

HYDROCHARITACEAE

水鳖科 shui bie ke

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Herbs, annual or perennial, submerged or floating, aquatic, in fresh or brackish water or marine. Stems short or elongated, sometimes stoloniferous. Leaves radical or cauline, alternate, opposite, subopposite, whorled, or pseudowhorled, sessile or petiolate, usually sheathing at base. Flowers unisexual or bisexual, actinomorphic, enclosed in a bifid spathe or within 2 opposite spathe bracts, or rarely not spatulate; spathes sessile or pedunculate. Stamens 1 to many, occasionally some staminodal; anthers 1–4-theous. Ovary inferior, 1-loculed; carpels 2–15, fused; ovules few to many, on parietal, sometimes intruding placentae; styles 2–5; stigmas usually bifid. Fruit a fleshy and berrylike capsule dehiscent or opening by decay of pericarp, or an achene (*Najas*). Seeds numerous, usually small, without endosperm; embryo straight.

Eighteen genera and ca. 120 species: widely distributed in tropical and subtropical regions of the world; 11 genera (one introduced) and 34 species (four endemic, one introduced) in China.

Wang Huiqin & Sun Xiangzhong. 1992. Hydrocharitaceae. In: Sun Xiangzhong, ed., Fl. Reipubl. Popularis Sin. 8: 151–190; Zhou Lingyun, You Jun & Zhong Xiongwen. 1992. *Najas*. In: Sun Xiangzhong, ed., Fl. Reipubl. Popularis Sin. 8: 108–125.

- 1a. Fruit an elliptic-oblong achene; perianth 2-lipped; plant annual, submerged in fresh or brackish water; leaves sessile 1. *Najas*
1b. Fruit a fleshy and berrylike capsule; perianth segments free, 1- or 2-seriate, 3 per series, outer often sepaloïd, inner petaloïd; plant perennial or annual, floating or submerged; leaves petiolate or sessile.
2a. Marine herbs; pollen grains threadlike.
3a. Plants slender; leaves usually opposite or binate, not in 2 rows, linear to ovate, usually petiolate 10. *Halophila*
3b. Plants robust; leaves alternate, in 2 rows, ribbonlike, sessile.
4a. Female inflorescence shortly pedunculate; leaves smaller, slightly falcate 5. *Thalassia*
4b. Female inflorescence long pedunculate; leaves larger, not falcate 4. *Enhalus*
2b. Freshwater herbs; pollen grains not threadlike.
5a. Leaves all basal; stems short.
6a. Leaves linear, ribbonlike, sessile; fruit narrowly cylindrical.
7a. Stamens 3–9; ovary attenuate into a long, filiform beak; peduncle of female flower shorter 6. *Blyxa*
7b. Stamens 1–3; ovary not as above; peduncle of female flower very long 7. *Vallisneria*
6b. Leaves lanceolate to orbicular, usually petiolate.
8a. Stolon absent; leaves submerged; spathes usually winged 2. *Ottelia*
8b. Stolon present; leaves floating; spathes not winged 3. *Hydrocharis*
5b. Leaves cauline; stems elongated.
9a. Leaves whorled.
10a. Leaves distinctly serrate to unaided eye 9. *Hydrilla*
10b. Leaves minutely serrate, magnification needed 11. *Egeria*
9b. Leaves alternate, opposite, or spirally arranged.
11a. Flowers usually bisexual; sepals linear to lanceolate, shorter than petals; leaves with prominent midvein 6. *Blyxa*
11b. Flowers unisexual; sepals ovate, subequal to petals; leaves lacking a prominent midvein 8. *Nechamandra*

1. NAJAS Linnaeus, Sp. Pl. 2: 1015. 1753.

茨藻属 ci zao shu

Herbs, annual, small, submerged in fresh or brackish water. Stem slender, fragile, much branched, rooting at base and lowermost nodes. Leaves subopposite or pseudowhorled, sessile, linear, small, 1-veined, sheathing at base, margin spinulose-toothed; sheaths variously shaped, often auriculate. Plants monoecious or dioecious; flowers minute, unisexual, solitary or few in leaf axil. Male flowers spatulate or rarely not spatulate; perianth (often named “involucre” or “envelope”) 2-lipped, membranous, closely applied to anther; stamen 1, anther subsessile, 1–4-theous, dehiscent at apex. Female flowers sessile; spathe absent or rarely present; perianth persistent. Fruit an elliptic-oblong achene; pericarp thin, membranous, indehiscent, persistent. Seeds without endosperm; testa hard, brittle, pitted; embryo straight.

About 40 species: cosmopolitan; eleven species (one endemic) in China.

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One of the Fl. China editorial committee, Wu Zhengyi, prefers to keep the Najadaceae separate because of its distinct morphology in having superior ovaries and nuclear endosperms.

- 1a. Plants dioecious; stems and abaxial surface of leaves usually spiny; areoles on seeds irregularly arranged 1. *N. marina*
 1b. Plants monoecious; stems and abaxial surface of leaves usually not spiny; areoles on seeds longitudinally arranged.
 2a. Anthers 1-theous.
 3a. Seeds with many transversely elongated ladderlike pits; areoles fusiform; fruit narrowed and slightly curved at apex 2. *N. minor*
 3b. Seeds with many longitudinally elongated pits; areoles rectangular or polygonal; fruit usually straight.
 4a. Auricles broadly triangular; leaves in pseudowhorls of 3 5. *N. browniana*
 4b. Auricles orbicular or obcordate; leaves in pseudowhorls of 5.
 5a. Male spathe present 3. *N. gracillima*
 5b. Male spathe absent 4. *N. pseudogracillima*
 2b. Anthers 4(or rarely 2)-theous.
 6a. Auricles broadly triangular to linear.
 7a. Male flowers without spathe 10. *N. graminea*
 7b. Male flowers with spathe 11. *N. pseudograminea*
 6b. Auricles rounded to obcordate.
 8a. Fruit semilunate; female flowers with spathe 6. *N. ancistrocarpa*
 8b. Fruit elliptic; female flowers without spathe.
 9a. Areoles hexangular, transversely elongated, arranged in ladderlike manner 7. *N. oguraensis*
 9b. Areoles rectangular or irregularly arranged.
 10a. Auricles orbicular; testa with apparently raised cell walls 8. *N. chinensis*
 10b. Auricles obcordate; testa without raised cell walls 9. *N. foveolata*

1. *Najas marina* Linnaeus, Sp. Pl. 2: 1015. 1753.

大茨藻 da ci zao

Stems 30–100 cm or more tall, 1–4.5 mm in diam., mostly armed with spines, spines sometimes absent except apically. Leaves 1.5–3 cm × 2–3.5 mm, fleshy, abaxial side of midvein usually with spines; sheath ca. 3 mm, entire or serrulate with 1–3 spine cells on upper side without auricle, leaf acute at apex, with 2–10 conspicuous teeth on each side of margin; teeth 1–2 mm. Plants dioecious; flowers yellowish green. Male flowers ca. 5 × 2 mm; spathe with a short neck; anther 4-theous. Female flowers 2–4.5 mm; style ca. 1 mm; stigmas 2- or 3-lobed. Fruit elliptic to obovoid-elliptic, 4–6 × 3–4 mm. Seeds ovoid; testa pitted; areoles polygonal, irregularly arranged. Fl. and fr. Sep–Nov. $2n = 12^*$, 24, 48, 60*.

