

PODOSTEMACEAE (C. G. G. J. van Steenis, Buitenzorg)

Mostly annual, rather small, of peculiar habit, often moss-like, gregarious, confined to swift running water in streams and cascades. Tissues with silicium. Roots often thallose, flat, stem sometimes absent. *Leaves* mostly alternate, sometimes scattered, decussate or distichous, base often provided with a sheath, and sometimes stipule-like appendages, often dentate or divided. *Flowers* terminal, often in cymose inflor., mostly ♂, actinomorphic to zygomorphic. Perianth of 3–5 free or subconnate tepals, if reduced to two small, ovate or linear appendages, the bud is enveloped by an originally closed thin 'spathella'. Stamens hypogyn, 1–∞, often 2 unilateral, frequently monadelphic. Anthers mostly introrse, 2–4-locular, splitting lengthwise. Pollen grains single, or in twos or fours. Ovary superior, ovate to elliptic, mostly 2-, rarely 3-locular with thickened central placenta and thin septa. Ovules ∞; styles as many as carpels, free, rarely 1. *Capsule* septacid (often) ribbed; seeds ∞, minute, exalbuminous, epidermis mucilaginous.

Distr. Principally confined to the tropics throughout the world, not yet recorded from the Pacific Islands and the greater part of Australia, northward as far as S. Japan, in Malaysia apparently very rare. The locality closest to Malaysia is isthmian Siam where Dr A. KEITH found *Podostemon ?algaeformis* BTH. in the nineties.

Ecol. All members of this aberrant stream-resistant family are confined to swift not too densely shaded streams with normally clear water. The rather numerous SE. Asiatic members are all tiny to minute plants growing socially and covering the rocks in sheets. During the rainy season they are mostly found only in the sterile thallose state and submerged. In the dry season the flowers appear and the thallus withers. They occur often very locally, and the plants are easily overlooked. Many additional records may be expected. Local dispersal is certainly effected by water; *Cladopus* seedlings have been found on rocks, a cemented dike, bamboo and an iron pipe at highwater mark. Dispersal from one river system to another unconnected is still obscure (birds, fishes, insects?). Transplanting experiments which I did with rocks covered by *Cladopus* from Mt Gedeh on Mt Salak in W. Java, were unsuccessful (1937). So were CIFERRI's in the Dominican Republic (Atti Ist. Bot. G. Briosi e lab. Crittog. Ital. Univ. Pavia V, 7 (1946) 18–21).

Notes. The affinity of the family is still uncertain; opinions are offered of alliance to *Saxifragaceae*; ENGLER accepts it to represent a separate Group *Podostemales* in the neighbourhood of the *Urticales*.

KEY TO THE GENERA

1. Flowering stems very short, hardly 1 cm. Leaves crowded, scattered, imbricate, digitately lobed
1. *Cladopus*
1. Flowering stems elongate, 2½–6½ cm. Leaves distichous, laterally compressed, entire, the upper 3–(4)-dentate 2. *Torrenticola*

1. CLADOPUS

H. MÖLL. Ann. Jard. Bot. Btzg 16 (1899) 115; STEEN. Bull. Jard. Bot. Btzg III, 13 (1936) 530 (*lit.*).

Small, flatly adhering to the substratum. Roots flat, ligulate, without stomata, side-branches mostly opposite, at last concrescent in a crust on the substratum. Leaves of the sterile sessile sprouts (? roots) partly linear partly digitate with 4–7 segments as are those of the fertile stems. Flowering stems minute, hardly 1 cm in length, densely covered with scattered, imbricate, digitately lobed leaves. Flowers solitary, pedicellate, zygomorphic, before anthesis enclosed in an oblique spathe; spathe oval-acuminate, apex nipple-shaped, mostly irregularly dehiscing, sometimes slit on one side. Tepals 2, narrow triangular to linear, at both sides of the base of the filament. Stamen 1 (rarely 2 ?), anther basifixed, cells divergent at the base, filament curved; pollen grains 2-celled. Ovary smooth, oblique-ellipsoid, as long as the filament, curved towards the anther. Capsule oblique-ellipsoid, smooth, the largest valve persistent.

Distr. S. Japan (Kyushu), *Malaysia*: Java and SW. Celebes.

