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PENTASTEMONACEAE

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The taxonomic position and rank of the only genus *Pentastemona* has been under discussion since Van Steenis (1982) described the genus in the *Stemonaceae*. Dahlgren et al. (1985) found it highly distinctive and suggested it worthy of family rank. Later on more material of *P. sumatrana* and *P. egregia* has become available facilitating a more accurate description of the androgynoecium. Conspicuous differences from the *Stemonaceae*, viz. the inferior ovary, the five pouches caused by the fusion of connectives and stigma (especially well-developed in *P. egregia*), the berry-like fruit and the exotesta (sarcotesta) of the seed, warranted the distinction of a separate new family for the genus.

Note — *Pentastemona* is the first genus in the Monocotyledons with normally regular 5-merous flowers. Checked on abundant material, occasional flowers with 4 or 6 perianth lobes and stamens occur in both species.

References: Dahlgren, R.M.T., H.T. Clifford & P.F. Yeo, The families of the Monocotyledons (1985) 123. — Duyfjes, B.E.E., Blumea 36 (1991) 239–252; ibid., 36 (1992) 551–552 (family description). — Steenis, C.G.G.J. van, Blumea 28 (1982) 151–163, f. 1.

PENTASTEMONA

Pentastemona Steenis, Blumea 28 (1982) 160. — Type: *Pentastemona sumatrana* Steenis.

Low juicy herbs with a short, unbranched, largely overground green rhizome with pale roots; stem curving up into a short erect portion bearing several leaves, leaving thin, almost ring-shaped scars; plants almost glabrous or with sparse uniseriate hairs. *Leaves* papyraceous when dry; blade ovate, with 6–8 pairs of arching basal and suprabasal nerves, shallowly depressed above, secondary intervenation fine-trabeculate, margin entire; petiole long, towards the base canaliculate and shortly sheathing, with the edge hyaline and fringed-hairy. *Inflorescences* axillary, either short-peduncled simple racemes or long-peduncled compound racemes; flowers and bracts dotted with raphides, bracteoles absent. *Flowers* with one kind of perianth, 5-merous; *tepals* free or partly united, imbricate, outside papillose, persisting in fruit. *Stamens* epitepalous; filaments apparently absent since they are completely united into a conspicuous fleshy ring, which is either free or partly fused to the base of the fleshy flower tube, which, together with the juicy-fleshy torus and the stigma, form a solid hypanthium with a flat or concave top; anthers, consisting of two short, broadly ovate thecae, each opening by a longitudinal lateral slit. The thecae are sessile, laterally directed and separated by broad fleshy connectives, which taper into slender or broad inward-curved appendices, the tips of which are fused with the stigma; the stamens and stigma thus form 5 pouches in the fleshy hypanthium, each containing two thecae, one from each of the adjacent anthers. Viewed from above, the appearance is as if the anthers are alternitepalous (*P. egregia*), or anthers shortly protruding