Ponds, lakes, slow-moving rivers; below 2700 m. Anhui, Guangdong, Guangxi, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Shandong, Shanxi, Taiwan, Xinjiang, Yunnan, Zhejiang [India, Japan, Kazakhstan, Korea, Kyrgyzstan, Malaysia, Mongolia, Myanmar, Pakistan, Russia, Sri Lanka, Tajikistan, Turkmenistan, Uzbekistan, Vietnam; Africa, SW Asia, Australia, Europe, North and South America].

- 1a. Stems without spines except at apex; abaxial side of leaf midvein without spines 1c. var. *brachycarpa*
 1b. Stems with spines; abaxial side of leaf midvein with spines.
 2a. Seeds 2.5–4 mm; style and stigma 0.2–1.4 mm; anther 1–3.3 mm 1d. var. *intermedia*
 2b. Seeds 4–6 mm; style and stigma 2–3 mm; anther ca. 4 mm.
 3a. Margins of leaves with 4–10 conspicuous teeth; stems with spines 1a. var. *marina*

- 3b. Margins of leaves with 2 or 4 teeth; stems with only 1

or 2 spines under nodes ... 1b. var. *grossidentata*

1a. *Najas marina* var. *marina*

大茨藻(原变种) da ci zao (yuan bian zhong)

Ittnera major (Allioni) C. C. Gmelin; *Najas major* Allioni; *N. major* var. *angustifolia* A. Braun; *N. marina* var. *angustifolia* (A. Braun) K. Schumann.

Stems mostly armed with spines. Leaves with 4–10 conspicuous teeth on margin, abaxial side of midvein with spines ca. 2 mm. Style and stigma 2–3 mm; anthers 3.8–4 mm. Seeds 4.5–5.7 × 2–2.8 mm.

Ponds, lakes, slow-moving rivers; below 2700 m. Anhui, Guangdong, Guangxi, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Shandong, Shanxi, Taiwan, Xinjiang, Yunnan, Zhejiang [India, Japan, Korea, Malaysia, Russia, Tajikistan; Africa, Australia, Europe, North America].

1b. *Najas marina* var. *grossidentata* Rendle, Trans. Linn. Soc. London, Bot. 5: 396. 1899.

粗齿大茨藻 cu chi da ci zao

Stems stout, with only 1 or 2 spines under nodes. Margins of leaves with 2 or 4 teeth, abaxial side of midvein with sparse spines. Style and stigma 2–3 mm; anthers 3.8–4 mm. Seeds 4–4.5 × 2.2–2.4 mm.

Ponds, lakes. Heilongjiang, Jilin, Liaoning [Korea].

1c. *Najas marina* var. *brachycarpa* Trautvetter, Bull. Soc. Imp. Naturalistes Moscou 40(3): 97. 1867.

粗果茨藻 duan guo ci zao

Najas intramongolica Y. C. Ma; *N. marina* subsp. *brachycarpa* (Trautvetter) Tzvelev.

Stems slightly slender, with spines only at apex. Leaves smaller, abaxial side of midvein without spines. Style and stigma 0.2–1.4 mm; anthers 1–3.3 mm. Seeds $2.2\text{--}2.5 \times 1.5\text{--}1.8$ mm.

Ponds. Nei Mongol, Xinjiang [C Asia].

1d. *Najas marina* var. *intermedia* (Gorski) Ascherson, Fl. Brandenburg 1: 670. 1864.

小果大茨藻 xiao guo da ci zao

Najas intermedia Gorski in Eichwald, Naturhist. Skizze, 126. 1830; *N. marina* subsp. *intermedia* (Gorski) Casper.

Stems only slightly spiny. Leaves with 4–8 conspicuous teeth on margin, abaxial side of midvein with spines. Style and stigma 0.2–1.4 mm; anthers 1–3.3 mm. Seeds $2.5\text{--}4 \times 1.2\text{--}2$ mm.

Ponds. Yunnan [cold to warm-temperate areas from Europe to C Asia, extending to a few subtropical parts of Asia].

2. *Najas minor* Allioni, Auct. Syn. Meth. Stirp. Horti Regii Taur. 3. 1773.

小茨藻 xiao ci zao

Caulinia minor (Allioni) Cosson & Germain; *Fluvialis minor* (Allioni) Persoon; *Itnera minor* (Allioni) C. C. Gmelin; *Najas moshanensis* N. Z. Wang.

Stems 4–25 cm tall, 0.5–1 mm in diam. Leaves recurved, 1–3 cm \times 0.5–1 mm; sheath ca. 2 mm; auricles truncate to rounded, with more than 10 teeth on upper and outer sides of leaf margin, each side serrulate with 6–12 teeth, apex acuminate. Plants monoecious; flowers yellowish green. Male flowers elliptic, 0.5–1.5 mm; spathe with a short neck, with brownish spine cells at apex; anther 1-theous. Female flowers ca. 2 mm; style 1–1.7 mm; stigmas 2-lobed. Fruit linear-ellipsoid, $2\text{--}3 \times$ ca. 0.5 mm, narrowed and slightly curved at apex. Seeds narrowly ellipsoid, with many rows of transversely elongated ladderlike pits; areoles fusiform. Fl. and fr. Jun–Oct. $2n = 12^*$, 24^* , 36, 46, 56.

Ponds, lakes, paddy fields and channels; below 2700 m. Anhui, Fujian, Guangdong, Guangxi, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Shandong, Taiwan, Xinjiang, Yunnan, Zhejiang [Afghanistan, India, Indonesia (Java), Japan (including Ryukyu Islands), Kazakhstan, Korea, Nepal, Pakistan, Philippines, Sri Lanka, Tajikistan, Thailand, Uzbekistan, Vietnam; Africa, SW Asia, Europe; introduced in North America].

3. *Najas gracillima* (A. Braun ex Engelmann) Magnus, Beitr. Kenntn. Najas, 23. 1870.

纤细茨藻 xian xi ci zao

Najas indica (Willdenow) Chamisso var. *gracillima* A. Braun ex Engelmann in A. Gray, Manual, ed. 5, 681. 1867; *N. japonica* Nakai.

Stems 8–20 cm tall, 0.3–0.5 mm in diam. Leaves often in pseudowhorls of 5, ca. 2 cm \times 0.3–0.5 mm; sheath 1–2 mm; auricles orbicular to slightly obcordate, short, minutely serrulate with 6 or 7 teeth, upper margin on each side minutely serrulate with 7–11 teeth. Plants monoecious; flowers 1–4 per axil, male

flowers in upper axils and female ones throughout. Male flowers elliptic, 1–1.5 mm; spathe with a short neck, with brownish spine cells at apex; anther 1-theous. Female flowers conspicuous, 2–3 mm; style 1–2 mm; stigmas 2-lobed. Fruit linear-ellipsoid, $2\text{--}3 \times$ ca. 0.5 mm. Seeds narrowly ellipsoid, with more than 20 rows of pits; areoles oblong, longitudinally elongated. Fl. and fr. Jun–Aug. $2n = 12, 24$.

