

PENTAPHRAGMATACEAE (H. K. AIRY SHAW, Kew)

AIRY SHAW, Kew Bull. 1941, 233 (1942); LEMÉE, Dict. Descr. Suppl. 9 (1951) 201.—*Campanulaceae*—*Campanuloideae*—*Pentaphragmeae* SCHÖNL. in E. & P. Nat. Pfl. Fam. 4, 5 (1889) 40, 68.—*Saxifragaceae* 'sect. *Francfleuryae*' CHEV. & GAGNEP. Rev. Bot. Appl. 7 (1927) 663.—'Pentaphragmacées' GAGNEP. *op. cit.* 8 (1928) 622, in adnot., nom. provis.

Perennial ± succulent herbs, often somewhat woody and procumbent and rooting at the base, often clothed with branched multicellular hairs; habit sometimes recalling certain *Gesneriaceae* (*Cyrtandra*, etc.). Leaves alternate, simple, mostly ± asymmetrical, sinuate-denticulate or subentire, ± fleshy, petiolate, exstipulate. Inflorescences axillary, cymose, often scorpioid, acropetal, solitary or 2–3 together in each axil. Bracts usually rather large and membranous. Flowers hermaphrodite (rarely unisexual), actinomorphic (calyx excepted), shortly pedicelled or sessile. Calyx-tube campanulate or linear-cylindric, adnate to the ovary by means of 5 longitudinal septa formed by the continuation of the filaments, leaving 5 deep nectariferous pits below the petals; lobes 5, imbricate, mostly membranous, persistent, unequal (2 larger and 3 smaller), coloured (mostly whitish). Corolla inserted at the apex of the calyx-tube, variously gamopetalous or less frequently choripetalous, ± campanulate, mostly fleshy or cartilagineous, occasionally delicate in texture, persistent, segments or petals 5 (rarely 4), valvate (sometimes induplicate), often reflexed at the apex. Stamens 5, alternipetalous, shortly adnate to the corolla (when gamopetalous); filaments persistent; anthers ovate, oblong or linear, introrse, basifixed, dehiscent by slits. Ovary inferior, 2-locular; placentas axile, bifid, multi-ovulate; style short, thick, simple; stigma massive, oblong-cylindric, often strongly 5-ribbed. Ovules very minute, very numerous, pendulous, anatropous, with 1 integument. Fruit baccate, indehiscent. Seeds minute, ovoid; testa reticulate, brown; embryo minute; albumen copious.

Distr. One genus. From Lower Burma, Indo-China and Kwangtung, throughout *Malaysia* to Central New Guinea—Java and the Lesser Sunda Islands excepted. Fig. 1.

Ecol. Damp primary rain-forest, often on rocks by streams, up to 4000 m.

Uses. Unimportant, as vegetable or medicine.

Notes. The family is a very isolated one. It is possible that there may be a remote connection with the *Campanulaceae*, with which it has long been associated, but the anatomy (see METCALFE in AIRY SHAW, *l.c.*) shows strong affinities with that of the *Begoniaceae*—an affinity also suggested by the asymmetrical leaves—and the habit recalls some of the *Gesneriaceae* (cf. *Cyrtandra*, *Epithema*, etc.) and even *Rubiaceae* (*Argostemma*). It is not at present possible to suggest a satisfactory place for the family in any recognized system.

RIDLEY (*l.c. infra*) states that 'plants with double flowers occur in most, if not all, the species' (of the Malay Peninsula). I cannot confirm this; I have never observed double flowers in *Pentaphragma*.

1. PENTAPHRAGMA

WALL. *ex* G. DON, Gen. Syst. 3 (1834) 731; A. DC. Prodr. 7 (1839) 495; MIQ. Fl. Ind. Bat. 2 (1857) 568; BENTH. & HOOK. *f.* Gen. Pl. 2 (1876) 558; CLARKE in HOOK. *f.* Fl. Br. Ind. 3 (1881) 437; BAILLON, Hist. Pl. 8 (1886) 323–4, 358; SCHÖNLAND in E. & P. Nat. Pfl. Fam. 4, 5 (1889) 60; BOERL. Handl. 2 (1891) 257; KING & GAMBLE, J. As. Soc. Beng. 74, 2 (1905) 55; RIDL. Fl. Mal. Pen. 2 (1923) 202; LEMÉE, Dict. Descr. 5 (1934) 134; *op. cit.* Suppl. 9 (1951) 201.

For characters see family description. *Pentaphragma* WALL. *ex* DC. Mon. Camp. (1830) 95, a superfluous name for *Scaevola*, is a *nomen nudum* and is discarded.

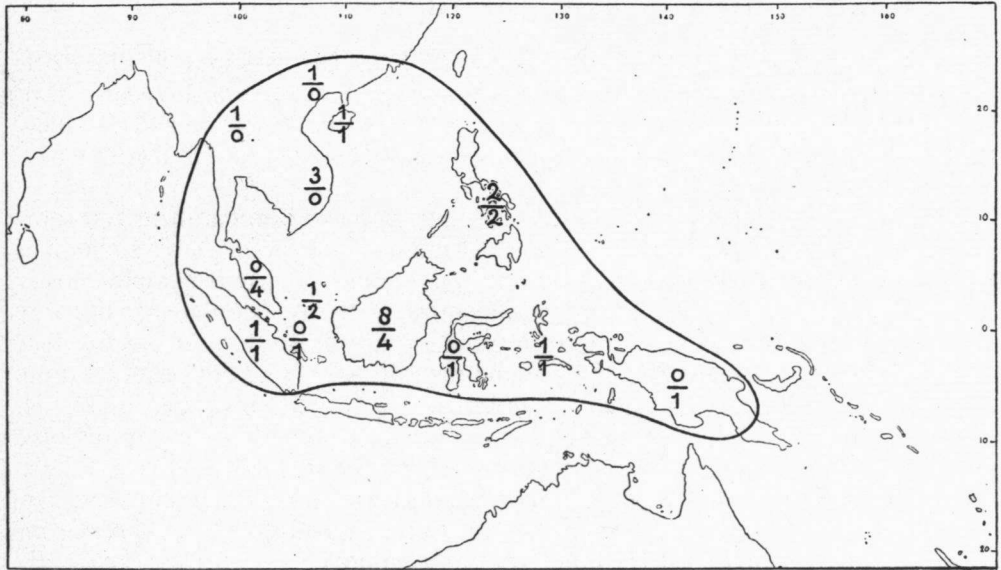


Fig. 1. Distribution of the genus *Pentaphragma*. In each island or island group the figure above the line indicates the number of endemic species, the figure below the line the number of species which are known from more than one island or island group. The corresponding figures from SE. Asia, outside Malaysia, have been derived from literature and are questionable, as the material on which they are based has not yet been revised.—ED.

Distr. About 25 *spp.* known, with main concentration in Borneo, where many more probably remain to be discovered. It is noteworthy that there are only 7 known Malaysian species which do not include Borneo as at least part of their known area: *P. begoniifolium* (northern Malay Peninsula, extending into Lower Burma and Peninsular Siam); *P. bartlettii* (Sumatra); *P. combretiflorum* (Natuna Isl.); *P. mindanaense* (Philippines); and the three large-flowered species, *P. grandiflorum*, *P. platyphyllum*, and *P. lanuginosum* (Philippines–Moluccas–New Guinea).