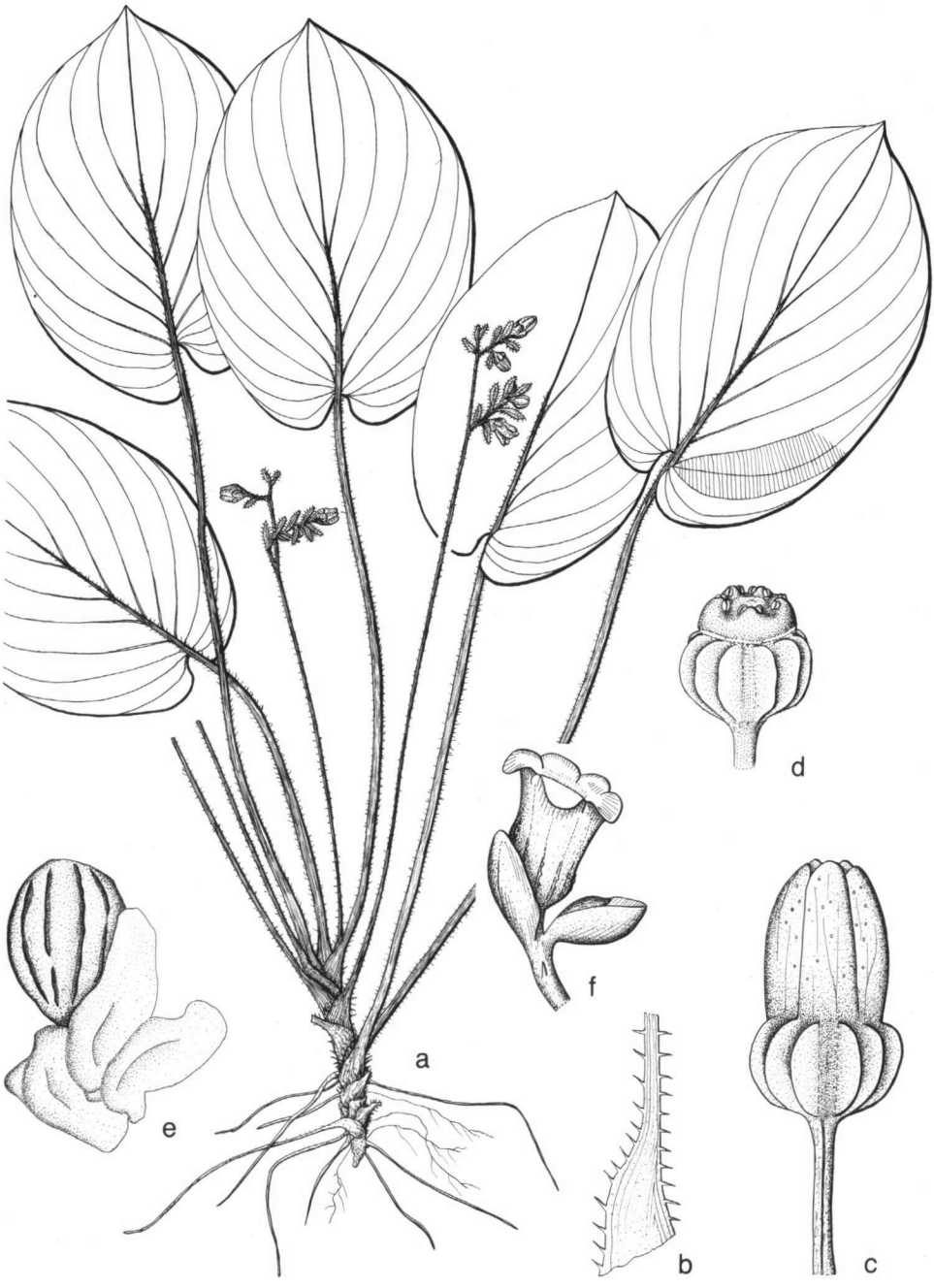


Fig. 1. *Pentastemona sumatrana* Steenis. a. Habit, × 0.5; b. base of leaf sheath, × 1.5; c. flower, × 6; d. flower, tepals removed, × 6; e. ribbed seed, sarcotesta torn away, × 25. — *P. egregia* (Schott) Steenis. f. Flower, × 2 (a–e: *de Wilde & de Wilde-Duyfjes 18695*; f: *Meijer 17010*).

(*P. sumatrana*). *Ovary* inferior, one-celled, ovules numerous on three inward projecting longitudinally furrowed, parietal placentas; style short and inconspicuous, stigma broad, flattish, entire or 3- or 4-lobed, papillose. *Fruit* berry-like, sharply longitudinally 10-ridged, the perianth persisting. *Seeds* many, with a collar-like undulate aril covering about one third of the seed; exotesta (sarcotesta) transparent; pericarp strongly ribbed; endosperm large; embryo small. — **Figs. 1–3.**

Distribution — *Malesia:* the genus is locally endemic to N and W Central Sumatra, with 2 species.