Ecol. Swift running streams and cascades, clinging to the rocks, also found on a cemented dike and occasionally young plants on bamboo, 5–1550 m.

Notes. The Japanese species *C. japonicus* IMAMURA belongs in my eye doubtless to *Cladopus* and does not represent a separate genus (*Lawiella* KOIDZ.). Specifically it differs in 8–12-lobed leaves.

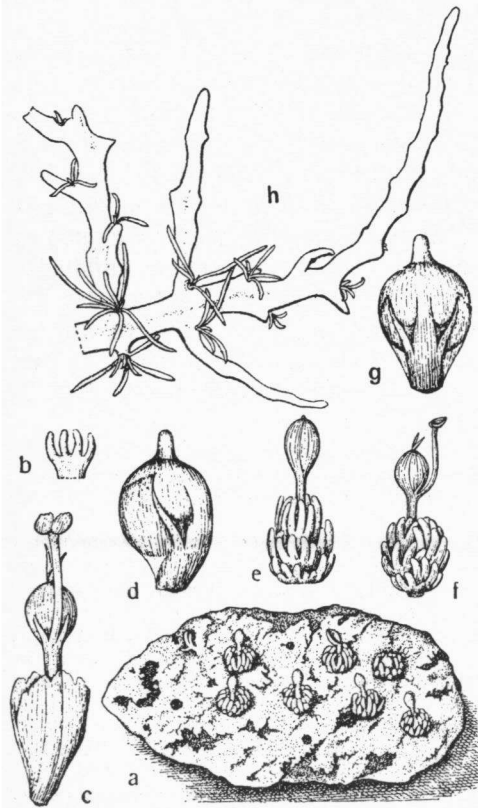
1. *Cladopus nymani* H. MÖLL., *ll. cc.*—Fig. 1.

Roots dark green often reddish tinged, densely branched at last forming a continuous conrescent sheet exceeding 60 cm diam., branches opposite or alternate, 1/2–3 mm broad, tips with a minute dorsal root cap. Sterile leaves in rosettes, simple or digitate, narrow 2–6 by 1/6–1/3 mm. Fertile stems at the root margins, up to 5 mm long, leaves with 3–7 segments 1/4–1 mm long. *Spathella* ca. 2 mm. Tepals narrow linear acute, 1 mm long. Stamens 1, rarely 2, anthers 3/4–1 mm long. Ovary 2-locular ca. 1 1/2 by 1 mm, stigmas 2, oblique, 2/3 mm long. *Capsule* smooth 1 1/2–1 3/4 by 1 mm; pedicel 2–3 mm.

Distr. *Malaysia*: W.–E. Java, SW. Celebes, 5–1550 m.

Ecol. See under the genus.

Fig. 1. *Cladopus nymani* MÖLL., a. piece of rock with fruiting plant, × 2, b. leaf, × 4, c. open flower with dehiscent spathella, × 6, d. bud, lateral, × 6, e. stem in fruit, × 4, f. flowering stem, × 4, g. bud, dorsally, × 6, h. sterile root system, juvenile plant, × 3.



2. TORRENTICOLA

DOMIN, *nom. prov.* *Bibl. Bot.* 89, 2 (vol. 20) (1925) 149, t. 35, f. 7–13; ENGL. in E. & P. ed. 2, 18a(1935) 484; STEEN, J. *Arn. Arb.* 28 (1947) 421.—*Podost. indet.* F. v. M. *Syst. Cens.* (1882) 23; 2nd Cens. (1889) 166; BAIL. *Compr. Cat.* (1913) 417.—*Podostemon* sp. DOMIN, *l.c.*, *nom. alt.*—Fig. 2.

Roots lingulate, sparsely ramified; sprouts very close, erect, mostly simple rarely branched, thin, rigid, densely foliate. *Leaves* distichous, equitant, base laterally compressed, obtriangular, upper ones toothed, minute, thick, 1–2-carinate, decurrent, lowest semi-amplexicaulous, blade ± patent. *Flowers* single, apical, strongly asymmetric. *Spathella* sub-oblique, tipped, irregularly circumscissile-dehiscent. Flower shortly stalked. Tepals 2, narrow, small. Stamen 1, articulate with the pedicel, in bud appressed to the ovary, filament broad, anther broad, connective emarginate, cells introrse. Pollen grains 2-celled. Ovary ± globular, smooth, 2-locular with 2 grooves where the dissepiment is attached; stigmas 2, oblong-lanceolate, in bud appressed to the ovary towards the stamen. *Fruit* slightly oblique, terete, the largest valve persistent, ribs 10, indistinct. Placenta globular, surrounded by a thin narrow membranous dissepiment, caducous. Seeds numerous sub-angular oblong.

