

VIOLACEAE (M. Jacobs, Leyden; D. M. Moore, Reading)

Shrubs, small trees, or lianas, in Malesia evergreen, or herbs. *Stipules* present. *Leaves* in Malesia spirally arranged, sometimes distichous, simple, the margin often shallowly incised; generally stalked. *Inflorescences* axillary variously modified bundles, or racemes, or panicles, sometimes terminal, or flowers solitary in the leaf axils; bracts small; pedicels often articulated, whether in the lower or in the upper part; bracteoles, if present, small and in the lower part of the pedicel. *Flowers* bisexual or rarely dioecious, actinomorphic or zygomorphic, particularly in the corolla; the parts often persistent in fruit. *Sepals* 5, the median one adaxial (posterior), free or occasionally for a small portion connate, often ciliate. *Petals* 5, free, generally sessile, the median one abaxial (anterior), often longer and differently shaped, the base then mostly with a sac or spur. *Androecium* often cylindrical, stamens 5, episepalous; filaments often more or less connate into a tube, in the Malesian genera with zygomorphic flowers, those near the odd petal with a recurved fleshy appendage; anthers introrse, in Malesia nearly always the connective at the top produced into an approximately triangular membranous appendage converging with the others, cells sometimes with a small appendage at the top. *Gynoecium* superior, sessile, ovary small, subglobose, one-locular, with generally 3 carpels, the median one adaxial, each carpel with a parietal placenta in the middle bearing 1-many anatropous ovules; style straight or, in the zygomorphic flowers S-shaped with the stigma curved towards the odd petal and club-shaped with variations. *Fruit* in Malesia capsular, the carpels thickened to boat-shaped leathery or woody valves (in the latter eventually the endocarp separated from the pericarp) which spread and often compress upon dehiscence. *Seeds* 1-many, sessile, one to a few mm in size, often with distinct raphe, sometimes with funicular outgrowths; rich in endosperm; embryo straight.

Distribution. A pantropical family; only *Viola* is cold-loving. *Hybanthus* extends into the subtropics* so does *Melicytus* (Pacific Plant Areas n. 103, Blumea Suppl. 5, 1966) in Polynesia and New Zealand. *Hymenanthera* (congeneric with the former? l.c. n. 104) is temperate in SE. Australia and New Zealand. Number of genera 16, 8 of them American; the largest are *Viola*, currently credited with c. 400 spp., *Rinorea* with c. 200, *Hybanthus* with perhaps 70, and there are about 50 more in the other genera altogether. Total number of species c. 720, in Malesia 31, two of these introduced.

Ecology. *Viola* is of temperate origin and occurs in Malesia in the mountains. The other Malesian genera occur in the lowlands; *Rinorea* and *Agatea* in everwet forests, *Hybanthus* in monsoon regions.

Phytochemistry. Accurate chemical information about *Violaceae* is scanty notwithstanding the fact that members of this family are used in popular medicine all over the world. The present summary of chemical characters, therefore, must be considered as a very preliminary one. Different types of crystals of oxalate of lime occur commonly. Members of the genera *Amphirrhox* and *Allexis* accumulate aluminium according to CHENEREY (Kew Bull. 1948, 173). Leaves and flowers contain rather large amounts of acidic mucilage in many instances; usually the mucilage is present in epidermal cells. In some taxa cells with a yellow or reddish 'resin-like' content replace mucilage cells; these latter cells also occur in the mesophyll and in the cortex, phloem and pith of stems. The chemical nature of the content of these idioblasts is not known. However, the fact that leucoanthocyanins are rather widespread in *Violaceae* suggests that the yellow to reddish cell contents may represent so-called 'myriophyllin' or 'inclusions'. Personal observation on rhizomes of *Viola mirabilis* L. confirm this supposition. According to PECKOLT (Ber. Deut. Pharm. Ges. 7, 1897, 97) fresh leaves of *Leonia glycyarpa* R. & P. are used for the preparation of a bird-lime in Brazil; this suggests that at least some members of the family may have rubber-containing idioblasts. Roots of several species of *Hybanthus* (= *Ionidium*) store inulin-like fructans instead of starch; other *Violaceae* store essentially sugars or starch (KRAUS, Sitz. Ber. Naturf. Ges. Halle, 1879, 6).

Preliminary observations about polyphenolic constituents of leaves (LEBRETON-BOUCHEZ, Phyto-

chemistry 6, 1967, 1601) showed a wide range of compounds; leucoanthocyanins, flavonol and flavones may be present in various combination; ellagic acid, however, was observed only in trace amount in three species of *Viola*. Saponins seem to be rather common in violaceous plants; they have been demonstrated to be present in many species of *Viola* and in some species of *Hymenanthera*, *Hybanthus*, and *Meliclytus*; none of the saponins has been investigated chemically hitherto.

There is much confusion about alkaloids in literature; roots and rhizomes of species of *Hybanthus* and of *Viola odorata* L., and other species of *Viola* were used formerly as a substitute for ipecacuanha root. Some authors claimed to have detected emetin or emetin-like compounds (e.g. *viola-emetin*; *violin*) in such crude drugs. Other authors, however, could not find emetin though some of them isolated minor amounts of alkaloids (e.g. *anchietin*, *ionidin*; compare PECKOLT, *l.c.*; LINDE, *Apoth. Z.* 34, 1919, 37). Most probably many *Violaceae* contain small amounts of alkaloids; species of *Anchieta*, *Hybanthus*, *Hymenanthera*, *Rinorea*, and *Viola* are listed in literature as alkaloid-bearing plants; however, the structures of violaceous alkaloids are totally unknown at present.

Most chemical work has been performed with European species of *Viola*. Glycosides of delphinidin and cyanidin occur constantly in blue and purple flowers; violanin is a delphinidin-derived anthocyanin acylated by *p*-cumaric acid. Rutin occurs in flowers and in leaves of several species of *Viola*. From the herb of *Viola tricolor* L. HÖRHAMMER *c.s.* (Tetrahedron Letters 1965, 1707) isolated apigenin-6,8-di-C-glucoside, which was called *violanthin*. The flavone glycoside *linarin* is the main flavonoid constituent of leaves of *Viola papilionacea* PURSH (V. PLOUVIER, C. R. Ac. Sc. Paris 264 D, 1967, 145).

Violatoside is an arabinoglucoside of methyl salicylate; it occurs in species of the section *Melanium* but seems to be lacking in other sections of *Viola* (PICARD, *Bull. Soc. Chim. Biol.* 8, 1926, 568). From roots and rhizomes of *Viola odorata* L. PAILER and NOVOTNY (*Naturwissenschaften* 45, 1958, 419) isolated 0.01–0.02 % of nitropropionic acid.

Concluding this survey it must be stated that a thorough chemotaxonomic discussion of *Violaceae* is not yet possible. At present no chemical characters are known which contradict the generally accepted relationships between *Flacourtiaceae* and *Violaceae*. — R. HEGNAUER.

Notes. BENTHAM & HOOKER's subdivision of the family (Gen. Pl. 1, 1862, 115) was extended and modified by MELCHIOR in E. & P. Nat. Pfl. Fam. ed. 2, 21 (1925) 346; for an account in English of the latter's phylogenetic considerations, see EXELL, *J. Bot.* 63 (1925) 330–333.

Dr. D. M. MOORE's contribution consists of the genus *Viola*; he also checked the family description.

Indexes to the examined specimens were published in the series 'Identification Lists of Malaysian Specimens', n. 27 *Rinorea* (1966) and n. 28 *Viola* (1967).

KEY TO THE GENERA

1. Flowers actinomorphic, in axillary bundles or racemes. Seeds not winged. Shrubs or trees.
 1. *Rinorea*
1. Flowers zygomorphic.
 2. Woody climbers. Flowers in elongate inflorescences. Seeds winged. 2. *Agatea*
 2. Herbs, sometimes with woody base. Flowers solitary in the leaf axils. Seeds not winged.
 3. Leaves (sub)sessile. Pedicels jointed. Seeds ribbed lengthwise. 3. *Hybanthus*
 3. Leaves stalked. Pedicels not jointed. Seeds smooth. 4. *Viola*

1. RINOREA

AUBL. *Hist. Pl. Guian.* Fr. 1 (1775) 235; TAUB. in E. & P. Nat. Pfl. Fam. 3, 6 (1895) 329; MELCH. *ibid.* ed. 2, 21 (1925) 349; JACOBS, *Blumea* 15 (1967) 127; TATON, *Fl. Congo*, *Viol.* (1969) 2. — *Pentaloba* LOUR. *Fl. Cochinch.* (1790) 154. — *Medusa* LOUR. *l.c.* 406. — *Alsodeia* THOUARS, *Hist. Vég. Isl. Austr. Afr.* (1806) 55; ENDL. *Gen. Pl.* (1839) p. 911, n. 5047; B. & H. *Gen. Pl.* 1 (1862) 118; BOERL. *Handl.* 1 (1890) 66. — *Vareca* ROXB. *Fl. Ind.* ed. Wall. 2 (1824) 445. — *Jürgensia* SPRENG. *Syst.* 3 (1826) 50. — *Prosthesis* BLUME, *Bijdr.* (1826) 866. — *Dioryktandra* HASSK. *Retzia* (1855) 125. — *Scyphellandra* THW. *En. Pl. Zeyl.* (1858) 21. — '*Imhofia* ZOLL.' *ex* TAUB. (1895) *l.c.*, *nomen in synon.*

Small shrubs to small trees; innovations mostly laxly pubescent, the hairs sometimes persistent; twigs pithy, generally angular when young, terete when older. *Leaves* distichous, rarely in a spiral. *Petiole* comparatively short, or rarely wanting, lacking distinct joints at base or top. *Stipules* caducous to long-persistent, some-

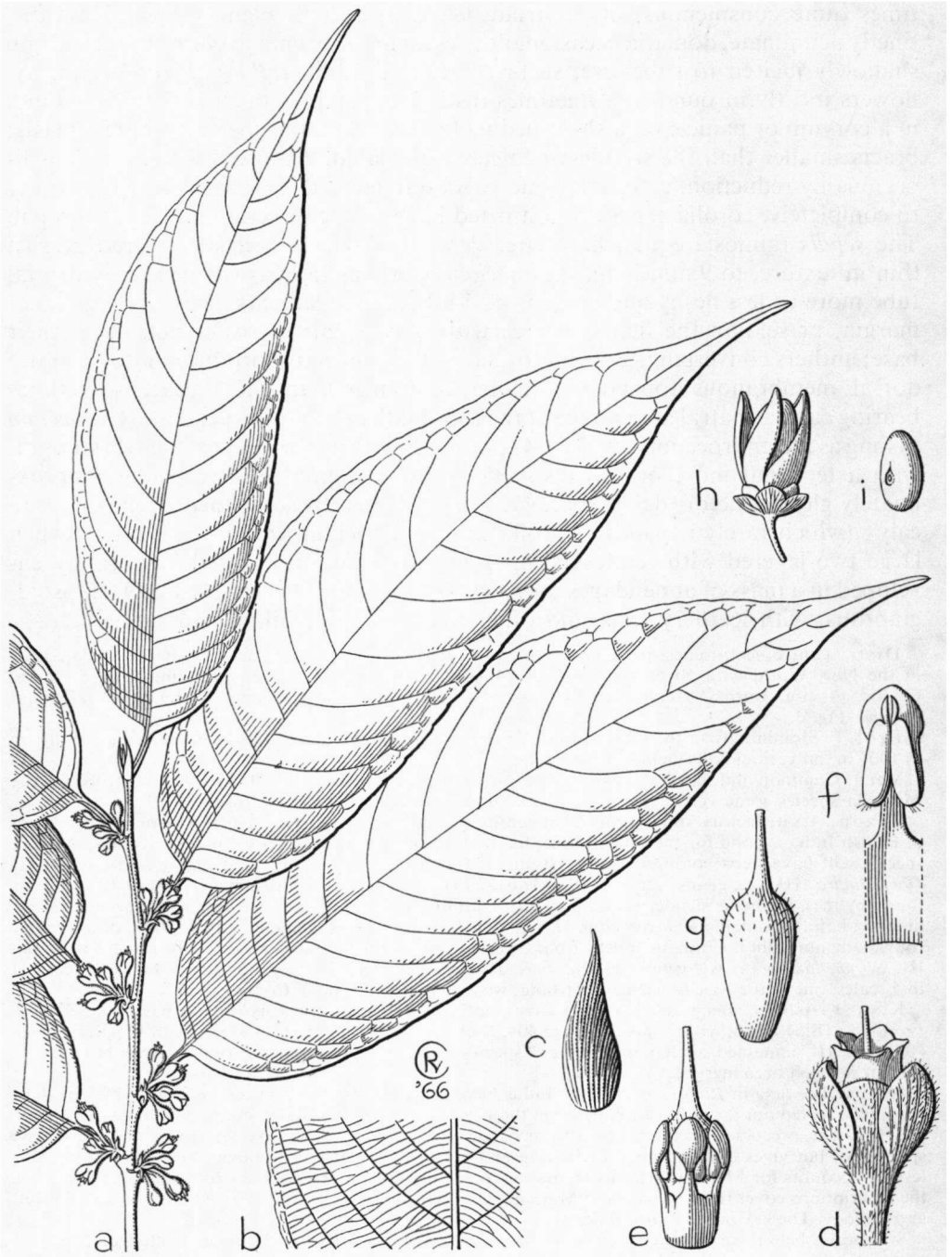


Fig. 1. *Rinorea horneri* (KORTH.) O.K. a. Habit, $\times \frac{2}{3}$, b. venation underneath, $\times \frac{2}{3}$, c. stipule, $\times 3$, d. flower, $\times 4$, e. gynoecium surrounded by stamens, $\times 6$, f. stamen from inside, $\times 12$, g. gynoecium, $\times 6$, h. fruit, subtended by calyx and corolla, $\times 1$, i. seed, $\times 1$ (a, d-g CURTIS 1898, b CLEMENS 9961, c SAN 42087, h PLEYTE 232).

times quite conspicuous, often striate lengthwise. Leaf blade more or less distinctly acuminate, domatia occasionally present in the primary vein axils, the margin shallowly incised to subentire, surfaces generally dull. *Inflorescences* lateral, the flowers mostly in bundles, sometimes distichous along a short rachis, sometimes in a corymb or panicle on a short peduncle, rarely in a raceme or on brachyblasts; bracts smaller than the stipules; pedicels articulated. *Flowers* bisexual, rarely dioecious by reduction, actinomorphic, calyx quincuncial, covering the bud halfway to completely, corolla generally contorted in the same direction as the third sepal. The *sepals* (almost) equal, fimbriate. *Petals* in Malesia (sub)equal, free, sessile, thin in texture, to 9 mm long. *Androecium* nearly as long as the petals, filamental tube more or less fleshy and sometimes 5-lobed, the filaments inserted on its inner margin, or seldom the filaments free with only a pair of scales outside at their base; anthers converging, glabrous or hairy, the connective produced into an entire dorsal membranous appendage smaller to longer than the thecae, sometimes bearing each a ventral appendage at the top smaller than the dorsal one. *Gynoecium* as long as the androecium, the 3 (–4) placentas with 1–3 ovules each; style straight, with a terminal more or less distinctly 3-lobed stigma. *Fruit* capsular, approximately globose before dehiscence, $\frac{3}{4}$ –4 cm \varnothing , generally subtended by the dried up calyx (which rarely expands), corolla, and androecium, the valves leathery, when large two-layered with reinforced apex, mostly smooth and glabrous, rarely enveloped in a mass of appendages, or hairy. *Seeds* sessile, 3–6, rarely 1 or 9, ellipsoid, glabrous, with leathery testa and often clearly defined hilum and raphe.

Distr. Pantropical, richest in Africa with c. 107 *spp.* on the mainland and 25 *spp.* in Madagascar; in the New World with 50–60 *spp.*; in Indo-Malesia 12–13 *spp.*, altogether extending from S. India/Ceylon, Assam, Burma, Hainan, to N. Australia, Melanesia, the Carolines; estimated total about 200 *spp.* Fig. 3.

Ecol. Predominantly in the understorey of primary rainforests, at very low altitude, occasionally up to 1000 m, on various soils including limestone.

Vern. Common and reliable names seem to be wanting. BURKILL, *Dict.* (1935) 1912, recorded for the Malayan species some vernacular names, and some unimportant medicinal uses.

Taxon. A satisfactory subdivision of the entire genus has not yet been made. The one in the Flora of British India is good for the present area, but is to be reconsidered when the neotropical and African species will have been comprehensively studied. *Alsodeia* is there subdivided into 3 sections, viz. I. *Doryctandra* (HASSK., genus, actually *Dioryctandra*) HOOK. f. & TH. with stamens "exserted" (not thus found by me), filaments slender (not a character), anthers cohering in a cone (notably by peculiar intertangling hairs). Contains *R. heteroclita*. II. Unnamed, with stamens included, anthers free, disk cupular (our filamental tube). Contains most of our species, and the former genera *Pentaloba* and *Prosthesis*. III. *Scyphellandra* (THW., genus) HOOK. f. & TH., with stamens included, anthers free, disk reduced to 5 scales, one at the base of each anther (and, we may add, dioecious). Contains our *R. virgata*.

KING, J. As. Soc. Beng. 58, ii (1889) gave another subdivision of *Alsodeia*; on page 400, Sect. I, *Prosthesis* (BL.) KING, with 7 *spp.*; on page 404, Sect. II, *Pentaloba* (WALL.) KING, with 6 *spp.*; on page 407, Sect. III, unnamed, with 1 *sp.* Various "species" placed by KING in different sections have in the present revision been merged.

Notes. The taxa in *Rinorea* east of the Indus have all been worked up in the same way, but the data have been sorted out for publication between the Flora Malesiana and its precursor in *Blumea* 15 (1967) 127–138. The precursor accounts for all names of all taxa, with their first references and their type specimens, but gives descriptions, distribution and ecology only of non-Malesian taxa. The Flora Malesiana accounts for Malesia as far as names and literature are concerned, later references included, but the descriptions cover the taxa found in Malesia over their full range, and the same holds for distribution and ecology. The key in the Flora Malesiana is also complete for all taxa.

Six species belonging to other families have been ascribed to *Rinorea*; see under Excluded.

KEY TO THE SPECIES

1. Stipules caducous. Seeds 6 or fewer.
2. Primary veins curving approximately parallel towards the margin at distances of 1–2 cm; secondary venation scalariform.

3. Inflorescences fasciculate (rarely stalked in *R. anguifera*).
4. Dorsal appendage of the anthers small. Style hairy. Fruit enveloped in moss-like appendages.
1. *R. anguifera*
4. Dorsal appendage of the anthers distinct. Style glabrous. Fruit smooth.
5. Anthers with small ventral appendages. Ovules 3. Fruit subglobose, with 3 seeds.
2. *R. bengalensis*
5. Anthers with ventral appendages about as long as the dorsal one. Ovules 6. Fruit conical, subtended by the expanded calyx, with 1 seed. 3. *R. horneri*
3. Inflorescences on a peduncle (if racemose, see *R. longiracemosa*).
6. Gynoecium glabrous. Petals to 4 mm long. Anthers with small dorsal appendage. Fruit triangular with rounded corners, 1-3 cm long, valves thick. 4. *R. sclerocarpa*
6. Gynoecium hairy. Petals to 9 mm long.
7. Pedicels jointed near the base. Anthers with small dorsal appendage. Fruit subglobose to ovoid, 8-11 mm long, hairy, with a hairy style remnant. 5. *R. lanceolata*
7. Pedicels jointed about the middle. Anthers with a dorsal appendage 1-2 times as long as the cells. (Fruit unknown.) 6. *R. macrantha*
2. Primary veins few, independently curved towards the margin, secondary venation irregular.
8. Inflorescences more or less elongate. Anthers with distinct ventral appendages. Fruit 1¼-4 cm ø.
9. Stipules 1-3½ mm long. Inflorescence axis ½-2½ cm long. Leaves often obovate.
7. *R. javanica*
9. Stipules (2-)4-21 mm long. Inflorescence axis to c. 10 cm long. Anthers often bearded at the base.
8. *R. longiracemosa*
8. Inflorescences fasciculate, or flowers densely set on a short rachis. Anthers with small or no ventral appendages. Fruit ½-1½ cm ø.
10. Leaves petiolate, more or less concolorous. Anthers with a dorsal appendage about as long as the cells or longer.
11. Leaves 1-7(-14) cm long. Petiole 1-5 mm. Plant dioecious; in the ♂ flowers only a style, in the ♀ flowers the anther cells vestigial, ovules 6. 9. *R. virgata*
11. Leaves 6-36 cm long. Petiole 5-35 mm. Flowers bisexual. Ovules 3.
12. Stipules 1½-6 mm, scarcely striate. Leaves dark-coloured in the dried state. Fruit sparsely hairy.
10. *R. macrophylla*
12. Stipules 4-16 mm, distinctly striate. Leaves greenish in the dried state. Fruit glabrous.
2. *R. bengalensis*
10. Leaves subsessile, discoloured, pale underneath, 3½-6 cm long. Anthers with a small dorsal appendage. Style hairy in the middle only. Ovary glabrous. Andamans, India?
R. heteroclita
1. Stipules long-persistent. Ovules and seeds 9. 11. *R. iliaspaiel*

I. Rinorea anguifera (LOUR.) O.K. Rev. Gen. Pl. 1 (1891) 42; CRAIB, Fl. Siam. En. 1 (1925) 88; MERR. Comm. Lour. (1935) 270; GAGN. Fl. Gén. I.-C. Suppl. 1 (1939) 187; JACOBS, Blumea 15 (1967) 127. — *Medusa anguifera* LOUR. Fl. Cochinch. (1790) 406. — *Alsodeia echinocarpa* KORTH. Ned. Kruidk. Arch. 1 (1848) 360; MIQ. Fl. Ind. Bat. 1, 2 (1859) 116; OUDEM. in Miq. Ann. 3 (1867) 68; HOOK. f. & TH. in HOOK. f. Fl. Br. Ind. 1 (1872) 188; KING, J. As. Soc. Beng. 58, ii (1889) 406; BOISSIEU, Fl. Gén. I.-C. 1 (1909) 214, f. 20: 6; RIDL. Fl. Mal. Pen. 1 (1922) 134, f. 12. — *Pentaloba corylifolia* TURCZ. Bull. Soc. Nat. Moscou 27, ii (1854) 341. — *Alsodeia corylifolia* (TURCZ.) TURCZ. Bull. Soc. Nat. Moscou 36 (1863) i 559. — *Alsodeia capillata* KING, J. As. Soc. Beng. 58, ii (1889) 407; KING, Ann. R. Bot. Gard. Calc. 5 (1896) 127, pl. 146A; RIDL. Fl. Mal. Pen. 1 (1922) 133. — *Alsodeia comosa* KING, J. As. Soc. Beng. 58, ii (1889) 407; KING, Ann. R. Bot. Gard. Calc. 5 (1896) 127, pl. 146B; BOISSIEU, Fl. Gén. I.-C. 1 (1909) 213; RIDL. Fl. Mal. Pen. 1 (1922) 133. — *Alsodeia echinocarpa* KORTH. var. *nervosa* CAPIT. Bull. Soc. Bot. Fr. 57 (1910) 394, et var. *zollingeri* BOERL. ex CAPIT. l.c. — *R. anguifera* var. *nervosa* (CAPIT.)

MERR. Philip. J. Sc. 11 (1916) Bot. 100. — *R. comosa* (KING) MERR. En. Born. (1921) 410. — *R. echinocarpa* BURK. Gard. Bull. S. S. 6 (1930) 172.