Paddy fields, shallow water of ponds and channels; below 1800 m. Fujian, Guangxi, Guizhou, Hainan, Hebei, Hubei, Jiangxi, Jilin, Liaoning, Nei Mongol, Taiwan, Yunnan, Zhejiang [Japan; North America].

Najas gracillima is most similar to *N. minor*, especially in vegetative condition. However, *N. gracillima* can be separated from *N. minor* by its fruit often straight and the areoles of its seeds longer than broad.

4. *Najas pseudogracillima* Triest, Mém. Acad. Roy. Sci. Outre-Mer, Cl. Sci. Nat. Méd., Collect. 8vo. 22: 98. 1988.

拟纤细茨藻 ni xian xi ci zao

Stems ca. 10 cm tall, ca. 0.3 mm in diam. Leaves often in pseudowhorls of 5, $9\text{--}11 \times$ ca. 0.3 mm; sheath 1–2 mm; auricles orbicular to slightly obcordate, short, minutely serrulate with 3–5 teeth, upper margin on each side minutely serrulate with 6–10 teeth. Plants monoecious; flowers 1–3 per axil, male flowers in upper axils and female ones below. Male flowers elliptic, 0.6–0.8 mm; spathe absent; anther 1-theous. Female flowers inconspicuous, ca. 1 mm; style ca. 1 mm; stigmas 2- or 3-lobed. Fruit $1.6\text{--}2 \times$ ca. 0.5 mm. Seeds elliptic-oblong, with more than 25 rows of pits; areoles oblong, longitudinally elongated; cell walls not raised. Fl. and fr. Jul–Nov.

• Known only from ponds on Chung Chi Campus, Hong Kong.

Najas pseudogracillima is most similar to *N. gracillima*, especially in vegetative condition. It differs by having male flowers without a spathe, whereas *N. gracillima* has male flowers with a spathe.

5. *Najas browniana* Rendle, Trans. Linn. Soc. London, Bot. 5: 420. 1899.

高雄茨藻 gao xiong ci zao

Stems 20–30 cm tall, ca. 1 mm in diam. Leaves often in pseudowhorls of 3, linear, 1–2 cm \times 0.5–1 mm; sheath shortly auriculate; auricles triangular, ca. 2 mm, minutely serrulate with several teeth on apex; leaf margin on each side minutely serrulate with 10–20 teeth. Plants monoecious; flowers solitary or 2 or 3 together. Male flowers ca. 1 mm; spathe with a short neck, with brownish spine cells at apex; anther 1-theous. Female flowers linear-ellipsoid, ca. 1 mm; style short; stigmas 2-lobed. Fruit linear-ellipsoid, 1.5–1.7 mm. Seeds narrowly ellipsoid, with many rows of pits; areoles squarish to pentangular. Fl. and fr. Aug–Nov. $2n = 12^*$.

Brackish water. Guangdong, Guangxi, Taiwan [India, Indonesia, New Guinea; Australia].

According to Triest (Mém. Acad. Roy. Sci. Outre-Mer, Cl. Sci. Nat. Méd., Collect. 8vo. 22: 118. 1988), *Najas browniana* is found only in Australia.

6. *Najas ancistrocarpa* A. Braun ex Magnus, Beitr. Kenntn. Najas, 7. 1870.

弯果茨藻 wan guo ci zao

Caulinia ancistrocarpa (A. Braun ex Magnus) Nakai;
Najas poyangensis S. F. Guan & Q. Lang.

Stems 10–30 cm tall, 0.5–1 mm in diam. Leaves narrowly linear or linear, 1–2 cm × ca. 0.5 mm; sheath 1–1.5 mm; auricles rounded, minutely serrulate with 5–8 teeth on upper side; leaf margin minutely serrulate with 4–16 (or more) spiny teeth on each side. Plants monoecious; flowers solitary. Male flowers 0.5–1.5 mm; spathe with a short neck, with 4 or 5 brownish spine cells at apex; anther 4-theous. Female flowers recurved, with a spathe; neck of spathe with brownish spine cells at apex; style ca. 0.5 mm; stigmas 2-lobed. Fruit semilunate, 1–2 × ca. 0.5 mm. Seeds curved, fusiform, with many rows of pits; areoles oblong. Fl. and fr. Jul–Oct. $2n = 12^*$, 24.

Still water. Fujian, Hubei, Jiangxi, Taiwan, Zhejiang [Japan].

7. *Najas oguraensis* Miki, Bot. Mag. (Tokyo) 49: 775. 1935.

澳古茨藻 ao gu ci zao

Caulinia oguraensis (Miki) Nakai.

Stems 20–30 cm tall, 1–2.5 mm in diam. Leaves narrowly linear to subulate, 1–2 cm × 1–3 mm, slightly curved; midvein sometimes with spines; sheath 3–5 mm; auricles orbicular to obcordate, short, minutely serrulate with several teeth at apex; leaf margin serrulate with 7–14 teeth on each side. Plants monoecious; flowers solitary, male flowers usually in upper axils, female ones throughout. Male flowers elliptic, ca. 1 mm; spathe with a neck, with several brownish spine cells at apex; anther 4-theous. Female flowers ca. 3 mm; style ca. 0.5 mm; stigmas 2-lobed. Fruit narrowly ellipsoid, 3–4 × ca. 1 mm, narrowed and curved at apex. Seeds narrowly ellipsoid, with many rows of transversely elongated ladderlike pits; areoles hexangular. Fl. and fr. Jul–Nov. $2n = 24$, 60*.

Still water. Hubei, Jiangxi, Taiwan [India, Japan, Korea, Nepal, Pakistan].

8. *Najas chinensis* N. Z. Wang, J. Wuhan Bot. Res. 3: 32. 1985.

东方茨藻 dong fang ci zao

Najas orientalis Triest & Uotila.

Stems 10–15 cm tall, 0.5–1 mm in diam. Leaves linear to narrowly lanceolate, 1–3 cm × 0.2–1 mm; sheath ca. 2 mm; auricles rounded, minutely serrulate with several teeth on each side; leaf margin minutely serrulate with 6–20 teeth on each side. Plants monoecious; flowers solitary or sometimes 2 together, male flowers in upper axils and female ones throughout. Male flowers elliptic, ca. 1 mm; spathe with a neck, with several brownish spine cells at apex; anther 4-theous. Female flowers 2–2.5 mm; style ca. 1 mm; stigmas 2–4(or 5)-lobed. Fruit narrowly ellipsoid, 2–2.5 × ca. 0.5 mm. Seeds slightly reniform, with ca. 20 rows of pits; areoles regularly arranged, subsquare; cell walls apparently raised. Fl. and fr. May–Aug. $2n = 12^*$.