KEY TO THE SPECIES

1. Stems with conspicuous raised lines or ridges, not caused by shrinkage in drying, running down from the decurrent leaf-bases (inflorescence not distinctly scorpioid).
 2. Robust plants, with glossy reddish stems. Inflorescences mostly 3-flowered, densely crispate-pubescent. Flowers large, with elongate calyx-tube. Corolla gamopetalous, fleshy. 4. *P. insigne*
 2. Smaller plants, stem not reddish nor conspicuously glossy. Inflorescences 10–12-flowered, almost glabrous. Flowers small, with shortly ellipsoid calyx-tube. Corolla choripetalous, membranous. 11. *P. decurrens*
1. Stems without raised lines from decurrent leaf-bases (or if obscure ridges present then inflorescences distinctly scorpioid).
 3. Leaves exceedingly asymmetrical, the shorter side usually concave-excised below and meeting the petiole (or midrib) sometimes 2 cm above the base of the longer side. (Inflorescence at first scorpioid, usually solitary on each stem. Flowers small) 16. *P. begoniifolium*
 3. Leaves less asymmetrical, sometimes almost symmetrical, the shorter side never concave.
 4. Leaves of a thick, fleshy or leathery texture. Bracts firm, not or scarcely membranous. (Inflorescence 6–10-flowered, subsessile. Flowers rather large. Corolla gamopetalous at least half-way). 7. *P. cyrtandriforme*
 4. Leaves not thick and leathery (or if thickish, other characters not as above), mostly papery or membranous when dry. Bracts always ± membranous.
 5. Flowers unisexual (♂ only known), delicate in texture. Calyx-tube elongate. Petals very delicate, lingulate, free. Leaves almost symmetrically ovate, subcordate at the base, rounded at the apex. 14. *P. tenuiflorum*
 5. Flowers ♂. Corolla ± fleshy or cartilagineous (except in *P. jaherü*). Leaves not cordate or subcordate (except in *P. platyphyllum*).
 6. Corolla usually 4-merous. Petals unguiculate-spatulate, almost free, with spreading elliptic limb, pale-margined when dry 13. *P. tetrapetalum*

- 6. Corolla usually 5-merous. Petals not usually unguiculate-spatulate, limb not conspicuously elliptic and pale-margined.
- 7. Corolla delicate in texture (segments free or almost so, externally pubescent). Stem dwarf, 5 cm. (Leaves thickish) 15. *P. jaherii*
- 7. Corolla ± fleshy or cartilaginous. Stem exceeding 5 cm.
- 8. Leaves conspicuously cordate at base (± hirsute below, up to 28 by 20 cm. Inflorescence large, lax, ± hirsute). Sepals large, rounded, the larger ones 2-2½ by 1½ cm. 2. *P. platyphyllum*
- 8. Leaves not (or only slightly and occasionally) cordate at base. Sepals mostly smaller; if as long or longer, then proportionately narrower.
- 9. Leaves gradually attenuate-acuminate at the apex, 8-18 by 3-6½ cm. (Inflorescence small.)
- 10. Inflorescence lax, rhachis 1-1½ cm long. Upper bracts conspicuous, linear-spatulate. Sepals elongate, oblong-spatulate. 12. *P. spatulisepalum*
- 10. Inflorescence compact, ± capitate, rhachis ± 5 mm long. Upper bracts small, inconspicuous, ± elliptic. Sepals small, elliptic. 19. *P. acuminatum*
- 9. Leaves not gradually attenuate-acuminate at apex, at most ± abruptly shortly acuminate or cuspidate.
- 11. Stems, petioles, midribs (below) and inflorescence-rhachis coarsely long-crispate-lanuginose. (Inflorescence large. Flowers elongate) 3. *P. lanuginosum*
- 11. Stems, etc., glabrous to crispulous-pubescent, but not coarsely lanuginose.
- 12. Flowers very elongate. Calyx-tube 3-8½ cm long 1. *P. grandiflorum*
- 12. Flowers much less elongate. Calyx-tube not more than 2 cm long.
- 13. Calyx-tube 8-20 mm long.
- 14. Calyx-tube turbinate-obovoid, 8-10 mm long, densely crispate-pubescent. Inflorescence 2-8-flowered, non-scorpoid. (Leaves sometimes thickish) 5. *P. aurantiacum*
- 14. Calyx-tube cylindrical or ellipsoid or fusiform-lanceolate, 10-15 mm long, shortly pubescent. Inflorescence scorpoid or subscorpoid. Flowers usually more numerous.
- 15. Inflorescence usually elongate. Flowers arranged in parallel regular rows. Hypanthia not or scarcely contiguous. Sepals 4-5 by 1-4 mm. Leaves broadly elliptic, practically symmetrical. 8. *P. cumbretiflorum*
- 15. Inflorescence usually rather robust and dense. Flowers less obviously in parallel rows, calyx-tubes usually contiguous. Sepals 13-15 by 3-8 mm. Leaves broadly elliptic to broadly ovate, slightly but distinctly asymmetrical, rather thin in texture, often drying yellowish 6. *P. albiflorum*
- 13. Calyx-tube 3-8 (rarely 10) mm long.
- 16. Corolla-segments erect, deltoid, acute, not recurved at the apex.
- 17. Sepals very broadly elliptic to suborbicular, 4 by 2-4 mm, slightly constricted at base, subconvex. Inflorescence small, subglobose. 10. *P. bartlettii*
- 17. Sepals inconspicuous, recurved, oblong, 2-3 by 1-2 mm, not constricted at base, flat. Inflorescence shortly scorpoid when young, later becoming lax and elongate. 9. *P. mindanaense*
- 16. Corolla-segments ± ovate or obovate, often ± recurved at apex.
- 18. Flowers 5-8 (rarely 10) mm long. Inflorescences usually strongly scorpoid. 18. *P. horsfieldii*¹
- 18. Flowers 10-15 mm long. Inflorescence dense and compact, scorpoid when luxuriant (20-30-flowered), capitate when few (± 10)-flowered. Similar to *P. horsfieldii*, but flowers twice as large 17. *P. viride*
(N.B. Young, few-flowered states of *P. albiflorum* may key out here.)

1. *Pentaphragma grandiflorum* KURZ, Flora 55 (1872) 136 (type: TEYSMANN 5615, from Batjan, Moluccas; Herb. Bogor.).—*P. macrophyllum* OLIVER, J. Linn. Soc. 15 (1875) 29 (lectotype: MEYER 9, from Geelvink Bay, NW. New Guinea; Herb. Kew.); F. v. M. Descr. Not. 1 (1876) 28, *in obs.*; SCHEFFER, Ann. Jard. Bot. Btzg 1 (1876) 181; SCHÖNLAND in E. & P. Nat. Pfl. Fam. 4, 5 (1889) 60; BOERLAGE, Handl. 2¹ (1891) 257; VALETON, Bull. Dép. Agr. Ind. Néerl. no 10 (1907) 68; PULLE, Nova Guinea 8¹ (1910) 407; *op. cit.* 8² (1911) 691; LAM, Nat. Tijd. Ned. Ind. 88 (1928) 213, 218, *in obs.*; MERR. & PERRY, J. Arn. Arb. 22 (1941) 384.—*P. philippinense* MERRILL, Philip. J. Sc. 2 (1907) Bot. 308 (type: MERRILL 6136, from

Mindoro, Philippines); C. B. ROBINSON, *op. cit.* 6 (1911) Bot. 227; MERRILL, En. Philip. 3 (1923) 587.—*P. paucinerve* QUIS. & MERR. Philip. J. Sc. 37 (1928) 211.

Stem usually robust, up to 2½ m high and 1 cm thick, glabrous or sparsely pubescent. *Leaves* ± obliquely elliptic, up to 45 by 20 cm, cuneate at base, shortly acuminate or apiculate at apex, shallowly denticulate or serrulate at margin, membranous when dry, glabrous above, finely puberulous to glabrescent below; nerves c. 6 pairs; petiole up to 10 cm, glabrous or puberulous. *Inflorescences* arising mostly singly from 1-4 upper axils, shortly subscorpoid when young, becoming lax and elongate at anthesis, up to 6

(1) Most segregates of the presumed hybrid *P. × ellipticum* POULS. will also key out here.

(rarely 10) cm, long- or short-peduncled. Bracts very variable, sometimes small and inconspicuous, sometimes large, lanceolate or elliptic, up to 3 by 1 cm. *Flowers* extremely variable, 3¹/₂–9¹/₂ cm long. Calyx-tube subcylindric or very narrowly obconic, 3–8¹/₂ cm by 1–4 mm, very gradually attenuate below into the pedicel (and indistinguishable from it until fruit develops), sometimes conspicuously 5-ridged, glabrous or puberulous. *Sepals* very variable, from linear-oblong, 12 by 2 mm, acuminate, to ovate, 29 by 14 mm, subacute or rounded, white. *Corolla* fleshy, choripetalous or almost so, segments elliptic-obovate, 8–12 by 3–5 mm, rounded or acute, glabrous, ± erect, often recurved at apex, yellow. Filaments c. 1 mm; anthers c. 2 mm. Style about 2 mm; stigma oblong, 3 by 2 mm, 5-ridged.