Young twigs terete, generally straight, densely covered with a persistent brown tomentum; pith narrow. Leaves distichous (spirally arranged on terminal or crooked branches). Stipules (4-) 5-9(-11) mm long, triangular, not appressed, with a distinct keel sometimes protracted into a slender tip, more or less striate, in Borneo persistent, otherwise the scars not conspicuous. Petiole (1-)2-8(-10) mm. Blade thin-coriaceous, to (8-)14-28(-37) by (3-)4-8(-10½) cm, widest at the middle to above, index 2.5-3.7(-4.4); base acute to (mainly in Borneo) narrowly cordate, top acuminate; midrib and veins flat above, prominent beneath, sometimes scarcely different in colour, sometimes lighter; no domatia; primary veins fairly regular and parallel, with distances in the order of 1 cm between, no smaller intermediate veins, secondary venation mostly distinct, scalariform, reticulation obscure; margin dentate, with often larger and smaller teeth alternating, to subentire; surfaces dull, brownish, often with a livid tinge, somewhat paler beneath, midrib and veins hairy beneath, to a smaller extent also

above, seldom nearly glabrous. *Flowers* with up to c. 20 in dense axillary (sub)sessile clusters on twigs and sometimes also on branchlets; bracts acute, resembling the sepals, pedicels very short. *Sepals* c. 4–5 mm long, fleshy, hairy, the inner ones narrower than the outer and slightly exceeding them. *Petals* c. 5–7 mm long, strap-shaped but wider in the middle, top recurved, often the whole petal S-shaped, outside with a median band of appressed silvery hairs. *Stamens* with distinct filamental tube, slender sometimes hairy filaments and small glabrous anthers; dorsal appendage $\frac{1}{2}$ of the anther's length or shorter, ventral appendages none or vestigial. *Ovary* with its long appressed hairs obconical, ovules 6, style with patent hairs, glabrous towards the top. *Fruit* subtended by the persistent sepals, before dehiscence globose, hidden in a (mostly) dense, moss-recalling mass of more or less branched, hairy appendages on the valves, in all $1\frac{1}{2}$ – $3\frac{1}{2}$ cm ϕ . After dehiscence the *seeds* become visible, about 3 in number, ellipsoid, 4–7 mm long, evenly straw-coloured, glossy.

Distr. In Indo-China scattered S of the 17th parallel. In *Malesia* common in the Malay Peninsula S of 7°35' N in Thailand; throughout Sumatra where very common in the East Coast Residency; scattered in Borneo N of the Kapuas in Kalimantan and Sarawak (all divisions) to Brunei; also at 2°50' N, 117°40' E in NE. Kalimantan.

Ecol. Primary forest, in humid places, sometimes recorded from heath-forest, swamp forest, light forest or forest edges, or secondary forest, mostly on sandy or loamy, rarely from calcareous soil; altitudes low, seldom up to 600 m.

Notes. A shrub 1 m to a treelet 10 m tall. Bark smooth, mottled. Flowers mostly white to sometimes yellow, facing upwards from the horizontal branches, anthers light brown. Fruit greenish at maturity. KING's collector's notes to 10084 from Perak: "in dense bamboo forest, flowers deep-red with pale reddish green, waxy tinged", do not fit in with any other data.

In RIDLEY 4824 from Singapore, the pedicels are 3 mm.

In TEJSMANN fl. 30.VIII.1872 from Lingga, Bt. Sipindjang off Sumatra, the branchlets are slender, somewhat crooked, the leaves almost glabrous, concolorous, and not distichous, 2–3 mm petioled, c. 4–6 by $1\frac{1}{2}$ –2 cm. TEJSMANN fl. 14.IX.1872 from Lingga, Sg. Tanda, is similar but the leaves are c. 7–9 by $1\frac{1}{2}$ cm. Habit unknown.

In RAHMAT 1674 from Sumatra East Coast, the globose, cluster-like inflorescences are 5 mm pedunculate.

2. *Rinorea bengalensis* (WALL.) O.K. Rev. Gen. Pl. 1 (1891) 42; GAGN. Fl. Gén. I.–C. Suppl. 1 (1939) 190; MERR. & CHUN, Sunyatsenia 5 (1940) 127, f. 12; JACOBS, Blumea 15 (1967) 128. — *Alsodeia bengalensis* WALL. Trans. Med. Phys. Soc. Calc. 7 (1835) 224; HOOK. f. & TH. in Hook. f. Fl. Br. Ind. 1 (1872) 186; KURZ, For. Fl. Burma 1 (1877) 70; KANJ. & DAS, Fl. Assam 1 (1934) 82. — *Alsodeia obtusa* KORTH. Ned. Kruiddk. Arch. 1 (1848) 359; MIQ. Fl. Ind. Bat. 1, 2 (1859)

115; OUDEM. in Miq. Ann. 4 (1869) 215. — *Pentaloba fasciculata* TURCZ. Bull. Soc. Nat. Moscou 27, ii (1854) 341. — *Pentaloba semigrata* TURCZ. l.c. 342. — *Alsodeia fasciculata* (TURCZ.) TURCZ. Bull. Soc. Nat. Moscou 36 (1863) i 559. — *Alsodeia paradoxa* BL. ex OUDEM. in Miq. Ann. 3 (1867) 71. — *Alsodeia wallichiana* HOOK. f. & TH. in HOOK. f. Fl. Br. Ind. 1 (1872) 187; KING, J. As. Soc. Beng. 58, ii (1889) 400; RIDL. Fl. Mal. Pen. 1 (1922) 128. — *R. wallichiana* (HOOK. f. & TH.) O.K. Rev. Gen. Pl. 1 (1891) 42; HEND. J. Mal. Br. R. As. Soc. 17 (1939) 35. — *R. obtusa* (KORTH.) O.K. Rev. Gen. Pl. 1 (1891) 42. — *Gelonium glandulosum* ELM. Leaf. Philip. Bot. 3 (1910) 917. — *Gelonium trifidum* ELM. l.c. 918. — *Alsodeia lankawiense* RIDL. J. Str. Br. R. As. Soc. 59 (1911) 70; Fl. Mal. Pen. 1 (1922) 129. — *Alsodeia pruinosa* PULLE, Nova Guinea 8 (1912) 669. — *Alsodeia salomonensis* RECH. in Fedde, Rep. 11 (1912) 184; Denkschr. K. Ak. Wiss. M.–N. Kl. Wien 89 (1913) 137, t. 6, f. 11b. — *R. paradoxa* (BL. ex OUDEM.) J. J. SMITH in K. & V. Bijdr. 13 (1914) 67. — *Alsodeia semigrata* (TURCZ.) J. J. SMITH, l.c. 72. — *R. semigrata* (TURCZ.) J. J. SMITH, l.c. 73; MERR. J. Arn. Arb. 35 (1954) 145; BACK. & BAKH. f. Fl. Java 1 (1964) 194. — *R. fasciculata* var. *minor* ELM. Leaf. Philip. Bot. 8 (1915) 2877. — *R. fasciculata* (TURCZ.) MERR. Philip. J. Sc. 12 (1917) Bot. 286; En. Philip. 3 (1923) 104; J. Arn. Arb. 32 (1951) 80. — *R. glandulosa* (ELM.) MERR. Philip. J. Sc. 12 (1917) Bot. 286; En. Philip. 3 (1923) 104; J. Arn. Arb. 32 (1951) 80. — *R. lankawiensis* (RIDL.) CRAIB, Fl. Siam. En. 1 (1925) 90. — *R. pruinosa* (PULLE) MELCH. in E. & P. Nat. Pfl. Fam. ed. 2, 21 (1925) 352; Bot. Jahrb. 62 (1929) 369. — *R. salomonensis* (RECH.) MELCH. in E. & P. Nat. Pfl. Fam. ed. 2, 21 (1925) 352. — *Suregada glandulosa* (ELM.) CROIZAT, Bull. Jard. Bot. Btzg III, 17 (1942) 216. — *Suregada trifida* (ELM.) CROIZAT, l.c.

Growth apparently in flushes, but internodes of equal length. Young parts with lax to rarely dense yellow-brown pubescence, glabrescent. Twigs greenish, furrowed when young, often zig-zag, nodes distinct, with stipular scars taking $\frac{1}{3}$ of the twig's circumference. *Leaves* often distichous. *Stipules* appressed, triangular, slender, (4–)8–16 mm long, brown and distinctly striate. Petiole $\frac{1}{2}$ – $2\frac{1}{4}$ (– $3\frac{1}{4}$) cm, may differ in length from the stipules. *Blade* coriaceous, 6–22 (–36) by $2\frac{1}{2}$ –9 (– $12\frac{1}{2}$) cm, widest at the middle or slightly above, index (1.9)–2.3 (–3.3); base acute, rarely to subcordate, top gradually acuminate; midrib and veins distinct, yellowish to sometimes brownish, often with hairy pit-domatia in the primary axils, major veins about 7–13 on either side, the basal one always thin; reticulation on both sides distinct, not very regular; margins shallowly crenate, rarely entire; surfaces distinctly greenish with variants, darker, glossy, glabrous above, beneath sometimes with a few hairs on the veins. *Inflorescences* on the young twigs; from an axillary rosette of caducous hypophylls 1–2 mm long and similar in kind as the stipules, a few (seldom

one) partial inflorescences crop out like curving fingers $\frac{1}{2}$ -1 cm long, which grow at the top while producing flowers in two rows, the pedicels leaving distinct scars, eventually 10-30. *Flower buds* initially protected by 2 keeled brownish bracteoles (?) c. $\frac{1}{4}$ mm long, the outer ones inserted on the dorsal side of the "finger" where they are to leave a broad pale scar. Sometimes the pattern is less clear, there being a cluster of flowers that may be dense and large in Philippine plants, seldom there is (in New Guinea) a stout common peduncle a few mm long. Pedicel 3-10(-20) mm, jointed at or near the base. *Sepals* $\frac{1}{3}$ - $\frac{1}{2}$ the length of the petals, rarely as long; fleshy, ciliate. *Petals* strap-shaped and often S-curved, ($\frac{2}{3}$ -)3-4 (-5) mm long. *Androecium* glabrous (occasionally a few hairs at the base of the thecae), filamental tube 0.1-0.5 times as long as the stamens, the filaments 0.1-0.4, the anthers 0.4-0.8; dorsal appendage varying in size and shape, mostly broad-triangular; ventral appendages mostly small. *Ovary* sometimes hairy, with 3 ovules, style glabrous. *Fruit* at the base with the dried striate sepals and petals, before maturity globose, ($\frac{1}{2}$ -)1-1 $\frac{1}{2}$ cm ϕ , with a rest of the style, dull, glabrous. *Seeds* 3, subglobose, 3-7 $\frac{1}{2}$ mm, yellow-brown with specks of purple to dull purple all over.

Distr. Ceylon, S. India, Assam, Burma, Indochinese Peninsula and Hainan, Andamans, scattered through *Malesia* (not in S. Sumatra and Java); Northern Queensland, Melanesia, Carolines.

Ecol. An understory plant of mixed rain-forest at low elevation; as an exception on Mt Kinabalu up to 1500 m. On various soils but often on steep limestone hills; once recorded from swampy forest; no apparent periodicity.

Notes. A shrub which may already be fertile when 2 feet tall, to a tree of c. 20 m by 28 cm. Wood yellow, flowers green to white, fruit orange with red seeds, or cream-brown, or pale green. Several records mention the rich green leaves. A very polymorphic species.

As the plant has never been found again in Java after BLUME's collection from Mts Salak and Burangrang, which was described as *Alsodeia paradoxo*, I think the record is apocryphous. ZOLLINGER 2979, the type of *Pentaloba semigrata*, was from a plant in the Bogor Gardens.

3. *Rinorea horneri* (KORTH.) O.K. Rev. Gen. Pl. 1 (1891) 42. — *Alsodeia horneri* KORTH. Ned. Kruidk. Arch. 1 (1848) 360; MIQ. Fl. Ind. Bat. 1, 2 (1859) 116; OUDEM. in Miq. Ann. 3 (1867) 70; MIQ. Ann. 4 (1869) 214; MERR. En. Born. (1921) 410; JACOBS, Blumea 15 (1967) 130. — *Alsodeia brownii* KORTH. Ned. Kruidk. Arch. 1 (1848) 361; HASSK. Retzia ed. nov. (1858) 33 ('*A. Brownei*'), name only, the description being of *R. lanceolata*; MIQ. Fl. Ind. Bat. 1, 2 (1859) 116 ('*A. Brownii*'); OUDEM. in Miq. Ann. 3 (1867) 70. — *Alsodeia kunstleriana* KING, J. As. Soc. Beng. 58, ii (1889) 401; KING, Ann. R. Bot. Gard. Calc. 5 (1896) 122, pl. 141; RIDL. Fl. Mal. Pen. 1 (1922) 128. — *R. brownii* (KORTH.) O.K. Rev. Gen. Pl. 1 (1891)

42. — *Alsodeia astrolabes* K. SCH. & LAUT. Fl. Schutzgeb. (1901) 451. — *R. copelandii* MERR. Philip. Gov. Lab. Bur. Bull. 35 (1906) 45; En. Philip. 3 (1923) 103. — *R. acuminata* MERR. Philip. J. Sc. 5 (1910) Bot. 201; En. Philip. 3 (1923) 103. — *Alsodeia hirtella* RIDL. Bull. Misc. Inf. Kew (1914) 377. — *R. amboinensis* MERR. Philip. J. Sc. 11 (1916) Bot. 292. — *R. hirtella* (RIDL.) MERR. En. Born. (1921) 410; Philip. J. Sc. 30 (1926) 413. — *R. castilloi* MERR. Philip. J. Sc. 21 (1922) 530. — *R. astrolabes* (K. SCH. & LAUT.) MELCH. in E. & P. Nat. Pfl. Fam. ed. 2, 21 (1925) 352; Bot. Jahrb. 62 (1929) 371, incl. var. *hirta* MELCH. l.c. 372. — *R. ledermannii* MELCH. l.c. 370. — *R. elmeri* MERR. Un. Calif. Publ. Bot. 15 (1929) 206. — *R. celebica* MELCH. Notizbl. Berl.-Dahl. 12 (1934) 205. — *R. hamelii* MERR. Pap. Mich. Ac. Sc. 19 (1934) 171. — Fig. 1, 2.

An undershrub (35-60 cm to a treelet 5 m tall. Twigs brownish yellow, furrowed when young, pithy, laxly to densely set with a greyish to fulvous indumentum puberulous to velvety. Terminal bud not completely enveloped by the stipules, the latter (3-6-11(-13) mm long, rather wide at the base, brown and striate, more or less hairy, leaving inconspicuous scars. *Leaves* spirally arranged. Petiole (3-8-25(-32) mm, hairy like the twig. *Blade* thin in texture, to 11-34 by 4-9 $\frac{1}{2}$ (-11) cm, widest above the middle, sometimes about, index (2.2-)-2.7-3.4(-3.8); base tapering, top acuminate; midrib and veins distinct, flat above, prominent beneath, yellowish brown, no domatia; primary veins fairly regular and parallel towards the margin at distances of c. 1(-2) cm, nearly always without smaller intermediate veins; secondary venation scalariform, often crossing the primary veins; reticulation distinct beneath; margins dentate to sometimes entire; surfaces fairly dull, paler beneath, some hairs on the midrib and major veins beneath often remaining, otherwise glabrous, brown-green in the dried state (yellowish when Schweinfurthed). *Inflorescences* originally subtended by a few stipule-like hypophylls in the axils of the (1st-)2nd-6th leaves of twigs, or sometimes the flowering part of a twig leafless, rarely flowering on an older branchlet, consisting of a more or less contracted (sub)sessile panicle with unequal branches, the main axis to 1 $\frac{1}{2}$ (exceptionally to 7) cm long; flowers few-20 (rarely more spirally arranged; bracts and bracteoles c. 1 mm; all pedicels jointed at $\frac{1}{4}$ -1 mm above their insertion, the distal part 3-10(-15) mm, thickened towards the top, puberulous. Buds and often flowers ovoid, but sometimes the outer sepals spreading in the dried state; calyx somewhat decurrent into the pedicel; petals converging, corolla with a narrow opening at the top. *Sepals* 2-4(-5) by 1-5(-6) mm, more or less fleshy, variously hairy, exceptionally the margins of the outer sepals recurved. *Petals* (2-)-3-6(-8) mm long, sometimes S-shaped or with recurved top, mostly thin but sometimes fleshy. *Androecium* glabrous but exceptionally a few hairs at the base of the anthers or also the filaments hairy; filamental tube 0.1-0.3 part of the length of the stamens, the fila-

ments 0.1–0.3(–0.5) part, the anthers 0.4–0.7 part; dorsal and ventral appendages always well developed. *Ovary* mostly hairy, sometimes glabrous, style glabrous, rarely hairy; ovules 6(–7). Calyx enlarging with the fruit, eventually leathery, funnel-shaped, 8–12 mm ϕ , on a firm pedicel, about 3–5 per inflorescence. *Fruit* ovoid, 10–15 mm long, glabrous, turbinate splitting, the valves thin but firm; *seed* one, ellipsoid to ovoid, c. 8–11 mm long, glossy even light brown.

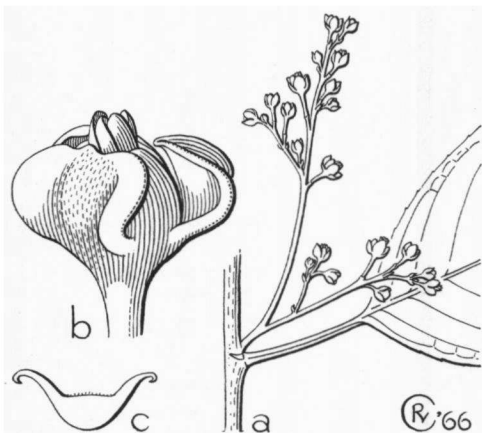


Fig. 2. *Rinorea horneri* (KORTH.) O.K., deviating specimens. a. An elongated inflorescence, $\times \frac{2}{3}$, b. flower with sepal margins recurved, c. such a sepal in cross-section (a KOSTERMANS 21471, b–c JACOBS 5431).

Distr. Peninsular Siam; scattered throughout *Malesia* except Java and the Lesser Sunda Is.; Solomons.

Ecol. In various kinds of primary forest, sometimes depleted, rarely in secondary forest, up to 600 m (to 1500 m on Mt Kinabalu); often on limestone, but also on sandstone or clay.

Notes. An undershrub (35–)60 cm to a treelet 5 m tall. Leaves dark green above, pale beneath; flowers weakly fragrant, white to pale green-yellow, the anthers pale brown. Fruit apparently green and hard at maturity.

For KING's remark of 1896 on the occurrence of both bisexual and f flowers, I found no confirmation in the material. That "the anthers have no pollen" may be due to their very early losing it.

The name *R. strobobas* is sometimes found as a corruption of *astrolabes*.

4. *Rinorea sclerocarpa* (BURGERSD.) JACOBS, *Blumea* 15 (1967) 131. — *Alsodeia sclerocarpa* BURGERSD. in *Miq. Pl. Jungh.* (1852) 122. — *Alsodeia rugosa* MIQ. *Sumatra* (1860) 390; *Ann.* 4 (1869) 215. — *Alsodeia condensa* KING, *J. As. Soc. Beng.* 58, ii (1889) 405; *Ann. R. Bot. Gard. Calc.* 5 (1896) 126, pl. 145; *RIDL. Fl. Mal. Pen.* 1

(1922) 132. — *Alsodeia pachycarpa* KING, *J. As. Soc. Beng.* 58, ii (1889) 407; *RIDL. Fl. Mal. Pen.* 1 (1922) 131. — *Alsodeia scortechinii* KING, *J. As. Soc. Beng.* 58, ii (1889) 405; *Ann. R. Bot. Gard. Calc.* 5 (1896) 126, pl. 144; *RIDL. Fl. Mal. Pen.* 1 (1922) 131. — *R. pachycarpa* (KING) CRAIB, *Fl. Siam. En.* 1 (1925) 91. — *R. scortechinii* (KING) CRAIB, *l.c.* — *R. sumatrana* MERR. *Pap. Mich. Ac. Sc.* 19 (1934) 172. — *R. condensa* (KING) MERR. *l.c.* 173.

Growth apparently in flushes; internodes of varying length. Twigs \pm terete, dull greyish or sometimes purplish tinged, initially with greyish pubescence but soon glabrescent; branchlets slightly crooked, bark with faint longitudinal ribs, pith narrow. *Leaves* mostly distichous. *Stipules* (3–)4–7(–10) mm long, not appressed, triangular, with a pale-hairy keel, more or less striate, their scars not conspicuous. *Petiole* 5–12 mm, dull greyish, often wrinkled. *Blade* thin-coriaceous, to $13\frac{1}{2}$ –25(–38) by $4\frac{1}{2}$ –9(–11) cm, widest about the middle to sometimes above, index (2.1)–2.6–3.5 (–3.9); base acute and slightly decurrent, top acuminate; midrib and veins often in a similar colour as the surface to somewhat lighter; no domatia; primary veins fairly regular and converging within the margin, with distances between in the order of $1\frac{1}{2}$ cm at the midrib, no smaller intermediate veins, secondary venation thin, scalariform, reticulation indistinct; margin shallowly dentate, entire near the base; surfaces dull, above grey-green-brown, glabrous, beneath with a characteristic chocolate-brownish colour, glabrous or seldom sparsely hairy on the main nerves. *Inflorescences* in the axil of the 2–4 latest leaves, 2–5 cm long, often rich-flowered and sometimes quite densely, peduncle mostly near the base divided into 2–4 main axes, which after anthesis may long persist as partly empty stalks; rather irregularly dichasially branched, axes laxly greyish puberulent; bracts late caducous, triangular, 1–2 mm; pedicels jointed below the middle, *i.e.* at 1–3 mm above their insertion. *Flowers* pear-shaped, the corolla converging. *Sepals* suborbicular, (2–)2 $\frac{1}{2}$ –3(–4) mm, fleshy, sparsely hairy. *Petals* $3\frac{1}{2}$ –4 mm long, sometimes the top slightly recurved, outside sparsely hairy towards the top. *Androecium* glabrous, filamental tube 0.3 part of the length of the stamens, filaments 0.4–0.5 part, anthers 0.2–0.3 part; dorsal appendage pale, short and narrow, no ventral appendages. *Pistil* glabrous; ovules 6. *Fruits* seldom more than 2 per inflorescence, subtended by the persistent sepals, before maturity mostly tapering to both ends, (0.9–)2.3–3 cm long, bluntly triangular with hollow sides (0.8–)1.5–2 cm wide, dull dark-purplish, the valves eventually spreading, compressed and separating into two layers, the inner one cartilaginous and straw-coloured, the outer one leathery. *Seeds* 3–6, c. (5–)6–8 mm long, evenly dull brownish.

Distr. *Malesia*: Malay peninsula (scattered between 6°17' N in S. Siam and Johore), Sumatra (scattered in Atjeh and East Coast, also near Palembang).

Ecol. Primary forest, on moist slopes or by small rivers, lowlands to 1000 m. Fl. March, fr. June-Sept.

Notes. Tree, more or less crooked, sometimes shrubby, to 10(-20) m tall, bole 7-13 cm ø, fluted or buttressed at the base, bark mostly smooth, fawn or grey; slash inner bark granular, yellow or dull orange, wood cream or white. Branches brittle. Leaves above dark green, beneath light green with darker veins. Flowers white, or pale green. Ripe fruits triangular, dark green, sometimes flushed with orange, 3¼ cm ø; unripe fruits may be globose.

MIQUEL, Fl. Ind. Bat. 1, 2 (1859) 115, had it under *Alsodeia obtusa*, our *Rinorea bengalensis*; BOERLAGE, Cat. Hort. Bog. 1 (1899) 48, under *Alsodeia javanica*.

