. Leaves paripinnate; leaflets usually 4 pairs, opposite to alternate, broadly elliptic or ovate-elliptic, shortly cuneate or rounded at base, entire along margins, acuminate at apex, 10 - 25 x 6 - 10 cm, thin, papery; secondary nerves 12 - 15 on each side. Flowers 5-merous. Capsules 7 - 10 cm across with 5-valves.

Native of Tropical Africa. Introduced in North Kanara in Karnataka.

3. *Khaya senegalensis* A. Juss. in Mem. Mus. Hist. Nat. 19: 249. 1830.

Senegal mahogany.

Lofty tree; bark fissured, brown or ash-coloured. Leaves paripinnate, ca 35 cm long; leaflets opposite to alternate, ovate-elliptic, shortly acuminate at apex, glabrous, pale in colour, somewhat shining; secondary nerves 10 - 12 on each side, conspicuous. Panicles axillary, usually shorter than leaves. Sepals 4. Petals 4, white, imbricate. Staminal tube with 8 - 10 teeth at mouth; anthers 8 - 10, sessile, alternating with teeth. Disk prominent, red or orange. Ovary 4-lobed; style short; stigma disk-shaped, exerted in open flowers. Capsules woody, ca 6 cm across, dehiscent by 4-valves; seeds flat, winged, brown, 10 - 12 in each locule.

Fl. & Fr. May - Sept.

Native of Africa, cultivated in Pondicherry.

Note. This plant was reported by Shankarnarayan (*J. Bombay Nat. Hist. Soc.* 56: 370 - 374. 1959) as a new record from Pondicherry where it was introduced more than a century ago but Dutt (*Ibid.* 58: 542 - 543. 1961) refuted the claim of Shankarnarayan.

4. *Lansium domesticum* Correa in Ann. Mus. Natl. Hist. Nat. 10: 157, t. 7, f. 1. 1807; Hiern in Hook. f., Fl. Brit. India 1: 558. 1875; Gamble, Fl. Pres. Madras 182. 1915. *Aglaia domestica* (Correa) Pellegrin in Lecomte, Fl. Indo-Chine 1: 766. 1911.

Medium-sized tree; young branches tomentose. Leaves pinnate, 20 - 50 cm long; leaflets 6 - 9, alternate, petiolulate, elliptic-oblong, more or less narrowed at base, acuminate at apex, 10 - 25 x 7 - 10 cm, glabrous, hairy on nerves beneath; young leaves pubescent beneath; petiolules 0.8 - 1.25 cm long. Racemes solitary or fascicled, arising from trunk or branches, erect, shorter than leaves, tomentose. Flowers sessile. Calyx deeply 5-lobed, persistent, imbricate. Petals 5, slightly exceeding calyx, yellowish. Staminal tube globose; anthers 10, in 2 rows. Ovary tomentose, 5-loculed; locules 1- or 2-ovuled; style short, thick, columnar; stigma flat. Berries oblong or ovoid, yellowish, slightly tomentose, 5-loculed, 5-seeded; seeds with a pulpy aril.

Distrib. India: Cultivated on the Nilgris for its edible fruits.

5. *Swietenia mahagoni* (L.) Jacq., Enum. Syst. Pl. 20. 1760.

Mahogany or small-leaved mahogany.

Tree, to 20 cm tall; bark rugose, greyish black. Leaves pinnate; leaflets 2 - 4(-5) pairs, very oblique or subfalcate,

tapering into petiolule, cuneate at base, acuminate at apex, 2.5 - 5 x 1 - 3 cm, glabrous on both surfaces; secondary nerves 6 - 10 on each side with prominent venation; petiolules to 5 mm long. Panicles supraaxillary, to 12 cm long. Flowers to 7 mm across, greenish; pedicels slender, to 4 mm long. Calyx short, 5-lobed. Petals 5, ovate-oblong, ca 3 mm long. Staminal tube slightly constricted at mouth with 10 appendages, yellow; anthers 10, included or partly exerted. Disk annular, red. Ovary 5-locular; locules multiovuled. Capsules woody, sepifragal, to 10 cm long.