Distr. *Malaysia*: Philippines, Moluccas (Bajau, Ceram, Buru), New Guinea.

Ecol. Damp primary rain-forest at low and medium altitudes (up to 1000 m), on limestone as well as sandstone; *fl. & fr.* throughout the year.

Uses. A recent Philippine collector suggests (*in sched.*) that the flowers are sufficiently showy to render the plant suitable for ornamental purposes.

Vern. *Bugaong*, *handanata*, *pitun*, *salangbangung*, Philippines, *nina kope*, Ceram.

Notes. Examination of a rather extensive series of specimens from the Philippines and W. New Guinea, and of a smaller number from the Moluccas, has convinced me that it is at present impossible to recognize more than one, very variable, species within this group. Certain local tendencies are perceptible, such as great elongation of the hypanthium, reduction of indumentum and narrowing of sepals in New Guinea, and rounding of sepals and greater development of pubescence in the Philippines, but the variations seem to be quite continuous and uncorrelated, and it is impossible to fix lines of demarcation between the three species hitherto recognized. KURZ's somewhat neglected species provides the earliest name for the group in the aggregate.

The eastern limit of the species in New Guinea appears almost to coincide with the boundary of Indonesian territory, since, although it has been collected many times to the west of this line, the only evidence for its occurrence east of it rests upon two specimens from the Fly River, collected both by d'ALBERTIS in 1877 (in Herb. BECCARI) and by BRASS in 1936 (cited by MERRILL & PERRY, *l.c.*, 1941).

2. *Pentaphragma platyphyllum* MERR. Philip. J. Sc. 17 (1920) 322; En. Philip. 3 (1923) 587.

Stem robust, up to 50 cm long, densely crispate-pubescent on the younger parts. *Leaves* large, broadly ovate to elliptic-ovate, slightly oblique, up to 28 by 20 cm, base cordate, apex very shortly triangular-cuspidate, subacute, margin rather distantly and shallowly denticulate, papyraceo-chartaceous when dry, glabrous above, thinly crispate-strigose below (densely when young), especially along the nerves; nerves 5–6 pairs; petiole up to 10 cm. *Inflorescences* apparently arising singly

in 2–3 upper axils, pubescent, up to 8 cm long. Bracts narrowly oblong, up to 1 cm. Pedicels about 1¹/₂ cm. Calyx-tube slender, elongate, up to 3 cm, terete or obscurely angled, ± pubescent. *Sepals* elliptic, the two larger 2–2¹/₂ by 1¹/₂ cm, the remainder about half as large, rounded, white. *Petals* oblong to narrowly oblong-obovate, c. 10 by 5–6 mm, rounded, fleshy.

Distr. *Malaysia*: Philippines.

Ecol. Primary rain-forest along small streams at low altitudes; *fl.* May.

Notes. Distinguished from the closely related *P. grandiflorum* and *P. lanuginosum* principally by its cordate-based leaves.

3. *Pentaphragma lanuginosum* AIRY SHAW, Kew Bull. (1953) 241.

Stem robust, but of unknown stature, 7–12 mm thick in upper part, shaggy. *Leaves* obliquely obovate, 25–35 by 12–17 cm, base cuneate, apex rounded to subacute, usually very shortly apiculate-acuminate, margin denticulate often revolute, membranous when dry, glabrous above, shortly hispidulo-pubescent below, ± conspicuously crispulous-shaggy along the midrib and larger nerves; nerves c. 6 pairs; petiole robust, 3–5¹/₂ cm by 4–8 mm, strongly crispulous-shaggy. *Inflorescences* arising singly from 1–2 upper axils, at first subscorpioid, soon becoming lax and elongate, 10–12 cm long, 10–20-flowered; peduncle 1¹/₂–2 cm, rhachis up to 7 cm, both shaggy. Bracts broadly ovate to oblong, acute, 10–15 by 3–10 mm, membranous, puberulous on the back. *Flowers* large, up to 6–7 cm long. Calyx-tube elongate, very narrowly obconic, very gradually widened upwards, 4–5 cm by 3–5 mm, crispulous-floccose. *Sepals* narrowly or broadly ovate, 13–17 by 4–12 mm, acute, membranous, sparsely crispulous-floccose on the back, otherwise glabrous. *Corolla* apparently choripetalous, or exceedingly shortly gamopetalous, fleshy, ± crispulous-floccose outside; segments oblong-elliptic, c. 12 by 5 mm, subacute, margins inflexed. Filaments ± 2 mm; anthers linear, ± 3 mm, acute. Style thick, 2–3 mm; stigma cylindric, 5-ribbed, 3 by 1¹/₂ mm.

Distr. *Malaysia*: Moluccas (Sula Islands: Taliabu); once collected.

Notes. Distinguished from the closely related *P. grandiflorum* and *P. platyphyllum* by the dense shaggy indumentum.

4. *Pentaphragma insigne* AIRY SHAW, Kew Bull. (1953) 241.

Stature unknown, probably 60 cm or more; stems robust, up to 12 mm thick, fistular, glabrous, glossy, dark red when dry, conspicuously costate-winged from the long imbricate-decurrent petiole-bases, wings 1–2 mm wide. *Leaves* broadly ovate to broadly elliptic, slightly oblique, 17–22 by 8–11¹/₂ cm, ± rounded to broadly cuneate at base, broadly acute at apex, passing into a cusp or short acute acumen, margin rather coarsely crenate-dentate, firmly papyraceous when dry, glabrous above, densely shortly hispidulo-pubescent below; nerves 3–5 pairs; petiole (free part)

1½–2½ cm by 3–4 mm, almost glabrous. *Inflorescences* arising singly from 3–4 middle or upper axils, mostly 3-flowered, erect; peduncle 3–4 mm, densely crispate-pubescent. Bracts ovate-lanceolate, up to 18 by 7 mm, much attenuate upwards, acute, crispulo-pubescent outside, glabrous and shining within; pedicels 1–2 mm. Calyx-tube elongate-fusiform or almost cylindrical, 15 by 2–4 mm, striate, densely crispulo-pubescent. *Sepals* rather small, subspatulate-ellipsoid, 8–10 by 2–3 mm, obtuse, slightly papillose-puberulous on the back, separated by broad rounded sinuses. *Corolla* widely cup-shaped, 6 mm long, gamopetalous for 1/3 or 1/2, firmly fleshy, segments ovate-deltoid, ca 4 mm wide at base, acute at apex, margin entire narrowly pale-cartilagineous. Filaments 3½–4½ mm; anthers lanceolate, attenuate at apex, acute, 3½ mm, linear after dehiscence. Style thick, 3 mm; stigma oblong, 3 by 1½ mm, obscurely 5-grooved.

Distr. *Malaysia*: Borneo (Sarawak); once collected.

Ecol. Primary rain-forest, on sandstone, between 450 and 900 m; fl. May.

Notes. This is certainly nearest to *P. aurantiacum* STAFF, but differs strikingly in the stem being prominently ridged and almost winged from the decurrent petiole-bases, and in the narrowly fusiform or cylindrical calyx-tube.

5. *Pentaphragma aurantiacum* STAFF, Trans. Linn. Soc. 4 (1894) 188; RIDL. J. Str. Br. R. As. Soc. no 63 (1912) 60; MERR. En. Born. (1921) 585.—*P. grande* RIDL. J. Linn. Soc. 38 (1908) 312; Fl. Mal. Pen. 2 (1923) 203; AIRY SHAW, Kew Bull. 1941, 235 (1942).—*P. pulgarensis* ELMER, Leaf. Philip. Bot. 8 (1915) 2572; MERR. En. Philip. 3 (1923) 587.—*P. obtusifolium* MERR. Sarawak Mus. J. 3 (1928) 556.