Ponds, channels, paddy fields, slow-moving rivers; below 1800 m.

Fujian, Guangdong, Guangxi, Hainan, Hubei, Jiangxi, Jilin, Liaoning, Taiwan, Yunnan, Zhejiang [Japan; Europe].

Najas chinensis is similar to *N. foveolata* but can be easily separated by its rounded sheath and apparently raised cell walls of the seed coat.

9. *Najas foveolata* A. Braun ex Magnus, Beitr. Kenntn. Najas, 7. 1870.

多孔茨藻 duo kong ci zao

Caulinia foveolata (A. Braun ex Magnus) Nakai.

Stems 10–20 cm tall, 0.5–1 mm in diam. Leaves linear, slender, 2–2.5 cm × 0.2–0.5 mm; sheath 2–2.5 mm; auricles obcordate, minutely serrulate with 4–9 teeth at apex and outer side; leaf margin on each side minutely serrulate with 6–24 teeth. Plants monoecious; flowers solitary, male flowers in upper axils and female flowers throughout. Male flowers elliptic, ca. 1 mm; spathe with a short neck, with several brownish spine cells at apex; anther 4-theous. Female flowers ca. 2.5 mm; style ca. 1 mm; stigmas 2-lobed, unequal. Fruit narrowly ellipsoid, ca. 1.5 × 0.5 mm. Seeds narrowly ellipsoid, with ca. 20 rows of pits; areoles subsquare to polygonal. Fl. and fr. Aug–Sep. $2n = 12^*$, 24, 36.

Ponds. Anhui, Guangxi, Hubei, Taiwan, Zhejiang [India, ?Indonesia, Malaysia].

Previously, this species was known only in China from S Guangxi.

10. *Najas graminea* Delile, Descr. Égypte, Hist. Nat. 2: 282. 1813.

草茨藻 cao ci zao

Stems 10–20 cm tall, 0.5–1 mm in diam. Leaves narrowly linear to linear, 1–2.5 cm × 0.4–1 mm; sheath 1.5–3 mm, deeply auriculate; auricles narrowly triangular or lanceolate, 1–2 mm, serrulate with several teeth on each side, apex acute; leaf margin minutely and densely serrulate with 30–50 inconspicuous teeth on each side, consisting of brownish spine cells only. Plants monoecious; flowers solitary, or sometimes 2 or 3 together. Male flowers usually more toward upper axils, ca. 1 mm, elliptic; spathe absent; anther 4-theous. Female flowers 1.5–2 mm; style ca. 1 mm; stigmas 2–4-lobed. Fruit oblong, 1.5–2 × ca. 0.8 mm. Seeds ellipsoid-oblong, with ca. 30 rows of pits; areoles hexangular and irregularly polygonal toward ends, or rectangular. Fl. and fr. Jun–Sep. $2n = 12^*$, 24, 36*, 48, 72.

Ponds, paddy fields, usually in still or slow-moving water; below 1800 m. Anhui, Fujian, Guangdong, Guangxi, Hainan, Hebei, Henan, Hubei, Jiangsu, Liaoning, Sichuan, Taiwan, Yunnan, Zhejiang [Afghanistan, Bangladesh, India, Indonesia, Japan (including Ryukyu Islands), Kazakhstan, Korea, Malaysia, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Sri Lanka, Tajikistan, Thailand, Uzbekistan, Vietnam; Africa, SW Asia, Australia, Europe; introduced in North America].

- 1a. Fruit not curved; areoles hexangular to polygonal 10a. var. *graminea*
- 1b. Fruit curved toward apex; areoles oblong 10b. var. *recurvata*

10a. *Najas graminea* var. *graminea*

草茨藻(原变种) cao ci zao (yuan bian zhong)

Caulinia graminea (Delile) Tzvelev.

Leaves ca. 1 mm wide; auricles narrowly triangular. Fruit usually straight. Seeds with hexangular or irregularly polygonal areoles.

Ponds, paddy fields, usually in still or slow-moving water. Anhui, Fujian, Guangdong, Guangxi, Hainan, Hebei, Henan, Hubei, Jiangsu, Liaoning, Taiwan, Yunnan [India, ?Indonesia, Japan (including Ryukyu Islands), Korea, Malaysia, Myanmar, Philippines; Africa, Australia, Europe; introduced in North America].

10b. *Najas graminea* var. *recurvata* J. B. He, L. Y. Zhou & H. Q. Wang, Bull. Bot. Res., Harbin 8(3): 126. 1988.

弯果草茨藻 wan guo cao ci zao

Leaves less than 0.5 mm wide; auricles shortly lanceolate. Fruit recurved at apex. Seeds with apparently oblong areoles.

- Paddy fields. Hubei, Zhejiang.

11. *Najas pseudograminea* W. Koch, Ber. Schweiz. Bot. Ges. 44: 339. 1935.

拟草茨藻 ni cao ci zao

Najas tenuifolia R. Brown subsp. *pseudograminea* (W. Koch) W. J. de Wilde.

Stems ca. 10 cm tall, ca. 1 mm in diam. Leaves often in pseudowhorls of 3, 16–20 × 0.6–0.9 mm; sheath 1–2 mm; auricles linear, short, minutely serrulate with 3–9 teeth, upper margin on each side minutely serrulate with 30–50 teeth. Plants monoecious; flowers 1–3 per axil, male flowers in upper axils and female ones below. Male flowers elliptic, 1.4–2.3 mm; spathe with short neck; anther 4-theous. Female flowers inconspicuous, ca. 1 mm; style ca. 1 mm; stigmas 2- or 3-lobed. Fruit 1–1.3 × ca. 0.4 mm. Seeds elliptic-oblong, with more than 20 rows of pits; areoles squarish to hexagonal or rectangular; cell walls not raised. Fl. and fr. Jul.

Known in China only from ponds on Chung Chi Campus, Hong Kong [East Timor, Indonesia, Philippines, Thailand; Australia].

2. OTTELIA Persoon, Syn. Pl. 1: 400. 1805.

海菜花属 hai cai hua shu

Boottia Wallich; *Oligolobos* Gagnepain.

Herbs, freshwater. Stems usually cormlike. Leaves all basal, petiolate, usually sheathing at base; blades submerged or sometimes floating, linear to broadly ovate, 3–11-veined. Spathes elliptic or ovate, usually 2–6-winged, apex bifid or trifid, with 1 to many flowers. Flowers bisexual or unisexual and plants dioecious. Male flowers with longer pedicel. Bisexual and female flowers shortly pedicellate or without pedicel. Sepals 3, greenish, linear, oblong, or ovate. Petals 3, colored, orbicular to broadly obovate, much longer and wider than sepals. Stamens 3–15; filaments linear, flattened; anthers laterally dehiscent; staminodes (absent or 1–)3, often present in female flowers. Ovary of 3, 6, or 9 (or more) carpels; ovules numerous; stigmas 2 per style, linear. Fruit cylindrical, fusiform, or conic. Seeds numerous, small, often hairy.

