BUTOMACEAE (C. G. G. J. van Steenis, Leyden)

Erect, glabrous, rhizomatous, terrestrial, water- and swamp herbs, laticiferous (*Butomus* excepted). *Leaves* radical, sheathing, curvinerved (cauline in *Hydrocleis*), leaf-blades above water (*Hydrocleis* excepted). *Flowers* umbellate (or solitary), actinomorphic, ☿. *Perianth* 2-seriate. *Sepals* 3, imbricate, mostly persistent, usually green. *Petals* 3, imbricate, usually thin, fugacious (persistent in *Butomus*). *Stamens* 8–9 or ∞, rarely less, sometimes the outer ones staminodial, filaments flattened, free; anthers basifixed, 2-celled, opening lengthwise with lateral slits. *Gynoecium* apocarpous, superior; carpels 6- ∞, rarely less by reduction, in a whorl, free or cohering only at the base, dehiscing with an adaxial slit. *Ovules* ∞, anatropous, scattered on reticulately branched placentas. *Fruitlets* ∞-spermous, at last dehiscing along the ventral (adaxial) side. *Seeds* ∞; embryo flat and horse-shoe shaped (elliptic-terete and straight in *Butomus*); endosperm 0.

Distr. Less than 10 *spp.* belonging to 5 genera, in temperate and tropical regions, absent from Africa S of the equator, in *Malaysia* one native and one introduced genus both represented by one species.

Morph. On their dorsal (abaxial) base the leaf-sheaths are provided with exceedingly thin scales of various shape already described by IRMISCH (*cf.* BUCHENAU, Bot. Jahrb. 2, 1882, 467) (*squamulae intravaginales*), examined anatomically by Miss ARBER in *Butomus* (Ann. Bot. 39, 1925, 172). I found them also in *Tenagocharis* and *Limnocharis*. According to PICHON (Not. Syst. 12, 1946, 170–183) *Butomaceae* ought to be confined to *Butomus*, the residual being referred as a special tribe to a widened concept of *Alismataceae*.

KEY TO THE GENERA

1. Leaves lanceolate to obovate-oblong, (3–)5-nerved. Corolla white. Stamens 8–13. Staminodes 0. **1. Tenagocharis**
1. Leaves rounded to ovate or obovate, about 9–13-nerved. Corolla yellow. Stamens more than 15, surrounded by a whorl of staminodes . . . . . **2. Limnocharis**

1. TENAGOCHARIS

HOCHSTETTER, Flora (Regensb.) 24 (28 June 1841) 369; BUCHENAU, Pfl. Reich Heft 16c (1903) 6.—*Butomopsis* KUNTH, En. Pl. 3 (Juli 1841) 164; MICHELI, in DC. Mon. Phan. 3 (1881) 87.—*Elattosis* GAGN. Bull. Soc. Bot. Fr. 86 (1939) 301; Fl. Gén. I.-C. 6 (1942) 1208, f. 115 (6–12). — **Fig. 1.**

Erect annual, 8–55 cm. *Flowers* in long-peduncled, 2–16-flowered, umbelliformous inflorescences exceeding the leaves, sometimes 2 whorls above another. Pedicels triangular. *Stamens* 8–9, sometimes less. *Ovaries* 4–9 (or by reduction less); style short. *Fruitlets* with their tips exserted from the calyx. *Seeds* broad-oblong, compressed, smooth; embryo folded.

Distr. Monotypic, Africa, tropical Asia through Malaysia to N. Australia, in *Malaysia* exceedingly rare.

Note. A new genus *Elattosis* was described from Indo-China by GAGNEPAIN differing from *Tenagocharis* by absence of petals, and 5 stamens. The type has appeared to represent a poor, deficient specimen of *Tenagocharis latifolia*, apparently beyond anthesis, when the petals have disappeared. Similar specimens have been found in India and Africa.

1. Tenagocharis latifolia (D. DON) BUCHENAU, Abh. Naturw. Ver. Bremen 2 (1868) 2, 3, 6; Pfl. Reich Heft 16c (1903) 7, f. 3; BACKER, Handb. Fl. Java pt 1 (1925) 56; Onkruidfl. Jav. Suiker. (1928) 21, Atl. t. 27. — *Butomus latifolius* D. DON, Prodr. Fl. Nep. (1825) 22.—*Butomopsis latifolia* KUNTH, En. Pl. 3 (1841) 165.—*Butomus lanceolatus* ROXB. Fl. Ind. ed. CAREY 2 (1832) 315; ROYLE, Ill. Bot. Him. 2 (1839) t. 95, f. 1.—*Butomopsis lanceolata* KUNTH *l.c.*; MICHELI, in DC. Mon. Phan. 31 (1881) 87; BAILEY, Queensl. Fl. pt 6 (1902) 1704; BISWAS & CALDER, Water & Marsh Pl. Ind. (1936) 79; GAGN. Fl. Gén. I.-C. 6 (1942) 1208.—*Elattosis apetala* GAGN. Bull. Soc. Bot. Fr. 86 (1939) 301; Fl. Gén. I.-C. 6 (1942) 1208, f. 115 (6–12).—**Fig. 1.**