Stem robust, up to 90 by 1.2 cm, sparsely puberulous above, otherwise glabrous, sometimes conspicuously lenticellate. *Leaves* obliquely ovate, 11–22 by 6–13 cm, cuneate to truncate-rounded at base, very shortly cuspidate-acuminate at apex, margin closely undulate-denticulate, often reflexed and then appearing entire, membranous and somewhat translucent when dry, glabrous above, scatteredly hispidulous-pubescent below; nerves 2–4 pairs, usually densely crispulo-puberulous below; petiole 2–6 cm, puberulous or glabrescent. *Inflorescences* 1–3 on each stem, from the upper axils, 2–8-flowered; peduncle 5–8 cm, pubescent. Lower bracts broadly ovate, about 10 by 7 mm, acute, coarsely papillose, upper ones smaller and narrower. *Flowers* large, nearly 2 cm long, very shortly pedicelled. Calyx-tube turbinate-obovoid, 8–10 mm long, densely crispate-pubescent. *Sepals* broadly or narrowly oblong, 6–8 by 2–5 mm, obtuse, reticulate-nerved, crispulo-pubescent outside, almost glabrous within. *Corolla* 2–2½ cm across when expanded, slightly or scarcely fleshy, sympetalous for 1/3 or more, very sparsely puberulous outside, segments broadly obovate, 7–8 mm wide, subacute, junction of adjacent segments marked internally by double thickened suture. Filaments flattened, 3 mm long;

anthers oblong, 2 mm. Style very short, stigma 3 mm long, cylindrical-pentagonal. *Fruit* turbinate-obovoid, 10 by 5–6 mm, densely crispate.

Distr. *Malaysia*: Malay Peninsula, Borneo (NE. Sarawak & Mt Kinabalu), Philippines (Palawan).

Ecol. Primary rain-forest, and upper dwarfed forest, 1500–2700 m; fl. & fr. March–April, June–September, December. Apparently not infrequent on Kinabalu.

Notes. The form described by RIDLEY as *P. grande* differs from the type of *P. aurantiacum* in its apparently more opaque and thickly coriaceous leaves, with shorter hairs on the lower surface. This form has, however, also been gathered on Mt Kinabalu (between Kamburangan and Paka, 2700 m, CLEMENS 28999), and as it appears to show no significant differences in floral structure it seems preferable to consider it for the present as a form of *P. aurantiacum*.

The range in flower colour is noteworthy, various collectors giving it as bright red with green sepals, orange, salmon yellow with green throat, yellow, and dirty white. It is possible that this sequence corresponds to the progressive age of the flowers.

The species is characterized by its generally robust habit and short, non-scorpoid inflorescences of large, somewhat turbinate, densely crispate-pubescent flowers.

6. *Pentaphragma albiflorum* H. H. W. PEARSON in Hook. Ic. Pl. 28 (1901) t. 2706; MERR. En. Born. (1921) 585.

Stem robust, up to 60 cm high, mostly glabrous or glabrescent and lenticellate, but sparsely crispate-pubescent on the young parts. *Leaves* broadly elliptic to broadly ovate, slightly oblique, 11–24 by 5½–13 cm, cuneate-attenuate at base, acute and very shortly acuminate or cuspidate at apex, obtusely sinuate-denticulate or undulate-serrate, glabrous above, shortly and sparsely hispidulous-pubescent below, more densely so on the nerves; nerves 3–4 pairs; petiole 2½–5 cm, shortly hispidulous or glabrescent. *Inflorescences* robust, shortly scorpoid, arising singly (? rarely 2 together) from 1–5 upper axils, 3–6 cm long, rather densely and shortly crispate-pubescent; peduncle 5–10 mm. Lower bracts oblong-ovate, up to 2 by 1 cm, membranous, minutely hispidulous, upper ones gradually diminishing in size. Pedicels 0–2 mm long. *Flowers* large, c. 2 cm long at anthesis, but rapidly elongating to c. 3 cm in fruit. Calyx-tube narrowly fusiform-lanceolate, c. 10 by 2–3 mm, attenuate above, shortly pubescent. *Sepals* large, membranous, oblong-elliptic, c. 13–15 by 3–8 mm, rounded-obtuse, erose-denticulate, sparsely to densely crispate-pubescent outside. *Corolla* 6–7 mm long, gamopetalous to c. 1/3, segments ± lanceolate or narrowly triangular, c. 3 mm wide at base, apex acute, spreading but not usually strongly reflexed, ± fleshy. Stamens about 3 mm long; anthers oblong, apparently often abortive. Style thick, 2–3 mm; stigma oblong, pentagonal, 2 mm long. *Fruit* ellipsoid, 15–20 by 3–5 mm, ± crispate-pubescent.

Distr. *Malaysia*: Natuna Islands (Bunguran), Borneo (W. Borneo, Sarawak, N. Borneo), ?Philippines (Palawan), ?Celebes.

Ecol. Primary rain-forest; at 600 m on Mt Ranai in Bunguran, at 3–4000 m on Mt Kinabalu; *fl. & fr.* April–May, Aug.–Sept., Nov.

Notes. The principal features of this species appear to be the rather large, \pm ferruginous-pubescent, shortly scorpioid inflorescences, large flowers, and large membranous sepals with rounded tips. The foliage varies considerably, but often dries a pale yellowish brown. The illustration of the inflorescence in HOOKER'S *IC. Pl.* is misleading, in showing apparently rotate corollas; the dissection (*l.c.* fig. 2), however, is correct.

A plant that has twice been collected in SW. Central Celebes (RACHMAT 581 and KJELLBERG 1757a, both in Herb. BOGOR.) possibly represents a small-flowered form of *P. albiflorum*, but further collections are required in order to decide its status. It is the only *Pentaphragma* so far known from Celebes.

7. *Pentaphragma cyrtandriforme* AIRY SHAW, Kew Bull. (1953) 242.

Stem 10–20 cm long, \pm prostrate. *Leaves* broadly elliptic to ovate, slightly oblique or almost symmetrical, 8–25 by 5–13 cm, base cuneate or rounded or slightly truncate-cordate, apex rounded or subacute, margin usually very closely sinuate-denticulate-crenulate, sometimes revolute and then apparently subentire, glabrous above, rather furfuraceous below (occasionally glabrescent between the nerves), coriaceous-fleshy when dry, mostly grey-olive above, pale ochraceous beneath; nerves 3–7 pairs; petiole 2½–13 cm, mostly elongate. *Inflorescences* arising singly or in pairs from upper axils, capitate, not or scarcely scorpioid, 1½–4 cm in diam., 6–10-flowered; peduncle up to 1 cm, sometimes almost absent. Bracts broadly elliptic, mostly herbaceous, the lowest 10–18 by 6–7(–12) mm, acute. *Flowers* 1–2 cm long, or sometimes up to 3 cm. Calyx-tube obovoid or ellipsoid, 8 by 2–3 mm, or sometimes narrowly fusiform, up to 2 cm by 3–4 mm, angled. *Sepals* elliptic, very unequal, 8–13 by 3–6 mm, subacute. *Corolla* gamopetalous, 7–10 mm long, tube urceolate-campanulate, 4–7 mm long, segments revolute, 2½–3 mm wide. Stamens 4 mm long; anthers subulate. Style thick, stigma pentagonal-cylindric 2–3 by 1 mm. *Fruit* ellipsoid, up to 15 by 7 mm.

Distr. *Malaysia*: Malay Peninsula (Trengganu, Pahang), Borneo.

Ecol. Primary rain-forest up to 1800 m; *fl. & fr.* March, June–Sept., Nov., Dec.

Notes. The thick, fleshy-coriaceous, often densely crenulate-denticulate leaves, and the sessile inflorescences of few, rather large flowers, with large, firm, not or scarcely membranous bracts, are characteristic of this species. The more or less prostrate stem, often long-petioled leaves, and capitate, sessile inflorescence, are suggestive of some of the *Gesneriaceae-Cyrtandroideae*. The species has been described from almost a dozen collections, and shows some variation; it is

possible that the material from SE. Borneo may even be distinct, but it seems preferable for the present to include it within the species.