Alsodeia rugosa was described with a hairy ovary; in the buds available this was glabrous.

A CHR. SMITH specimen (BM), stated to be from Ceram, fl. II. 1802, must have been wrongly labelled.

5. *Rinorea lanceolata* (WALL.) O.K. Rev. Gen. Pl. 1 (1891) 42; MERR. J. Arn. Arb. 35 (1954) 145; JACOBS, Blumea 15 (1967) 133. — *Vareca lanceolata* WALL. in Roxb. Fl. Ind. ed. Wall. 2 (1824) 445; ed. Carey 1 (1832) 648. — *Pentaloba lanceolata* (WALL.) ARN. Mag. Zool. Bot. 2 (1848) 544. — *Alsodeia brownii* (non KORTH.) HASSK. Retzia ed. nov. (1858) 22. — *Alsodeia cymulosa* MIQ. Fl. Ind. Bat. 1, 2 (1859) 116, non WELW. 1868; BACK. Schoolf. (1911) 67. — *Alsodeia dasypyxis* MIQ. Sum. (1860) 391; Ann. 4 (1869) 215 ('*dasypryxis*' in Kew Index). — *Alsodeia lanceolata* OUDEM. in Miq. Ann. 3 (1867) 68; Arch. Néerl. Sc. Ex. Nat. 2 (1867) 196; HOOK. f. & TH. in Hook. f. Fl. Br. Ind. 1 (1872) 188; KING, J. As. Soc. Beng. 58, ii (1889) 404; RIDL. Fl. Mal. Pen. 1 (1922) 131. — *Alsodeia maingayi* HOOK. f. & TH. in Hook. f. Fl. Br. Ind. 1 (1872) 188; KING, J. As. Soc. Beng. 58, ii (1889) 402; RIDL. Fl. Mal. Pen. 1 (1922) 130. — *Alsodeia mollis* HOOK. f. & TH. in Hook. f. Fl. Br. Ind. 1 (1872) 188; KURZ, For. Fl. Burma 1 (1877) 70. — *Alsodeia floribunda* KING, J. As. Soc. Beng. 58, ii (1889) 406; Ann. R. Bot. Gard. Calc. 5 (1896) 125, pl. 143B; RIDL. Fl. Mal. Pen. 1 (1922) 132. — *R. cymulosa* (MIQ.) O.K. Rev. Gen. Pl. 1 (1891) 42; KOORD. Exk. Fl. Java 2 (1912) 65; J. J. SMITH in K. & V. Bijdr. 13 (1914) 70; BACK. & BAKH. f. Fl. Java 1 (1964) 193. — *R. maingayi* (HOOK. f. & TH.) O.K. Rev. Gen. Pl. 1 (1891) 42; TAUB. in E. & P. Nat. Pl. Fam. 3, 6 (1895) 329. — *R. mollis* (HOOK. f. & TH.) O.K. Rev. Gen. Pl. 1 (1891) 42; CRAIB, Fl. Siam. En. 1 (1925) 90. — *Alsodeia grandiflora* RIDL. Bull. Misc. Inf. Kew (1914) 377. — *R. floribunda* (KING) MERR. Pap. Mich. Ac. Sc. 19 (1934) 171.

Growth mostly in flushes; the first internodes shorter. Twigs slender, ± straight, generally purplish, terete when young, lengthwise striate, pith narrow; sometimes laxly fulvous velvety but mostly glabrous from an early stage. Terminal bud with some tips as the stipules do not com-

pletely envelop it. *Leaves* mostly spirally arranged, sometimes distichous. *Stipules* 4-11 mm long, rather wide at the base, brown and striate, leaving rather distinct scars. *Petiole* 2-7(-10) mm, generally dark-coloured. *Blade* thin-coriaceous in texture, to 10-29(-42) by (2.3-)3.3-9(-20) cm, widest about the middle to sometimes above, index (2-)2.5-4.8(-6.1); base tapering to obtuse, top acuminate; midrib and veins flat above, prominent beneath, mostly in a similar colour as the leaf surface; no domatia except in Java; primary veins fairly regular and converging within the margin, with distances between them in the order of ¾-1(-1½) cm at the midrib, smaller intermediate veins rare, secondary venation indistinct, scalariform, reticulation obscure; margin (often minutely) dentate; surfaces generally dull, and concolorous, green-brownish, midrib and veins on both sides hairy like the twigs, if so, sparsely hairy between the veins underneath but mostly glabrous. *Inflorescences* on the young twigs rarely also on branchlets, laxly globose to compound corymbose in shape, 1-9 cm long in all; peduncle a few mm to 3(-4½) cm long, hairy like the twig, coloured like the petioles, mostly divided into two subequal axes of about ½ its length; bracts c. 2-3 (if on a main axis to 10) mm long, lanceolate; number of *flowers* few to several dozens; pedicels to 4(-8) mm, jointed in their basal half. *Sepals* 2¼-5 by 1¾-4½ mm, suborbicular, elliptic or ovate, more or less fleshy, with thin margin, the outer sepals somewhat shorter and wider than the inner ones and sometimes with a cucullate top, somewhat hairy particularly in the centre. *Petals* 3½-7(-9) by 1¼-2 mm, widest about the middle, thin, top sometimes recurved, outside with a pale median band of hairs. *Stamens* consisting of a filamental tube of 0.2-0.3 part of the total length, a filamental of 0.4-0.5 part, and an anther of (0.2)-0.3-0.4 part; upper part of the filament and back of the connective between the thecae hairy, exceptionally glabrous; dorsal appendage triangular, ¼-½ the length of the thecae, ventral appendages up to half the length of the dorsal one, or wanting. *Pistil* hairy, ovules 6, once 3. *Fruits* subtended by the persistent sepals and petals, before dehiscence subglobose to slightly ovoid, the hairy style always persistent, 8-11 mm long, the valves leathery, brownish, more or less hairy, splitting straightly; *seeds* c. 3, c. 3-6 by 2-4 mm, dull evenly light brown.

Distr. Burma: S. Tenasserim; Peninsular Siam; in *Malesia*: common in Malaya, scattered in Sumatra (also Lingga Is.) and in the very SW of Java (also Peutjang I. in Sunda Straits.)

Ecol. Primary forest and (open) jungle, also forest edges, in fertile volcanic loam, also on coral limestone, below 750 m.

Notes. A shrub ½-3 m to a tree 6-13(-21) m by 4-30 cm ø, bark grey smooth thin, the twigs may be drooping at the top. Leaves light or yellowish green, once reported darker above, and once glossy. Flowers with green calyx and (waxy) white-yellow corolla. Fruits (pale) green when ripe.

In one specimen the fruits are 4-merous.

The species is quite polymorphic. All specimens from Penang (the type locality) are glabrous, with narrow leaves: index 3.3–6.1, and small inflorescence: peduncle 1½–5 mm. All specimens from Perak are hairy, with rather wide obovate leaves: index 2.6–3.3, with broad base, and large inflorescences: peduncle 2½–3 cm. All specimens from Peninsular Burma and Siam ('*R. mollis*') are hairy, with still wider leaves: index 2.4–2.8, and very wide sepals. All specimens from West Java and Peutjang are glabrous, with 1 cm stalked large leaves with domatia, and lax inflorescences 5–8 cm long in all. KOORDERS 4498 and 4499 are placed here on account of their domatia. Except for the domatia, the above forms are not restricted to the districts mentioned, and in other provinces various forms have been found.

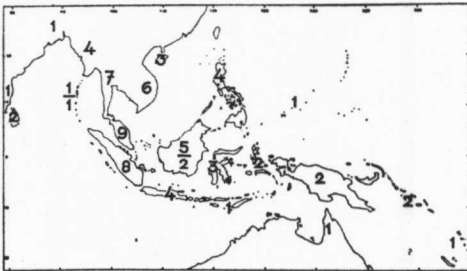


Fig. 3. *Rinorea*, number of species in Malesia and adjacent regions, the number of endemics, if any, below the hyphen.

6. *Rinorea macrantha* JACOBS, Blumea 15 (1967) 133, f. 1.

Twigs angular, glossy light brown, glabrous; branchlets terete, zig-zag. *Stipules* 7 mm long, brown, striate. *Leaves* probably spirally arranged, subsessile to ¾ cm petiolate; *blade* (sub)coriaceous, 15–33 by 5½–10 cm, widest about the middle; base blunt to obtuse and subcordate, top long-acuminate; midrib strong and prominent, veins regularly curved with c. 1½ cm between, reticulation distinct beneath, more or less scalariform; margin crenate; surfaces dull, and glabrous from the beginning. *Flowers* with several in lax lateral racemes 1–1½ cm long, bracts 2–3 mm long, pedicels 6–7 mm, jointed just above the middle. *Sepals* thin, 3½–5 by 2½–4½ mm, glabrous or nearly so. *Petals* thin, 6–9 by 2–3½ mm, glabrous. *Androecium* glabrous, filamental tube fleshy and distinctly 5-lobed, the filaments as long or shorter, anthers with a triangular dorsal appendage 1–2 times as long as the cells; ventral appendages none. *Pistil* club-shaped, brown-puberulous in the basal ½–⅔ part; ovules 6. *Fruit* unknown.

Distr. *Malesia*: W. Central Borneo.

Notes. For the slight differences between the two collections on which the above description has been based, see JACOBS, *l.c.*

A sterile collection from Singkep in the Lingga

Archipelago, BUNNEMBIER 7384 (BO) may also belong here.

7. *Rinorea javanica* (BL.) O.K. Rev. Gen. Pl. 1 (1891) 42; KOORD. Exk. Fl. Java 2 (1912) 625; J. J. SMITH in K. & V. Bijdr. 13 (1914) 64; BACK. & BAKH. f. Fl. Java 1 (1964) 194; JACOBS, Blumea 15 (1967) 134. — *Prosthesis javanica* BL. Bijdr. (1826) 867. — *Alsodeia haplobotrys* HASSK. Versl. Kon. Ak. Wet. 4 (1856) 137; Retzia *ed. nov.* (1858) 19; MIQ. Fl. Ind. Bat. 1, 2 (1859) 116. — *Alsodeia javanica* (BL.) MIQ. Fl. Ind. Bat. 1, 2 (1859) 117; OUDEM. in Miq. Ann. 3 (1867) 71; MIQ. Ann. 4 (1869) 216; BACK. Schoolfl. (1911) 68. — *Alsodeia hookeriana* KING, J. As. Soc. Beng. 58, ii (1889) 402; Ann. R. Bot. Gard. Calc. 5 (1896) 123, pl. 142A; RIDL. Fl. Mal. Pen. 1 (1922) 130. — *Alsodeia wrayi* KING, J. As. Soc. Beng. 58, ii (1889) 403; Ann. R. Bot. Gard. Calc. 5 (1896) 124, pl. 142B; RIDL. Fl. Mal. Pen. 1 (1922) 129. — *R. haplobotrys* (HASSK.) O.K. Rev. Gen. Pl. 1 (1891) 42; KOORD. Exk. Fl. Java 2 (1912) 624. — *R. wrayi* TAUB. in E. & P. Nat. Pfl. Fam. 3, 6 (1895) 329. — *Alsodeia minahassae* KOORD. Minah. (1898) 645. — *Alsodeia formicaria* ELM. Leaf. Philip. Bot. 5 (1913) 1850. — *R. formicaria* (ELM.) MERR. Philip. J. Sc. 12 (1917) Bot. 286; En. Philip. 3 (1923) 104. — *R. hookeriana* (KING) BURK. Bull. Misc. Inf. Kew (1935) 319; Dict. (1935) 1913.

Growth in flushes, internodes rather variable in length. Young twigs grooved, purplish to light-coloured but soon with grey bark; pith narrow; glabrous almost from the beginning to sometimes rather densely short-pubescent. *Leaves* largely distichous. *Stipules* 1–3(–3½) mm long, with broad base and narrow top, keeled, sometimes late caducous. Petiole 3–15 mm, leaving a conspicuous scar. *Blade* more or less thinly coriaceous, 10–17(–20) by 2¾–5½(–7) cm, widest at the middle or often well above, index (2.5–) 2.8–3.3(–4); base cuneate and slightly decurrent to seldom rounded, top acuminate; midrib flat to subprominent above, veins 5–9(–14) on either side, converging within the margin, comparatively slender, no domatia; reticulation distinct (less so in Indo-China), without much regularity; margins more or less distinctly dentate, rarely (sub)entire; surfaces dark green-brown with variants, mostly lighter underneath, dull but sometimes very glossy above, glabrous or with some hairs on the midrib beneath. *Inflorescences* mostly on the branchlets, axillary (sometimes a whole row of them on a leafless part of a twig), generally consisting of a bracteate pubescent axis 0.5–2.6 cm long, sometimes cluster-like or rarely simple to 3 cm long and then the flowers distichous, with 3–7 lateral cymes c. ½ cm long with a few to several flowers each; bracts resembling the stipules; pedicels 3–5 mm, jointed about the middle. *Sepals* more or less fleshy, triangular to elliptic, 1–2 by ¾–1 mm, outside with some hairs. *Petals* thin, 3 by 1–1½ mm, sometimes in the apical half the margins like pinched together, outside often with some hairs. Filamental tube about ½ part the total

length of the *stamens*, glabrous; filaments 0.2–0.3 part, sometimes hairy; anthers 0.3–0.2 part, glabrous; dorsal appendage broad, triangular, as long as or somewhat longer than the cells, ventral appendages about half as long as the dorsal one. *Ovary* sometimes hairy, with 3–9 ovules; style glabrous. *Fruit* subtended by the dried diverging perianth, on a very short stipe, globose to elliptic before dehiscence and c. 1½–2½ cm long; valves glabrous or short-hairy, dark-coloured, with some veins like a man's skin, leathery with woody back and top, the latter folded inwards upon dehiscence. *Seeds* 3–6, c. 8–9 by 6–7 mm, with irregular pattern of dark and light colour, sometimes evenly dark-coloured, hilus distinct.

Distr. Indo-China (only in Annam near Quang-tri); Southwestern and Peninsular Siam; in *Malesia* frequent in the everwet parts of Malaya; in Sumatra very rare and not in the northern part; in W. Java in several places; in the Philippines once found in Palawan; in Celebes once found in the NE. Peninsula.

Ecol. Mostly in primary, also in light forest, sometimes in swamp or peat forest, at low elevations and on hillsides up to 1000 m. No records from calcareous soil.

Notes. Tree 5–10 m with spreading hanging branches. Leaves bright and sometimes glossy green, paler beneath. Flower white to pale green. Capsules dark greenish brown or black, c. 1¾ by 1 cm, dehiscing explosively.

In BLUME's type specimen and some others the outer layer of the fruit is 4–5 mm thick and corky — a malformation?

Alsodeia formicaria owes its name to the small black ants which ELMER found inhabiting the hollow and sometimes bladder capsules, "passing in and out through the distinctly circular aperture at the top."

As the only collection from Borneo is one by KORTHALS, whose labelling was often inaccurate, this record is considered apocryphous; it may be from Sumatra.

8. *Rinorea longiracemosa* (KURZ) CRAIB, Fl. Siam. En. 1 (1925) 90; JACOBS, Blumea 15 (1967) 134. — *Alsodeia longiracemosa* KURZ, J. As. Soc. Beng. 39, ii (1870) 63; For. Fl. Burma 1 (1877) 70. — *Alsodeia cinerea* KING, J. As. Soc. Beng. 58, ii (1889) 403; Ann. R. Bot. Gard. Calc. 5 (1896) 124, pl. 143A; RIDL, Fl. Mal. Pen. 1 (1922) 130. — *Alsodeia cinerea* var. *hirsutiflora* KING, J. As. Soc. Beng. 58, ii (1889) 404; Ann. R. Bot. Gard. Calc. 5 (1896) 125; RIDL, Fl. Mal. Pen. 1 (1922) 130. — *Alsodeia macropyxis* CAPIT. Bull. Soc. Bot. Fr. 57 (1910) 395. — *R. macropyxis* (CAPIT.) MERR. En. Born. (1921) 411. — *R. gaultheriiflora* J. J. SMITH, Bull. Jard. Bot. Btzg III, 4 (1922) 231, t. 5; BACK. & BAKH, f. Fl. Java 1 (1964) 193. — *R. borneensis* MERR. Un. Calif. Publ. Bot. 15 (1929) 206.

Growth apparently in flushes, internodes of largely similar length. Twigs when young furrowed and more or less puberulous; branchlets somewhat crooked, the bark brownish or greyish, sometimes

dull purplish, corky with faint longitudinal ribs, pith narrow. *Leaves* mostly distichous. *Stipules* with broad base, (2–)4–14(–21) mm long, striate, more or less closely appressed, often late caducous. *Petiole* 2–10 mm. *Blade* firmly thin-coriaceous, to (3¾–)8–18(–22) by (1¾–)2½–5½(–7½) cm, widest about the middle, index 2.3–3.4(–4); base blunt to acute, top acuminate; midrib narrow, prominent on both sides, major veins about 6–11(–14) on either side, converging within the margins, their axils mostly with hairy domatia (not in North Borneo), secondary veins and reticulation lax and rather irregular; margin with small roundish teeth; surfaces dull, olive-green to brownish, with a greyish aspect, mostly somewhat lighter beneath, glabrous but sometimes the midrib above sparsely pubescent, rarely pilose on the veins beneath, too. *Inflorescences* axillary (sometimes the subtending leaf gone), on the mainland of Asia and in Sabang generally a simple, rather densely-flowered raceme to 9 cm long 1½ cm wide, initially resembling a cone due to the conspicuous bracts which are persistent, in Borneo and Java a lax-flowered panicle to 10 cm long, 3½ cm wide, with an occasional leaf or only stipules subtending the first branches, the bracts less conspicuous, and caducous; axes sometimes puberulous, bracts 2–3 mm, striate, pedicels 2–4(–6) mm, jointed in the basal or apical part. *Flower* when young conical, the calyx covering the basal half. *Sepals* thin, (sub)equal, more or less triangular, surface glabrous or pubescent, margin ciliate. *Petals* thin, straight, (2½–)3½–4(–5½) by 1–3 mm, glabrous, sometimes sparsely ciliate. *Androecium* consisting of a filamental tube 0.1–0.3 part of the total length, filaments 0.1–0.4 part, mostly glabrous, anthers 0.5–0.6 part, bearded at the base, the dorsal appendage broad, triangular, nearly as long as the thecae or somewhat longer, ventral appendages nearly reaching the top of the dorsal one. *Ovary* mostly glabrous, sometimes sparsely hairy, style glabrous, ovules 6. *Fruit* in Asia (few known) globose before dehiscence, 1¼–1½ cm ϕ with seeds subglobose 4 mm ϕ , in Borneo (well-known) on woody stalk, glabrous, before dehiscence 3-sided with blunt corners, 2¾–4 cm long, 2½ cm wide, the base not or scarcely narrowed, valves leathery, veined, mostly 2-layered after dehiscence, with woody back; the seeds obconical, c. 8 mm long, 7 mm ϕ . *Seeds* to 6 in number, with a circular depression at the place of insertion, and evenly straw-coloured.

Distr. In SE. and Peninsular Burma; Indo-China (Laos: near Vientiane, Cambodia, and Blao NE of Saigon); Hainan (one coll.); in Siam at 15° N in the West, and further S in the SW and the Peninsula, also in SE. Siam. In *Malesia* in Sabang I. (N off Sumatra), Malay Peninsula (Perak and Trengganu), W. Java, Borneo (northern central Kalimantan, Sarawak, Brunei, and very common in Sabah); scattered in all other regions mentioned.

The sole record from India, Assam, is uncertain, KANJILAL & DAS having "not found it anywhere in this Province".

Ecol. Mostly primary forest, but also from secondary, bamboo and swampy forest and forest edges, on clayey or loamy soil, also from limestone and basalt, often by streams mostly at low altitude but in Hainan from 1000 m.

In the monsoon area generally at least partly deciduous, the fresh leaves then cropping out at flowering time.

Notes. A shrub, sometimes climbing or sprawling, (1/2–)1 1/2–4 m, to a treelet or small unbuttressed tree 3–12 m. Leaves light green; calyx (greenish) white, corolla (yellow) white, anthers yellow, the dorsal appendage white with brown base. Fruit green when more or less ripe, to light brown when fully ripe.

The species is very polymorphic and looks different in various parts of its area, but although in Sabah it is both strikingly common and uniform ('*borneensis*'), there is not enough reason for the recognition of subspecies. The material from Java ('*gaultheriiflora*') resembles that of Sabah, although the leaves in the former are smaller. The material of *R. macropyxis* (two out of the four collections outside Sabah) with its domatia, hairy leaves 7–9 cm long, and hairy twigs is unique for Borneo, but agrees quite well with CHEW 63 from Malaya. The Sabah type of inflorescence is also found in SCHMID anno 1961 from Blao in S. Vietnam. Moreover, throughout the area, all the examined flowers have a great mutual resemblance.

9. *Rinorea virgata* (THW.) O.K. Rev. Gen. Pl. 1 (1891) 42; JACOBS, *Blumea* 15 (1967) 135. — *Scyphellandra virgata* THW. En. Pl. Zeyl. (1858) 21. — *Alsodeia minutiflora* RIDL. J. Str. Br. R. As. Soc. 59 (1911) 71; Fl. Mal. Pen. 1 (1922) 131.

Growth apparently in flushes. Twigs mostly long, slender, but rarely crooked; when young angular, greenish, often puberulous with curved hairs. Branchlets terete, with longitudinal ridges of brown-grey bark; the very short axillary brachyblasts sometimes producing an extra, smaller leaf. Leaves generally distichous, on the same plant variable. *Stipules* triangular to subulate, 1–2 mm long, brownish. Petiole 1–5 mm, hairy as the twig. *Blade* firmly herbaceous to thinly coriaceous, more or less rhombic, 1–7 (–13 1/2) by 3/4–3 (–6) cm, index 1.7–4.7; base cuneate to rounded, top acute to obtuse or sometimes acuminate, occasionally mucronate; midrib slender, above mostly prominent, major veins 2–6 on either side, thin; no domatia; reticulation lax and irregular; margins dentate; surfaces sometimes with a few hairs on the midrib above, otherwise glabrous, dull, colorless, greenish. Dioecious; *flowers* with a few apparently spirally arranged on the knob-like brachyblasts; bracts persistent, triangular, about 1/2 mm long, brownish; pedicels slender, 3–6 mm, jointed near the base, puberulous. *Sepals* more or less equal, thin, often triangular, 1–2 by 3/4–1 mm, sometimes hairy. *Petals* thin, 1 3/4–3 1/2 by 3/4–1 1/2 mm, glabrous, sometimes the top recurved, the margin sometimes undulate. *Androecium* about as long as the petals, glabrous,

in the ♂ flowers the anthers sessile, about as wide as the petals, with outside at the base an elongate scale 1/4–1/2 mm long; thecae 0.4–0.5 part of the total length of the anther, dorsal appendage tapering towards the top, ventral appendages none or vestigial. In the ♀ flowers the staminodes subsessile, sometimes narrower than the petals, the basal gland at the outside minute, the thecae abortive. *Gynoecium* glabrous, as long as the petals; in the ♀ flowers the ovary globose with thick style and (5–)6 ovules; in the ♂ flowers ovary none, only a slender style rising from a flat receptacle. *Fruit* before dehiscence (sub)globose, c. 1 cm ø, after dehiscence valves spreading, olive-green, leathery, veined. *Seeds* subglobose, 2 1/2–3 by 2–2 mm, even straw-coloured, with distinct raphe.

Distr. Ceylon; Burma, NE. part: LACE 5462; Siam (scattered, not in the E. part); Laos (near Pak Lay W of Vientiane: KINGDON WARD 9026); S. Vietnam (scattered S of 12°30'); Hainan. In *Malesia*: Perlis in the very NW of the Malay Peninsula.

