CABOMBACEAE

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Rich. ex A.Rich. in Bory, Dict. Class. Hist. Nat. 2 (1822) 608, as 'Cabombeae', nom. cons; Richard, Nouv. Élém. Bot., ed. 4 (1828) 420, as 'Cabombeae'; Williamson & Schneider in Kubitzki et al. (ed.), Fam. Gen. Vasc. Pl. 2 (1993) 157; Wiersema, Fl. N. Amer. 3 (1997) 78; Fu & Wiersema, Fl. China 6 (2001) 119; Heywood in Heywood et al., Fl. Pl. Fam. World (2007) 77; Siti-Munirah & Chew, Malayan Nat. J. 62 (2010) 242; Siti-Munirah, Fl. Penins. Malaysia, ser. 2, 4 (2013) 25; Ørgaard, Fl. Thailand 14(2) (2019) 256. **Type:** *Cabomba* Aubl.

Hydropeltidaceae (DC.) Dumort., Comment. Bot. (1822) 64, as 'Hydropeltideae'. **Basionym:** Hydropeltideae DC., Syst. Nat. 2 (1821) 36. **Type:** *Hydropeltis* Michx. (= *Brasenia* Schreb.).

Perennial aquatic herbs. **Leaves** alternate, peltate, margins entire and floating (*Brasenia*), or dimorphic with submerged and floating leaves (*Cabomba*); submerged leaves opposite or 3-verticillate, palmately dissected with 3–7 primary segments, these with successive dichotomous divisions; floating leaves produced when flowering, alternate, peltate, margins entire. **Flowers** solitary, axillary, floating or emersed, bisexual, actinomorphic. **Sepals** (2–)3, free or nearly so. **Petals** (2–)3. **Stamens** 3–6 (*Cabomba*) or 12–36(–51) (*Brasenia*). **Carpels** 1–4 (*Cabomba*) or 4–18 (*Brasenia*), apocarpous. **Fruit:** aggregates of fruitlets, fruitlets leathery, indehiscent, pericarps slowly disintegrating after maturity. **Seeds** 1–3(–5) per fruitlet.

Distribution. Cabombaceae consists of 2 genera and 7 species: *Brasenia* Schreb. (1 species) and *Cabomba* Aubl. (6 species). *Brasenia schreberi* J.F.Gmel. is widespread, occurring naturally in tropical montane areas as well as in subtropical and temperate regions of the Americas, Africa, Asia and Australia (but absent from Europe). *Cabomba* is native only to tropical and/or subtropical America but several species have naturalised in other parts of the world. In Singapore, 1 species of *Cabomba* is present as an occasional escape from cultivation (i.e., is casual).

Ecology. Plants of streams, ponds and lakes, often in slow-moving or relatively still waters although some species of *Cabomba* have also been recorded in fast-flowing streams. *Brasenia* is wind pollinated while *Cabomba* is predominantly insect pollinated but self-pollination has been reported in *C. caroliniana* A.Gray in cultivation (Ørgaard, Nordic J. Bot. 11 (1991) 189).

Uses. *Brasenia schreberi* is commercially grown in East Asia as a vegetable. Several species of *Cabomba* are traded as ornamental plants for aquaria and ponds.

Taxonomy. Cabombaceae, along with Nymphaeaceae and Hydatellaceae, are placed in the order Nymphaeales (APG IV, Bot. J. Linn. Soc. 181 (2016) 1–20) which is one of the earliest diverging lineages of the angiosperms. Cabombaceae is closely related to Nymphaeaceae

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but differs in having free carpels that are few-seeded. Earlier versions of the Angiosperm Phylogeny Group classification (APG I and APG II) included Cabombaceae as a synonym of Nymphaeaceae but the families are now considered distinct based on molecular evidence (Gruenstaeudl et al., Pl. Syst. Evol. 303 (2017) 1251–1270).

CABOMBA Aubl.

(from a vernacular name)

Hist. Pl. Guiane 1 & 3 (1775) 321, pl. 124; Fassett, Castanea 18 (1953) 116; Ørgaard, Nordic J. Bot. 11 (1991) 179; Williamson & Schneider in Kubitzki et al. (ed.), Fam. Gen. Vasc. Pl. 2 (1993) 160; Siti-Munirah & Chew, Malayan Nat. J. 62 (2010) 242; Siti-Munirah, Fl. Penins. Malaysia, ser. 2, 4 (2013) 25; Lima et al., Acta Bot. Brasil. 28 (2014) 327; Ørgaard, Fl. Thailand 14(2) (2019) 256. **Synonym:** *Nectris* Schreb., Gen. Pl., ed. 8[a], 1 (1789) 237, nom. illeg. superfl. **Type:** *Cabomba aquatica* Aubl.