Habitat & Ecology — Gregarious but very local. In damp places on rocks in rain forest of lowland and hills and apparently often more or less kremnophytic. The berry-like fruit probably decays, by which the seeds become free. When a mature fruit of *P. sumatrana* is opened, the seeds, with their ribbed endocarps, lie in a jelly-like mass of the arils and exotestas, appearing as one coherent mass and suggesting an as yet unknown mode of dispersal.

Pentastemona sumatrana may produce young plants at the top of the inflorescences in a viviparous manner, while in *P. egregia* young plants easily sprout from the margins of broken leaves in their natural habitat. Under damp hothouse conditions *P. egregia* can be propagated in this way.

There are indications that the family possibly is dioecious. The collection *de Wilde 20113* of *P. sumatrana* contains solely female flowers and fruits with ripe seeds; the anthers, although present, appeared to be empty. The collection *Bogner 1724* of *P. egregia* bears functionally male flowers, the anthers of which contain good pollen. Ovaries are also present in these flowers, but are not well-developed and probably contain abortive ovules.

According to Van Steenis (1982) the smallish deep pouches in the receptacle, as in *P. egregia,* suggest nectarial structures, but microscopical examination proved that such structures are absent.

Although gregarious in their natural habitat, the plants themselves are not conspicuous and may have escaped the attention of collectors. This may be a reason for their late discovery.

Floral morphology — The androecium shows a corona-like development of the basal staminal region like that in *Peliosanthes* (*Liliaceae/Convallariaceae*). The late differentiation of the stamens into extensions that contact the stigma, as well as the inferior position of the ovary, suggest a relationship with *Trichopus* (*Trichopodaceae*) and *Stenomeris* (*Stenomeridaceae*).

Reference: Heel, W.A. van, Blumea 36 (1992) 481–499, pl. 6, 7.

Seed — The seed shows a remarkable character, viz., a distinct, proportionally thick exotesta (sarcotesta) which in dried condition is only little visible. For the description of ovules and seeds, see Bouman & Devente (1992).

Reference: Bouman, F. & N. Devente, Blumea 36 (1992) 501–514, pl. 1, 2.