Fl. & Fr. Apr. - Nov.

Native of the West Indies and coasts of C. America.

Cultivated in garden avenues and also some forest localities. Bihar, W. Bengal, Karnataka, Tamil Nadu, Kerala, Sikkim and Maharashtra.

Note. It yields a valuable timber used for various purposes.

6. *Swietenia macrophylla* King in Hooker's Icon. Pl. 16, t. 1550. 1886.

Large-leaved mahogany.

Hindi & Beng.: *Bara mahagni*.

Large tree; bark brown. Leaves pinnate, to 50 cm long; leaflets to 6 pairs, subfalcate, ovate-lanceolate, cuneate at base, acuminate at apex, 8 - 16 x 3 - 6 cm, glabrous, shining above, pale green beneath; secondary nerves 6 - 12 on each side; petiolules 3 - 6 mm long. Panicles shorter than leaves, glabrous. Flowers 0.6 - 1 cm across, greenish, fragrant. Capsules inverted club-like, 10 - 20 cm long, woody.

Fl. & Fr. Apr. - Mar.

Cultivated in Uttar Pradesh as an avenue tree, also planted in Bihar and W. Bengal.

Native of Honduras.

Notes. It was described by King (*Lc.*) on the basis of a tree at the Calcutta Botanic Garden raised from seeds received from Honduras (Rolfe in Bull. Misc. Inform. 1919: 205 - 207. 1919). It grows almost 3 times as fast as *S. mahagoni*. Sets seeds freely. Its timber is graded with that of *S. mahagoni*.

DICHAPETALACEAE

(N.C. Nair)

Small trees, shrubs or lianas. Leaves simple, spirally arranged but often seemingly distichous, petiolate, entire, cuneate or rounded and often slightly oblique at base, pinnately nerved, almost always with circular flat glands on lower surface of leaves especially near base; stipules often early caducous, triangular to subulate. Inflorescence axillary or sometimes epiphyllous, dichotomously branched umbels, glomerules, corymbs or fascicles; lower forks often with bractlets; pedicels articulate near apex. Flowers actinomorphic or zygomorphic, typically 5-merous, rarely 4-merous, bisexual, unisexual, or polygamo-dioecious, hypo- or slightly perigynous. Sepals slightly united at base, imbricate. Petals spatulate, bifid or notched, often inflexed at apex, free or united at base, equal or unequal, creamy white, drying black, open in aestivation. Stamens in a whorl of 5 or 4, subperigynous, all or 3 fertile, free or adnate to bases of sepals; filaments long or short; anthers introrse, dehiscing by longitudinal slits; connectives strongly thickened on dorsal side; pollen 2- to 3-colporate. Disk of 5 intrastaminal epipetalous glands or scales or a 5-glandular or 5-lobed cup. Pistil 2- or 3-carpellary, syncarpous; ovary superior or semi-inferior, pubescent or hispid; styles 2 or 3, free or connate; ovules 2 per locule, pendulous, anatropous, unitegmis, only one developing into a seed; micropyle directed upwards. Fruit a drupe or capsule, oblong, compressed, hispid or pubescent, 1- or 2-locular. Seeds sometimes carunculate, nonendospermous; testa membranous; embryo large; cotyledons thick; radicle small, superior.

S. America, Africa, Asia to Malesia, exclusively in the tropical regions except one genus in extra-tropical Africa; 4 genera and ca 210 species, one genus and 3 species in India.

Literature. LEENHOUTS, P.W. (1957) *Dichapetalaceae*. In: STEENIS, Fl. Males. Ser. 1.5: 305-316. & (1972); 6: 941-943, Add. & Corr.

Notes. The most striking morphological feature of the family is frequent concrecence of petiole and peduncle of inflorescence which then apparently seems to arise from base of leaf blade.

Pollen grains are colpore(oid)ate, small (longest axis 10-17 μ), flattened and angulaperturate in *Dichapetalum* Thouars and spheroidal or somewhat oblong in other genera (Erdtman, G. 1905. Pollen morphology and plant taxonomy).