Leaf-blades glaucous, oblong to oblong-lanceolate or oblanceolate, base acute, apex acute or obtuse, tipped by a hard blunt mucro at the underside of which is a large hydathode, with (3–)5 main nerves and an intramarginal one, (2½–)4–15 by (½–)1¾–3½ cm; secondary nerves many, thin, parallel, obliquely ascending, reticulations dense; petiole (3–)5–15 cm. *Peduncle* (5–)25–30 cm. Umbels (1–2–)4–12(–15)-flowered. Pedicels thin, erect, elongate in fruit, (1–)5–14 cm. Bracts outside and between the flowers, reticulately veined, acute-triangular-lanceolate, decreasing in size inwards, the largest 1¼ by ½ cm at the base, scarious, acute, ovate, 1–1½ cm long. *Sepals* broad-elliptic to obovate, apex rounded or slightly emarginate, reticulately veined, margin scarious, 4–6 by 3½ mm. *Petals* white, exceeding the sepals in size, after anthesis withering and disintegrating into a mucilaginous mass. Filaments 2–3 mm; anthers narrow, 1–1½ by ⅓ mm. *Ovaries* reticulately veined, 4–5 by 1¾–2 mm; stigma yellow. *Fruitlets* 10–13 mm long, adaxial wall membranous. *Seeds* hardly ½ mm, elliptic, shiny, brown.

Distr. Tropical Africa to SE. Asia (India, Assam, Laos), through Malaysia to N. Australia (N. Territory & Queensland), in *Malaysia:* West Java (near Djakarta) and Madura Island (E off Java).

Near Djakarta (Mr Cornelis) for the first time collected by Dr WEEHUIZEN (1917), later also in the same place by BACKER (1919) and by BAKHUIZEN VAN DEN BRINK Sr and the author (1929–1930), in Madura Island collected in 1933.

Ecol. In Malaysia in wet rice-paddies, but apparently very rare, though locally common in both localities mentioned, 10–50 m; *fl.* May, July.

No pollinating agent is known to me. In bud the anthers are not yet opened; beyond anthesis the petals shrivel over the then opened anthers and bring them close to the stigmas forming with these a sticky mass, similar as in *Drosera* and *Turnera*. The stigmas are then thickly covered with yellow pollen, thus ensuring pollination.

Part of the seeds I found already germinated in the follicles (fig. 1*j*).

Fig. 1. *Tenagocharis latifolia* (D. DON) BUCHENAU. *a.* Plant, × 2/5, *b.* open flower, × 2½, *c.* sepal, showing nervation, × 2½, *d.* petal, *ditto*, × 2½, *e.* petal and stamen from bud, × 5½, *f.* full-grown stamen, × 5, *g.* developed carpel with slit on adaxial side, × 6½, *h.* empty follicle, × 2½, *i.* seed, × 17, *j. ditto*, germinated in the follicle.

2. LIMNOCHARIS

H.B. & K. Pl. Aequin. 1 (1807) 116.

Flowers in umbelliformous, peduncled inflorescences. *Stamens* ∞, surrounded by a whorl of staminodes. *Ovaries* ∞, strongly laterally compressed, free, densely

set, seemingly forming one ovary. Stigmas sessile, lineate. *Fruitlets* semi-circular, in a head, dorsal wall thick. *Seeds* ∞, small, horse-shoe shaped; testa spongy.

Distr. Monotypic, tropical and subtropical America, in Asia and in *Malaysia* introduced.

1. Limnocharis flava (L.) BUCHENAU, Abh. Naturw. Ver. Bremen 2 (1868) 2; Pfl. Reich Heft 16c (1903) 9, f. 4, incl. *var. indica* BUCHENAU; MICHELI, in DC. Mon. Phan. 3 (1881) 89; BACKER, Ann. Jard. Bot. Btzg Suppl. 3 (1909) 406; Trop. Natuur 1 (1912) 129–135, f. 1–6; Handb. Fl. Java pt 1 (1925) 57; HEYNE, Nutt. Pl. (1927) 139; BACKER, Onkruidfl. Jav. Suiker. (1928) 22, Atl. t. 28; OCHSE & BAKHUIZEN VAN DEN BRINK, Ind. Groenten (1931) 87, f. 51; STEEN. Arch. Hydrobiol. Suppl. Bd 11 (1932) 272, f. 41; BURKILL, Dict. (1935) 1347; BISWAS & CALDER, Handb. Water & Marsh Pl. Ind. (1937) 80; VAN DER PIJL, Trop. Natuur 27 (1938) 136–138, f. 1–2; SENARATNA, Trop. Agric. 94 (1940) 362; Ceylon J. Sc. (A. Bot.) 12 (1945) 164.—*Alisma flava* LINNÉ, Sp. Pl. 1 (1753) 343.— *L. emarginata* H. B. & K. Pl. Aequin. 1 (1807) 116, t. 34; MICHELI, in DC. Mon. Phan. 3 (1881) 89; KOORD. Nat. Tijd. Ned. Ind. 60 (1901) 380; J. J. SMITH, Teysmannia 13 (1902) 66.—*L. plumieri* RICH. Mém. Mus. Hist. Nat. Paris 1 (1815) 370, t. 19, f. II, t. 20; TEYSM. & BINNEND. Cat. Hort. Bog. (1866) 26; EDELING, Nat. Tijd. Ned. Ind. 31 (1870) 297; HUB. WINKLER, Bot. Jahrb. 44 (1910) 518; MERR. En. Born. (1921) 37.