Distr. Monotypic, Queensland and *Malaysia*: SE. New Guinea.

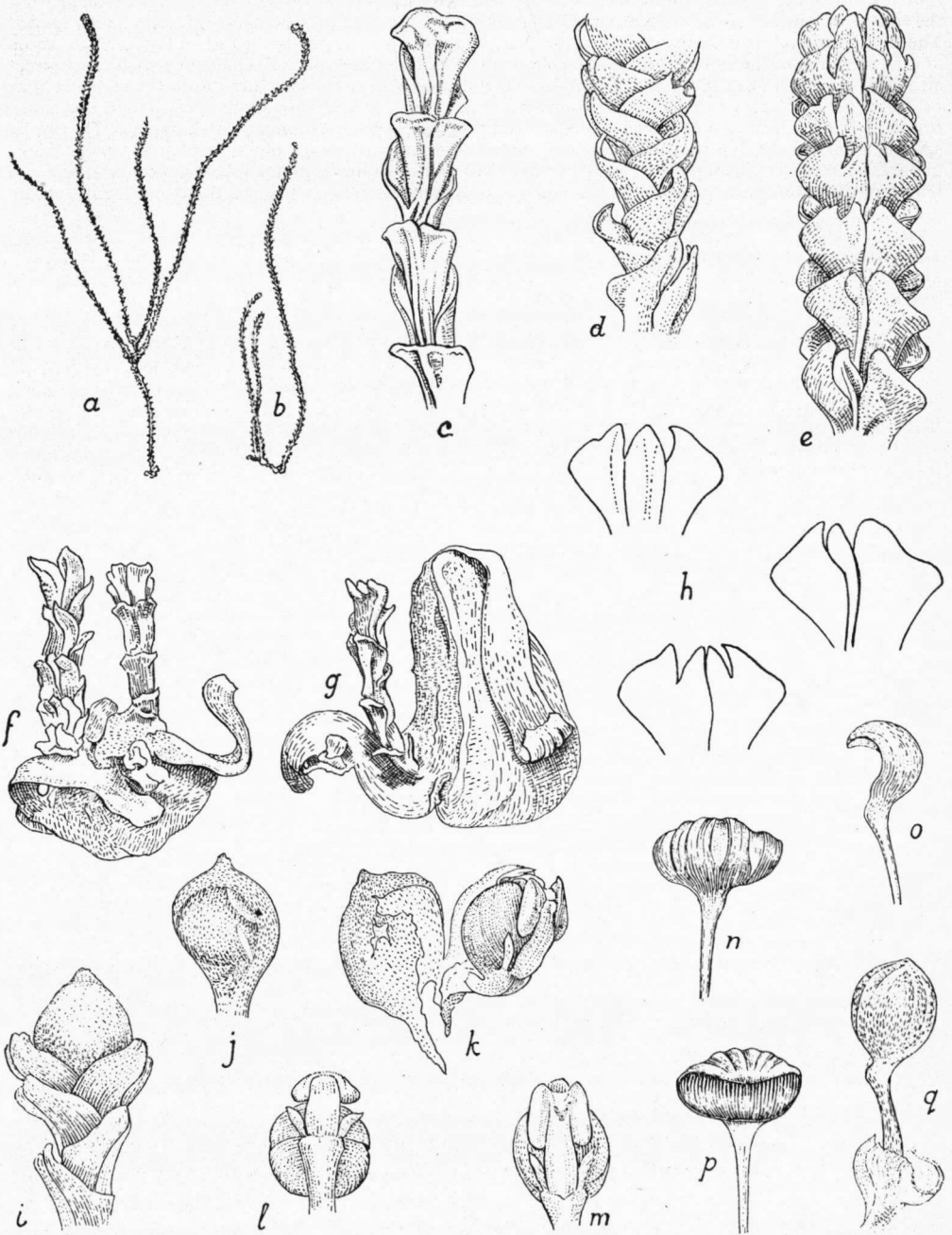


Fig. 2. *Torrenticola queenslandica* DOMIN. a-b. branched and unbranched stems, c. lower part of stem, d. central part, e. upper part, f-g. stem-bases attached to lingulate roots on pieces of gravel, h. leaf types, i. bud on apex of stem, j. closed spathella with bud, k. spathella opened artificially, l-m. dorsal view of flower, n-p. larger valve of fruit, q. unopened fruit. (a-b, $\times \frac{3}{4}$, c-g, $\times 9$).