Ecol. In more or less open evergreen forest, in thickets, in teak plantations, on dry slopes and in ravines, mostly on rocky, sometimes on sandy soil, up to 600 m.

Note. A shrub (0.2–)0.5–1.5 (–4) m, rarely a tree 2 m. Leaves paler green beneath. Flowers white.

10. *Rinorea macrophylla* (DECNE) O.K. Rev. Gen. Pl. 1 (1891) 42; JACOBS, *Blumea* 15 (1967) 135. — *Alsodeia macrophylla* DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 468, t. 19 = Herb. Timor. Descr. (1835) 100, t. 19; MIQ. Fl. Ind. Bat. 1, 2 (1859) 115; OUDEM. in Miq. Ann. 3 (1867) 69. — *Alsodeia horsfieldii* MIQ. Fl. Ind. Bat. 1, 2 (1859) 117; MIQ. Ann. 4 (1869) 216; BACK. Schoolfl. (1911) 216. — *Alsodeia dasycaula* MIQ. Sumatra (1860) 391; Ann. 4 (1869) 216; RIDL. Fl. Mal. Pen. 1 (1922) 129. — *Alsodeia horsfieldii* TURCZ. Bull. Soc. Nat. Moscou 36 (1863) i 559. — *Alsodeia membranacea* KING, J. As. Soc. Beng. 58, ii (1889) 402; Ann. R. Bot. Gard. Calc. 5 (1896) 122, pl. 140B. — *R. horsfieldii* (MIQ.) O.K. Rev. Gen. Pl. 1 (1891) 42; KOORD. Exk. Fl. Java 2 (1912) 625; J. J. SMITH in K. & V. Bijdr. 13 (1914) 68; BACK. & BAKH. f. Fl. Java 1 (1964) 194. — *R. palawanensis* MERR. Philip. J. Sc. 1 (1906) Suppl. 210; En. Philip. 3 (1923) 104, incl. var. *mollis*. — *Alsodeia hispida* RIDL. J. Str. Br. R. As. Soc. 6 (1912) 50. — *R. dasycaula* (MIQ.) CRAIB, Fl. Siam. En. 1 (1925) 88; GAGN. Fl. Gén. I.–C. Suppl. 1 (1939) 194. — *R. yatesii* MERR. Pap. Mich. Ac. Sc. 19 (1934) 173.

Growth apparently gradually; internodes of similar length. Young parts velvety with persistent brownish hairs to sparsely puberulous. Twigs initially dark purplish tinged, later greyish, lengthwise striate, terete, comparatively thick with wide pith, often slightly zig-zag, stipular scars indistinct. Leaves mostly distichous. *Stipules* not always adpressed, 1 1/2–5 (–6) mm, subulate and not visibly striate, often late caducous. Petiole 3/4–2 cm. *Blade* before unfolding curved inward like a bow, of

papery texture, $10\frac{1}{2}$ –25 by 4 – $8\frac{1}{2}$ cm, widest at the middle to well above, index (2.2)–2.6–3.9 (–4.2); base more or less tapering and slightly decurrent, top acuminate; midrib and particularly the veins thin, flat above, no domatia, about 7–10(–12) major veins on either side converging within the margin, secondary veins and reticulation lax and rather irregular, dark-tinged; margins from base to top more or less distinctly dentate-serrate; surfaces dull and mostly colorous in variants of brown and green, glabrous to sparsely hairy on the midrib and veins mainly beneath. *Inflorescences* mostly densely hairy, in structure like those of *R. bengalensis* but hypophylls more scale-like, the axes no more than 4 in number, with c. 5–25 flowers each and these but seldom in a clearly distichous arrangement, the pedicel scars mostly obscure; bracts minute, triangular; pedicels 3–10 mm, jointed near the base. *Sepals* \pm equal, fleshy, $1\frac{1}{2}$ –3 mm long, bluntly triangular to elliptic, dark-coloured, hairy outside. *Petals* fleshy, $2\frac{1}{2}$ – $5\frac{1}{2}$ mm long, widest about the middle, more or less diverging, top sometimes recurved, more or less hairy outside. *Androecium* often glabrous, consisting of a filamental tube 0.2–0.4 part of the total length, sometimes with a few hairs, filaments up to 0.2 part, rarely hairy, and anthers 0.5–0.8 part, the dorsal appendage broad, triangular, 1–2 times as long as the thecae, ventral appendages tiny to half as long as the dorsal one, sometimes wanting; sometimes a few hairs on the base of the thecae and on the back of the connective between. *Ovary* hairy, each carpel with 1 ovule; style glabrous. *Fruit* subtended by the dry spreading or reflexed sepals and petals, before dehiscence (sub)globose, c. $1\frac{1}{4}$ cm ϕ , valves leathery, dark purplish brown, sparsely hairy; *seeds* 3, c. 6–7 by 5 mm, glossy brown, with distinct raphe.

Distr. Asia and *Malesia*; in the very east of Siam and in Indo-China at \pm 16–17° N, SE. Siam, and Peninsular Siam southwards to Pahang in the Malay Peninsula (also Langkawi Is.); Sumatra (East Coast Res. and Lampongs, ? Palembang); Java (frequent on Nusa Kambangan, rare in Central Java, also Kangean Is.); Lesser Sunda Is. (Timor); Philippines (on the smaller islands S of the 12th parallel; Palawan, Culion, Guimaras, Cebu, Jolo). Scattered everywhere.

Ecol. Light forest, secondary forest, teak forest, jungle, forest edges, mostly on limestone, sometimes on other rich soils, below 600 m.

Notes. A shrub laxly branched often crooked (although in the herbarium many twigs are long and simple) 1–3 m tall, to a tree 6 m tall. Leaves bright green. Flowers with pale green calyx and yellow-green-white corolla. Fruits first pale green, greyish brown when ripe.

Occasionally the fruit 4-merous with 4 seeds.

11. *Rinorea iliaspaiei* JACOBS, *nov. sp.*

Stipulae longe-triangularis, persistentes. *Folia* majora angusta minute serrata, basi obtusa apice acuminata. *Flores* majores, stamminous gioris anthera appendice dorsale magna late triangulare

appendicibusque ventralibus distinctis, ovario cylindrico dense pubescente ovulis 9. Fructus major apicem versus pubescens seminibus 9. — Typus: S 28099 ILIAS PAIE (E, K, L holo, SAR, SING), Borneo, Sarawak, Serian subdistr., Bk. Emperan Ra'a, fl. 30-IX-1968.

Branchlets straight, with short internodes and distinct leaf scars, bark greyish. *Stipules* rather adpressed, long-triangular, dull dark purple-brown, to 12–15 mm long (shorter on the smaller branchlets), base half-amplexicaul, more or less distinctly keeled and/or striate, initially with minute hairs, long persistent. *Petiole* 3–7 mm. *Leaf* blade coriaceous, to (10)–15–27 by (2)–3– $6\frac{1}{2}$ cm, widest somewhat above the middle, index (3.5)–3.8–5; base blunt and slightly unequal, top gradually and long-acuminate; midrib narrow, prominent on both sides, major veins c. 13–17 on either side, with often in between a secondary vein half as long, the major ones converging and connected to an intramarginal vein, reticulation rather irregular; margin with minute dark coloured teeth c. $\frac{1}{3}$ – $\frac{1}{2}$ cm apart; surfaces dull, above olive-green to brownish, beneath somewhat paler, glabrous (youngest leaves unknown); no domatia. *Inflorescences* axillary (sometimes the subtending leaf gone), axis single or branched, 2–3 cm long; bracts like the stipules but smaller; pedicel c. 4 mm, initially with minute hairs, jointed in the apical part. *Sepals* rather unequal, the outer ones fleshy, 4 mm ϕ , outside with some adpressed hairs, the inner ones membranous, 6 by 5 mm, glabrous but ciliate at the top. *Petals* not very fleshy, rather concave, glabrous, 8 by 3 mm, top slightly cucullate. *Androecium* 3 mm high, glabrous, filamental tube c. 0.3 part of the total length, free portion of the filaments c. 0.2–0.3 part, anthers 0.4–0.5 part, the dorsal appendage broad, triangular, somewhat longer than the thecae, ventral appendages nearly reaching the top of the dorsal one. *Ovary* cylindrical, densely soft white hairy; style glabrous; ovules 9. *Fruit* (only known after dehiscence) with thick leathery valves $2\frac{1}{2}$ – $3\frac{3}{4}$ cm long, wrinkled and, especially towards the top, with short soft patent hairs. *Seeds* 9 in number, obconical, 8 by 7 by 6 mm, with a circular depression at the place of insertion, evenly straw-coloured.

Distr. *Malesia*: Borneo (Sarawak, 4 collections).

Ecol. Mixed dipterocarp and kerangas forests at 100–600 m, on sandstone or clayey soil or shale. *Fl. Sept., fr. March, Aug., Nov.*

Notes. Tree 2–4 m tall. Flower buds white, when open yellow with reddish white stamens. Ripe fruit green.

Close to *R. longiracemosa* (to which S 18905 and SF 35738 were reckoned in the Identification List; actually they belong here, like S 20935), and to *R. macrantha*; the differences have been pointed out in the Latin diagnosis.

Excluded

Alsodeia chrysochrysis MIQ. Sumatra (1861) 390 = *Paropsia vareciformis* (GRIFF.) MAST. (*Flacourtiaceae*).

Alsodeia dubia ELM. Leaff. Philip. Bot. 8 (1915) 2875 = *Trigonopleura malayanum* HOOK. f. (Euphorbiaceae).

Alsodeia glabra BURGERSD. in Miq. Pl. Jungh. (1852) 122. — *Rinorea glabra* (BURGERSD.) O.K. Rev. Gen. Pl. 1 (1891) 42 = *Celastrus paniculatus* WILLD. (Celastraceae).

Alsodeia grandis MIQ. Sumatra (1861) 391 =

Eriobotrya bengalensis (ROXB.) HOOK. f. (Rosaceae). *Rinorea pulgarensis* ELM. Leaff. Philip. Bot. 5 (1913) 1849 = *Diospyros cauliflora* BL. (Ebenaceae).

Vareca moluccana ROXB. Fl. Ind. ed. 2, 1 (1832) 647 = *Pittosporum moluccanum* (LAMK) MIQ. (Pittosporaceae). In Fl. Mal. I, 5 (1954) 33 it was but tentatively assigned to *Rinorea*.

2. AGATEA

A. GRAY, Proc. Am. Ac. Arts Sc. 2 (1852) 323; Bot. U.S. Expl. Exp. 1 (1854) 89; BRONGN. Bull. Soc. Bot. Fr. 8 (1861) 80 ('*Agation*'); B. & H. Gen. Pl. 1 (1862) 118; BRONGN. & GRIS, Ann. Sc. Nat. V, 1 (1864) 346; GUILL. Ann. Mus. Col. Mars. II, 9 (1911) 98; Bull. Mus. Hist. Nat. Paris 17 (1911) 350; *ibid.* 26 (1920) 362; F. SARASIN & ROUX, Nova Caled. B I, 3 (1921) 184; BAKER f. J. Linn. Soc. Bot. 45 (1921) 263; MELCH. in E. & P. Nat. Pfl. Fam. ed. 2, 21 (1925) 360; GUILL. Bull. Soc. Bot. Fr. 89 (1942) 20; A. C. SMITH, Sargentia 1 (1942) 57.

Scandent shrubs to lianas, innovations mostly laxly pubescent, indumentum sometimes persistent. *Twigs* slender, with dull dark violet bark finely longitudinally striate. *Leaves* in a spiral, petiolate. *Stipules* deltoid, *c.* 1 mm long, persistent, often inconspicuous. *Leaf* blade thinly to thickly coriaceous, *c.* 9–13 by 4–9 cm, index *c.* 1.6–2.2(–2.6); widest about the middle to somewhat lower; base acute to rounded, top acute to abruptly acuminate with a short tip; veins (3–)5–7(–10) on either side, reticulation more or less distinct; margin entire to crenate; surfaces dull, glabrous. *Inflorescences* racemes but mostly panicles, few to 30 cm long, axillary and terminal mostly combined, pubescent; bracts small, triangular; pedicels with 2 bracteoles above the base, articulated higher up. *Flowers* bisexual, zygomorphic. *Sepals* subequal, 1–2 mm, covering a minor part of the bud, not persistent. *Petals* unequal, sessile, the posterior also outer pair *c.* 3–4 mm, symmetrical, the middle pair somewhat larger, asymmetrical, the inner, anterior one *c.* 7–10 mm, the base gibbose, the apical part wide, thus making a lip, in bud longitudinally rolled up, surface sometimes woolly above. *Androecium* equalling the smallest petals, stamens subequal, (2–)4 connate at the base and converging at the top but the posterior one apart; the two anterior ones at the base with a fleshy outgrowth into the sac of the odd petal; filaments broad, flat; inner locules longer than the outer ones, their thecal appendage small, single or bifid or double or vestigial; connective appendage about twice as long as the anther, triangular, brown-membranous. *Gynoecium* slightly exceeding the androecium, ovary subglobose, sometimes hairy, with 3 placentas and many ovules; style S-curved, glabrous, stigma anterior, clavate. *Fruit* (see note) a capsule, elongate, 1¼–5 cm, with 3 leathery to woody valves. *Seeds* many, imbricately arranged, flat, with an irregularly elliptic wing; testa with a hard black inner layer and membranous yellowish outer layer.

Distr. New Guinea, Solomons, New Caledonia, Fiji, Tonga. Number of species probably 1; see below. Ecol. Primary rain-forest in the lowland.

Notes. The above generic description covers the whole diversity of the genus; the specific description applies to the New Guinea materials only. For the insignificant differences with the conspecific *A. salomonensis* MERR. & PERRY, J. Arn. Arb. 24 (1943) 209, see the description of the only collection, KAJEWSKI 2309 (A! BO! BRI! P!), from Bougainville.

A cursory inspection of several dozens of Fiji and New Caledonian plants revealed that no two specimens match in all details — in climbers not an unusual feature. But while all plants from Fiji were placed under *A. violaris*, in New Caledonia, where there is no more diversity than in Fiji, 7 species were described, on trifling characters and mostly without fruits; see GUILLAUMIN, Bull. Soc. Bot. Fr. 89 (1942) 20. The differences can be summarized: in Fiji generally the young parts are sometimes glabrous, the stipules sometimes wanting, the leaves acute and tending to be ovate, with (sub)entire margin, the in-

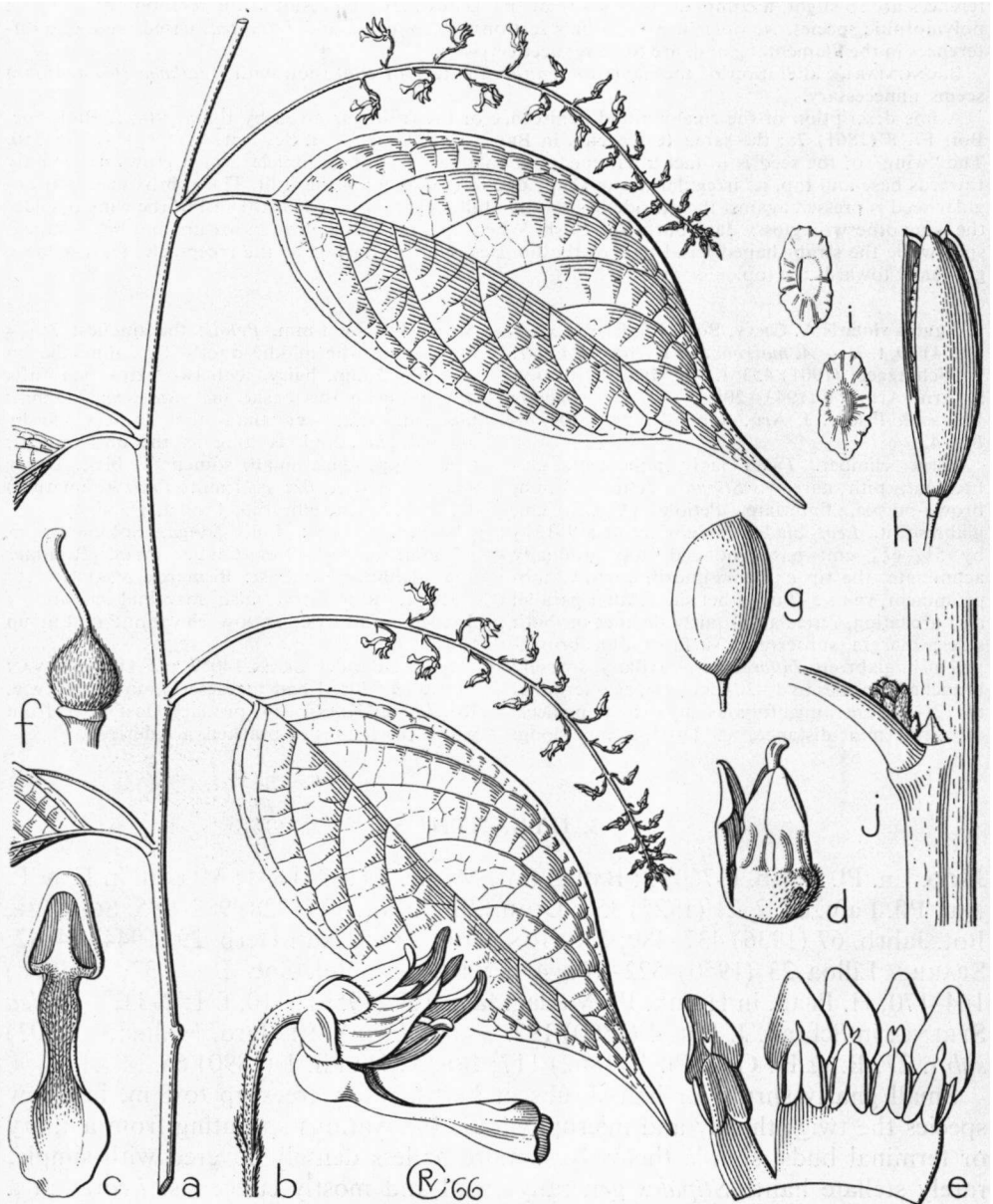


Fig. 4. *Agatea violaris* A. GRAY. a. Habit, $\times \frac{2}{3}$, b. flower, $\times 4$, c. the odd petal, from above, $\times 6$, d. androecium and stigma, from the right, $\times 6$, e. stamens, from inside, $\times 8$, f. gynoecium, from the right, $\times 6$, g. fruit, immature, $\times \frac{2}{3}$, h. another fruit, mature, with i. seeds, both $\times \frac{2}{3}$, j. leaf axil, $\times 6$ (a, g, j BRASS 14057 from New Guinea, b-f A. C. SMITH 66, h-i A. C. SMITH 6287, both from Fiji).

florescence up to 7(–14) cm, the lip 5–7 mm; in New Caledonia the young parts are mostly hairy, the stipules always present, the leaves acuminate and widest at the middle, with often an incised margin, the inflorescences up to 6–20 cm, the lip 6–9½ mm. The few fruits collected in New Caledonia are 12–34 mm long, the valves thick-coriaceous and covered with a grey felt, the seeds are c. 11 by 6–7 mm. The dozen or so fruiting numbers from Fiji have valves 23–50 mm long, thin-woody and mostly glabrous but in SEEMANN 12 (unripe) and A. C. SMITH 346 (ripe) they are more or less felty, too; the seeds are 13–22 by 9–10 mm, depending on the size of the fruit. As the fruit characters seem to overlap, and regional differences are so slight, a comprehensive study of this genus may well result in the retention of only one polymorphic species, *A. violaris*. MELCHIOR's sections *Macrobotrys* and *Euagatea*, based on subtle differences in the filamental gland, are to be reduced anyway.

BRONGNIART's alteration of the name to *Agation* for fear of confusion with *Agathaea* (*Compositae*) seems unnecessary.

A fine description of the ripening and dehiscence of the fruit was given by BRONGNIART, Bull. Soc. Bot. Fr. 8 (1861) 78; the same text occurs in BRONGN. & GRIS, Ann. Sc. Nat. V, 1 (1864) 346–350. The "wing" of the seed is in fact a flattened and enlarged part of its funicle, which grows out mainly towards base and top, its irregularities in shape due to cramming in the fruit. The approximately triangular seed is pressed against the outside of its wing, dull grey-brownish as is the rest of the wing outside; the wing otherwise glossy dark purple-blackish. When ripe, the valves, firm in texture and boat-shaped, split while the strap-shaped basal part of the funicles remain attached to the receptacle, tearing loose gradually towards the top.

1. *Agatea violaris* A. GRAY, Bot. U.S. Expl. Exp. 1 (1854) 89, t. 7. — *A. macrobotrys* K. SCH. & LAUT. Fl. Schutzgeb. (1901) 453, t. 14; MERR. & PERRY, J. Arn. Arb. 24 (1943) 208. — *A. salomonensis* MERR. & PERRY, J. Arn. Arb. 24 (1943) 209. — Fig. 4.

Large climber. Twigs laxly pubescent, glabrescent, pith narrow. Stipules deltoid, 1 mm, brown-purple, fimbriate. Petiole 1½–2½ cm, glabrescent. Leaf blade thin-coriaceous, 9–12½ by 5¼–6¾ cm; base rounded, top gradually acuminate, the tip c. 1 cm; midrib narrow, subprominent, veins 5–7 on either side, rather parallel and arcuating, reticulation fairly distinct on both sides; margin subserrate; surfaces dull brown-greenish, glabrous. Inflorescences axillary, sparsely branched racemes to 8(–20) cm long, also terminal to 17(–20) cm long, fulvous pubescent; pedicels at some mm distance, c. (3–)5–8 mm long.

Sepals 1–2 by 1 mm. Petals: the smallest 3½–4 by 1½ mm, the middle ones 4 by 2 mm, the lip 7(–9) by 5 mm, hairy, with two extra hair tufts distally near the basal sac. Stamens 2–3 mm; filaments narrower than the anthers; fleshy appendages about as long as the anther cells; thecal appendage small, sometimes bifid. Ovary sparsely pilose, size c. 1 mm. Fruit (immature) 3¼ by 1¾ cm, ellipsoid, brown, glabrous.

Distr. Pacific: Fiji, Tonga, Solomons; in Malesia: northern New Guinea (West: Rouffaer and Idenburg R.; East: Bismarck Mts).

Ecol. Rain-forest, also marginal growth of flooded rain-forest, at low elevation; in Fiji up to 1000 m.

Note. Besides BRASS 14057 and DOCTERS VAN LEEUWEN 9708, I had the description of the type, RODATZ & KLINK 236, probably lost in B, from which the figures in brackets are derived.

3. HYBANTHUS

JACQ. En. Pl. Carib. (1760) 2; BAILL. Bot. Médic. 2 (1884) 841; MELCH. in E. & P. Nat. Pfl. Fam. ed. 2, 21 (1925) 357; DOMIN, Bibl. Bot. 89 (1928) 982–985; SCHULZE, Bot. Jahrb. 67 (1936) 437–489; MORTON, Contr. U.S. Nat. Herb. 29 (1944) 74–82; SPARRE, Lilloa 23 (1950) 522–574, 4 pl.; ROBSON, Bol. Soc. Brot. 32, ii (1958) 164–170; H. PERR. in Humb. Fl. Madag. fam. 139 (1959) 3–10, f. 1: 2–11. — *Solea* SPRENG. in Schrad. J. Bot. 4 (1800) 192. — *Ionidium* VENT. Jard. Malmais. (1803) sub t. 27; B. & H. Gen. Pl. 1 (1862) 117; BOERL. Handl. 1 (1890) 65.