Perennial submerged herbs. **Rhizomes** rooted in substrate, brittle, breaking off easily into rooted or free-floating segments with buoyant shoots. **Stems** erect, ± mucilaginous, variable in length according to the water level, and growing up to 3–4 m or more. **Leaves** heteromorphic. **Submerged leaves** decussate or ternate to verticillate, lamina orbicular or reniform in outline, finely dissected into primary divisions, these again subdivided dichotomously several times into finer filiform segments. **Floating leaves** alternate, peltate, appearing only on flowering shoots, lamina entire, linear-elliptic, broadly elliptic to ovate or sagittate in outline. **Flowers** on distal ends of shoots, buds developing underwater, at anthesis held 2–4 cm above the water surface, pinkish purple, white or yellow, bisexual, actinomorphic. **Sepals** (2–)3, petaloid, slightly connate at base, oblong to obovate in outline, base truncate. **Petals** (2–)3, alternating with sepals, ovate, oblong to obovate in outline, base auriculate, nectaries present as yellow lobes on adaxial surface. **Stamens** 2–6, opposite petals. **Carpels** 1–4, apocarpous. **Fruitlets** indehiscent, pericarps leathery. **Seeds** 1–3(–5) per fruitlet; ovoid to ellipsoid, apiculate at one end, testa tuberculate, tubercles in longitudinal rows.

Distribution. A genus of 6 species, native to tropical and/or subtropical America but 3 species are naturalised or casual in other countries, including some countries in Europe, Asia and Australasia. In Singapore, 1 casual species.

Uses. *Cabomba aquatica* Aubl. (yellow Cabomba), *C. caroliniana* (green Cabomba/Carolina fanwort) and *C. furcata* Schult. & Schult.f. (red Cabomba/red fanwort) are popular ornamental plants for aquaria and ponds.

Notes. *Cabomba caroliniana* is a seriously invasive weed of waterways in the United States (in states where it is not native), Canada, China, Thailand and Australia (CABI Invasive Species Compendium, 2022). *Cabomba aquatica* and *C. furcata* are naturalised in Peninsular Malaysia. All three of these species are imported into Singapore for the aquarium and pond plant trade but, thus far, only *Cabomba aquatica* is known to have escaped.

Cabomba aquatica Aubl.

(Latin, *aquatica* = growing in water; referring to the habit)

Hist. Pl. Guiane 1 & 3 (1775) 321, pl. 124; Fassett, Castanea 18 (1953) 125; Ørgaard, Nordic J. Bot. 11 (1991) 194, fig. 1: A, fig. 2: A, fig. 4: A, fig. 5: A, a, Fig. 6: B, C, p.p.; Turner et al., Gard. Bull. Singapore 46(2): 13 (1995 [‘1994’]); Siti-Munirah & Chew, Malayan Nat. J. 62 (2010) 244, fig. 1, fig. 3: A; Silva & Leite, Rodriguésia 62 (2011) 919; Siti-Munirah, Fl. Penins. Malaysia, ser. 2, 4 (2013) 26, fig. 1. Lima et al., Acta Bot. Brasil. 28 (2014) 327, fig. 1: A, fig. 2: A, B, I, J, N, O, P, fig. 3: A–C, fig 4: B1, B2, F, fig. 6: B, I, M; Lindsay et al., Gard. Bull. Singapore 74(Suppl. 1) (2022) 227. **Synonyms:** *Nectris aquatica* (Aubl.) J.F.Gmel., Syst. Nat., ed. 13[bis], 2(1) (1791) 580. – *Nectris peltata* Pursh, Fl. Amer. Sept. 1 (1813) 239, nom. illeg. superfl. **Type:** [Published illustration] *Cabomba aquatica* in Aublet, Hist. Pl. Guiane 3 (1775) pl. 124, lectotype designated by Ørgaard, Nordic. J. Bot. 11 (1991) 194. **Fig. 1.**