The family is not reputed to be economically very important. Several species of *Dichapetalum* are poisonous. Wood is sometimes used as a construction material.

Acetic fluor a strikingly poisonous compound is known to be present in some members (Peters, R. in Endeavour 13: 147. 1954).

Chromosome no. $2n = 20$ is reported in *Dichapetalum* (Mangenot, S. & G. Mangenot in Rev. Cytol. Biol. Veg. 25: 411-447. 1962).

The family is distinguished by a series of anatomical characters - stomata have subsidiary cells parallel to pore as in Rubiaceae and occur only on lower surface of leaf; cork is superficial in origin; indumentum is composed solely of unicellular hairs; absence of glandular hairs; presence of wart-shaped papillae on surface of leaves; frequent occurrence of mucilaginous cells in epidermis, hypodermis and sometimes in ground-tissue of petioles and branches (Metcalfe, C.R. & R. Chalk, 1950. Anatomy of the dicotyledons).

The systematic position of the Dichapetalaceae is controversial. Euphorbiaceous affinity is generally upheld by most recent workers.

Dichapetalum Thouars

Trees, shrubs or lianas, monoecious or dioecious. Leaves apparently distichous, usually thickened along margins by a nerve; stipules deciduous. Inflorescence axillary or seemingly terminal on leafless shoots or epiphyllous umbels or reduced to 1 or 2 flowers. Flowers 5-merous, bi- or unisexual, hypogynous or slightly epigynous. Sepals slightly united at base, ovate, pubescent on both sides. Petals free, clawed, bipartite or bifid, white. Stamens 5, free or slightly adnate to petals; anthers as long as wide. Disk of 5 glands, intrastaminal. Pistil 2- or 3- carpellary; ovary 2- or 3-locular; styles free or connate at base; stigmas apical. Fruit a drupe or dehiscent exposing orange to scarlet thin mesocarp, lobed or not, usually tomentose or glabrescent, orange-brown, greyish or yellowish, with or without sutures; endocarp crustaceous; stones 1 - 3, slightly united, 1-seeded; cotyledons planoconvex.

Africa, Asia, northern Australia to Malesia; ca 200 species, 3 in India.

Literature. LEENHOUTS, P.W. (1956) Florae Malesianae praecursores 12 (Dichapetalaceae). Some notes on the genus *Dichapetalum* (Dichapetalaceae) in Asia, Australia and Melanesia. Reinwardtia 4: 75-87.

KEY TO THE SPECIES

- | | |
|--|---------------------------|
| 1a. Inflorescence usually 5 - 7 cm long; drupes unlobed, without sutures | 3. <i>D. timoriense</i> |
| b. Inflorescence 0.75 - 4 cm long; drupes lobed, with distinct sutures | 2 |
| 2a. Inflorescence usually 0.75 - 1 cm long; drupes 1(-2)-lobed; lobes reniform | 1. <i>D. gelonioides</i> |
| b. Inflorescence 1 - 4 cm long; drupes (2-)3-lobed; lobes obovate | 2. <i>D. platyphyllum</i> |

1. *Dichapetalum gelonioides* (Roxb.) Engl. in Engl. & Prantl, Pflanzenfam. 3, 4: 348. 1896. *Moacura gelonioides* Roxb., [Hort. Beng. 21. 1814, *nomen*], Fl. Ind. 2: 69.

1832. *Chailletia gelonioides* (Roxb.) Beddome, Fl. Sylv. S. India 59, t. 9, f. I. 1-8. 1870, p.p.; Hook. f., Fl. Brit. India 2: 570. 1875.

Dioecious trees, lianas or woody creepers; young branches scattered-pubescent, becoming glabrous. Leaves elliptic or obovate, gradually acuminate, acute or blunt at apex, usually undulate along margins, up to 16 x 7 cm, herbaceous, glabrous or nearly so; glands few, near acute base below; lateral nerves 5 - 10 pairs, interarching near margins. Inflorescence 7 - 10-flowered, in axillary clusters. Flowers, 2 - 3 mm across. Disk lobes quadrate, round or cordate. Ovary velvety-pubescent in female flowers and pubescent to woolly in male flowers, 2- or 3-locular. Fruits 1- or 2-lobed, usually obcordate, grey- or tawny-tomentose or subglabrous and muricate; sutures clearly discernible.