Small gnarly shrubs or half-shrubs or herbs, rarely trees up to 8 m, in a few species the twigs thorny and microphyllous. Innovations sprouting from axillary or terminal buds, simple themselves, more or less densely covered with simple, rarely stellate hairs. Stipules generally small and mostly caducous. Leaves in a spiral or rarely (sub)opposite, often herbaceous, sometimes leathery, more or less sessile with a tapering base, to c. 15 by 4 cm, but mostly smaller to sometimes almost needle-shaped, margin entire to incised, rarely thickened underneath, the



Fig. 5. *Hybanthus enneaspermus* (L.) F.v.M. in Sumbawa, Lesser Sunda Islands (photogr. DE VOOGD).

teeth sometimes glandular. *Flowers* generally solitary in the leaf axils, rarely in more or less reduced axillary cymes or dichasia up to several cm long or in raceme-like elongated monochasia, rarely in a terminal leafy panicle; bracts mostly present; pedicel slender, with 2 bracteoles beneath an articulation, the top curved downwards to give the flower an horizontal position. Flower 0.3–2 cm, bisexual, but rarely cleistogamous, zygomorphic. *Sepals* subequal, small, more or less triangular, persistent, rarely the margin with deep incisions. *Petals* unequal, persistent, posterior ones small and straight, middle ones longer and falcate, anterior one extended to a lip, with a claw more or less deeply saccate to shortly spurred and distinct blade often hairy above. *Filaments* free or seldom partly connate, sometimes short; the anterior pair with a patent gland at the base outside; anthers with rounded to elongate thecae (which rarely have an appendage at the top) and a distinct membranous connective appendage. *Ovary* with 3 placentas bearing

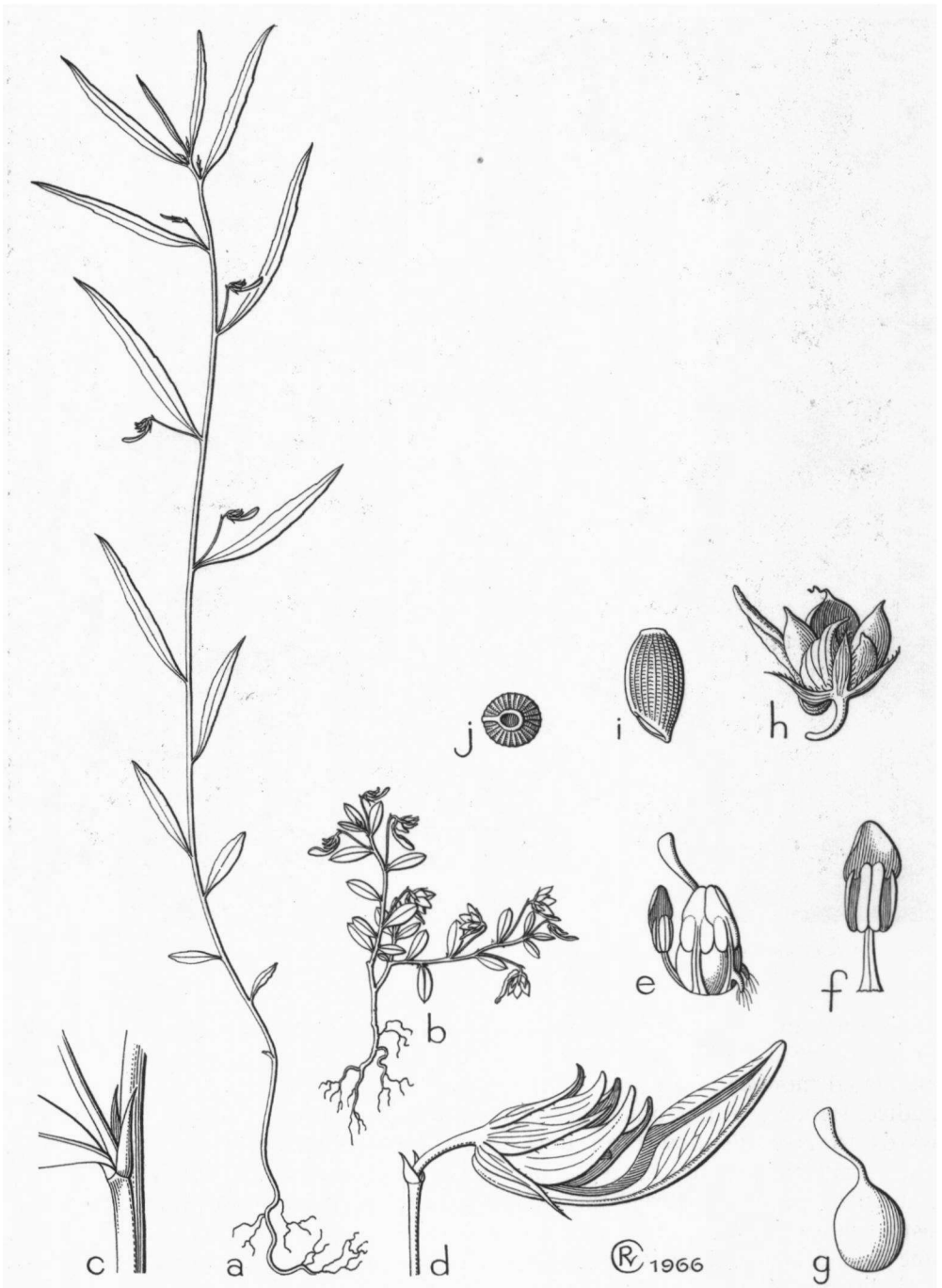


Fig. 6. *Hybanthus enneaspermus* (L.) F.v.M. *a*, *b*. Two different plants, $\times \frac{2}{3}$, *c*. stipules, $\times 8$, *d*. flower, $\times 6$, *e*. filaments and pistil, also from the right, $\times 8$, *f*. stamen from inside, $\times 12$, *g*. pistil, $\times 8$, *h*. open fruit surrounded by floral parts, $\times 3$, *i*. seed, $\times 8$, in *j*. from above (*a*, *d*-*g* BRASS 8434, *b*, *c* BS 27307 RAMOS, *h*-*j* JENSEN 313).

3–24 ovules; style S-shaped with anterior stigma. *Fruit* subtended by the dried up flower, c. 1 cm in size, subglobose before maturity, capsular with 3 leathery valves. *Seeds* a few mm, ellipsoid, mostly with a small caruncula.

Distr. Tropical and subtropical regions of the world, preferring a dry period. The number of species that will stand in a critical monograph is hard to estimate; there may be about 50 in the New World, some in Africa and Madagascar, some in Australia, a few woody ones in New Caledonia. The one *Malesian* species is palaeotropical (seems not to occur in New Caledonia) and possibly pantropical.

Notes. The literature cited under the genus refers chiefly to the most recent revisions in all parts of the world. The name was in 1905 conserved over *Calceolaria* LOEFL. 1758. The above description applies to the entire genus; it was largely based on SCHULZE. The specific description below was made on material from Malesia, where only part of the diversity of the species is represented.

1. *Hybanthus enneaspermus* (L.) F. v. M. *Fragm. Phyt. Austr.* 10 (1876) 81; BACK. *Onkr. Suiker.* (1930) 454, pl. 429; ROBSON, *Fl. Zambes.* 1 (1960) 254, t. 40; TENNANT, *Kew Bull.* 16 (1963) 431. — *Viola enneasperma* L. *Sp. Pl.* (1753) 937. — *Ionidium enneaspermum* (L.) VENT. *Jard. Malmais.* 1 (1803) sub t. 27; GING. in DC. *Prod.* 1 (1824) 308; DALZ. & GIBS. *Bombay Fl.* 1 (1861) 12; OUDEM. in *Miq. Ann.* 3 (1867) 72; *Miq. Ann.* 4 (1869) 217; MERR. *En. Philip.* 3 (1923) 106. — *Ionidium heterophyllum* VENT. *Jard. Malmais.* 1 (1803) sub t. 27; BACK. *Schoolfl.* (1911) 66. — *Ionidium frutescens* BL. *Bijdr.* (1825) 58. — *Ionidium thymifolium* PRESL, *Rel. Haenk.* 2 (1835) 97, non Bot. *Bemerk.* (1844) 11, nec MERR. *Philip. J. Sc.* 10 (1915) Bot. 191. — *Ionidium molle* TURCZ. *Bull. Soc. Nat. Moscou* 27, ii (1854) 338. — *Ionidium zippelii* OUDEM. in *Miq. Ann.* 3 (1867) 73. — *H. suffruticosus* (L.) BAILL. *Bot. Médic.* 2 (1884) 841; BACK. & BAKH. *f. Fl. Java* 1 (1963) 194. — Fig. 5, 6.

Herb 15–60 cm tall, more or less profusely branched, often woody at the base; young stems angular, more or less pubescent. *Stipules* triangular to subulate, 1–2 mm long, thin in texture and light in colour, sometimes fimbriate towards the base, the tip sometimes glandular. *Leaves* spirally arranged, herbaceous, in one plant varying somewhat in size; in different plants 2–7 cm long, 2–17 mm wide, index c. 2.4–20, widest sometimes above the middle becoming spatulate; base decurrent sometimes into a petiole 5–7 mm, top acutish or blunt to gradually acuminate, often with a mucro; margin entire to serrate or remotely crenate. *Flowers* solitary; pedicels filiform, $\frac{3}{4}$ –2(–4) cm; bracteoles at the joint in the upper part, their tip sometimes glandular. *Sepals* subequal, triangular, membranous, 2–4 by $\frac{3}{4}$ –1 mm, glabrous or ciliate. *Petals*: posterior pair $2\frac{1}{2}$ – $3\frac{1}{2}$ by $\frac{3}{4}$ –1 mm, middle pair $2\frac{3}{4}$ –4 by $1\frac{1}{2}$ mm, falcate; odd one c. $5\frac{1}{2}$ –19 mm long, the lip 4–10 mm wide, the base 1–2 mm saccate. *Stamens* c. 2–3 mm long, the filaments and the dorsal appendage each c. 0.3 times that long, the anther c. 0.4 times; anterior stamens with a small recurved fleshy appendage, glabrous or hairy, sometimes their connective woolly outside. *Pistil* glabrous, ovary subglobose, $\frac{3}{4}$ – $1\frac{1}{2}$ mm \varnothing , the placentas each bearing 2–5 ovules attached in the middle; style $1\frac{1}{4}$ –2 mm long. *Fruit* subglobose, 4–5 mm \varnothing , valves boat-shaped, eventually

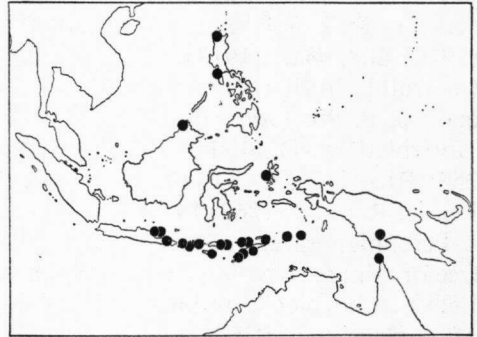


Fig. 7. Distribution of *Hybanthus enneaspermus* (L.) F.v.M. in Malesia.

compressed, light green, each with 2–3 seeds which are ellipsoid c. 2 by 1 mm, straw-coloured, lengthwise ribbed, at the base obliquely truncate, with distinct raphe, the top with a shallow crater.

Distr. Widely in Africa and Madagascar, scattered in India and Ceylon, in SE. China and Hainan, a few localities in the Indochinese Peninsula, but not in Peninsular Thailand. In *Malesia*: E. Java (Sumbarwaru and Baluran in the very northeast), also Madura I.; Lesser Sunda Is.; Borneo (Kudat in NW. Sabah); the Philippines (Ilocos Norte in Luzon, Cotabato in Mindanao, Golo I.; Moluccas (Ternate, Kai Is.); New Guinea (SW. Papua) and Thursday I. in Torres Straits; tropical Australia. Fig. 7.

Ecol. With irregular frequency in monsoon areas, at roadsides, savannahs, grasslands, pastures, in the open or sometimes in shade, on sandy or calcareous or volcanic soils; generally at low altitudes, but in Timor to 750 m, in Flores to 1200 m.

Notes. After study of the type and other materials at the British Museum and Kew, I am inclined to agree with Mr J. R. TENNANT's conception of the species. With his excellent paper on African, Indian, and Chinese *Hybanthus* handy, only the names recorded for Malesia need to be evaluated here and the number of references can be restricted to a minimum.

AS Mr TENNANT found out, DALZELL &

GIBSON, *l.c.*, were probably the first to make a choice between the two Linnean epithets *enneasperma* and *suffruticosa*, as early as 1861.

It seems that *Ionidium frutescens* BL. was based on *Polygala frutescens* BURM. Thes. Zeyl. (1737)

195, t. 85, or on *Ionidium frutescens* ROEM. & SCHULT. Syst. Veg. 5 (1819) 394; GING. in DC. Prod. 1 (1824) 311 (which in turn may have been based on BURMAN's species), from Ceylon and India, but BLUME refers to none of them.

4. VIOLA

LINNÉ, Gen. Pl. ed. 5 (1754) 402; Sp. Pl. (1753) 933; BL. Cat. Gew. Buitenzorg (1823) 57; Bijdr. (1825) 57; KORTHALS, Ned. Kruidk. Arch. 1 (1848) 357; BURGERSDIJK in Miq. Pl. Jungh. 1 (1852) 118; OUDEMANS in Miq. Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 73; MIQ. Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 217; BOISSIEU & CAPITAINE, Bull. Soc. Bot. Fr. 57 (1910) 337; BECKER, Beih. Bot. Centralbl. 34, ii (1916) 208; *ibid.* (1917) 373; Bot. Jahrb. 54 (1917) Beibl. 120, 156; Beih. Bot. Centralbl. 36, ii (1918) 15; *ibid.* 40, ii (1923) 20, 69, 119; BECKER & MELCHIOR in E. & P. Pfl. Fam. ed. 2, 21 (1925) 363; MELCHIOR, Bot. Jahrb. 62 (1929) 368; Notizbl. Berl.-Dahl. 12 (1934) 205; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 258; RIDL. J. Bot. 73 (1935) 13; LIN, Taiwania 1 (1950) 269; D. M. MOORE in Fedde, Rep. 68 (1963) 81-86; Nova Guinea, Bot. n. 11 (1963) 177.

Perennial, rarely annual herbs (in Mal.). *Leaves* alternate, petioled. *Stipules* free or adnate to petiole, persistent, often conspicuous, usually serrate or fimbriate. *Leaves* suborbicular to linear-lanceolate, the margin serrate to crenate or subentire, often glandular in indentations. *Flowers* bisexual, solitary, axillary, with a pair of bracteoles usually in the upper half of the peduncles. *Sepals* equal, entire to denticulate or fimbriodentate, prolonged into appendages below the point of their insertion, persistent. *Corolla* zygomorphic. *Petals* unequal, the lower saccate or spurred and usually broader than the others, the lateral pair smaller than the upper pair, the lateral petals often, the others more rarely, bearded inside. *Androecium* shorter than the petals; filaments connivent around the gynoecium; anthers 2-celled, subsessile, the 2 lower with appendages projecting into the spur; connective produced into an apical appendage. *Gynoecium* as long as the androecium or longer, the ovary glabrous or pubescent, with 3 placentas and ∞ ovules; style straight, curved or geniculate, filiform to conspicuously clavate, often lobed at apex; with the stigma terminal or anterior and subterminal. *Fruit* a 3-valved loculicidal capsule, subtended by dried-up calyx, globose to cylindrical or ellipsoidal, 4-16 mm long; valves boat-shaped, usually with thick rigid keels and thin sides so that on drying they contract and forcibly discharge the seeds, glabrous or pubescent. *Seeds* ∞ , usually ellipsoidal, glabrous, with leathery testa, usually with terminal elaiosome.

Distr. About 400 *spp.* occurring in temperate regions throughout the world.

Ecol. Terrestrial, generally in open or lightly shaded places in the mountains above 1000 m, exceptionally descending to c. 250 m.

The elaiosome may contain oils attractive to dispersal of seeds by ants.

Notes. With the exception of *V. biflora* (sect. *Dischidium* GING.) and the introduced *V. tricolor* (sect. *Melanum* GING.), all species occurring in Malesia may be included in sect. *Viola* (sect. *Nomimum* GING.). The separation of *V. hederacea* and its allies into sect. *Erpetion* (SWEET) BECKER (in E. & P. Nat. Pfl. Fam. ed. 2, 21, 1925, 376) does not appear to be justified in view of the intermediates between this and sect. *Viola*. The various subsectional groupings within sect. *Viola* (see BECKER in E. & P. *l.c.*) prove impossible to apply effectively and have been omitted in this account. Any useful subsectional treatment must await a monographic revision of the whole genus.

Chromosomes. There has been little cytological work on Malesian violets, and chromosome numbers

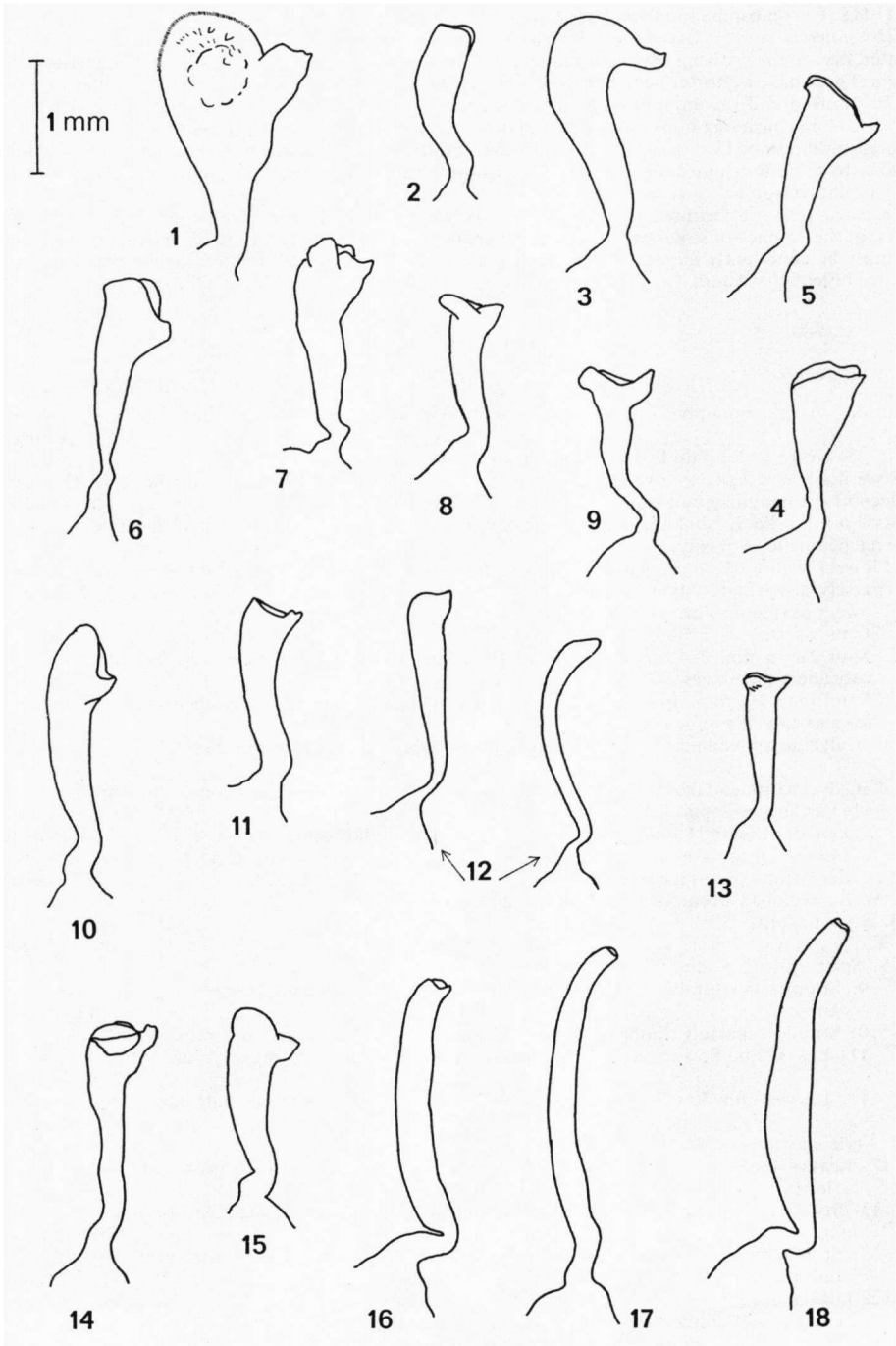


Fig. 8. Style of all Malesian *Viola* species. The number sequence is the same as in the text, 1 referring to 1. *V. tricolor*, etc.

are available for only 5 of the 16 native species. The counts on Malesian material were all made on plants from New Guinea and were published by MOORE in Fedde, Rep. 68 (1963) 81 and BORGMANN, Z. Bot. 52 (1964) 118. Chromosome numbers based on extra-Malesian material are indicated in the text.

Cleistogamous flowers. Except for *V. tricolor*, the species in Malesia produce during some, usually the later, part of the growing season or under abnormal environmental conditions so-called cleistogamous flowers. These have a shorter peduncle, a reduced corolla not expanded beyond the calyx; up to 3 anthers may be aborted and the amount of pollen produced is greatly reduced, while the style is usually much shorter than in chasmogamous flowers and may be much contorted. Such flowers produce plenty of seed, from self-pollination. The variation within species resulting from this sort of reproduction often does not conform to a pattern amenable to formal taxonomic recognition, and may partly explain the multiplicity of names applied to some taxa.

Chasmogamous (i.e. normal, expanding) flowers are essential for the reliable determination of most violets. In the absence of suites of flowering specimens for comparison, fruiting or cleistogamous material can rarely be confidently identified, particularly since, in such material, related species often show convergence in leaf characters.

KEY TO THE SPECIES
(see fig. 8 for the shape of the styles)

1. Stipules, at least the upper ones, pinnatifid or palmatifid. Style expanded above into a globose head.
 1. *V. tricolor*
1. Stipules entire to long-fimbriate. Style not as above.
 2. Style hooked at apex to give stigmatic beak about as long as the diameter of the style. Capsule on decumbent peduncle, not explosive. 3. *V. odorata*
 2. Style not markedly hooked, stigmatic beak much shorter than the diameter of the style. Capsule on erect peduncle, explosive.
 3. Flowers yellow. Leaves reniform to broadly ovate, apex rounded or obtuse. Stipules entire or sparsely denticulate. Style with apex lobes fused behind, no stigmatic beak. 2. *V. biflora*
 3. Flowers purple or white, rarely yellow (*sp.* 13).
 4. Stems or stolons absent.
 5. Spur $2\frac{1}{2}$ –6 mm, 2–4 times as long as wide, generally downwards curving, 2–5 times as long as calycine appendages. 7. *V. philippica*
 5. Spur up to $3\frac{1}{2}$ mm, up to $1\frac{1}{2}$ times as long as wide, straight or slightly upcurved, up to 3 times as long as calycine appendages.
 6. Calycine appendages (1–)2–4.8 mm, incised, often conspicuous, $\frac{1}{2}$ – $\frac{3}{4}$ (–1) as long as sepal. 6. *V. inconspicua*
 6. Calycine appendages 0–2 (– $2\frac{1}{2}$) mm, rounded or subdentate, not conspicuous, up to $\frac{1}{3}$ (rarely $\frac{1}{2}$) as long as sepal.
 7. Leaves at least 16 mm, long-decurrent on petiole, glabrous. 5. *V. betonicifolia*
 7. Leaves up to 16 mm, not or scarcely decurrent on petiole, with clusters of hairs in marginal indentations on upper side. 9. *V. mearnsii*
 4. Well-developed decumbent or ascending stems or stolons.
 8. Style filiform.
 9. Spur at least 3 mm. 18. *V. papuana*
 9. Spur up to $2\frac{1}{2}$ mm.
 10. Stipules long-fimbriate. Calycine appendages at least 0.8 mm, pointed or denticulate, usually hirsute. 12. *V. pilosa*
 10. Stipules sparsely fimbriate-dentate. Calycine appendages up to 1 mm, rounded, glabrous.
 11. Leaves and flowers grouped in distinct rosettes at intervals along stolons. Stipules free.
 17. *V. hederacea*
 11. Leaves and flowers not grouped in distinct rosettes. Stipules half-adnate to petiole.
 16. *V. kjellbergii*
 8. Style clavate.
 12. Leaves usually broader than long, arcuate or ovate, usually with prominent upturned basal lobes, crenulate or dentate.
 13. Style with separate rounded marginal lobes at apex. Stipules usually entire or shortly fimbriate-dentate. 10. *V. arcuata*
 13. Style with apex having flattened marginal lobes which are fused posteriorly. Stipules long-fimbriate. 11. *V. javanica*
 12. Leaves usually longer than broad, if broader than long then with rounded apex and prominently round-crenate (see *V. diffusa*).
 14. Leaves with hairs on upperside confined to zone towards margins, glabrous in central portion. 8. *V. merrilliana*
 14. Leaves glabrous or, if hairy, hairs not distributed as above.