About 21 species: tropical to temperate areas; five species (two endemic) in China.

1a. Flowers bisexual.

2a. Spathe with only 1 flower; flowers without gland; leaf sheath absent 1. *O. alismoides*2b. Spathe with many flowers; flowers with gland; leaves sheathed at base 2. *O. balansae*

1b. Flowers unisexual.

3a. Female spathe with 2–9 female flowers; styles 3; fruit triangular-cylindric to fusiform 5. *O. acuminata*

3b. Female spathe with only 1 female flower; styles more than 3; fruit oblong.

4a. Leaves dimorphic, submerged and floating; seeds smooth; male spathe with 10–30 male flowers 3. *O. cordata*4b. Leaves not dimorphic, emerged; seeds densely hairy; male spathe with 47–60 male flowers 4. *O. emersa***1. *Ottelia alismoides* (Linnaeus) Persoon, Syn. Pl. 1: 400. 1805.**

龙舌草 long she cao

Stratiotes alismoides Linnaeus, Sp. Pl. 1: 535. 1753; *Damasonium alismoides* (Linnaeus) R. Brown; *D. indicum* Willdenow, nom. illeg. superfl.; *Ottelia alismoides* f. *oryzeturum* Komarov; *O. condorensis* Gagnepain; *O. dioecia* S. Z. Yan; *O. indica* Planchon ex Dalzell & A. Gibson, nom. illeg. superfl.; *O. japonica* Miquel; *S. quinquealatus* Stokes, nom. illeg. superfl.

Petiole varying greatly in length according to depth of water; leaf blade wholly submerged, varying greatly in shape and size, usually broadly ovate, ovate-elliptic, suborbicular, cor-

date, or sometimes lanceolate, ca. 20 × 18 cm or more, membranous. Flowers bisexual or plants occasionally dioecious-polygamous. Spathe 2.5–4 × 1.5–2.5 cm, 2- or 3-lobed at apex, with 3–6 longitudinal wings. Flowers solitary, sessile. Petals white, slightly purple, or bluish. Stamens 3–9(–12); filaments glandular hairy; anthers narrowly oblong, 3–4 mm. Ovary subglobose, with 3–9(or 10) carpels; styles 6–10, deeply 2-lobed. Fruit 2–5 × 0.8–1.8 cm. Seeds fusiform, 1–2 mm, densely hairy. Fl. and fr. Apr–Oct. $2n = 44$.

Still or running water. Anhui, Fujian, Guangdong, Guangxi, Guizhou, NW Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Cambodia, India, Indonesia, Japan (including Ryukyu Islands), Korea, Laos, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Thailand, Sri Lanka, Vietnam; Africa, Australia; introduced in North America].

2. *Ottelia balansae* (Gagnepain) Dandy, J. Bot. 72: 137. 1934.

贵州水车前 *gui zhou shui che qian*

Oligolobos balansae Gagnepain, Bull. Soc. Bot. France 54: 543. 1907; *Boottia sinensis* H. Léveillé & Vaniot; *Ottelia demersa* H. Li & C. X. You; *O. sinensis* (H. Léveillé & Vaniot) H. Léveillé ex Dandy.

Leaves wholly submerged, translucent, young leaves linear or lanceolate, mature ones usually oblong or ovate, 20–40 × 6–9 cm, base truncate, rounded, or cordate, apex acute or rounded; petiole ca. 20 cm. Spathe elliptic, 3–6 × ca. 1.5 cm, with many longitudinal ribs and often with wings on lateral sides, with 3–11 flowers. Flowers bisexual. Sepals green. Petals white with yellow base, obtriangular or obovate, 2–3 × ca. 2.5 cm. Stamens 3; filaments 4–5 mm; anthers elliptic, 4–5 mm; glands 3. Ovary triangular-cylindric, with 3 carpels; styles 3, hairy; stigmas 6, hairy. Fruit narrowly elliptic, 5–9 cm × ca. 8 mm. Seeds cylindric to fusiform, ca. 3 mm. Fl. and fr. Jun–Nov.

Ponds, rivers, lakes. Guangxi, Guizhou, Yunnan [Vietnam].

3. *Ottelia cordata* (Wallich) Dandy, J. Bot. 72: 137. 1934.

水菜花 *shui cai hua*

Boottia cordata Wallich, Pl. Asiat. Rar. 1: 52. 1830; *B. heterophylla* Merrill & F. P. Metcalf; *Ottelia heterophylla* (Merrill & F. P. Metcalf) T. L. Wu.

Leaves dimorphic; submerged leaves narrowly elliptic to ligulate, 30–60 × 4.5–10 cm; floating leaves broadly lanceolate or oblong-ovate, 10–20 × 4–10 cm, base cordate, apex acute to acuminate; petiole 30–120 cm. Flowers unisexual. Spathe oblong-ovate, 3.5–8 × 1.5–2 cm, with 6 longitudinal ribs, bifid at apex. Male spathe with 10–30 male flowers; sepals yellowish; petals white, obovate, 2.5–4.5 cm; stamens 12; filaments densely hairy; anthers ca. 6 mm; staminodes 3; reduced pistil 1; glands 3. Female spathe with only 1 female flower; perianths similar to male ones; ovary oblong, with 9–15 carpels; styles 9–18, papillate, bifid at apex; staminodes 3–8; glands 3. Fruit oblong, 4–4.5 × 1.6–2 cm. Seeds fusiform, ca. 1.5 mm, smooth. Fl. May. $2n = 22$.

Ponds, channels. Hainan [Cambodia, Myanmar, Thailand].

4. *Ottelia emersa* Z. C. Zhao & R. L. Luo, J. Wuhan Bot. Res. 5: 339. 1987.

出水水菜花 *chu shui shui cai hua*

Leaves emersed; petiole 45–90 cm; leaf blade narrowly cordate, 9–20 × 4.5–14 cm, leathery, base cordate, apex obtuse. Flowers unisexual. Spathe 5–7.5 × 3–3.5 cm, with 3 longitudinal ribs. Male spathe with 47–60 male flowers; sepals greenish; petals white with yellow base, obovate, 4–5.5 cm; stamens 12; filaments upper densely hairy; anthers 4–9 mm; staminodes 3; reduced pistil 1. Female spathe with only 1 female flower; perianth larger than male ones; ovary ovoid, with 14–16 carpels; styles 14–18, bifid and hairy at apex; staminodes 6–9. Fruit oblong, 4.5–7 × 3–5 cm. Seeds fusiform, ca. 1.6 mm, densely hairy. Fl. May, fr. Jun–Jul. $2n = 22^*$.

• Ponds. Guangxi (Guixian).

This species differs from *Ottelia cordata* by its leaves emersed and not dimorphic, male flowers in each spathe with up to 47–60 flowers, and seeds densely hairy.

5. *Ottelia acuminata* (Gagnepain) Dandy, J. Bot. 72: 137. 1934.