KEY TO THE SUBSPECIES

- | | |
|--|--------------------------------|
| 1a. Leaves elliptic, long-acuminate or caudate at apex | 1.2. subsp. <i>gelonioides</i> |
| b. Leaves obovate, obtuse at apex | 1.1. subsp. <i>andamanicum</i> |

1.1. subsp. *andamanicum* (King) Leenh. in Reinwardtia 4: 82. 1956 & in Steenis, Fl. Males. ser. I. 5: 312. 1957. *Chailletia andamanicum* King in J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 93. 1895. *Dichapetalum andamanicum* (King) Engl. in Engl. & Prantl, Pflanzenfam. 3, 4: 348. 1896.

Small trees (up to 10 m high) or shrubs. Leaves usually undulate, glossy above, yellowish green when dry; lateral nerves 4 - 6 pairs. Flowers axillary, greenish white. Fruits usually 2-lobed, ash-coloured, smooth, densely tomentose.

Fl. April-May; *Fr.* Nov.-Dec.

Distrib. India: In low level inland evergreen forests. Andaman Islands.

Endemic.

1.2. subsp. *gelonioides* Leenh. in Reinwardtia 4: 81. 1956 & in Steenis, Fl. Males. ser. I. 5: 311. 1957. *Chailletia sumatrana* auct. non Miq. 1861: T. Cooke, Fl. Pres. Bombay 1: 232. 1902; Talbot, For. Fl. Bombay 1: 253. f. 151. 1909. *Dichapetalum gelonioides* sensu Kanj. et al., Fl. Assam 1: 245. 1937.

Small trees or shrubs, up to 12 m high. Fruits 1- or 2-lobed, densely greyish-yellow-tomentose, smooth.

Fl. March-June; *Fr.* Aug.-Dec.

Distrib. India: Wet evergreen forests of North-eastern hill states and Western Ghats, up to 1500 m. Assam, Meghalaya, Karnataka, Tamil Nadu and Kerala.

Myanmar, China (Yunnan), Thailand, Malesia and Sri Lanka.

2. *Dichapetalum platyphyllum* Merr. in Philipp. J. Sci. 30: 401. 1926; Leenh. in Reinwardtia 4: 81. 1956 & in Steenis, Fl. Males. ser. 1. 5: 310. 1957.

Lianas; branches terete, dark brown, faintly ribbed, gland-dotted, glabrescent when young. Leaves elliptic to broadly elliptic or oblong-elliptic, cuneate at base, entire along margins, acuminate at apex with up to 1.2 cm long acumen, 9 - 17.5 x 2.4 - 9.1 cm, coriaceous, greyish-green with scattered glands beneath especially on lateral nerves and midnerve; lateral nerves 5 - 7 pairs, curved, distinctly interarching, ca 5 mm short of margins; petioles 1 - 5 mm long, minutely pubescent. Inflorescence distinctly stalked, fulvous-tomentose, up to 20-flowered. Calyx up to 3 mm long, densely fulvous-tomentose outside. Petals slightly emarginate, glabrous. Fruits solitary or up to 4 together, 2 - 3-lobed, 2 - 3-loculed, slightly warty, up to 3.2 x 3 cm, globose with a distinct suture on each lobe; lobes obovate, velvety-tomentose; stalk up to 1.2 cm long with persistent calyx; stones rugose; seeds 2 - 3, one per locule, pear-shaped, ca 1.5 x 0.8 cm, violet-brown when dry.

Fl. & Fr. July-Sept.

Distrib. India: In inland forests of Great Nicobar Island.

Malesia and Philippines.

3. *Dichapetalum timoriense* (DC.) Boerl., Handl. Fl. Ned. Ind. 1: 199. 1890. *Chailletia timoriense* DC., Prodr. 2: 57. 1825. *Chailletia deflexifolia* Turcz. in Bull. Soc. Imp. Naturalistes Moscou 36: 611. 1863; Hook. f., Fl. Brit. India 1: 571. 1875, incl. var. *tomentosa* Hook. f.