15. Leaves \pm twice or more as long as broad, elliptical to lanceolate-ovate. 14. *V. curvistylis*
 15. Leaves up to $1\frac{3}{4}$ times as long as broad, suborbicular to ovate or elliptical.
 16. Petiole conspicuously winged. Leaves orbicular to orbicular-ovate, rarely elliptical when
 base cuneate to subcordate. 4. *V. diffusa*
 16. Petiole not or scarcely winged. Leaves ovate to triangular-ovate, rarely elliptical when base
 with narrow deep sinus.
 17. Style not or slightly marginate at apex. 12. *V. pilosa*
 17. Style distinctly marginate at apex.
 18. Leaves white-hirsute above and beneath, elliptical to ovate. 15. *V. rupicola*
 18. Leaves glabrous or sparsely hirsute in marginal indentations or on veins, especially below,
 ovate to triangular-ovate.
 19. Lateral petals not bearded. 13. *V. sumatrana*
 19. Lateral petals bearded.
 20. Sepals at least 4 by 1 mm, margins entire, appendages rounded or denticulate. Leaves
 subcoriaceous, glabrous or sparsely hirsute on veins towards base. 11. *V. javanica*
 20. Sepals c. 3 by 1 mm, margins denticulate, appendages dentate. Leaves herbaceous,
 sparsely hirsute in crenations. 9. *V. mearnsii*

1. *Viola tricolor* LINNÉ, Sp. Pl. (1753) 935; BACK. & BAKH. f. Fl. Java 1 (1963) 195. — Fig. 8.

Annual, biennial or perennial; rhizome short or none. Stems 10–40 cm, ascending or erect, usually branched. *Leaves* ovate-lanceolate to -elliptical, cuneate or subcordate at base, obtuse, crenate. *Stipules* deeply and pinnately lobed, terminal segment larger than the others, lanceolate, entire or crenate, leaf-like. *Flowers* c. 2–3 cm, violet, yellow or parti-coloured, very variable in colour and size; peduncle 3–10 cm, exceeding leaves. *Sepals* 7–14 by 2–5 mm, linear-lanceolate, acute, glabrous; appendage 3–5 mm, prominent. *Petals* obovate, 1–2 times as long as broad; spur 4–6 mm, variable up to twice as long as calycine appendages. *Style* 2–2½ mm, geniculate at the base, clavate distally with globose apex having prominent broad, anterior stigmatic beak. *Capsule* 8–14 mm, ellipsoid, glabrous.

Distr. Widespread throughout Europe extending to Asia Minor and Himalayas, in *Malesia*: garden-ornamental in mountain regions of Java and the Philippines (Luzon), not known to be naturalized. *Fl.* Jan.–Dec.

Note. These garden forms probably represent derivatives [*V. × wittrockiana* (= *V. hortensis* auct.)] from hybridization with *V. lutea* HUDS. and *V. altaica* KER-GAWLER.

2. *Viola biflora* LINNÉ, Sp. Pl. (1753) 936; BECKER Bot. Centralbl. 36, ii (1918) 39; LIN, Taiwania 1 (1950) 280. — Fig. 8.

Perennial; rhizome horizontal or oblique, more or less stout, roots on lower surface, leaves and stems at apex. Stems up to 8 cm, slender, ascending to erect, with leaves along their length and flowers distally. *Leaves* $\frac{3}{4}$ – $1\frac{1}{4}$ by 1–2½ cm, $1\frac{1}{4}$ –2 times as broad as long, reniform to broadly ovate, more or less deeply cordate, rounded to broadly obtuse, subrenate to repand-dentate, especially on lobes, subcoriaceous, glabrous beneath, sparsely hirsute towards margins and on veins above, dark green; petiole ½–5 cm, slender. *Stipules* 2–4 by 2–3 mm, ovate, acute, entire to sparsely denticulate, glabrous, fuscous, free. *Flowers* 8–12 mm, yellow with brownish-purple

veins; peduncle 1.4–8 cm, much exceeding leaves, slender. *Sepals* 3–4 by c. 1 mm, linear to linear-oblong, acute, glabrous or shortly ciliate on margin, fuscous, with margin scarious; appendage up to ½ mm, rounded, glabrous. *Petals* 2–3 times as long as broad, obovate to almost oblong, basal exceeding the others, laterals not bearded; spur 1–1½ mm, cylindrical, obtuse. *Style* 1.2–1½ mm, slightly geniculate at base, clavate distally, apex with 2 lateral lobes fused behind, no stigmatic beak. *Capsule* 4–6 mm, oblong to ellipsoid, glabrous.

Distr. Circumboreal, south to 40° N in North America, to c. 38° N in Europe. Through Himalayas to Japan, China, Korea, and Formosa, in *Malesia*: N. Sumatra (Mts Losir and Kemiri). Fig. 9.

Ecol. Alpine grassland, among rocks and grass tussocks, 3000–3500 m. *Fl.* Oct.–March.

3. *Viola odorata* LINNÉ, Sp. Pl. (1753) 934; BACK. & SLOOT. Handb. Theonkr. (1924) 178, t. 178; BACK. & BAKH. f. Fl. Java 1 (1963) 195. — Fig. 8.

Perennial; rhizome vertical, stout, bearing rosette of leaves and usually long, procumbent rooting stems at apex. *Leaves* by 2½–6½ cm, orbicular-reniform to -ovate, deeply cordate, rounded to obtuse, shallowly crenate to crenate-serrate, glabrous or sparsely pubescent on veins and margins; petiole up to 20 cm. *Stipules* 8–12 by 3–5 mm, ovate to ovate-lanceolate, usually glandular-fimbriate, glabrous, free. *Flowers* 10–15 mm, purple or white; peduncles 5–14 cm, slender. *Sepals* c. 5 by c. 2 mm, ovate, obtuse, entire, with ciliate margins; appendage 1–2 mm, dentate. *Petals* broadly obovate, laterals bearded or not; spur c. 4 mm, straight or slightly upcurved. *Style* c. 2 mm, uncinuate at apex. *Capsule* globose, pubescent.

Distr. Throughout Europe except the extreme north, Asia Minor, Caucasus, in *Malesia*: garden-ornamental in mountain regions of Java and the Philippines (Luzon); not known to be naturalized but BACKER & BAKHUIZEN f. stated that "it is planted to prevent erosion by rain-wash". *Fl.* May–Oct., perhaps all the year.

4. *Viola diffusa* GINGINS in DC. Prod. 1 (1824) 298. — Fig. 8.

See for synonyms under the subspecies.

Perennial or annual; rhizome vertical, rather thin, fibrillose, bearing rosette of leaves and flowers and procumbent rooting stems. Stems up to 12 cm, rooting at ends and producing dense rosettes of leaves and flowers. Leaves $\frac{1}{2}$ – $3\frac{1}{2}$ by 1–2 cm, smaller on stolons, suborbicular to ovate or elliptic, cordate to cuneate at base, subacute to obtuse or rounded, crenate to serrate-crenate on margin, long-decurrent on petiole; hirsute or rarely glabrous; petiole 1–7 cm. Stipules 5–9 by c. 1 mm, lanceolate or ovate-lanceolate, long-acute, dentate to fimbriate, green or pale brown, free. Flowers up to 9 mm, pale violet to almost white; peduncle $1\frac{1}{2}$ –6 cm. Sepals 3–6 by $1\frac{1}{2}$ –2 mm, lanceolate to ovate, acute, sparsely hairy, fimbrio-ciliate, green; appendage c. $\frac{1}{2}$ mm, rounded, sparsely fimbrio-ciliate. Petals $1\frac{1}{2}$ –2 times as long as broad, obovate, the basal smaller than the others, the laterals not bearded; spur 0.4 to c. 1 mm, obtuse. Style c. $1\frac{1}{2}$ mm, slightly geniculate at base, clavate distally, apex with 2 lateral lobes, with small anterior beak between lobes. Capsule 4–6 mm, ellipsoid, glabrous.

Distr. Himalayas, China, Indo-China, Japan, Formosa, in Malesia: Philippines, New Guinea. Fig. 9.

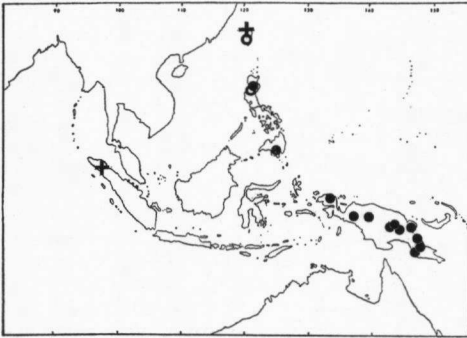


Fig. 9. Distribution in Malesia of *Viola diffusa* GING. *ssp. diffusa* (circles), *ssp. apoensis* (ELM.) D. M. MOORE (dots), and *V. biflora* L. (+).

Ecol. Open places in montane forest and grassy clearings, often along tracks and other disturbed places, a weed of cultivation, 1400–2500 m. Fl. Aug.–March, probably later.

This species comprises two subspecies, as follows:

ssp. diffusa. — *V. diffusa* GING.; MERR. Philip. J. Sc. 5 (1910) Bot. 201; BECKER, Philip. J. Sc. 19(1921) 713; Beih. Bot. Centralbl. 40, ii (1923) 114; LIN, Taiwania 1 (1950) 271. — *V. tenuis* BENTH. in Hook. Lond. J. Bot. 1 (1842) 482. — *V. diffusa* GING. *ssp. tenuis* (BENTH.) BECKER, Philip. J. Sc. 19 (1921) 714, *pro parte*.

Leaves $(1\frac{1}{2})$ – $1\frac{3}{4}$ – $3\frac{1}{2}$ by (0.9–)1–2 cm, ovate to ovate-elliptic, cuneate to shallowly cordate at base, obtuse to acute, rarely rounded, with crenate-serrate to serrate margins; petiole $1\frac{1}{2}$ times as long as the blade. Chromosome number: $2n = 26$ (Japan, MIYAJI, Cytologia 1, 1929, 28).

Distr. Himalayas, China, Indo-China, Japan, Formosa, in Malesia: Philippines (Luzon: Mts Data and Pukis).

ssp. apoensis (ELM.) D. M. MOORE, *comb. nov.* — *V. apoense* ELM. Leaf. Philip. Bot. 8 (1915) 2878. — *V. diffusa* GING. *ssp. tenuis* (BENTH.) BECKER, Philip. J. Sc. 19 (1921) 714, *pro parte*; D. M. MOORE, Nova Guinea, Bot. n. 11 (1963) 181.

Leaves $\frac{3}{4}$ – $1\frac{1}{2}$ (–2) by $1\frac{1}{2}$ cm, suborbicular to broadly ovate, deeply, rarely shallowly, cordate at base, rounded at apex, with round-crenate margins; petiole 1–3.2 times as long as the blade.

Distr. Malesia: Philippines (Luzon: Mt Data; Mindanao: Mt Apo), New Guinea.

Note. It is not known whether the two subspecies occupy different habitats on Mt Data, but some hybridization is likely since these populations, although readily distinguished, are closer morphologically than other populations of the two taxa. It is possible that they have come into contact by recent introduction of one of the subspecies, in view of the weedy habitats favoured by the species.

5. *Viola betonicifolia* J. E. SMITH in Rees, Cyclop. 37, I (1817) n. 7. — Fig. 8.

See for synonyms under the subspecies.

Perennial; rhizome short, oblique or vertical, rather stout, bearing rosette of leaves and flowers at apex, aculescent. Leaves $1\frac{1}{2}$ – $7\frac{1}{2}$ by $\frac{1}{2}$ –3 cm, 1–19 times as long as broad, linear-lanceolate to triangular-hastate or triangular-ovate, cuneate, truncate or widely and shallowly cordate with basal lobes often laterally prominent, acute or sometimes roundish obtuse, shallowly and distantly crenate, sometimes dentate on basal lobes, usually long-decurrent on petiole, glabrous; petiole 1– $10\frac{1}{2}$ cm. Stipules 2–7 by $\frac{1}{2}$ –1 mm, ovate-lanceolate, acuminate, sparsely short-fimbriate, glabrous, fuscous, adnate to petiole to $\frac{3}{4}$ length. Flowers 6– $14\frac{1}{2}$ mm, white to purple with darker veins; peduncle equalling or exceeding leaves, glabrous. Sepals 3– $6\frac{1}{2}$ by 0.6–2.5 mm, ovate to ovate-lanceolate, acute or acuminate, glabrous or ciliate, green with scarious margins; appendage 0.2– $2\frac{1}{2}$ mm, or absent, $(\frac{1}{2})$ – $\frac{1}{3}$ – $\frac{1}{7}$ as long as sepal, rounded to squarish or somewhat subdentate, glabrous. Petals $1\frac{1}{2}$ –3.4 times as long as broad, obovate, laterals usually bearded; spur 0.6– $3\frac{1}{2}$ mm, half to twice as long as broad, cylindrical, obtuse, straight or slightly upcurved. Style $1\frac{1}{2}$ – $2\frac{1}{2}$ mm, geniculate at base, clavate distally, apex with prominent marginal lobes fused behind, anterior stigmatic beak. Capsule 7–10 mm, ellipsoid to oblong, glabrous.

Distr. Himalayas, India, Ceylon, China, Japan, Indo-China, Australia, in Malesia: Sumatra, E. Java (Mts Tengger and Idjen), Lesser Sunda

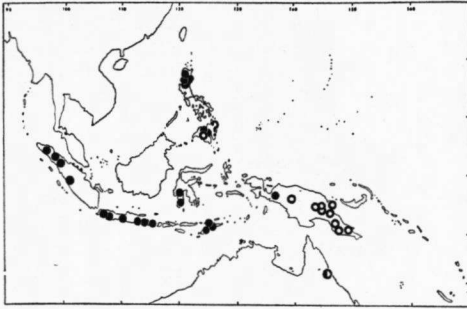


Fig. 10. Distribution in Malesia of *Viola betonicifolia* J. E. SMITH *ssp. betonicifolia* (dots), an intermediate in N. Queensland, and *ssp. nova-guineensis* D. M. MOORE (circles).

Islands (Alor, Bali, Timor), Celebes, Philippines (Mindanao, Luzon), and New Guinea. Fig. 10.

Ecol. Usually in grasslands, sometimes in open montane woodland of *Eucalyptus*, (650–)1100–2100(–2700) m. Apparently sometimes a ruderal and occurring along path margins and in cultivated ground. *Fl.* Jan.–Dec.

Notes. This species shows considerable variation in leaf-shape, on the basis of which two subspecies have been recorded.

V. betonicifolia differs from *V. inconspicua* in having the calycine appendages less than half as long as the sepals, in leaf-shape and in the lamina generally being long-decurrent on the petiole. It differs from *V. philippica* by its generally shorter spur which is less than twice as broad as long, by the heavy bearding of the lateral petals, and by its leaf-shape.

The widespread references to *V. patrinii* in Malesian literature concern *V. betonicifolia* and *V. inconspicua*. In an analysis of this group BECKER (Bot. Jahrb. 54, Beibl. 120, 1917, 156) has shown that the name *V. patrinii* DC. should be restricted to the plant from northern E. Asia. This species appears to be diploid (MIYAJI, Cytologia 1, 1929, 28) and some of the taxonomic difficulties may be due to its genome being present in the species further south, of which those known cytologically are tetraploid or hexaploid.

ssp. betonicifolia. — *V. betonicifolia* J. E. SM. — *V. betonicifolia* J. E. SM. *ssp. australis* BECKER, Bot. Jahrb. 54 (1917) Beibl. 120, 166. — *V. betonicifolia* J. E. SM. *ssp. nepalensis* BECKER, l.c.; Philip. J. Sc. 19 (1921) 716; MERR. En. Philip. 3 (1923) 105; OOSTSTR. & H. J. LAM, Blumea 5 (1945) 594. — *V. patrinii* DC. var. *napaulensis* DC. Prod. 1 (1824) 293. — *V. caespitosa* D. DON, Prod. Fl. Nepal. (1825) 205. — *V. patrinii* DC. var. *caespitosa* RIDL. J. Bot. 73 (1935) 17. — *V. patrinii* (non DC.) MERR. Philip. J. Sc. 5 (1910) Bot. 200, *pro parte*; BOISSIEU & CAPITAINE, Bull. Soc. Bot. Fr. 57 (1910) 337; KOORD. Exk. Fl. Java 2 (1912) 627, *pro parte*.

Leaves linear-lanceolate to triangular-ovate. Chromosome number: $2n = 48, 72$ (Australia, MOORE in Fedde, Rep. 68, 1963, 84).

Distr. As the species but in New Guinea only in extreme west.

Notes. The northernmost (including the type of *ssp. nepalensis*) and southernmost (including the type of *ssp. betonicifolia*) populations cannot be differentiated and intergrade continuously with the various leaf-forms present throughout much of Malesia, though there is a tendency for more definitely triangular cordate forms in the centre of the range. Confusion between this and the next subspecies may result partly from hybridization with *V. inconspicua*. Populations from N. Sumatra have a conspicuously narrow cuneate leaf which is 4–19 times as long as broad.

ssp. nova-guineensis D. M. MOORE in Fedde, Rep. 68 (1963) 82.

Leaves triangular-hastate with basal lobes prominent laterally, even deltoid. Chromosome number: $2n = 72$.

Distr. *Malesia*: Sumatra, Timor, Philippines, Celebes, New Guinea (except extreme west).

Note. This subspecies, which is centred in New Guinea, intergrades with *ssp. betonicifolia* in N. Queensland, and it is possible that many of the triangular-leaved forms north from New Guinea represent intermediates between the two subspecies.

6. *Viola inconspicua* BLUME, Cat. Gew. Buitenzorg (1823) 57; Bijdr. 1 (1825) 58; KORTH. Ned. Kruidk. Arch. 1 (1848) 357; MIQ. Fl. Ind. Bat. 1, 2 (1858) 112; BECKER, Bot. Jahrb. 54 (1917) 167; Philip. J. Sc. 19 (1921) 718; MERR. En. Philip. 3 (1923) 105; RIDL. J. Bot. 73 (1935) 14; BACK. & BAKH. f. Fl. Java 1 (1963) 195. — *V. trinervis* KORTH. Ned. Kruidk. Arch. 1 (1848) 357; MIQ. Fl. Ind. Bat. 1, 2 (1858) 112. — *V. confusa* CHAMP. ex BENTH. in Hook. J. Bot. Kew Misc. 3 (1851) 260, *pro parte*; RIDL. J. Bot. 73 (1935) 14. — *V. patrinii* (non DC.) BOISSIEU & CAPITAINE, Bull. Soc. Bot. Fr. 57 (1910) 340; MERR. Philip. J. Sc. 5 (1910) Bot. 200, *pro parte*; KOORD. Exk. Fl. Java 2 (1912) 627, *pro parte*; BACK. & SLOOT. Handb. Theonkr. (1924) 179, t. 179. — *V. serpens* (non WALL.) RIDL. Fl. Mal. Pen. 1 (1922) 126, *pro parte*. — Fig. 8.

Perennial; rhizome vertical or oblique, rather short and stout, with rosette of leaves and flowers at apex, acaulescent. *Leaves* $1\frac{3}{4}$ –9 by 1 – $1\frac{1}{2}$ cm, 1–2.2 times as long as broad, broadest at base, triangular-ovate, cordate at base with usually prominent, rounded basal lobes, acute, crenate to subdentate, sometimes dentate on basal lobes, decurrent to $\frac{1}{3}$ length of petiole, glabrous or sparsely pubescent in sinus; petiole 1–10 cm. *Stipules* 3–10 by 1–2 mm, ovate-lanceolate, acute, sparsely short-fimbriate, glabrous, fuscous, adnate to petiole to $\frac{3}{4}$ of length. *Flowers* 9–11 mm, pale purple with darker veins; peduncle shorter than to somewhat exceeding leaves, glabrous or pubescent distally. *Sepals* $2\frac{1}{2}$ –7 by 1–1.8 mm, ovate-lanceolate, acute, glabrous or sometimes ciliate,

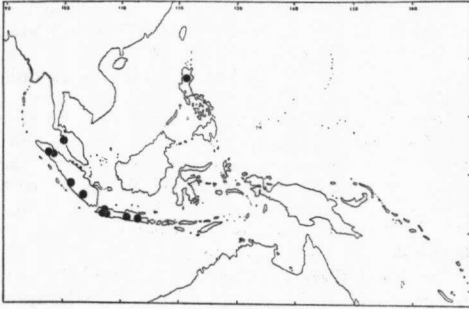


Fig. 11. Distribution of *Viola inconspicua* BL.

green with scarious margin; appendage ($1\frac{1}{2}$ –)2–4.9 mm, at least half as long as sepal, incised. *Petals* 2–3 times as long as broad, obovate, the laterals bearded; spur 1.8–2.6 mm, 1.1–1.3 times as long as broad, $\frac{2}{3}$ to $\frac{1}{2}$ as long as calycine appendages, cylindrical, straight, obtuse. *Style* c. 2 mm, geniculate at base, clavate distally, apex with large marginal lobes fused behind, anterior stigmatic beak. *Capsule* 9–16 mm, oblong, glabrous.

Distr. Himalayas, Burma, China, in *Malesia*: Sumatra, Malay Peninsula (Penang), Java, Philippines (Luzon). Fig. 11.

Ecol. Grasslands, fallow lands, path margins; apparently normally ruderal, 500–1700 m. *Fl.* Nov.–Febr.

Notes. Closely related to *V. betonicifolia* but differing by its shortly decurrent lamina and by the conspicuous leaf-like calycine appendages which are more than half as long as the sepals. Intermediates between the two species occur in several places throughout the range of *V. inconspicua*. These are considered to be hybrids rather than clinal variants, because no geographical pattern can be discerned, because the weedy habitats preferred by both species are conducive to interspecific crossing, and both species occur sympatrically in some Philippine and Sumatran localities. Only occasional collections, from Sumatra and the Philippines, have chasmogamous flowers and this, together with the apparently weedy nature of *V. inconspicua*, supports the suggestion of BECKER (1917) and of BACKER & BAKHUIZEN f. (1963) that the species is a relatively recent immigrant from continental Asia.