海菜花 *hai cai hua*

Leaves wholly submerged; petioles varying greatly in length according to depth of water; leaf blades varying greatly in shape and size, linear to broadly cordate, base cordate to attenuate, margin entire, undulate, or serrulate, apex obtuse. Flowers unisexual. Spathe with 2–6 longitudinal ribs. Male spathe with 40–190 male flowers; sepals green; petals white with yellow base, obcordate or obovate, 1–3.5 cm; stamens 9–12; filaments hairy; anthers ovoid-elliptic; staminodes 3. Female spathe with 2–9 female flowers; perianth similar to male ones; ovary triangular-cylindric with 3 carpels; styles 3, deeply bifid; staminodes 3. Fruit triangular-cylindric to fusiform, ca. 8 cm. Seeds narrowly elliptic, with or without hairs. Fl. May–Oct. $2n = 22^*$.

• Lakes, ponds, channels, paddy fields, rivers, streams. Guangdong, Guangxi, Guizhou, Hainan, Sichuan, Yunnan.

- 1a. Male spathe with 60–190 flowers; female spathe with 8 or 9 flowers 5d. var. *jingxiensis*
- 1b. Male spathe with 40–50 flowers; female spathe with 2 or 3 flowers.
 - 2a. Male spathe without veins, with bulbs within 5c. var. *lunanensis*
 - 2b. Male spathe with several veins, without bulbs within.
 - 3a. Fruit triangular-conic; leaves not ligulate 5a. var. *acuminata*
 - 3b. Fruit slightly curved, fusiform; leaves ligulate 5b. var. *crispa*

5a. *Ottelia acuminata* var. *acuminata*

海菜花(原变种) *hai cai hua* (yuan bian zhong)

Boottia acuminata Gagnepain, Bull. Soc. Bot. France 54: 538. 1907; *B. yunnanensis* Gagnepain; *Ottelia acuminata* var. *tonhaiensis* H. Li; *O. cavaleriei* Dandy; *O. yunnanensis* (Gagnepain) Dandy; *Xystrolobos yunnanensis* Gagnepain.

Leaves linear to broadly cordate, base usually cordate, margin entire or minutely serrulate. Spathe with 2–6 ribs. Male spathe with 40–50 male flowers, with several veins; male flowers with filiform staminodes. Female spathe with 2 or 3 female flowers. Fruit triangular-conic. Seeds without hairs.

• Lakes, ponds, channels, paddy fields. Guangdong, Guangxi, Guizhou, Hainan, Sichuan, Yunnan.

5b. *Ottelia acuminata* var. *crispa* (Handel-Mazzetti) H. Li, Acta Phytotax. Sin. 19: 36. 1981.

波叶海菜花 *bo ye hai cai hua*

Boottia crispa Handel-Mazzetti, Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 62: 253. 1925; *Ottelia crispa* (Handel-Mazzetti) Dandy; *Xystrolobos crispus* (Handel-Mazzetti) Dandy ex Handel-Mazzetti.

Leaves ligulate, base attenuate to subcordate, margin undulate. Male spathe with several veins. Fruit slightly curved, fusiform.

- Lakes. Yunnan (Lugu Hu).

5c. *Ottelia acuminata* var. *lunanensis* H. Li, Acta Phytotax. Sin. 19: 38. 1981.

路南海菜花 lu nan hai cai hua

Male spathe small, without veins, with bulbs within; male flowers with minute, obcordate or ligulate staminodes.

- Lakes. Yunnan (Lunan).

5d. *Ottelia acuminata* var. *jingxiensis* H. Q. Wang & S. C. Sun, J. Wuhan Bot. Res. 10(1): 12. 1992.

靖西海菜花 jing xi hai cai hua

Male spathe with 60–190 male flowers; male flowers with staminodes bifid at apex. Female spathe with 8 or 9 female flowers. Seeds sparsely hairy.

- Rivers, streams. Guangxi (Jingxi).

3. **HYDROCHARIS** Linnaeus, Sp. Pl. 2: 1036. 1753.

水鳖属 shui bie shu

Herbs, floating. Stems short, stoloniferous. Leaves basal, floating or submerged, rarely emerged, petiolate and stipulate; blade ovate, orbicular, or reniform, entire, with more than 5 curved veins, sometimes with a central pad of spongy tissue on abaxial surface of floating blade. Plants monoecious; flowers unisexual. Spathes 1- or 2-valved, male spathes pedunculate, 1–6-flowered; female spathes sessile, 1-flowered. Sepals greenish white. Petals white or yellowish, much larger than sepals. Stamens 6–12; anthers 2-theous. Ovary elliptic; ovules numerous; styles 6, bifid. Fruit with 6 ribs, irregularly dehiscent at apex. Seeds ellipsoid.

About three species: Africa, Asia, Australia, Europe, North America; one species in China.

1. *Hydrocharis dubia* (Blume) Backer, Handb. Fl. Java 1: 64. 1925.

水鳖 shui bie

Pontederia dubia Blume, Enum. Pl. Javae 1: 33. 1827; *Hydrocharis asiatica* Miquel; *H. morsus-ranae* Linnaeus; *H. morsus-ranae* var. *asiatica* (Miquel) Makino; *Limnobium dubium* (Blume) Shaffer-Fehre; *Monochoria dubia* (Blume) Miquel.

Leaves floating or sometimes emerged; blade cordate or orbicular, 4.5–5 × 5–5.5 cm, 5–7-veined, base cordate, apex rounded. Male flowers 5 or 6 in spathe; peduncles 0.5–3.5 cm; pedicels 5–6.5 cm; sepals ca. 6 × 3 mm; petals yellow, ca. 1.3 ×

1.7 cm; stamens 12, inner 3 stamens staminodal; anthers 1–1.5 mm; staminodes hairy at base and papillose at apex. Female flowers larger than male flowers; sepals ca. 1.1 cm × 4 mm; petals white, yellow at base, ca. 1.5 × 1.8 cm; staminodes 6; glands 3, reniform; styles ca. 4 mm, with dense glandular hairs. Fruit berrylike, spherical to obovoid, 8–10 mm, ca. 7 mm in diam. Seeds gradually acute toward apex. Fl. and fr. Aug–Oct. $2n = 16$.

Still water. Anhui, Fujian, Guangdong, Guangxi, NE Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Shaanxi, Shandong, Sichuan, Taiwan, Yunnan, Zhejiang [Bangladesh, India, Indonesia, Japan (including Ryukyu Islands), Korea, Myanmar, New Guinea, Philippines, Thailand, Vietnam; N Australia].

4. **ENHALUS** Richard, Mém. Cl. Sci. Math. Inst. Natl. France 1811(2): 64. 1814.

海菖蒲属 hai chang pu shu

Herbs, submerged marine; rhizome robust, with persistent fibrous remains of leaf sheaths. Leaves 2–6, narrowly linear or ribbon-shaped, sheathing at base, with many parallel veins, unequal at apex. Plants dioecious; flowers unisexual. Male inflorescence shortly pedunculate, enclosed by 2 spathal bracts; flowers numerous, minute, shortly pedicellate, breaking off just before anthesis, floating on surface of water at maturity; tepals reflexed; stamens 3; anthers sessile, laterally dehiscent; pollen grains very large. Female inflorescence 1-flowered, with a long peduncle, enclosed by 2 overlapping, scarcely fused, strongly keeled spathal bracts; sepals narrowly elliptic; petals linear; carpels 6, fused; styles 6, bifid. Fruit irregularly dehiscent. Seeds few.