8. *Pentaphragma combretiformum* AIRY SHAW, Kew Bull. (1953) 243.

Stature unknown; stems robust below, up to 9 mm thick, smooth, glabrous except for the sparsely crispulo-pubescent young parts, leafy. *Leaves* very broadly elliptic or obovate-elliptic, hardly asymmetrical, 13–19 by 7–13½ cm, base cuneate-attenuate, rarely \pm rounded, sometimes slightly unequal-sided, apex very broadly cuspidate-acuminate, margin very shortly undulate-denticulate, thinly papery in texture when dry, glabrous above, very shortly and sparsely papillose-hispidulous or almost glabrous below, quintuplinerved or rarely septuplinerved; petiole 3–5½ cm, slender, glabrous. *Inflorescences* arising singly or two together from 4 of the upper axils, shortly or rather elongate-scorpioid, 1–3½ cm long, 4–20-flowered, flowers elongate, arranged very regularly, parallel, recalling the inflorescence of some *Combretum*; peduncle 7–8 mm long, crispulo-puberulous; bracts small in proportion, ovate, 5–7 by 3–5 mm, the lowest one sometimes larger, up to 12 mm long, membranous, ciliolate, puberulous on the back; pedicels none. *Flowers* 1½–2 cm long. Calyx-tube at first almost cylindrical, then narrowly fusiform-lanceolate, almost rostrate, 11–13 by 1–3 mm, \pm pentagonal, striate, sparsely puberulous. *Sepals* oblong-ovate or oblanceolate, 4–5 by 1–4 mm, rounded, membranous, puberulous on the back. *Corolla* campanulate, gamopetalous for more than ½ (later more deeply split), 6 mm long, 5 mm wide, sparsely or rather densely crispate-puberulous outside, segments oblong or ovate, erect, subcarinate on the back, acute or subacute and recurved at apex. Filaments 2½ mm; anthers narrowly linear-lanceolate, 1½ mm, acutely apiculate. Style 2 mm; stigma oblong, pentagonal, 2 mm long. Mature *fruit* not seen; young fruit fusiform-lanceolate, 13 by 4 mm. Seeds dark chestnut, apparently completely immersed in placental tissue.

Distr. *Malaysia*: Natuna Islands (Bunguran); twice collected.

Ecol. Stated to be frequent in primary forest at ca 600 m; *fl.* April–May.

Notes. The almost symmetrical, broadly elliptic leaves, and subscorpioid cymes of elongate parallel flowers, render this a very distinct species.

9. *Pentaphragma mindanaense* MERRILL, Philip. J. Sc. 20 (1922) 472; En. Philip. 3 (1923) 587.

Stems up to 50 cm by 5–10 mm, conspicuously crispulo-pubescent in younger parts. *Leaves* obliquely elliptic-lanceolate or elliptic-ovate or almost regularly elliptic, 15–23 by 6–9 cm, broadly cuneate at the base, narrowed to the obtuse apex, entire or most obscurely undulate-crenate, membranous, glabrous above, sparsely crispulo-puberulous below (rather densely on the nerves); nerves 4–5 pairs; petiole 2–3 cm long, pubescent. *Inflorescences* arising 1–3 together from 1–3 upper

axils, shortly scorpioid when young, elongating and scarcely scorpioid at anthesis, up to 10–12-flowered, 2–5 cm long including 1–1½ cm long pubescent peduncle. Bracts inconspicuous, elliptic or subspatulate, 7–10 by 3–4 mm, obtuse, membranous, ciliate. Pedicels 1–2 mm. *Flowers* 8–10 mm long. Calyx-tube obconic or oblong or ellipsoid, attenuate into the pedicel, 6–8 by 3–4 mm, crispulo-puberulous. *Sepals* small and inconspicuous, oblong, 2–3 by 1–2 mm, membranous, obtuse, puberulous, recurved. *Corolla* shortly and widely campanulate, 3–4 mm long, fleshy, gamopetalous for 1–2 mm; segments deltoid, 2 mm long, 1½–2 mm wide at base, acute, ± erect. Filaments c. 2 mm; anthers not seen. Style very short and thick; stigma conical-pileiform, 1.3 mm diam. *Fruit* broadly ellipsoid, 9 by 5 mm.

Distr. *Malaysia*: Philippines (Mindanao); twice collected.

Ecol. By small streams in forests at low altitudes; fl. & fr. Oct.–Nov.

Notes. The small recurved sepals and erect, acute, deltoid corolla-segments, suggesting a 5-pointed crown, are characteristic of this species.

10. *Pentaphragma bartlettii* MERRILL, Pap. Mich. Acad. Sc. 19 (1934) 201.

Stem up to 70 cm high, upper part ± hispidulopilose, the young parts rather densely crispate-pubescent. *Leaves* broadly ovate or broadly elliptic, slightly oblique, 18–25 by 9–12 cm, rounded to cuneate-attenuate at base, ± rounded or narrowed and very shortly cuspidate-acuminate at apex, margin closely crenulate, often ± bullate, glabrous above, very shortly and rather densely hispidulo-puberulous below; nerves c. 5 pairs; petiole 2½–4½ cm, hispidulous. *Inflorescences* small, subglobose-capitate, arising singly or in pairs from 2–3 upper axils, 1½–2½ cm diam., often dark brown when dry, very shortly pedunculate. Lower bracts ovate, acute, c. 10 by 5 mm, papillose-puberulous on the back. Pedicels almost none. Calyx-tube obconic, c. 5–6 by 3–4 mm, shortly crispate-puberulous. *Sepals* very broadly ovate-elliptic or suborbicular, 4 by 2–4 mm, slightly constricted at the base, broadly rounded at the apex, margins quite entire and slightly reflexed and hence subconvex, glabrous, or puberulous on the back towards the base. *Corolla* c. 4 mm long, shortly (1 mm) gamopetalous, slightly fleshy, segments deltoid, acute, erect, 2 mm broad at base, margins slightly thickened and slightly involute below the apex. Stamens not seen. Style c. 1 mm; stigma discoidally expanded. *Fruit* ellipsoid-obovoid, c. 10 by 5 mm.

Distr. *Malaysia*: Sumatra; several times collected.

Ecol. Damp places and tuff cliffs in primary forest, up to 1850 m; fl. & fr. April–May, Nov.–Dec.

Notes. Characterized by the elongate stem, frequently bullate leaves, rather small subglobose inflorescences often drying dark brown, entire, glabrous, suborbicular sepals, and erect, deltoid-acute corolla-lobes.

11. *Pentaphragma decurrens* AIRY SHAW, Kew Bull. (1953) 244.

Stem 15–20 cm by 4–6 mm, smooth, glabrous, marked with 4–5 conspicuous raised lines from the decurrent petiole-bases. *Leaves* broadly ovate-elliptic, slightly oblique, 20–21 by 9–11 cm, cuneate-attenuate at base, narrowed and acute (sometimes shortly subacuminate) at the apex, margin very obscurely denticulate or subentire, rather thick in texture, quite glabrous; nerves 4–5 pairs; petiole 1½–2½ cm by 2–4 mm, apparently acutely keeled on the back, glabrous, conspicuously decurrent. *Inflorescence* apparently single on each stem, arising from an upper axil, not or scarcely scorpioid, 3–4 cm long, 10–12-flowered, glabrous except for the ciliolate bracts and sepals. Lower bracts 12–14 by 4–7 mm, elliptic, acuminate, subentire or sparsely ciliolate, submembranous, the upper ones smaller and more strongly ciliolate. Peduncle c. 1½ cm. Pedicels almost absent. Calyx-tube shortly ellipsoid-ovoid, 5 by 2–3 mm, ± angled, glabrous. *Sepals* subspatulate-elliptic, 4–5 by 2–2½ mm, not very unequal, rounded at apex, erose-ciliolate, separated by rounded sinuses. *Corolla* known only from buds and damaged open flowers, apparently almost choripetalous; segments elliptic-obovate, 3–4 by 1½–2 mm, thinly petaloid in texture (not fleshy), the margins ± induplicate-valvate in bud, apparently soon falling or broken off. Stamens known only from the bud: filaments very short; anthers ovate, apiculate, 1–1½ mm long. Style very short; stigma shortly pentagonal-cylindric, c. 1 mm long. *Fruit* shortly oblong, 8 by 4 mm.