Lianas; young parts tomentose; glands on young stems and leaves circular. Leaves elliptic, oblong, ovate or obovate, 10 - 24 x 6 - 12 cm, acute or abruptly acuminate at apex; nerves 5 - 8 pairs, prominent beneath, distinctly curved, distant; petioles up to 1.5 cm long; stipules triangular, acuminate. Inflorescence axillary or terminal, repeatedly dichotomously branched, 5 - 7 cm long. Flowers 3 - 4 mm across, bisexual or unisexual. Sepals persistent. Petals caducous, incised more than half, densely pubescent outside, dichotomously nerved. Disk lobed; lobes bifid, glabrous or with a few hairs. Ovary densely pubescent, 2 - 3-locular; styles connate more than half their length; stigma rounded. Fruits pear-shaped or globose to ovoid, velvety-pubescent; pericarp fleshy; seeds 1 - 3.

Fl. & Fr. June-Sept.

Distrib. India: Rare in inland hill forests, up to 100 m, in shaded places. Great Nicobar Island (on banks of Alexandra river as well as between Chingeh and Indira Gandhi Point).

Malesia except Sumatra and Melanesia (New Britain and Solomon Islands).

Uses. Seems to be not used in India. Fruits and young leaves are reported to be eaten and young branches used as rope in Malesia.

Notes. A very variable species with regard to shape, texture and degree of pubescence. Relatively broad leaves which are densely tomentose when young, several-flowered inflorescences and tomentose sutureless fruits make it very distinct from other species. Inflorescence in Indian specimens is smaller than in Malesian ones. In Malesian ones stems are sometimes hollow and inhabited by ants.

ADDENDA

The following species is an addition discovered while this book was passing through the press.

BALSAMINACEAE

Impatiens sivarajanii Muktesh & Stephen in *Rheedea* 6(2): 51-54. t. 1. (Dec. 31) 1996.

Herbs, perennial, epiphytic, scapigerous, tuberous; tubers white with light violet tinge on upper surface. Leaves 1 - 2, radical, ovate, acute or acuminate at apex, obliquely subcordate at base, distantly subcrenate along margins with minutely apiculate crenules, glabrous except nerves; petiole 4 - 5 cm long. Inflorescence a 1 - 3-flowered raceme; peduncle filiform, ca 10 cm long, glabrous. Flowers ca 2 x 1.25 cm, creamy white; pedicels 1.4 - 1.8 cm; bracts linear-lanceolate. Lateral sepals ovate-elliptic, acute or acuminate, ca 0.5 x 2.5 mm, glabrous, green. Lip widely obovate, acuminate, concave, 1.2 - 0.75 mm, glabrous; spur rounded at apex, ca 2 mm long. Standard widely depressed, obovate, concave, ca 0.75 - 1 cm, glabrous; spur rounded at apex, ca 2 mm long. Standard widely depressed, obovate, concave, ca 0.75 - 1 cm, glabrous. Wings 3-lobed, ca 1.75 x 0.9 cm; basal lobe ovate-oblong, obtuse at apex; middle lobe more or less confluent with distal one; distal lobe minutely lobed; dorsal auricle absent. Stamens 5, united, ca 4 mm long; anther ca 1 mm long. Ovary ovate-elliptic, acute at apex, ca 3 x 1.4 mm, glabrous; stigma sessile, toothed. Capsules oblong-ovate, beaked, many-seeded, glabrous; seeds narrowly elliptic, ca 0.8 x 0.3 mm, orange, tufted ciliate at apices, otherwise glabrous.

Fl. & Fr. Aug. - Oct.

Distrib. India: Growing on moss-clad tree-trunks, 1700 - 1800 m. Kerala (Silent Valley).

Endemic.

Notes. Closely related to *Impatiens agumbeana* Bhaskar & Razi but differs mainly in having : glabrous (except nerves) lamina, creamy white flowers, widely obovate lip, absence of dorsal auricle and unbanded seeds that are glabrous except at apices.

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