One species: widely distributed along the coasts of the Indian and W Pacific Oceans.

1. *Enhalus acoroides* (Linnaeus f.) Royle, Ill. Bot. Himal. Mts. 1: 377. 1839.

海菖蒲 hai chang pu

Stratiotes acoroides Linnaeus f., Suppl. Pl. 268. 1782; *Enhalus koenigii* Richard.

Roots robust, 10–20 cm, 3–5 mm in diam. Leaves 0.3–1.5 m × 1–2 cm, veins 13–19, margin entire, apex obtuse. Peduncle of male inflorescences ca. 5 cm; bracts sessile, slightly keeled,

midvein hairy; male flowers pedicellate; sepals white, oblong, ca. 2 mm; petals white, larger than sepals; stamens white, 1.5–2 mm. Peduncle of female flower to 50 cm, coiled and contracted after anthesis; bracts 4–6 × 1–2 cm, midvein keeled, apparently hairy; sepals reddish; petals white, strap-shaped, strongly folded, 4–5 cm × 3–4 mm, papillose; ovary ovoid, with long hairs. Fruit ovoid, 5–7 cm. Seeds angular, 1–1.5 cm in diam. Fl. May.

Submerged in shallow water along seacoasts. Hainan [Cambodia, India, Indonesia, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand, Vietnam; Africa, Australia].

5. THALASSIA Banks ex K. D. Koenig, Ann. Bot. (König & Sims) 2: 96. 1805.

泰来藻属 tai lai zao shu

Herbs, submerged marine. Rhizome elongated, creeping, with scales and extended internodes, giving rise to erect, short, leafy shoots. Leaves usually 2–6, distichous, ribbonlike or slightly falcate, veins 9–15, parallel, connected by cross veins, sheathed at base. Inflorescences pedunculate, 1-flowered; spathes 2, fused. Plants dioecious; flowers unisexual. Male flowers pedicellate; perianth segments 3; stamens 3–12; anthers subsessile, 2–4-theous, laterally dehiscent; pollen grains spherical, stuck together into moniliform chains; female flowers subsessile; ovary 1-loculed; styles 6, each with 2 filiform stigmas. Fruit spherical or elliptic, split open at top by stellate dehiscence of fleshy pericarp into a number of irregular valves. Seeds numerous.

Two species: Indian and W Pacific Oceans, Caribbean Sea, Gulf of Mexico; one species in China.

1. Thalassia hemprichii (Ehrenberg ex Solms) Ascherson, Petermanns Geogr. Mitt. 17: 242. 1871.

泰来藻 tai lai zao

Schizotheca hemprichii Ehrenberg ex Solms, Abh. Königl. Akad. Wiss. Berlin 1: 429. 1832.

Rhizomes terete, with persistent leaf sheaths. Leaves curved, 6–12(–40) cm × 4–8 mm. Peduncle of male inflores-

cence 2–3 cm, female inflorescence without peduncle; spathe linear. Male flower on a pedicel 2–3 cm; perianth segments elliptic, petaloid; anthers oblong; female flower with ovary of 6 carpels; stigmatic branches 1–1.5 cm. Fruit greenish, 2–2.5 × 1.8–3.2 cm.

Submerged in shallow water along seacoasts. Hainan, Taiwan [India, Indonesia, Japan (Ryukyu Islands), Malaysia, Myanmar, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; Red Sea to Indian Ocean and W Pacific Ocean].

6. BLYXA Noronha ex Thouars, Gen. Nov. Madagasc. 4. 1806.

水筛属 shui shai shu

Herbs, submerged freshwater. Stems short or elongated, erect or stoloniferous. Leaves basal or spirally arranged along stem, sessile, lanceolate or linear, with prominent midvein and several lateral veins, sheathed at base, minutely serrulate along margin. Spathe tubular, sessile or pedunculate, bifid at apex, with longitudinal veins, 1-flowered or sometimes several flowered. Flowers bisexual or unisexual. Sepals 3, persistent, green, linear or lanceolate. Petals 3, white, longer than sepals. Stamens 3–9; filaments slender; anthers 4-theous. Pistils 3; ovary linear, attenuate into a long, filiform beak; styles 3; ovules numerous. Fruit linear to terete, long, narrow. Seeds numerous, oblong-fusiform, smooth or with spines, sometimes with a filiform projection from each end.

About 11 species: tropical and subtropical regions; five species in China.

1a. Stems elongate; leaves cauline.

2a. Spathe sessile; anthers 1.8–2.5 mm; styles 3–4 mm; seeds narrowly elliptic 1. *B. japonica*

2b. Spathe shortly pedunculate; anthers 3.5–5 mm; styles 5–6 mm; seeds ovoid 2. *B. leiosperma*

1b. Stems much shortened, or absent; leaves basal.

3a. Flowers unisexual; stamens 9 5. *B. octandra*

3b. Flowers bisexual; stamens 3.

4a. Seeds with a filiform projection from each end, and with prominent acute spines on surface 4. *B. echinosperma*

4b. Seeds without a projection, and with broad, short, obtuse tubercles or ridges 3. *B. aubertii*

1. Blyxa japonica (Miquel) Maximowicz ex Ascherson & Gürke in Engler & Prantl, Pflanzenfam. 2(1): 253. 1889.

水筛 shui shai

Hydrilla japonica Miquel, Ann. Mus. Bot. Lugduno-Batavi 2: 271. 1866; *Blyxa angustipetala* (Ridley) Masamune var. *laevissima* (Hayata) Masamune; *B. laevissima* Hayata.

Stems elongated, 10–20 cm tall, branched. Leaves cauline, lanceolate, 3–6 cm × 1–3 mm, veins 3, apex acuminate. Spathes sessile, green, 1–3 cm × 1–3 mm. Flowers bisexual. Sepals green with purple midvein, linear-lanceolate, 2–4 × 0.5–1 mm. Petals 6–10 × 0.5–1 mm. Stamens 3; filaments 1–3 mm, smooth; anthers 1.8–2.5 mm. Ovary conic; styles 3–4 mm. Fruit 1–2.5 cm. Seeds 30–60, narrowly elliptic, smooth. Fl. and fr. May–Oct. $2n = 72$.

Paddy fields, ponds, channels. Anhui, Fujian, Guangdong, Guang-

xi, Guizhou, Hainan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Sichuan, Taiwan, Zhejiang [Bangladesh, India, Japan, Korea, Malaysia, Myanmar, Nepal, New Guinea, Thailand, Vietnam; Europe].