Distr. *Malaysia*: Borneo (Sarawak); several times collected.

Ecol. Unknown, but doubtless rain-forest; fl. Aug.

Notes. Very distinct in the raised decurrent lines on the stem (the only other known species showing this feature being the very different *P. insigne* AIRY SHAW) and in the petaloid texture of the apparently almost free corolla-segments, which are more or less induplicate-valvate in bud.

12. *Pentaphragma spatulisepalum* AIRY SHAW, Kew Bull. (1953) 245.

Stem 10–20 cm long, slender, glabrous. *Leaves* subfalcately elliptic or ovate, 11–18 by 5–6½ cm, cuneate-attenuate at base, attenuate, subacuminate and acute at apex, margin undulate-serrate, very thin in texture, quite glabrous; nerves 2–4 pairs; petiole very slender 1.3–2 cm. *Inflorescences* arising singly from the 1–3 uppermost axils, 6–12-flowered, rather lax, not scorpioid at anthesis, 2–3 cm diam.; rachis up to 1½ cm; peduncle 5 mm, minutely ramentaceous-hispidulous. Bracts linear-spatulate (except for the lowest which is elliptic-oblong), c. 10 by 1–2 mm, attenuate at the base into a 2–3 mm long petiole, obtuse or emarginate at apex, membranaceous, glabrous. Pedicels slender, 2–3 mm, glabrous. *Flowers* 8–10 mm long, glabrous. Calyx-tube narrowly ellipsoid, 4–5 by 1–2 mm. *Sepals* spatulate-oblong, 5–6 by 1½–2 mm, obtuse or retuse, erect or slightly

patent, less unequal than in most species. *Corolla* 4–5 mm long, gamopetalous to beyond the middle; segments oblong-ovate, 1.3 mm wide, subobtuse, erect, recurved at apex. Filaments c. 2 mm; anthers oblong, 1 mm. Style 1½ mm; stigma thickly pentagonal-discoïd, 1 by 0.8 mm, 5-lobulate. *Fruit* ellipsoid, 7–8 by 3–4 mm, attenuate at base.

Distr. Malaysia: Borneo (Sarawak); twice collected.

Ecol. Unknown, but probably primary rain-forest; *fl.* & *fr.* August.

Notes. In foliage scarcely distinguishable from *P. acuminatum* AIRY SHAW, but differing strongly in the lax inflorescence with elongate rhachis, conspicuous linear-spatulate upper bracts, and elongate oblong-spatulate sepals.

13. *Pentaphragma tetrapetalum* AIRY SHAW, Kew Bull. (1953) 246.

Stem c. 10 cm high, glabrescent below, crispate-setulose above. *Leaves* obliquely broad-ovate, 13–19 by 8–11 cm, rather broadly cuneate at base, almost rounded at apex and narrowed into a very short subacute cusp (sometimes almost absent), very obscurely shallowly sinuate-crenulate, glabrous above, shortly pubescent on the nerves below; nerves 2–4 pairs; petiole slender, 2–3 cm, glabrescent. *Inflorescences* arising singly from 1–2 of the upper axils, shortly and densely scorpioid, 2½–3 cm long, c. 12–14-flowered, peduncle 5–10 mm. Lower bracts broadly elliptic-ovate, c. 8 by 6–8 mm, membranous, pubescent, the upper ones smaller. Pedicels almost none. Calyx-tube ellipsoid, 3 by 1½ mm, pubescent. *Sepals* 5, obovate or spatulate-obovate, c. 5 by 2–3 mm, obtuse, membranous, hispidulous, ciliolate. *Corolla segments* 4, rarely 5, almost free or very shortly connate at base, unguiculate-spatulate, the 'claw' erect, broadly oblong, 2 mm, the 'limb' ± spreading or recurved, ± flat or somewhat twisted, broadly elliptic, 3 by 2½ mm, subacute, margin quite entire and conspicuously pale when dry, as though cartilagineous. Filaments slender, 1 mm, anthers linear, 2 mm. Stigma sessile or subsessile, thickly pileiform or subcerebriform or excavated at the summit, 1 by 1½–2 mm. *Fruit* ellipsoid, 8–10 by 3–4 mm, sparsely pubescent.

Distr. Malaysia: N. Borneo; twice collected.

Ecol. Unknown; probably rain-forest; *fl.* & *fr.* Aug.

Notes. Very distinct in its usually 4-rous corollas, almost free unguiculate-spatulate petals with flattish spreading pale-margined limb, and (? always) subsessile pileiform stigma.

14. *Pentaphragma tenuiflorum* AIRY SHAW, Kew Bull. (1953) 246.

Stem 15 cm by 7 mm, glabrous except for the young parts. *Leaves* elliptic-ovate or ovate, 9½–16 by 7–10 cm, truncate-rounded or subcordate at base, obtuse or ± rounded at apex, margin very closely and finely undulate-crenulate, rather thick, glabrous above, minutely and remotely hispidulous below, nerves densely crispulo-puberulous; nerves 3–4 pairs; petiole 4–6 cm. *Inflorescences*

apparently arising up to 4 together from 3–4 upper axils, ca 4-flowered, apparently weak. *Flowers* elongate, congested at the apex of the 1½–2 cm long peduncle. Bract at middle of peduncle oblong-elliptic, 10–12 by 5 mm, shortly acuminate, bracts subtending flowers broadly ovate-elliptic or spatulate-elliptic, 15 by 9 mm or 15 by 6–7 mm or 10–11 by 3 mm, acute or rounded, papillose or glabrous on back, margin ciliolate. *Flowers* apparently dioecious, males only known, erect (?), 2½ cm long. Calyx-tube elongate, cylindrical, 1.6–1.9 cm by 2–3 mm, very shortly and sparsely pilose. *Sepals* ovate-elliptic or oblong-elliptic, 8–9 by 3–5 mm, rounded or obtuse, minutely sparsely ciliolate, membranous. *Petals* free, lingulate, 8–9 by 1½–1.8 mm, obtuse, delicate or 'petaloid' in texture, ± induplicate-valvate in bud. Stamens very short: filaments 1–1½ mm; anthers oblong, slightly incurved, thick, 2 mm. No trace of ovary or style. Female flowers and fruit unknown.

Distr. Malaysia: Borneo (Sarawak); once collected.

Ecol. Unknown, but doubtless rain-forest; *fl.* May.

Notes. This is the only dioecious *Pentaphragma* known. The free petals, of delicate texture and with infolded margins in bud, resemble in these respects those of *P. decurrens* and *P. jaherii*, but are longer and narrower in proportion, and the three species are not otherwise similar. More ample material of *P. tenuiflorum* is very desirable.

15. *Pentaphragma jaherii* AIRY SHAW, Kew Bull. (1953) 247.

Stem dwarf, 5 cm by 3–4 mm, ± densely crispulo-puberulous above. *Leaves* subfalcately ovate-lanceolate, 7½–9 by 3½–4½ cm, rounded or subcordate at base, gradually narrowed into the subobtuse or subacute apex, margin narrowly revolute, apparently entire but probably actually very minutely crenulate, thickish in texture, distinctly rounded-papillose below, glabrous except for the nerves sparsely puberulous below; nerves 3–5 pairs; petiole slender, 8–13 by 2 mm, puberulous. *Inflorescence* apparently solitary on each stem, arising from a subterminal axil, compact, scarcely evidently scorpioid, 2 cm diam.; peduncle 1 cm, pubescent. Bracts rather large in proportion, broadly ovate or suborbicular, up to 10 by 8 mm, membranous, crispulo-puberulous, conspicuously lacinate-ciliate or fasciculate-pilose on the margin. *Flowers* 9–12 mm long. Calyx-tube campanulate or oblong-ovoid, 4–6 by 3–4 mm, puberulous. *Sepals* very unequal: smallest one oblong-elliptic, 4 by 1½ mm, largest suborbicular, 4–5 mm diam.; remainder intermediate; all membranous, crispulo-puberulous, erose-ciliate. *Petals* free (or possibly arising from a membranous annulus?), elliptic-oblong, 4 by 1½ mm, delicate in texture, margins inflexed, subcucullate at apex, crispulo-puberulous on back. Filaments 1½ mm; anthers linear, 1 mm. Style broadly conical, 1 mm long; stigma conical, 1 mm long.