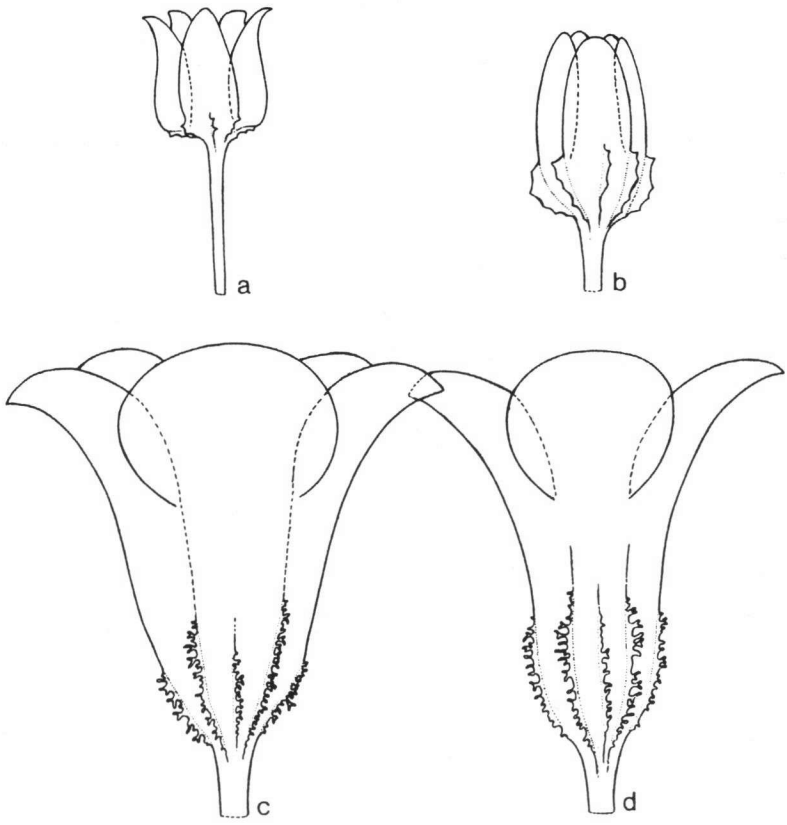


Fig. 2. *Pentastemona*, lateral views of mature flowers. a, b. *P. sumatrana* Steenis, male and female flower respectively; c, d. *P. egregia* (Schott) Steenis, ditto; all ×4 (a, b: *de Wilde & de Wilde-Duyfjes 21399*; c: *Bogner 1724*; d: *Meijer 17010*).

Anatomy — Leaf epidermis anticlinal cell walls straight; stomatal complex tetracytic to cyclocytic; crystals present as abundant styloids and raphides, also as minute, irregularly shaped, solitary crystals. Minute druses have been found throughout the mesophyl. For comparison with *Stemonaceae*, see there (p. 400).

Reference: Baas, P., in C.G.G.J. van Steenis, Blumea 28 (1982) 159.

Palynology — *Pentastemona* pollen is small-sized (13–23 μm) and ellipsoidal to spheroidal. The grains are inaperturate, but the intine shows a thick oncus, which limits the exit of the pollen tube at germination. The exine is intectate; exine thickness is c. 0.6 μm throughout (nexine 1/3 to 1/2 of the sexine). The sexine consists of more or less densely arranged composite scabrae of 0.3 to 0.5 μm in diameter, in *P. sumatrana* sometimes in a fossulate pattern. These scabrae are much like the Ubisch bodies on the anther wall. Similar exine ornamentation as well as resemblance to Ubisch bodies was found in *Peliosanthes teta* (*Convallariaceae*).

Pollen of *Pentastemona* is different from that of *Stemonaceae* in being intectate and small (av. 16 µm versus 29, 28 and 27 µm in *Croomia, Stemona* and *Stichoneuron*, respectively). In terms of pollen morphology, the *Pentastemonaceae* and *Stemonaceae* do not show any affinity.

References: Ham, R.W.J.M. van der, Blumea 36 (1991) 127–159. — Steenis, C.G.G.J. van, Blumea 28 (1982) 159.

R.W.J.M. van der Ham

Chromosome number — 2n = 14 (*P. egregia*).

Reference: Duyfjes, B.E.E., Blumea 36 (1991) 242.

Note — The descriptions of both species given below have been largely made on living material and material preserved in alcohol.

KEY TO THE SPECIES

1a. Inflorescence compound, as long as or exceeding the petiole; flowers 3–5 mm long, tepals free ..... **2. P. sumatrana**

b. Inflorescences simple, generally shorter than the petiole; flowers 10–15 mm long, tepals partly united into a tube ..... **1. P. egregia**

1. Pentastemona egregia (Schott) Steenis, Blumea 28 (1982) 162; Meijer & Bogner, Nature Malaysiana 8, 1 (1983) 26; Hotta, Rep. 1987/1988 Sumatra Research (1989), pl. 7, lower left; Duyfjes, Blumea 36 (1991) 245, f. 2, 3. — *Cryptocoryne egregia* Schott in Miq., Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 122. — Type: *Korthals s.n.*, West Sumatra (L, sh. 898-88.409).