Notes. The first specimens were found in Queensland, Johnstone river, by WALTER HILL, in 1873; they remained a long time undescribed; OLIVER sent the specimens in 1874 to WEDDELL who recognized the species as new but could not place it. The New Guinean material exactly matches DOMIN's description. The floral structure is described here for the first time. Though manifestly distinct in the lingulate roots and in phyllotaxis, the closest ally is difficult to find, as there are several genera of which the flower-structure is very similar (*Cladopus*, *Polypleurella*) but their vegetative structure differs widely from that of *Torrenticola*. Vegetatively some *Podostemon* species from America are similar. Decussate leaves are found in *Willisia* from the Anamalais, but this genus possesses an androphore with 2 stamens. The tipped spathella *Torrenticola* has in common with *Cladopus*. For these reasons it stands more or less isolated and apparently represents a separate genus. Between the pollen grains I found globular bodies 1/10th the length of the grains, measuring about 3 μ . They were sometimes in twos. I accept these to represent stérile pollen grains.

1. *Torrenticola queenslandica* DOMIN, *l.c.*; ENGLER, *l.c.*; STEEN. *l.c.*—*Podostemon* sp. DOMIN, *l.c. nom. altern.*—Fig. 2.

Roots ca $\frac{1}{2}$ –2 mm broad. Stems $2\frac{1}{2}$ – $6\frac{1}{2}$ cm long, densely set, darkgreen. Leaves ridged on the back, ca. $\frac{1}{2}$ –2 mm long. Spathella \pm sessile, to $\pm \frac{1}{2}$ mm stalked, \pm 2 mm long. Pedicel $\frac{1}{2}$ – $1\frac{1}{4}$ mm in bud, 2 mm in fruit. Tepals $\pm \frac{1}{2}$ mm long, filament $\pm \frac{1}{2}$ mm long, thecae $\pm \frac{3}{4}$ mm, cells slightly unequal, pollen grains $\pm 30 \mu$. Ovary $1\frac{1}{4}$ mm diam.; stigmas $\pm \frac{1}{2}$ mm; seeds ca $\frac{1}{4}$ – $\frac{1}{3}$ mm diam.

Distr. Queensland and Malaysia: SE. New Guinea, Roona (Laloki river), c. 200 m alt.

Ecol. On submerged rocks in the river (May 1935, CARR 12415). The stems and leaves were attacked by a fungus forming brown spots.

Excluded

Lemnopsis major ZOLL. Syst. Verz. 1 (1854) 75, 86, acc. to BACKER, Handb. Fl. Java pt 1 (1925)

59 (ZOLL. 3430) = *Halophila ovalis* HOOK. f.

Lemnopsis minor ZOLL. *ibid.* (ZOLL. 3334) = *Halophila ovata* GAUD.

Lemnopsis mnioides ZIPP. Flora 12 (1829) I, 285; Alg. Konst- & Letterbode 1 (1829) 297, acc. to HALLIER f. Med. Rijksherb. Leiden 1 (1910) 40 = *Utricularia orbiculata* WALL.

Tristicha bifaria PRESL. Rel. Haenk. 1 (1827) 86 is suspected to represent *T. hypnoides* SPR. and was erroneously recorded from the Philippine Islands acc. to MERRILL (Philip. J. Sci. 10 (1915) Bot. 189).

Sp.: D'ALBERTIS, "What I did and what I saw" 2 (1880) 93 mentions a plant which he found June 17, 1876 in the Fly River (STEEN. *l.c.* 1947) which was advanced by LAM (Blumea 2 (1936) 117) as a possible representative of the *Pod.* in New Guinea; the record will remain doubtful as no material was collected.

BECCARI Piant. Sum. 482 in herb. Kew (STEEN. 1936, *l.c.*) = *Aneura tamariscina* STEPH. (*Hepaticae*).