Distr. Malaysia: Central Borneo, once collected.

Ecol. Primary rain-forest on sandstone mountain.

Notes. Spirit material is particularly necessary for the proper examination of species with delicate corollas, such as this. *P. jaherii* differs from the other two known Malaysian species possessing this character, *P. decurrens* and *P. tenuiflorum*, especially in the unusual feature of the petals being externally pubescent. In these features, however, it agrees with *P. gamopetalum* GAGNEP., of Annam, a species differing in its taller habit, larger, thinner, denticulate leaves and larger flowers. GAGNEPAIN appears to have misinterpreted the corolla of *P. gamopetalum* (cf. Fl. Gén. 1. C. 3, 1930, 696, f. 79, 1-2). Dissection of the type showed 5 free or almost free, delicate, narrowly oblong-elliptic petals, as in *P. jaherii*, *P. decurrens* and *P. tenuiflorum*.

16. *Pentaphragma begoniifolium* (ROXB. ex JACK) WALL. [Cat. (1829) 1313*] ex G. DON, Gen. Syst. 3 (1834) 731; A. DC. Prod. 7 (1839) 496; MIQ. Fl. Ind. Bat. 2 (1857) 568; HOOK. f. & THOMS. J. Linn. Soc. 2 (1858) 26; KURZ, J. As. Soc. Beng. 46, 2 (1877) 210; CLARKE in HOOK. f. Fl. Br. Ind. 3 (1881) 437; BAILL. Hist. Pl. 8 (1886) 358, in adnot.; RIDL. Trans. Linn. Soc. 3 (1893) 315; CURTIS, J. R. As. Soc. Str. Br. no 25 (1894) 113; RIDL. op. cit. no 33 (1900) 103; RIDL. Fl. Mal. Pen. 2 (1923) 202, f. 90; BURKILL & HANIFF, Gard. Bull. Str. S. 6 (1930) 218; BURKILL, Dict. 2 (1935) 1691; KERR, Fl. Siam. En. 2 (1936) 308.—*Phyteuma begoniifolium* ROXB. [Hort. Beng. (1814) 85, nomen] ex JACK, Mal. Misc. 1 (1820) no 1, 5; in HOOK. Bot. Misc. 1 (1830) 276, t. 57; ROXB. Fl. Ind. ed. CAREY 1 (1832) 505.—*P. begonioides* BAILL. Hist. Pl. 8 (1886) 324-5, f. 152-4.

Stem 10-25 cm long, simple or rarely with 1 or 2 branches, thinly crispate-floccose, especially above. Leaves very 'begonia-like', exceptionally asymmetrical, obliquely ovate to obliquely lanceolate or oblong or even obliquely reniform or sub-cultriform, 10-30 by 6-13½ cm, base rounded or cordate on the longer side, strongly excised-concave on the shorter side, apex narrowed to a very short acute acumens or cusp, margin strongly and sharply but shallowly serrate, sparsely crispate-puberulous below (densely so when young), glabrous above; nerves flabellately arranged, straight or little curved; petioles 2-4 cm, crispate-puberulous. Inflorescence terminal or subterminal (rarely lower), solitary (very rarely 2-4) on each stem, at first dense and scorpioid, ultimately lax and almost straight, 4-5 cm long; peduncle 1-2 cm, crispate-floccose, often bearing a ± leafy bract midway. Bracts subtending the flowers orbicular-obovate, rounded at apex, membranous, 5-9 mm long. Flowers biseriate, 8-9 mm long. Calyx-tube obovoid, 4-5 by 3 mm, sparsely pilose. Sepals unequal, ovate to orbicular, 2-2½ mm long, margins often revolute, membranous, pilose or glabrescent on both surfaces. Corolla shortly (1

mm) gamopetalous, 3 mm long, slightly fleshy, glabrous, segments spatulate-obovate, rounded, erect, recurved at apex. Filaments 1 mm; anthers ovate, shortly acuminate, 1 mm long. Stigma massive, cylindrical-pentagonal, 1 mm long. Fruit ellipsoid, 8-9 by 3-4 mm.

Distr. Lower Burma, Peninsular Siam; in Malaysia: northern part of Malay Peninsula.

Ecol. Evergreen rain-forest, often on rocks by streams, up to 600 m; fl. Feb.-April (June-Aug. in Siam).

Vern. *Salang suang* (? = *balong ayam*), Perak.

Uses. Poultice from roots applied to swellings.

Notes. *P. begoniifolium*, the type-species of the genus, is immediately recognizable by its exceptionally oblique leaves. The superior ovary shown in the dissected flower in the illustration in RIDLEY'S Flora (l.c.) is, of course, erroneous.

17. *Pentaphragma viride* STAFF & GREEN, J. Linn. Soc. 42 (1914) 100; MERR. En. Born. (1921) 585.—*Francfleurya hosei* GAGNEP. Rev. Bot. Appl. 7 (1927) 665.—*P. hosei* GAGNEP. op. cit. 8 (1928) 621.

Stem of unknown length (tops only collected), up to 1 cm thick, glabrescent or sparsely crispate-setulose above. Leaves obliquely elliptic or ovate or obovate, 8-20 by 5-10½ cm, cuneate-attenuate at base, apex rounded and shortly apiculate or narrowed and shortly acuminate, margin undulate-denticulate, glabrous above, almost glabrous below except for some short setulae on the midrib, sparsely setulose below when young, thin in texture; midrib sometimes rather broad towards base; main nerves 2-4 pairs; petiole 2-3 cm, glabrescent to rather densely and shortly crispate-setulose. Inflorescences borne singly in the uppermost 1-2 axils, capitate to scorpioid, 10-30-flowered, dense and compact, 2-4 cm long; peduncle 7-8 mm, setulose. Bracts membranous, the lower ones broadly elliptic-ovate, 10-13 by 7-10 mm, glabrous. Flowers 10-15 mm long. Calyx-tube ellipsoid, 7 by 3 mm, gradually narrowed below into the short pedicel (which elongates later). Sepals obovate, 4-7 by 2-3½ mm, rounded or retuse, erose-denticulate. Corolla 3-4 mm long, gamopetalous to about 1½-1½, fleshy; segments ovate, obtuse to subacute, recurved at apex. Filaments 1½-2 mm; anthers linear-oblong, 1½ mm, connivent round stigma. Style thick, 2 mm, narrowed upwards; stigma discoid-capitate, 5-lobulate, 1½ mm diam., 1 mm thick. Fruit ellipsoid-obovoid, 8 mm.

Distr. Malaysia: Borneo (Sarawak, Brunei, N. Borneo).

Ecol. Primary and secondary rain-forest on sandstone at 3-400 m; fl. & fr. Nov.-Dec., Feb.

Notes. There is little that is distinctive in the foliage of this species; but the inflorescence sometimes suggests a luxuriant, coarse edition of that of *P. horsfieldii*, the flowers being about double the size of the latter. The luxuriant condition, described by GAGNEPAIN as *Francfleurya hosei* (later transferred to *Pentaphragma*), is not specifically separable from *P. viride* STAFF & GREEN.

* The combination was not validly published here, since the genus *Pentaphragma* was not described until 1834 (by G. DON, l.c.).



Fig. 2. *Pentaphragma begoniifolium* (ROXB. ex JACK) WALL, ex G. DON. a. Habit, $\times 1/2$, b. flower, $\times 2$, c. corolla, d. stamen, e. style (after JACK).—*P. grandiflorum* KURZ. f. Flower, $\times 3/4$, g. style, $\times 3$, h. stamen, $\times 3$ (PULLE 406).—*P. aurantiacum* STAF. i. Flower, $\times 1 1/4$, j. style, $\times 1 1/2$ (CLEMENS 28999).