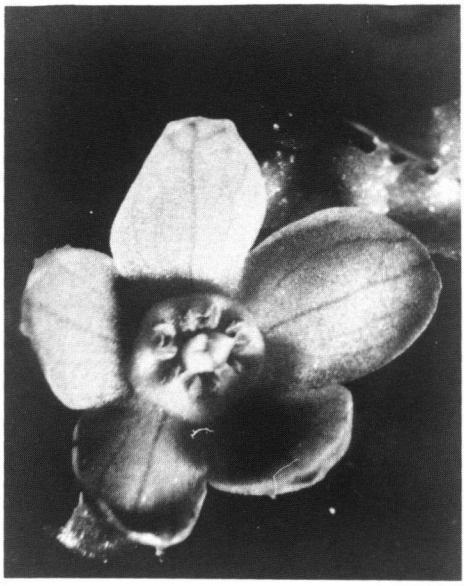
Plants almost glabrous, up to 25 cm; stem terete, 5–10 cm long, c. 1 cm diameter. *Leafblade* ovate to broad-ovate, base shallowly emarginate to cordate, apex short or distinctly acute-acuminate, 7–17 by 5–10 cm; petiole 4–6(–15) cm long. *Inflorescences* shortly peduncled, simple, pauciflorous racemes, hidden under the leaves, 2–5 cm long, after flowering bent towards the ground; bracts ovate, 5–12 mm long, leaf-like, one-nerved, the nerve smooth or with antler-like branched emergences, margin translucent and irregularly undulate. *Flowers* campanulate-urceolate, 12–20 mm long, 18–20 mm diameter; pedicels 3–4 mm long; perianth rather thickly fleshy, connate for slightly over half of its length, pale greenish yellow, tube 6–12 mm long, c. 10 mm wide, lobes roundish, 6–9 mm long, spreading and somewhat recurved in anthesis. *Staminal ring* fused with the basal part of the perianth tube and the hypanthium; outgrowths of the connectives narrow and somewhat bent down towards the stigma; *ovary* dentately ribbed, shorter than the perianth, c. 5 mm high, the ribs extending on the perianth-tube; stigma flattish, 3- or 4-lobed. *Fruit* c. 13 mm long, with 10 firm ribs fringed with antler-like emergences which extend on the persisting perianth. *Seeds* many, almost globular, c. 1.5 by 1.25 mm, glossy. – **Figs. 1f, 2c, d.**

Distribution – *Malesia:* Central West Sumatra, very local.

Habitat & Ecology – On steep shady slopes in primary forest, up to 500 m altitude.

2. Pentastemona sumatrana Steenis, Blumea 28 (1982) 161; Duyfjes, Blumea 36 (1991) 245, f. 2, 3. — Type: *de Wilde & de Wilde-Duyfjes 18695*, N Sumatra (L).

Herbs to 40 cm tall, with scattered hairs; stem short, up to 5 cm. *Leafblade* broad-ovate, base deeply cordate, apex acute, 9–16 by 6–9 cm, upper surface glabrous, lower surface hairy on the nerves; petiole hairy, 6–20 cm long. *Inflorescence* compound, with (1 or) 2–4 densely flowered, raceme-like branches; bracts ovate-lanceolate, green, 3–8 mm long, one-nerved, the nerve hairy, margin shallowly undulate; peduncle (sub)erect, 10–30 cm long, hairy. *Flowers* ± globose in bud, opening during anthesis and the male flowers soon falling off; perianth 5–6 mm diameter; pedicels c. 2 mm



long; tepals delicate, free, broad-ovate, creamy white, 2–3 mm long, somewhat accrescent in fruit. *Staminal ring* fused with the hypanthium; outgrowths of the connectives broad, flattish. *Ovary* undulately ribbed, as long as the perianth, c. 2.5 mm high, stigma 3- or 4-lobed, but in ageing flowers becoming entire, flat and round. *Fruit* c. 4 mm long, with 10 ribs, with faintly undulating ridges or with antler-like emergences, not extending on the persisting perianth. *Seeds* up to 60, ellipsoid, c. 1 mm long, distinctly spiny ribbed. – **Figs. 1a–e, 2a, b, 3.**

Distribution – *Malesia:* N Sumatra, southern Alas Lands; very locally.

Habitat & Ecology – Among rock blocks in damp places, up to 100 m altitude.

Fig. 3. *Pentastemona sumatrana* Steenis. Flower, c. × 10 (Photograph P.J. van der Vlugt, taken from a cultivated specimen).