7. *Viola philippica* CAVANILLES, *Icon. Descr.* 6 (1801) 19; MIQ. *Fl. Ind. Bat.* 1, 2 (1858) 113; BECKER, *Bot. Jahrb.* 54 (1917) 174, *incl. ssp.*; Philip. J. Sc. 19 (1921) 719; MERR. *En. Philip.* 3 (1923) 105; BACK. & BAKH. f. *Fl. Java* 1 (1963) 195. — *V. confusa* CHAMP. ex BENTH. in Hook. *J. Bot. Kew Misc.* 3 (1851) 260, *pro parte*; BACK. *Schoofl.* (1911) 66. — *V. selkirkii* (non PURSH) BOUISSIEU & CAPITAIN, *Bull. Soc. Bot. Fr.* 57 (1910) 337. — *V. edanoi* BECKER, *Philip. J. Sc.* 19 (1921) 722; MERR. *En. Philip.* 3 (1923) 105. — Fig. 8.

Perennial; rhizome vertical or suboblique,

rather slender, bearing rosette of leaves and flowers at apex, acaulescent. *Leaves* 1–4 by $\frac{1}{2}$ –3 cm, 1–2 times as long as broad, ovate-elliptic to ovate or triangular-hastate, deeply to shallowly cordate to subtruncate at base, with the basal lobes usually somewhat converging, obtuse to rounded, round-crenate to crenate-serrate, usually long-decurrent on petiole, glabrous or puberulent beneath on veins and margins; petiole 1–6 cm. *Stipules* 2–8 by 0.8–3 mm, ovate-lanceolate, acute, shortly fimbrio-dentate, glabrous or sparsely pubescent, green to rather fuscous, adnate to petiole to $\frac{3}{4}$ length. *Flowers* $9\frac{1}{2}$ – $14\frac{1}{2}$ mm, pale to dark violet; peduncle usually much exceeding leaves, glabrous or puberulent distally. *Sepals* 3–5.2 by 0.7–1.8 mm, ovate to ovate-lanceolate, acute or rounded entire, glabrous or ciliolate, green with scarious margin; appendage $\frac{1}{2}$ –2 mm, ($\frac{1}{2}$ –) $\frac{1}{3}$ – $\frac{1}{6}$ as long as sepal, rounded to denticulate, glabrous or sparsely pubescent. *Petals* 1.2– $3\frac{1}{2}$ times as long as broad, obovate, the laterals not or lightly bearded; spur $2\frac{1}{2}$ –6 mm, 2–4 times as long as broad, 2–5 times as long as calycine appendages, usually slightly tapering and downwards curving. *Style* $1\frac{1}{2}$ –2.4 mm, geniculate at base, clavate distally, apex with prominent lateral lobes partially fused behind, anterior stigmatic beak. *Capsule* 5–8 mm, ellipsoid, glabrous.

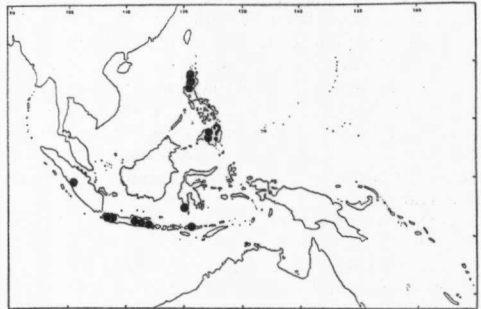


Fig. 12. Distribution of *Viola philippica* CAV.

Distr. Himalayas, India, Mongolia, China, Burma, Korea, Japan, in *Malesia*: Sumatra, Java, Lesser Sunda Islands (Flores), Celebes (Loha), Philippines (Luzon, Mindanao). Fig. 12.

Ecol. Grasslands; path margins; sometimes ruderal, 250–1700 m. *Fl.* Oct.–July, probably all year.

Notes. BECKER (1917, *l.c.*) recognized two subspecies distinguished mainly on leaf-shape, viz *ssp. munda* BECKER, lamina lanceolate or oblong, cuneate to subcordate at base, and *ssp. malesica* BECKER, lamina broader and shorter with cordate base. The type material contains leaves referable to both these entities, as do collections from a variety of areas (*cf.* STEWARD, *Man. Vasc. Pl. Lower Yangtze Valley*, 1958, Corvallis), and no subspecific differentiation seems justified on present knowledge. *V. philippica* is only likely to be con-

fused with *V. betonicifolia* and the distinguishing characters are summarized under that species.

8. *Viola merrilliana* BECKER, Beih. Bot. Centralbl. 34, ii (1916) 234; Philip. J. Sc. 19 (1921) 712; MERR. En. Philip. 3 (1923) 105. — Fig. 8.

Perennial; rhizome vertical to oblique, rarely horizontal, bearing leaves and stems at apex. Stems up to 15 cm, creeping to ascending, rooted at some nodes, with leaves and flowers at some nodes. Leaves $\frac{1}{2}$ – $2\frac{1}{2}$ by $\frac{1}{2}$ – $1\frac{3}{4}$ cm, (1–) $1\frac{1}{4}$ times as long as broad, ovate, with cordate base, and rounded basal lobes, acute, crenulate or crenate-serrate, especially on basal lobes, upper surface with hairy zone towards margin and glabrous in central portion, glabrous or sparsely pubescent on veins beneath; petiole 1–8 cm, slender, glabrous. Stipules 3–6 by 1– $1\frac{1}{2}$ mm, the lower ovate-lanceolate, fimbrio-dentate, the upper lanceolate, dentate near base, all glabrous or sparsely pubescent, fuscous or greenish, adnate to petiole to $\frac{1}{2}$ length or more. Flowers 10–15 mm, white or pale purple, with darker veins; peduncle 4–9 cm, usually exceeding the leaves. Sepals 3–5 by 0.6–1.7 mm, lanceolate, acute, entire, glabrous; appendage 0.4–0.8 mm, rounded, glabrous. Petals 2–3 times as long as broad; the basal obovate; the laterals oblanceolate, bearded; spur $1\frac{1}{2}$ –2 mm, exceeding calycine appendages, cylindrical, obtuse. Style 1.2–1.6 mm, geniculate at base, clavate distally, apex with lateral margins fused behind, with stigmatic beak projecting anteriorly and somewhat upcurved. Capsule 5–7 mm, oblong, glabrous.

Distr. *Malesia*: Philippines (Luzon). Fig. 13.

Ecol. Damp places along streams and in mossy forest, c. 2100 m. Fl. March–June.

Notes. Distinguished from *V. mearnsii* by the distribution of hairs on its upper surface of the leaf, the narrower and deeper basal leaf sinus, the larger flowers, the entire sepals and the small rounded calycine appendages. *V. merrilliana* appears to be sympatric with *V. rupicola* on Mt Pulog but the latter species differs in its hairy petioles, completely hairy uppersides of the leaves, ciliate sepals and free or slightly adnate stipules.

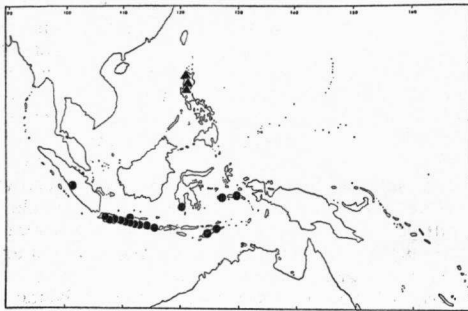


Fig. 13. Distribution of *Viola pilosa* BL. (dots) and *Viola merrilliana* BECKER (triangles).

9. *Viola mearnsii* MERRILL, Philip. J. Sc. 5 (1910) Bot. 200; BECKER, Beih. Bot. Centralbl. 34, ii (1916) 411; Philip. J. Sc. 19 (1921) 715; MERR. En. Philip. 3 (1923) 105; MELCHIOR, Notizbl. Berl.-Dahl. 12 (1934) 206. — Fig. 8.

Perennial; rhizome vertical or oblique, slender, bearing rosette of leaves, flowers and sometimes stems at apex. Stems, when present, up to 3 cm, rooted at terminal node. Leaves $\frac{1}{2}$ – $1\frac{1}{2}$ by $\frac{3}{4}$ – $1\frac{1}{2}$ cm, about as long as broad, triangular-ovate, broadly and shallowly cordate at base, obtuse, rarely acute, crenulate or serrate-crenate, pubescent in crenations above, glabrous beneath, herbaceous; petiole 1–4 cm, slender, glabrous. Stipules 3–5 by c. 1 mm, linear-lanceolate, acute, fimbrio-dentate, fuscous or greenish, slightly adnate to petiole. Flowers 7– $11\frac{1}{2}$ mm, whitish with purple veins; peduncle 3–9 cm, slender, glabrous. Sepals c. 3 by c. 1 mm, lanceolate, acute, glabrous or ciliate near base, sparingly denticulate on margin; appendage c. 1 mm, dentate. Petals 2– $2\frac{1}{2}$ times as long as broad; basal obovate, shorter than others; laterals oblanceolate, bearded; spur $1\frac{1}{2}$ – $2\frac{1}{2}$ mm, exceeding calycine appendages, cylindrical, obtuse. Style c. $1\frac{1}{2}$ mm, geniculate at base, clavate distally, apex with margins fused behind and stigmatic beak projecting anteriorly. Capsule c. 6 mm, globose, glabrous.

Distr. *Malesia*: Philippines (Luzon, Negros, Mindanao), Celebes. Fig. 18.

Ecol. Along streams and in montane forest, c. 2200 m. Fl. April–May.

Notes. Differs from *V. merrilliana* in its more triangular, shallowly cordate leaves which have hairs only in the marginal crenations on the upper side, smaller flowers, denticulate sepals and dentate calycine appendages. The occurrence in Celebes is based on a single collection (KJELLBERG 2658) which differs from Philippine material in having glabrous leaves, and entire glabrous sepals and calycine appendages. The terminal portion of the style is absent. Further material is required to confirm this determination.

10. *Viola arcuata* BLUME, Bijdr. (1825) 58; KORTH, Ned. Kruidk. Arch. 1 (1848) 357; MIQ. Fl. Ind. Bat. 1, 2 (1858) 114; KOORD. Exk. Fl. Java 2 (1912) 629; BECKER, Beih. Bot. Centralbl. 34, ii (1916) 226; Philip. J. Sc. 19 (1921) 710; MERR. En. Philip. 3 (1923) 104; BACK. & SLOOT. Handb. Theonkr. (1924) 177, t. 177; RIDL. J. Bot. 73 (1935) 14; BACK. & BAKH. f. Fl. Java 1 (1963) 195; D. M. MOORE, Nova Guinea, Bot. n. 11 (1963) 178. — *V. distans* WALL. [Cat. (1831) n. 4022] Trans. Med. Soc. Calc. 7 (1835) 227; BACK. Schoolfl. (1911) 66. — *V. japonica* (non LANGSD.) KORTH, Ned. Kruidk. Arch. 1 (1848) 357. — *V. alata* BURGERSDIJK in Miq. Pl. Jungh. 1 (1852) 121; MIQ. Fl. Ind. Bat. 1, 2 (1858) 114; BACK. Schoolfl. (1911) 65; KOORD. Exk. Fl. Java 2 (1912) 629; BECKER, Beih. Bot. Centralbl. 34, ii (1916) 227; RIDL. J. Bot. 73 (1935) 13. — *V. toppingii* ELM. Leaf. Philip. Bot. 2 (1908) 504. — *V. semilunaris* (MAXIM.) BECKER var. *philip-*

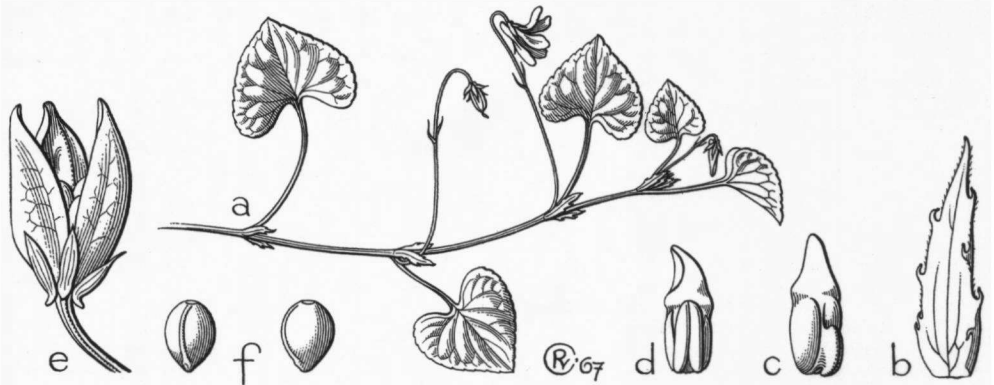


Fig. 14. *Viola arcuata* BL. a. Habit, $\times \frac{2}{3}$, b. stipule, $\times 4$, c. & d. stamens, $\times 6$, e. fruit, $\times 3$, f. seeds, $\times 6$ (a VAN STEENIS 7446, b, e BÜNNEMEIJER 9595, c-d VAN STEENIS 4306, f BACKER 12848).

pinarum BECKER, Beih. Bot. Centralbl. 34, ii (1916) 231; Philip. J. Sc. 19 (1921) 712; MERR. En. Philip. 3 (1923) 106. — *V. lunata* RIDL. Trans. Linn. Soc., Bot. 9 (1916) 18. — *V. herbivaga* RIDL. J. Bot. 73 (1935) 17. — Fig. 8, 14.

Perennial; rhizome vertical to oblique, slender to rather stout, bearing stems and leaves at apex. Stems up to 80 cm, slender, procumbent to ascending or erect, often rooted at lower nodes, with leaves and flowers along their length. Leaves $\frac{1}{2}$ – $\frac{3}{4}$ by $\frac{3}{4}$ – $\frac{1}{4}$ cm, (1.1–)1.3–2.3 times as broad as long, broadly hastate, sometimes ovate, broadly and deeply to shallowly cordate, with prominent basal lobes which are (3–)6–21 mm long, typically curved upwards and usually rounded, cuspidate to obtuse at apex, crenulate, rarely dentate on basal lobes, glabrous, rarely sparsely ciliate or pubescent on veins beneath, usually herbaceous, sometimes thicker and darker green; petiole 1–14 cm, slender. Stipules 4–14 by 1–3(–6) mm, generally prominent and sometimes leaf-like, lanceolate to oblong-lanceolate, acute to mucronate, dentate to shortly fimbriate-dentate, glabrous or rarely white to pale purple, with darker veins; peduncle 2–15 cm, slender. Sepals by 1.2–2 mm, ovate-lanceolate to lanceolate, acute, entire, glabrous, green or fuscous with scarious margins; appendage c. 1 mm, rounded, glabrous. Petals (1½–)2–4(–4½) times as long as broad, oblong to oblanceolate; the basal shorter than the others; laterals not or lightly bearded; spur ½–2 mm, equalling or slightly exceeding calycine appendages, cylindrical, obtuse. Style 1–2 mm, geniculate at base, clavate distally, with rounded marginal lobes at apex not joined behind, stigmatic beak projecting anteriorly. Capsule 4–10 mm, oblong, glabrous. Chromosome number: $2n = 24$.

Distr. India, N. Burma, China, Indo-China, in Malesia: Sumatra, Java, Philippines (Luzon), Moluccas (Buru), New Guinea. Fig. 15.

Ecol. Typically a plant of wet meadows, marshes, stream and lake margins, ditches and

grassy clearings, 1000–3000 m. Fl. Jan.–Dec.

Notes. In its typical, widespread form *V. arcuata* is readily recognised by its glabrous, arcuate leaves and long prostrate stems. It varies in the size and marginal dissection of the stipules and in the presence or absence of bearding on the lateral petals, while some forms have thicker, more pubescent and deeply cordate leaves than is usual. Variation in these characters cannot be correlated with each other, or with any distributional pattern, and intermediates occur. No formal recognition of such variation is possible and much of it may be due to plants which occupy drier habitats than usual.

11. *Viola javanica* BECKER, Beih. Bot. Centralbl. 34, ii (1916) 260; BACK. & BAKH. f. Fl. Java 1 (1963) 195. — *V. arcuata* (non BL.) MIQ. Fl. Ind. Bat. 1, 2 (1859) 686; RIDL. J. Bot. 73 (1935) 14. — Fig. 8.

Perennial; rhizome vertical, rather stout, bearing leaves and stems at apex. Stems up to 26 cm, rather slender, creeping or somewhat ascending, rooted at some nodes, bearing leaves along their length and flowers usually distally. Leaves ½–2½ by ¾–3 cm, 1–1.6 times as broad as long, triangular-ovate, rarely subhastate, shallowly and rather broadly cordate at base, acute to obtuse or rounded, crenate or subdentate, glabrous or sparsely pubescent on veins towards sinus, subcoriaceous, dark green. Stipules 5–10 by 1–2 mm, lanceolate, acute, fimbriate, glabrous, fuscous, free. Flowers 6–12 mm, purple with darker veins; peduncle 2–9 cm, exceeding leaves, sparsely hirsute distally. Sepals 4–5½ by 1½–1.8 mm, ovate-lanceolate, acute, entire, glabrous or sparsely pubescent near base, green with scarious margin; appendage ½–1 mm, rounded or slightly dentate. Petals about 3 times as long as broad, oblong to obovate-oblanceolate; laterals heavily, rarely lightly bearded; spur ½–1½ mm, shorter than to slightly exceeding calycine appendages, cylindrical, obtuse. Style 1½–2 mm,

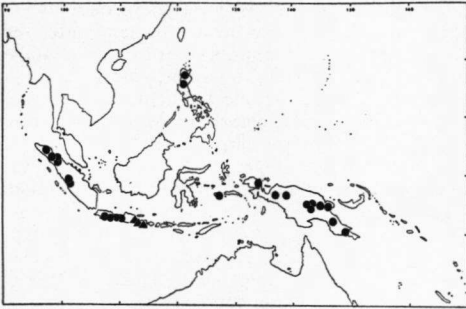


Fig. 15. Distribution of *Viola arcuata* BL. in Malesia (dots) and *V. javanica* BECKER (triangles).

geniculate at base, clavate distally, apex with flattish marginal lobes fused behind and anterior stigmatic beak. Capsule 5–9 mm, oblong, glabrous.

Distr. Malesia: E. Java (Mts Ardjuno, Tengger & Jang). Fig. 15.

Ecol. Grasslands, 2000–3000 m. Fl. Jan.–Nov., probably all year.

Notes. Closely related to *V. arcuata* but

readily distinguished from typical forms of that species by its subcoriaceous, strongly crenate, ovate leaves and its long-fimbriate stipules. Some forms of *V. arcuata*, particularly in drier habitats, approach *V. javanica* in these characters but the stigma has the rounded separate lobes of *V. arcuata* and not the posteriorly fused, flatter margin of *V. javanica*. There is a superficial resemblance to some forms of *V. pilosa* but in that species the style is scarcely clavate and the stigma is emarginate.

12. *Viola pilosa* BLUME, Cat. Gew. Buitenzorg (1823) 57; Bijdr. (1825) 57; KORTH. Ned. Kruidk. Arch. 1 (1848) 357; MIQ. Fl. Ind. Bat. 1, 2 (1858) 113; BACK. & SLOOT. Handb. Theconkr. (1924) 180, t. 180; DOCTERS VAN LEEUWEN, Trop. Natuur 16 (1927) 187; Verh. Kon. Ak. Wet. A'dam II, 31 (1933) 184. — *V. serpens* WALL. ex GING. in DC. Prod. 1 (1824) 296; MIQ. Fl. Ind. Bat. 1, 2 (1858) 113; BACK. Schoolfl. (1911) 66; KOORD. Exk. Fl. Java 2 (1912) 628, *pro parte*; BECKER, Beih. Bot. Centralbl. 40, ii (1923) 103; OOSTSTR. & H. J. LAM, Blumea 5 (1945) 594; BACK. & BAKH. f. Fl. Java 1 (1963) 195. — *V. palmaris* BUCH.-HAM. ex GING. in DC. Prod. 1 (1824) 298; BURGERSDIJK in Miq. Pl. Jungh. 1



Fig. 16. *Viola pilosa* BL. on Mt Gedeh in W. Java (photogr. VAN WOERDEN).

(1852) 120; MIQ. Fl. Ind. Bat. 1, 2 (1858) 113. — *V. hamiltoniana* D. DON, Prod. Fl. Nepal. (1825) 206; BOISSIEU & CAPITAINE, Bull. Soc. Bot. Fr. 57 (1910) 340. — *V. sarmentosa* BURGERSDIJK in Miq. Pl. Jungh. 1 (1852) 120; MIQ. Fl. Ind. Bat. 1, 2 (1858) 114. — *V. burgersdijkii* OUDEMANS in Miq. Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 77; BOISSIEU & CAPITAINE, Bull. Soc. Bot. Fr. 57 (1910) 337, incl. *f. nodosa* BOISS. & CAPIT. l.c. 338; BECKER, Beih. Bot. Centralbl. 40, ii (1923) 106; RIDL. J. Bot. 73 (1935) 16, incl. *var. timorensis* RIDL. — *V. glaucescens* OUDEMANS in Miq. Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 74; BECKER, Beih. Bot. Centralbl. 40, ii (1923) 109. — *V. confusa* (non CHAMP.) BOISSIEU & CAPITAINE, Bull. Soc. Bot. Fr. 57 (1910) 339. — *V. canescens* (non WALL.) BOISSIEU & CAPITAINE, l.c. 338; BECKER, Beih. Bot. Centralbl. 34, ii (1916) 256. — ? *V. celebica* BECKER in Fedde, Rep. 14 (1916) 321; Beih. Bot. Centralbl. 34, ii (1916) 416. — Fig. 8, 16, 17.

Perennial; rhizome vertical to oblique, 1½–4 mm ø, bearing leaves and stems at apex. Stems up to 1 m, slender, rooted at some nodes, leafy, with flowers at some nodes. Leaves 1–10 by

1–6½ cm, 1–2 times as long as broad, ovate, deeply cordate at base, acute to acuminate, serrate or serrate-crenate, pubescent to hirsute above and beneath, especially on veins, rarely glabrous, usually pale green; petiole 1–17 cm, pilose especially distally, rarely glabrous. Stipules 7–30 by 1½–5 mm, lanceolate, long-acute, long-fimbriate, pubescent, fuscous or green. Flowers (5–)8–14 mm long, purple to white with darker veins; peduncle 4–12 cm, pilose especially distally, rarely glabrous. Sepals 3½–9 by 1–2 mm, linear-lanceolate, acute, entire or denticulate, usually pilose especially near base, ciliate; appendage 0.8–2½ (–3) mm, pointed or denticulate, rarely rounded, pilose or rarely glabrous. Petals 1½–4 times as long as broad; basal obovate, sometimes slightly bearded; laterals oblanceolate, bearded; upper pair usually lightly bearded; spur 1–2½ mm, slightly shorter than to just exceeding calycine appendages, cylindrical, obtuse. Style 1½–3 mm, geniculate at base, somewhat thickened distally, apex gently or strongly curved to appear flattened or sometimes hooked, with simple emarginate stigma. Capsule 5–10 mm, ellipsoid, glabrous or pubescent in centre of valves.