Leaf-blades ovate to broad elliptic or suborbicular, inrolled when young, with blunt, rounded or even emarginate base, acutely tapering into the petiole, apex rounded or emarginate, light-green, at the underside of the tip with a purple-margined, active hydathode, 6–28 by 4½–20 cm; main nerves 9–13 and a marginal one; secondary nerves very numerous, parallel, nearly perpendicular to the midrib, reticulations dense, very fine; petiole thick, triangular, 20–65 cm. *Peduncles* 1–4, axillary, flattened at the base, higher triangular, 20–90 cm. *Umbels* 2–15-flowered, sometimes with 1–2 leaves between the flowers. Bracts roundish to broad elliptic, the (largest) outer 1½–2 by 1–1½ cm, lengthwise fine parallel-nerved. Pedicels 2–7 cm. *Sepals* green, obtuse, 1¾–2½ by 1–1½ cm. *Petals* pale-yellow, with darker base, broad-ovate to orbicular, lengthwise folded in bud, apex rounded, 2–3 by 1–2 cm. *Fruitlets* enclosed by the calyx, forming a rounded whole *c.* 1½–2 cm diam. *Seeds* with thin, transverse ridges, brown or black-brown 1 mm long.

Distr. Native of tropical America, introduced into SE. Asia (Siam, S. Burma, Ceylon) and *Malaysia:* Sumatra (incl. also Enggano Isl.), Malay Peninsula, Java, Anambas Isl., Borneo, apparently still absent from many islands.

Ecol. Shallow swamps, ditches, pools, and specially common on wet rice-paddies, always it seems in more or less stagnant fresh water, most abundant below 700 m, but found up to 1300 m[1]; *fl. fr.* Jan.–Dec.

Apparently an escape from the Botanic Gardens, Bogor, where the species was recorded in 1866 to be cultivated; for the first time mentioned 'as a newly introduced alien' in 1870 by EDELING (*l.c.*) from the banks of the river Tjiliwung near Djakarta, which same river flows also through the Botanic Gardens, Bogor.[2] Soon afterwards becoming gradually a common rice-paddy plant in the environs of Bogor and now spread all over West Malaysia. In Siam it has been introduced about 40 years ago (BURKILL, *l.c.*) and in Ceylon about 1930 (SENARATNA, *l.c.*)

Biol. The flowers open in the morning and close after a few hours, after which the stamens and corolla disintegrate into a mucilaginous mass. There is no record of any pollinating agent in Malaysia. Various authors have observed that the fruiting peduncle bends downward (by weight or active curving?) and produces leaves and roots in the mud, in which way a vegetative reproduction is established.

VAN DER PIJL (*l.c.*) observed in experiments details about the dispersal of the seeds which are reproduced in great quantities. The seeds themselves are hardly buoyant, but the fruitlets are for some days. Then the adaxial margin of the fruit shows a slit, which widens through an active curving of the narrow, thicker, green, dorsal (abaxial) side; through this pressure the thin, lateral sides of the fruitlets bulge, causing the slit to open wider and permitting the seeds to escape. Later the dorsal side curves back again, and the slit of the emptied fruitlet closes.

BACKER states that the species is perennial, but can turn annual through desiccation of the habitat.

Uses. In West Java juvenile specimens represent one of the commonest estimated vegetables. OCHSE recommends to plant it in places where rice does not grow well. He states that it could replace spinach or endive. In many places the excellent edible qualities of the plant are yet unknown. In the Toba Lands (N. Sumatra) used as fodder for pigs (HEYNE).

Its occurrence would indicate a fertile soil.

Vern. *Gele sawahsla*, D, ètjèng, M, S, *sabèr, bang-èng, gèndot*, S, *gèndjèr*, S, J, *anggrè, bèrèk, bĕngok, gunda wèwèhan, tĕmpukjung, tjèntongan*, J (the latter word meaning rice-spoon, alluding to the shape of the leaves), *halèjo, lumbur*, Batak, *jinjir*, Mal. Pen.

(1) KOENS claims to have found *L. flava* at 2000 m, in Kawa Bertjek, W. slope of Mt Guntur, Preanger Reg. (W. Java) (Trop. Natuur 2, 1913, 111).

(2) The introduction in the East of *Eichhornia crassipes* SOLMS took place in the same way (*cf.* vol. 4, p. 260).