Stem green, olive green to reddish green, pilose. **Leaves** heteromorphic. **Submerged leaves** opposite, petioles 1.7–3.4 cm long, lamina ± orbicular or reniform in outline, finely dissected, primary divisions 5, terminal segments linear to oblong, apex mucronate. **Floating leaves** alternate; petioles hairy, c. 1–3 cm long, appearing only on flowering shoots; lamina peltate, broadly elliptic to ovate in outline, 2.1–3.5 × 1.4–2 cm, simple, margins entire, adaxial surface dark green, abaxial surface vinaceous. **Flowers** long pedicellate, pedicels hairy, to c. 7 cm in length, buds developing underwater, held 2–4 cm above the water surface at anthesis, bright yellow, c. 1 cm in diameter. **Sepals** 3, oblong, 9–10 × c. 4 mm, apex rounded, base reddish yellow. **Petals** 3, oblong, c. 10 × 2–3 mm, apex truncate, rounded or emarginate, base auriculate, nectaries visible as two yellowish orange patches on the adaxial surface. **Stamens** 6, filaments c. 4 mm long, erect, anthers c. 1 mm long. **Carpels** 2–3, each c. 3–4 × c. 0.7 mm. **Fruitlets** 1–3 (though rare for all carpels to develop into fruitlets), somewhat bottle-shaped, 6.3–7.2 × 1.9–2.5 mm, typically 1-seeded. **Seeds** 2–3.5 × 1.3–2.5 mm.

Distribution. Native to the north of South America (Colombia, Venezuela, Guyana, Suriname, French Guiana, Peru, Brazil and Bolivia) but naturalised in several places in Asia including Bangladesh, Myanmar and Peninsular Malaysia (Johor). In Singapore, photographic records from the 1990’s indicate that *Cabomba aquatica* used to be naturalised in ponds in several public parks such as Kent Ridge Park (K.S. Chua, pers. comm.) and Ang Mo Kio Town Garden West (K.H. Ong, pers. comm.). Also in the 1990’s, a sterile *Cabomba* specimen was collected from a pond near Normanton Park (*Chua et al. 959*, 12 Nov 1993, SINU [SING0350055, SING0350056, SING0350057, SING0350058]) and another from the vicinity of Upper Seletar reservoir (*Turner et al. NRS 17*, 1 Apr 1992, SING [SING0232567]). Without flowers, these specimens cannot be confidently identified but it seems likely that they are *Cabomba aquatica.* Today, the species is known only in Singapore Botanic Gardens where it inhabits several of the ponds and lakes, including Symphony Lake (*Chen LCMJ 2022–119*, 27 Apr 2022, SING [SING0291156]) and the Marsh Garden (*Leong SING 2022-1129,* 14 Dec 2022, SING [SING0390705]). Based on its current restricted distribution and its ephemeral nature at former localities, *Cabomba aquatica* is best considered casual in Singapore (Lindsay et al., Gard. Bull. Singapore 74(Suppl. 1) (2022) 227).

Ecology. In Singapore, found as a casual weed of ponds and waterbodies with slow flowing or still waters. Various Diptera and Hymenoptera have been reported as pollinators in its native