18. *Pentaphragma horsfieldii* (MIQ.) AIRY SHAW, Kew Bull. (1953) 249.—*Cyrtandra horsfieldii* MIQ. Fl. Ind. Bat. 2 (1857) 738.—*P. scortechinii* KING & GAMBLE, J. As. Soc. Beng. 74, 2 (1905) 55, incl. var. *parvifolia* and *flocculosa* K. & G.; RIDL. Fl. Mal. Pen. 2 (1923) 203; BURK. Dict. 2 (1935) 1691.—*P. sumatranum* RIDL. J. Fed. Mal. St. Mus. 8, 4 (1917) 56.—*P. integrifolium* MERR. Pap. Mich. Acad. Sc. 19 (1934) 202.—? *P. integrifolium* var. *longipetiolata* MERR., l.c. 203.

Very variable. Stem 10–50 cm long, simple, ± crispate-floccose above. Leaves only slightly asymmetrical, broadly ovate to obliquely elliptic-oblong, 10–30 by 4–12(–20) cm, base cordate to cuneate, apex acute to obtuse, margin strongly dentate-serrate to entire, frequently reflexed, glabrous and shining above, ± crispate-floccose below (usually densely so when young), at least on the nerves, but sometimes almost glabrous; nerves 2–4 pairs, steeply ascending; petiole 1½–8 cm, ± crispate-floccose or glabrescent. Inflorescences arising singly or more often 2–3 together from the upper (1–5) leaf axils, dense, many-flowered, scorpioid, short or long, 1–7 cm, peduncle ± 1 cm. Bracts orbicular to obovate, 5–8 mm long, ciliate. Flowers biserial, 5–8 mm long. Calyx-tube obovoid, 3–4 by 2 mm, pilose. Sepals unequal, scarcely 2 mm long, pilose, margins reflexed. Corolla very shortly (scarcely 1 mm) gamopetalous, 3 mm long, glabrous; segments oblong or spatulate-obovate, erect, recurved at apex. Filaments 1½ mm, slender, sometimes sigmoid; anthers oblong, 1 mm. Stigma ovoid-oblong, 1 mm. Fruit ovoid or obovoid, 5 by 3–4 mm.

Distr. *Malaysia*: Sumatra (incl. Batu Island), Riouw and Lingga Archip., Malay Peninsula, Banka, Anambas Islands, Borneo (Sarawak).

Ecol. Evergreen rain-forest, up to 1200 m; fl. Jan.–Dec.

Vern. *Kobeh*, *balong ayam batu*, Mal. Pen., *silam buwie*, Sumatra.

Uses. Leaves eaten as spinach (Kemaman, acc. to CORNER *in sched.*).

Notes. The true limits of this species are at present quite uncertain. On the assumption, however, that the complex of forms here placed under *P. × ellipticum* POULSEN represents a hybrid swarm between *P. acuminatum* A.S. and another species, one may postulate for 'pure' *P. horsfieldii* a plant, crispate-pubescent throughout, with large, broadly ovate, subtire, long-petioled leaves and dense, scorpioid, many-flowered inflorescences. A close approach to such a plant is in fact made by several specimens from the Malay Peninsula that have been currently referred to *P. scortechinii*, and I would propose therefore provisionally to regard these as being for practical purposes 'pure'. There is, however, no evident break between them and the presumed hybrids with *P. acuminatum*.

It is noteworthy that the only collection seen from Borneo that appears to be referable to this species (Sarawak: Mt Lambia, 29 May 1895, HAVILAND & HOSE 2027, in Herb. Mus. Brit.) is markedly heterogeneous. It consists of five 'snip-

pets', each bearing one or two leaves with (in four cases) their subtended inflorescences and very short lengths of stem. In three of the pieces the leaves are entire, and the inflorescences quite glabrous, while in the other two the leaves are sinuate-denticulate and the inflorescences densely crispate-pubescent. This may well be part of another hybrid swarm, such as is postulated for *P. × ellipticum* POULS.

The leaves of a gathering from Sumatra bore on their margins a growth of the moss *Distichophyllum cuspidatum* DOZY & MOLK. (det. VAN DER WIJK).

18a. *Pentaphragma × ellipticum* POULSEN (*pro sp.*), Vid. Medd. Nat. Foren. Kjöbenhavn 1903, 321 (1903), t. IV–V; MERR. Sarawak Mus. J. 3 (1928) 557, *in obs.*; *emend.* AIRY SHAW.—*P. ridleyi* KING & GAMBLE, J. As. Soc. Beng. 74, 2 (1905) 57; RIDL. Fl. Mal. Pen. 2 (1923) 204.—? *P. acuminatum* AIRY SHAW × *P. horsfieldii* (MIQ.) AIRY SHAW.

Heterogeneous populations showing various combinations of the characters of the putative parents.

Distr. *Malaysia*: Malay Peninsula, Lingga Archipelago, Banka.

Ecol. Evergreen rain-forest.

Vern. *Dauñ djari kretèh* (*kèrètah*), *sètabel* (Lingga).

Uses. BÜNNEMEIJER states (*in sched.*) that an infusion of leaves, and especially roots, is used for venereal disease, and leaves are laid on the stomach for constipation in small children, in Lingga. According to FURTADO the leaves are eaten as a vegetable in Perak.

Notes. It is difficult to account for the extraordinarily mixed populations apparently occurring in the southern part of the Malay Peninsula and in the Lingga Archipelago, except on the assumption of extensive hybridization between two or more species. The solution here suggested is purely tentative; it is evident that these populations can be adequately interpreted only in the field.

19. *Pentaphragma acuminatum* AIRY SHAW, Kew Bull. (1953) 248.

Stem 12–30 cm long, glabrous, or sometimes ± furfuraceo-puberulous on the young parts. Leaves rather small, obliquely ovate to (more often) ovate-lanceolate, 8–15 by 3–5 cm, base decurrent-cuneate, more rarely ± rounded, apex gradually attenuate-acuminate, margin very shortly obtusely undulate-dentate and often revolute, glabrous above or (especially on the nerves) sparsely and minutely puberulous or very minutely granulose-papillose, mostly thin in texture; nerves 2–3 pairs, little curved; petiole 1–2½ cm, slender, glabrous or sparsely furfuraceo-puberulous. Inflorescences arising singly or in pairs from the 1–4 middle or upper (but not uppermost) leaf-axils, small, capitate, not scorpioid, c. 1 cm diam., 2–10-flowered, peduncle c. 5 mm, glabrous. Bracts glabrous, the lowest ovate-lanceolate, 7 by 3 mm, acute, the upper ones decreasing



Fig. 3. *Pentaphragma spatulisepalum* A.S. a. Habit, $\times \frac{2}{3}$, b. flower, $\times 2\frac{1}{2}$ (J. C. MOULTON s.n., SING.).—*P. combretiflorum* A.S. c. Habit, $\times \frac{2}{3}$, d. flower, $\times 2$ (BÜNNEMEIJER 5821).

rapidly in size. *Flowers* c. 1 cm long. Calyx-tube 5–6 by 3–4 mm, glabrous. *Sepals* c. 3 by up to 2 mm, obtuse. *Petals* c. 3 by almost 2 mm, obtuse or slightly cucullate, reflexed. *Stamens* c. 1½ mm long; anthers oblong. Style thick, 1–1½ by 1 mm; stigma very thick, 1.25 by 1.25 mm. *Fruit* ellipsoid, 7–8 by 4–5 mm, glabrous.

Distr. Malaysia: Borneo; several times collected.

Ecol. Primary rain-forest up to 1500 m; *fl. & fr.* Aug.–Oct.

Notes. It is tentatively suggested that this species may represent one parent of the presumed hybrid swarm here referred to *P. × ellipticum* POULSEN. Its almost completely glabrous condition, the gradually acuminate, shallowly sinuate-dentate leaves, and the small, few-flowered inflorescences, are characteristic.