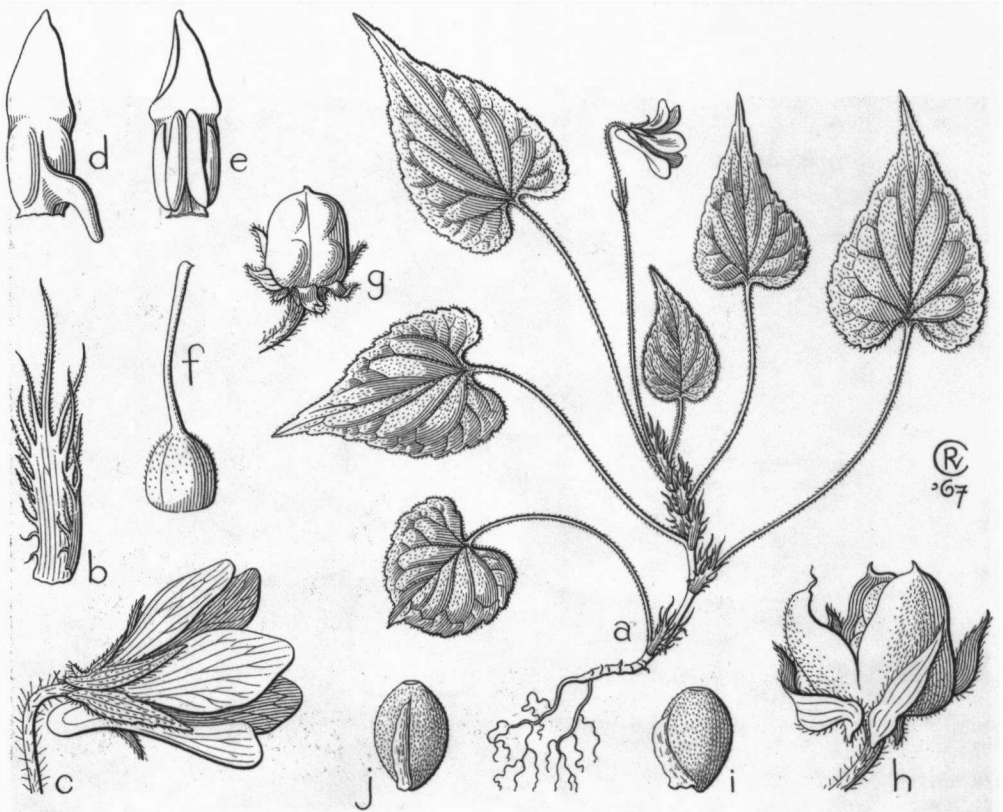


Fig. 17. *Viola pilosa* BL. a. Habit, $\times \frac{2}{3}$, b. stipule, $\times 2$, c. flower, $\times 2$, d. & e. stamens, $\times 6$, f. pistil, $\times 6$, g. young fruit, $\times 3$, h. ripe fruit, $\times 3$, i. & j. seed, $\times 6$ (a–f KOORDERS 43653, g–j KUHLE s.n.).

Distr. Himalayas, India, Burma, Thailand, China, in *Malesia*: Central Sumatra (Mt Kerintji), Java, Lesser Sunda Islands (Bali, Timor), SW. Celebes (Mt Bonthain), Moluccas (Buru, Ceram). Fig. 13.

Ecol. Grasslands, alpine woods, pathsides, 1100–3300 m. *Fl.* Jan.–Dec.

Notes. This is a rather variable species within which no satisfactory formal subdivision seems possible at present. The variation is principally in such characters as size, leaf-shape and indumentum, which are notoriously subject to environmental modification in this genus and no correlation can be detected between such variation and distribution. Conspicuously large and robust specimens, undoubtedly the result of particularly sheltered habitats, have been separated as *V. burgersdijkii* and *V. sarmentosa*. The most distinctive populations within *V. pilosa* are those from the Moluccas. Two collections from Buru (TOXOPEUS on 1 and 3 III 1922), at different elevations on Mt Fakal, superficially resemble *V. sumatrana* in leaf-colour, and in having glabrous, more or less entire calycine appendages; they are undoubtedly, however, subglabrous forms of *V. pilosa*. Material from Mt Pinaia in Ceram (STRESEMANN 302, EYMA 2259) is superficially like *V. papuana* in its coriaceous leaves and like *V. kjellbergii* in its rounded calycine appendages; it differs from both in having free stipules and from each in other characters. It is possible that these populations are worthy of subspecific status, but further material would be desirable since some of these characters are undoubtedly the result of the exposed alpine habitat which the species occupies in Ceram.

V. celebica BECKER was described from a SARASIN collection on Mt Bonthain in SW. Celebes. The undistributed collection was destroyed at Berlin, but the subsequent extensive collections by BÜNNEMEIJER from Mt Bonthain leave little doubt that it is referable to *V. pilosa*.

It may be that a fragment of the type is present in the diary of the SARASINS which is preserved at the Botanical Institute at Basel, but it has not been possible to examine this.

13. *Viola sumatrana* MIQUEL, Sum. (1860) 389; BECKER, Beih. Bot. Centralbl. 40, ii (1923) 108; RIDL. J. Bot. 73 (1935) 18. — *V. sumatrana* MIQ. var. *caerulescens* BOISSIEU & CAPITAINE, Bull. Soc. Bot. Fr. 57 (1910) 341. — *V. hossei* BECKER, Beih. Bot. Centralbl. 34, ii (1916) 257, *pro parte*; RIDL. J. Bot. 73 (1935) 18. — *V. sikkimensis* BECKER var. *acuminatifolia* BECKER, Beih. Bot. Centralbl. 34, ii (1916) 260. — *V. serpens* (non WALL.) RIDL. Fl. Mal. Pen. 1 (1922) 126. — *V. korinchensis* RIDL. J. Bot. 73 (1935) 15. — *V. robinsonii* RIDL. Lc. 16. — *V. jugalis* RIDL. Lc. 18. — Fig. 8.

Perennial; rhizome vertical to oblique, 1½–6 mm ø, bearing leaves and stems at apex. Stems up to 60 cm, slender, rooted at some nodes, with leaves and flowers at many nodes. *Leaves* ¾–7 by ¾–4 cm, 1–1¼ times as long as broad, ovate, mod-

erately to deeply cordate at base, acute, serrate, glabrous or rarely with scattered hairs below, especially on veins, dark green or purplish above, glaucous below; petiole 1–15 cm, glabrous. *Stipules* 6–14 by 1–3 mm, linear-lanceolate, long-acute, long-fimbriate, fuscous. *Flowers* 10–14½ mm, purple to creamy white, with darker veins; peduncle 5–13 cm, glabrous or rarely hispid distally. *Sepals* 5–7 by c. 1 mm, linear-lanceolate, acute, entire, glabrous or sparsely pubescent, rarely ciliate; appendage 0.4–1(–1.4) mm, rounded or slightly denticulate, glabrous or rarely hispidulous. *Petals* 2–4 times as long as broad; basal rather shorter than the others, obovate; laterals oblanceolate, not bearded; spur 1–2 mm, usually twice as long as calycine appendages, cylindrical, obtuse. *Style* 1.7–2 mm, geniculate at base, clavate distally, apex with two lateral lobes and anterior stigmatic beak. *Capsule* 7–11 mm, ellipsoid, glabrous.

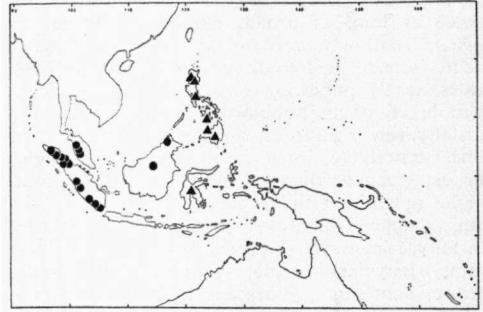


Fig. 18. Distribution of *Viola sumatrana* MIQ. (dots) and *V. mearnsii* MERR. (triangles).

Distr. China, Burma, Thailand, Indo-China, in *Malesia*: Sumatra, Malay Peninsula, Borneo (Sarawak: Batu Tibang; North Borneo: Mt Kinabalu). Fig. 18.

Ecol. River banks, pathsides, openings in montane woodland, 900–2800 m. *Fl.* Jan.–Dec.

Notes. This species has close affinities with *V. pilosa* and *V. curvistylis*. It differs from *V. pilosa* in the marginate stigma, unbearded lateral petals, short rounded calycine appendages, entire and usually glabrous sepals, and the generally glabrous leaves which are usually much darker on the upper side and which have glandular-serrate margins. *V. curvistylis* differs in its leaf-shape, bearded lateral petals, frequently hirsute sepals and its pale green, usually pilose leaves. *V. sumatrana* is apparently sympatric with *V. curvistylis* in the Malay Peninsula (Pahang), North Borneo (Mt Kinabalu) and Sumatra (Mt Kerintji), and with *V. pilosa* in Sumatra (Mt Kerintji).

The type description gives flower colour as yellowish, hence the recognition of var. *caerulescens* by BOISSIEU & CAPITAINE to account for their purple-flowered specimens. Plants with yellowish

or whitish flowers have been encountered sporadically throughout the range of the species, sometimes with the typical purple-flowered form. These specimens cannot otherwise be distinguished from the rest of the material examined and are undoubtedly colour mutants which do not merit formal taxonomic recognition.

14. *Viola curvistylis* BOISSIEU & CAPITAINE, Bull. Soc. Bot. Fr. 57 (1910) 339; BECKER, Beih. Bot. Centralbl. 40, ii (1923) 168. — *V. ovalifolia* BECKER, Beih. Bot. Centralbl. 34, ii (1916) 256; RIDL, J. Bot. 73 (1935) 15. — *V. malvina* RIDL, J. Fed. Mal. St. Mus. 15 (1917) 135. — *V. serpens* (non WALL.) RIDL, Fl. Mal. Pen. 1 (1922) 126, *pro parte*. — *V. lecomteana* BECKER ex GAGNEP. Suppl. Fl. Gén. I.-C. 1 (1939) 181, *descr. gall., illeg.* — Fig. 8.

Perennial; rhizome vertical to oblique, slender to rather stout (4 mm \varnothing), bearing leaves and stems at apex. Stems up to 35 cm, slender, creeping, bearing rooted rosettes of leaves and flowers at some nodes. *Leaves* 1–9 by $\frac{1}{2}$ –5 cm, about twice as long as broad, elliptic to lanceolate-ovate, shallowly cordate to cuneate at base, acute, serrate or crenate-serrate, hirsute on both sides, rarely pubescent or glabrous, pale green; petiole 0.6–10 cm, pubescent or scabrid, especially distally, rarely glabrous. *Stipules* 7–11 by 1–5 mm, linear-lanceolate, long-acute, long-fimbriate, glabrous, green or fuscous, free. *Flowers* 8–11 mm, violet or white with darker veins; peduncle 2–13 cm, slender, pubescent or scabrid, especially distally, sometimes glabrous. *Sepals* 4–6 by 0.6–1 mm, triangular- to linear-lanceolate, acuminate, entire, sometimes pubescent near base, usually ciliate; appendage $\frac{1}{2}$ –1 mm, rounded or slightly denticulate, glabrous or scabrid. *Petals* 2–3 times as long as broad; basal $\frac{2}{3}$ as long as others, obovate; laterals oblanceolate, bearded; spur 1–1 $\frac{1}{2}$ mm, exceeding calycine appendages, cylindrical, obtuse. *Style* $1\frac{1}{2}$ –2 mm, geniculate at base, clavate distally, with two large marginal lobes and anterior stigmatic beak at apex. *Capsule* 6–10 mm, globose to oblong, glabrous or pubescent.

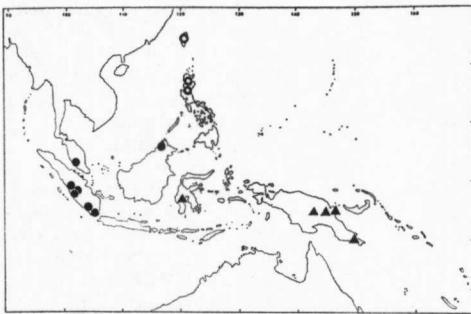


Fig. 19. Distribution of *Viola curvistylis* BOISS. & CAPIT. in Malesia (dots), *V. rupicola* ELM. (circles), and *V. kjellbergii* MELCH. (triangles).

Distr. Indo-China, Burma, in *Malesia*: Sumatra, Malay Peninsula, North Borneo (Mt Kinabalu). Fig. 19.

Ecol. Openings in montane woodlands, river banks, (600–)1000–3000 m. *Fl.* Jan.–Dec.

Notes. Differs from *V. sumatrana* in having bearded lateral petals and usually pilose leaves, and from *V. pilosa* in the prominent lateral margin of the style apex and in the usually rounded short calycine appendages, and from both species in leaf-shape. It is apparently sympatric with *V. sumatrana* in the Malay Peninsula (Pahang) and North Borneo (Mt Kinabalu), and with both *V. sumatrana* and *V. pilosa* on Mt Kerintji, Central Sumatra. The specific name derives from the curved, short style in the cleistogamous flowers of the type specimen; the species would be much better designated by BECKER's epithet *ovalifolia*.

15. *Viola rupicola* ELMER, Leaf. Philip. Bot. 1 (1908) 324; BECKER, Beih. Bot. Centralbl. 34, ii (1916) 415; Philip. J. Sc. 19 (1921) 712; Beih. Bot. Centralbl. 40, ii (1923) 171; MERR. En. Philip. 3 (1923) 106; LIN, Taiwania 1 (1950) 273. — *V. adenothrix* HAYATA, Ic. Pl. Formos. 3 (1913) 23. — *V. effusa* BECKER, Beih. Bot. Centralbl. 34, ii (1916) 424. — Fig. 8.

Perennial; rhizome vertical to oblique, rather stout, bearing leaves and usually stems at apex. Stems up to 25 cm, creeping to ascending, sometimes rooted at lower nodes. *Leaves* $\frac{3}{4}$ –2 $\frac{1}{2}$ by $\frac{3}{4}$ –1 $\frac{3}{4}$ cm, (1–)1 $\frac{1}{4}$ –1 $\frac{1}{2}$ times as long as broad, elliptical to elliptic-ovate, cordate at base with narrow sinus and basal lobes rounded and somewhat converging, acute to subobtusate, shallowly crenate, subdentate on lobes, pubescent, often densely so; petiole $\frac{3}{4}$ –12 $\frac{1}{2}$ cm, slender, hirsute. *Stipules* 3–9 by 0.6 to c. 1 mm, lanceolate, acute, fimbriate to dentate, glabrous, fuscous. *Flowers* 9–12 mm, pale purple with darker veins; peduncle 4–9 cm, exceeding leaves, slender. *Sepals* 2–4 by c. 1 mm, ovate-lanceolate, acute, entire, sparsely pubescent on back and margin; appendage c. $\frac{1}{2}$ mm, rounded, ciliate. *Petals* 2–3 times as long as broad, obovate to oblanceolate; basal usually shorter than the others; laterals and usually upper bearded; spur 0.8–2 mm, exceeding calycine appendages, cylindrical, obtuse. *Style* 1.2–1.4 mm, geniculate at base, clavate distally, with apex distinctly lobed on both sides and anterior stigmatic beak. *Capsule* 4–5 mm, globose to oblong, glabrous.

Distr. Formosa, in *Malesia*: Philippines (Luzon). Fig. 19.

Ecol. Damp ravines, rocky ledges and stream margins, c. 2000–2500 m. *Fl.* Febr.–May.

Note. Sympatric with *V. merrilliana* on Mt Pulog.

16. *Viola kjellbergii* MELCHIOR, Notizbl. Berl.-Dahl-12 (1934) 206. — *V. arcuata* (non BL.) OOSTSTR. & H. J. LAM, Blumea 5 (1945) 594. — *V. lagaipensis* D. M. MOORE, Nova Guinea, Bot. n. 11 (1963) 182. — Fig. 8.

Perennial; rhizome more or less vertical, up to

2½ cm, bearing leaves, flowers and stems at apex. Stems up to 25 cm, slender, glabrous, leafy, with flowers and rooted at some nodes. *Leaves* 0.4–3 by 0.6–2.8 cm, ovate to somewhat reniform, shallowly to deeply cordate at base, obtuse to acute, crenate to distantly dentate, glabrous, sometimes sparsely pilose near sinus; petiole 0.2–8 cm, glabrous or pubescent, especially distally. *Stipules* 2–3 mm, ovate-lanceolate to lanceolate, acute, sparsely dentate or dentate-fimbriate, glanduliferous on margin and apex, glabrous or slightly ciliate, fuscous, adnate to petiole for ½ length. *Flowers* 4–10 mm, pale purple to white, with darker veins; peduncle 2½–25 cm, glabrous or sparsely pubescent distally. *Sepals* 2½–6½ by ½–1½ mm, lanceolate to ovate-lanceolate, acute, entire or sparsely fimbriodentate, glabrous, green or fuscous, with scarious margin; appendage up to 1 mm, rounded. *Petals* 1½–2 times as long as broad; basal obovate; others oblanceolate; laterals bearded; spur 0.2–2.4 mm, shorter than to slightly exceeding calycine appendages, rounded. *Style* 1.8–2½ mm, geniculate at base, somewhat curved, filiform; stigma simple, somewhat cupuliform at maturity. *Capsule* 5–7 mm, ellipsoid, glabrous, purple to green. Chromosome number: $2n = 48$.

Distr. *Malesia*: SW. Central Celebes (Lati-mondjong Range), E. New Guinea. Fig. 19.

Ecol. Alpine heath and grasslands, occasionally wood margins, c. 2000–3540 m. *Fl.* June–March.

Notes. Superficially similar to the populations of *V. pilosa* from Ceram but differing in its adnate, shorter fimbriate stipules and in stigma shape. This species is related to *V. papuana* from which it is distinguished by the short spur, smaller flowers, shorter style and bearded lateral petals (occasionally so in *papuana*), and to *V. hederacea* from which it differs in the adnate stipules, the absence of leaves grouped in distinct rosettes, and in the much less marked bearding of the lateral petals.

17. *Viola hederacea* LABILL. Pl. Nov. Holl. 1 (1804) 66, t. 91; BECKER, Beih. Bot. Centralbl. 34, ii (1916) 428; D. M. MOORE, Blumea 11 (1963) 535, map. — Fig. 8.

Perennial; rhizome horizontal to oblique or vertical, rather stout, bearing leaves, flowers and stems at apex. Stems up to 25 cm, slender, prostrate, with rosettes of leaves and flowers at some nodes, rooted at some nodes. *Leaves* 0.9–2 by 0.9–3 cm, (1–)1.2–1½ times as broad as long, reniform to suborbicular, cordate, broadly obtuse, distinctly repand-crenate, sparsely pubescent beneath, more heavily above, subcoriaceous, dark green; petiole 0.8–9 cm, glabrous or sparsely pilose. *Stipules* 2–3 by 1–2 mm, ovate-lanceolate, acute, fimbriodentate to fimbriate, glabrous, green to fuscous, free. *Flowers* 7–9 mm, white with purple centre; peduncle 2–19 cm, much exceeding leaves, slender. *Sepals* 4–6 by c. 1½ mm, linear-lanceolate, acute, entire, glabrous, green with scarious margin; appendage up to ½ mm,

rounded, glabrous. *Petals* about twice as long as broad, obovate-oblong; laterals bearded; spur absent or rudimentary. *Style* c. 2½ mm, geniculate at base, slightly curved, filiform; stigma terminal, simple. *Capsule* c. 8 mm, ellipsoid, glabrous.

Distr. Tasmania, Australia (S. Australia, Victoria, New South Wales, Queensland), in *Malesia*: Malay Peninsula (Cameron Highlands, Pahang). Fig. 20.

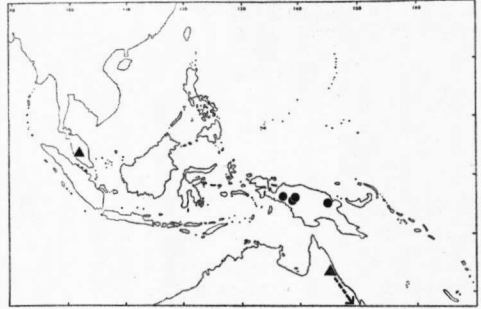


Fig. 20. Distribution of *Viola hederacea* LABILL. in *Malesia* (triangles) and *V. papuana* BECKER & PULLE (dots).

Ecol. Montane grassland, 2030 m. *Fl.* Sept.–Nov.

Note. The isolated occurrence in Malaya of this Australian species is surprising, and falls outside the accepted migration track of cold-loving plants from the southern hemisphere into *Malesia*. However, in view of its relatively recent discovery in the Cameron Highlands, an area which has been well-collected in the past, in a locality close to the radio station on Batu Brinchang, it is possible that this species has been introduced by man.

18. *Viola papuana* BECKER & PULLE, Nova Guinea 8 (1912) 670; BECKER, Beih. Bot. Centralbl. 34, ii (1916) 431; D. M. MOORE, Nova Guinea, Bot. n. 11 (1963) 184. — *V. klossii* RIDL. Trans. Linn. Soc., Bot. 9 (1916) 18. — Fig. 8.

Perennial; rhizome more or less vertical, stout, bearing leaves and stems at apex. Stems up to 24 cm, rather slender, rooting at nodes with leaves and flowers along their length. *Leaves* 0.4–1.4 by 0.6–1.8 cm, ovate, rather deeply cordate at base with rounded basal lobes, acute to subobtusate, more or less repandate to undulate-serrate, glabrous or sparsely pubescent on veins above and sparsely ciliate, rather coriaceous, dark green and often purple-tinged; petiole ½–4 cm. *Stipules* 3–4 by c. 1 mm, lanceolate to ovate-lanceolate, acuminate, subtentate to sparsely fimbriate, sometimes glanduliferous, glabrous, fuscous. *Flowers* (excluding spur) 8–13 mm, pale violet to white with violet centre; peduncle 4–14 cm, glabrous. *Sepals* 3–6 by c. 1 mm, lanceolate to ovate-lanceolate,

acute, sparsely fimbriodentate; appendage c. $\frac{1}{2}$ mm, rounded, glabrous. *Petals* 2–3 times as long as broad; basal obovate, slightly shorter than others; laterals oblanceolate to obovate, usually not bearded; spur (3–)4–9 mm, cylindrical, straight or slightly upcurved, obtuse. *Style* $2\frac{1}{2}$ –3 mm, geniculate at base, slightly curved, filiform; stigma simple, more or less indistinctly cupuliform. *Capsule* 7–9 mm, oblong-ellipsoid, glabrous. Chromosome number $2n = 48$.

Distr. *Malesia*: New Guinea. Fig. 20.

Ecol. Pathsides and open places in montane forest and among rocks of alpine areas, 2100–3350 m. *Fl.* Oct.–Febr.

Doubtful

Viola ramosiana BECKER, Philip. J. Sc. 19 (1921) 716.

Based on a fruiting specimen from “c. 1350 m, along streams, Mt. Masingit, Lubuagan, Kalinga Subprovince, Luzon, Philippines, on ii. 1920, by RAMOS & EDAÑO, Bur. Sci. 37548”. The holotype was destroyed in the Manila herbarium. An isotype (US) does not agree with the description in that it is not stoloniferous, the stipules are partially adnate to the petiole, and some of the leaves are sparsely pubescent. This material may be referable to *V. philippica*, which is known from the same locality, but it differs from that species in the well-developed glands on the marginal crenations of some leaves. This, together with the absence of flowers and the firm reference to stolons in the destroyed holotype, precludes any definite application of this specific name.

Excluded

Tribe *Sauvagesieae*, including the genera *Neckia* KORTH., *Sauvagesia* L., *Schuermansia* BL., and *Indovethia* BOERL. were sometimes arranged in *Violaceae*, but are now unanimously classified in *Ochnaceae*.

Gestroa BECC. *Malesia* 1 (1877) 184 is, according to SLEUMER, *Fl. Mal.* I, 5 (1954) 6, a synonym of *Erythrospermum* (*Flacourtiaceae*).

Perissandra GAGNEP. *Bull. Soc. Bot. Fr.* 95 (1948) 27, from Indo-China is, according to JACOBS, *Blumea* 15 (1967) 138, a synonym of *Vatica* (*Dipterocarpaceae*).