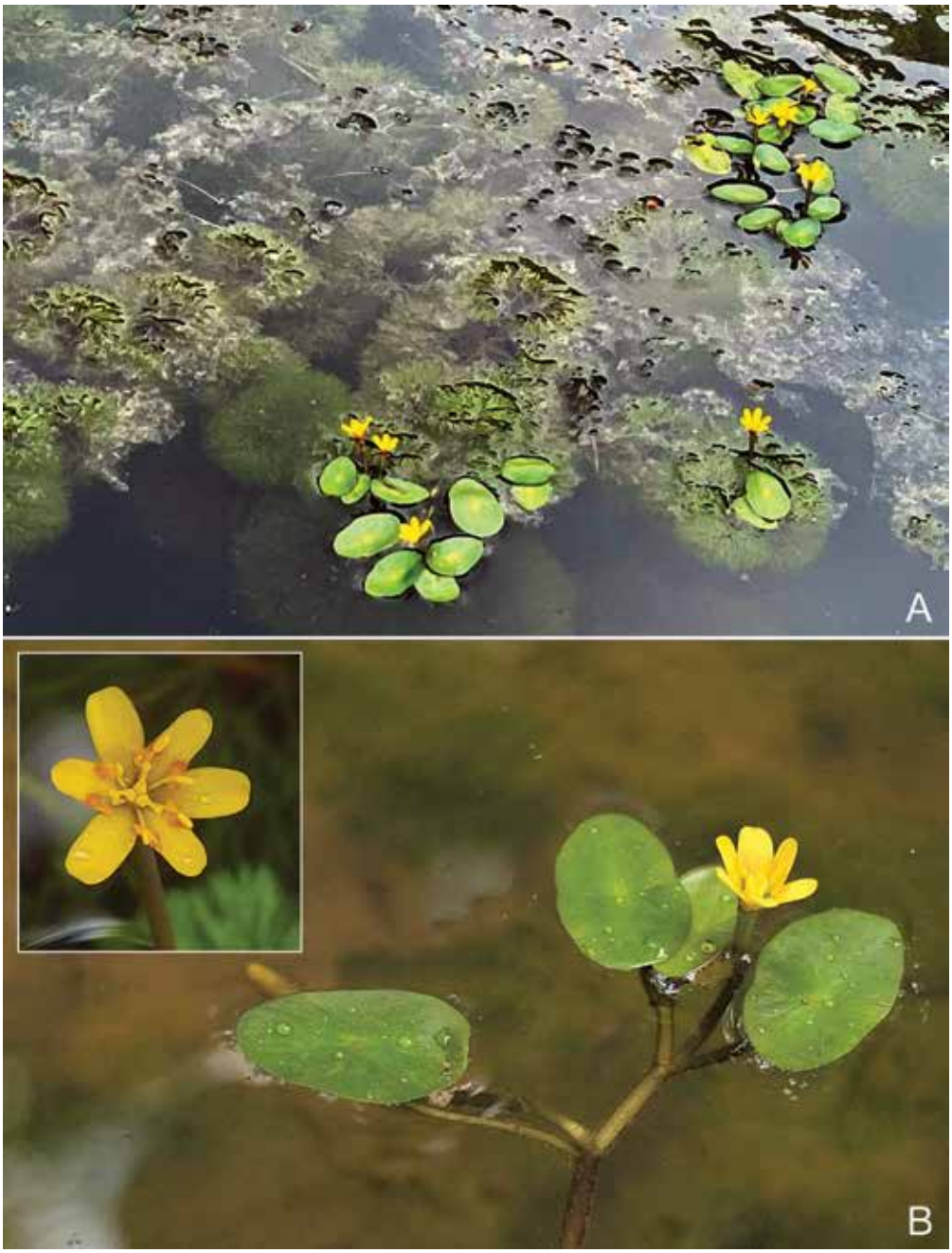

Figure 1. *Cabomba aquatica* Aubl. **A.** Habit. **B.** Flowering shoot with submerged leaves and peltate floating leaves. Inset: Front view of opened flower. (A, B & B inset from Singapore, Singapore Botanic Gardens, A, Symphony Lake; B & B inset, Marsh Garden, *Leong SING2022-112*. Photos: A, L.M.J. Chen; B & B inset, P.K.F. Leong).

range (Silva & Leite, Rodriguésia 62 (2011) 919–926) but neither pollination nor fruit have yet been observed in Singapore; its spread appears to be solely vegetatively through fragmentation of rhizomes and stems.

Conservation assessment. Globally, Least Concern (LC), assessed here. Not native in Singapore.

Uses. Ornamental plant for aquaria and ponds.

Vernacular name. *Yellow Cabomba* (Flora & Fauna Web, 2026).

Taxonomy. Ørgaard (Nord. J. Bot. 11 (1991) 194–195) considered the number of floral parts in *Cabomba aquatica* to be more variable than is presented here and, consequently, treated *Cabomba schwartzii* Rataj from Brazil as a synonym. Her view was adopted by several later authors but *Cabomba schwartzii* has recently been reinstated as a distinct species based on molecular evidence (Barbosa et al., Phytotaxa 367 (2018) 245–255). It differs from *Cabomba aquatica* by having di-(tri)merous flowers, (3–)4(5–6) stamens, usually 1 carpel (rarely 2), and smaller, narrower seeds (Barbosa et al., Phytotaxa 367 (2018) 245–255).

Notes. The species description above is based almost entirely on the two specimens from Singapore Botanic Gardens. However, the descriptions of the fruit and seeds are based on Ørgaard (Nordic J. Bot. 11 (1991) 194), Lima et al. (Acta Bot. Brasil. 28 (2014) 327) and Pellegrini (Flora e Funga do Brasil, 2026).