2. Blyxa leiosperma Koidzumi, Bot. Mag. (Tokyo) 31: 257. 1917.

光滑水筛 guang hua shui shai

Stems elongated, 2–6 cm tall, branched from base. Leaves cauline, lanceolate, 6–9 cm × ca. 2.5 mm, veins 3, apex acuminate. Spathes green, 2.5–3 cm × ca. 2 mm, with peduncle 0.2–2.2 cm. Flowers bisexual. Sepals yellowish green, linear-lanceolate, 4–5 × ca. 0.5 mm. Petals 9–10 × ca. 1 mm. Stamens 3; filaments 3–5 mm; anthers 3.5–5 mm. Ovary conic; styles 5–6 mm. Fruit 2.5–3 cm. Seeds 40–60, ovoid, smooth. Fl. and fr. May–Sep. $2n = 72$.

Paddy fields. Anhui, Fujian, Guangdong, Hainan, Jiangxi, Zhejiang [Japan].

3. *Blyxa aubertii* Richard, Mém. Cl. Sci. Math. Inst. Natl. France 1811(2): 19. 1814.

无尾水筛 wu wei shui shai

Blyxa ecaudata Hayata.

Stems shortened. Leaves all in basal rosette, linear, 5–17(–60) cm × 3(–12) mm, veins 5–9, apex acuminate. Spathe green, 3–5 cm × ca. 2 mm, with peduncle 2.7–8 cm. Flowers bisexual. Sepals greenish purple, linear-lanceolate, 5–7 × ca. 1 mm. Petals 9–17 × ca. 0.5 mm. Stamens 3; filaments 3–6 mm; anthers 1–1.8 mm. Ovary narrowly cylindrical, 2.5–4 cm; styles ca. 7 mm. Fruit (2–)4–6(–8) cm. Seeds 30–70, oblong-ovoid, 1.2–1.8 × ca. 0.6 mm, 6–12-ribbed; ribs obscurely tuberculate or ridged. Fl. and fr. May–Sep. $2n = 16$.

Paddy fields and channels. Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Bangladesh, Bhutan, India, Indonesia, Japan (Ryukyu Islands), Korea, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; Africa, Australia; introduced in North America].

4. *Blyxa echinosperma* (C. B. Clarke) J. D. Hooker, Fl. Brit. India 5: 661. 1888.

有尾水筛 you wei shui shai

Hydrotrichus echinospermus C. B. Clarke, J. Linn. Soc., Bot. 14: 8. 1873; *Blyxa aubertii* Richard var. *echinosperma* (C. B. Clarke) C. D. K. Cook & Lüönd; *B. bicaudata* Nakai; *B. ceratosperma* Maximowicz ex Ascherson & Gürke; *B. shimadae* Hayata; *B. somae* Hayata.

Stems shortened. Leaves all in basal rosette, strap-shaped, 10–20(–40) cm × 4–7 mm, veins 7–9, apex acuminate. Spathe green, 2–5 cm × ca. 2 mm, with slender peduncle 2–12 cm.

Flowers bisexual. Sepals green, linear, ca. 6 × 1 mm. Petals 1–1.4 cm × 0.5–0.8 mm. Stamens 3, 4–6 mm. Ovary narrowly cylindrical, 3–7 cm; styles 0.6–1.5 cm. Fruit 4–7 cm. Seeds 30–50, fusiform or oblong-fusiform, 1.5–2 × ca. 0.8 mm, with filiform projections or ridges 2–12 mm from each end, and with prominently acute spines on surface. Fl. and fr. Jun–Oct. $2n = 42$.

Paddy fields and channels. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hebei, Hunan, Jiangsu, Jiangxi, S Shaanxi, Sichuan, Taiwan, Zhejiang [Bangladesh, India, Indonesia, Japan, Korea, Malaysia, Myanmar, Nepal, Papua New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; Australia].

5. *Blyxa octandra* (Roxburgh) Planchon ex Thwaites, Enum. Pl. Zeyl. 332. 1864.

八药水筛 ba yao shui shai

Vallisneria octandra Roxburgh, Pl. Coromandel 2: 34. 1802; *Blyxa roxburghii* Richard, nom. illeg. superfl.; *B. saivala* Steudel, nom. illeg. superfl.

Stems shortened or absent. Leaves all in basal rosette, linear, 6–60 cm × 5–7 mm, veins faint, 20 or more, spiny toward apex. Spathe 6–10 cm, with a long peduncle 20–120 cm. Plants dioecious; flowers unisexual, 1 female or 5–10 male flowers in a spathe. Sepals reddish, linear, 9–10 × ca. 1.5 mm. Petals 2–2.5 cm or longer. Stamens 9; filaments 2–5 mm; anthers 1–2 mm. Ovary narrowly cylindrical, 6–9 cm, with a beak 8–10 cm; styles ca. 2 cm, hairy. Fruit 7.5–10 cm. Seeds numerous, oblong-elliptic, 1–2 × 0.5–1 mm, with up to 12 longitudinal ridges bearing 8 rows of ± blunt spines ca. 0.5 mm, with-out filiform projections. $2n = 16, 32$.

Guangdong, S Guangxi (Fangcheng), Sichuan, Yunnan [Bangladesh, India, Myanmar, New Guinea, Sri Lanka, Vietnam; Australia].

7. VALLISNERIA Linnaeus, Sp. Pl. 2: 1015. 1753.

苦草属 ku cao shu

Physcium Loureiro.

Herbs, submerged, stoloniferous, without erect stems. Leaves basal, sessile, linear or strap-shaped, veins 3–9, parallel, slightly sheathed at base, margin minutely serrulate or entire. Plants dioecious; flowers unisexual. Male flowers numerous, minute, shortly pedicellate, clustered together on a central column enclosed by a common spathe, each flower finally breaking free and floating on water surface; spathe ovate or broadly lanceolate, shortly pedunculate; sepals 3, convex, 2 larger than other; petals 2 or 3, minute; stamens 1–3. Female flowers solitary in spathe; spathe tubular, bifid at apex, pedunculate; peduncles long, coiled after anthesis; sepals 3; petals 3, minute; ovary narrowly cylindrical or narrowly triangular-cylindrical; ovules numerous; styles 3, bifid. Fruit cylindrical or triangular-cylindrical. Seeds numerous, oblong or fusiform.

About eight species: tropical and subtropical regions; three species (one endemic) in China.

- 1a. Stamen 1; fruit cylindrical; veins without spines 1. *V. natans*
 1b. Stamens 2; fruit triangular-cylindrical; midveins with minute spines.
 2a. Seeds 2–5-winged 2. *V. spinulosa*
 2b. Seeds without wings 3. *V. denseserrulata*

1. *Vallisneria natans* (Loureiro) H. Hara, J. Jap. Bot. 49: 136. 1974.

苦草 ku cao

Physcium natans Loureiro, Fl. Cochinch. 2: 663. 1790; *Vallisneria asiatica* Miki; *V. asiatica* var. *higoensis* Miki; *V. gigantea* Graebner; *V. gigantea* var. *higoensis* (Miki) Kitamura;

V. higoensis (Miki) Ohwi; *V. natans* var. *higoensis* (Miki) H. Hara; *V. physcium* Jussieu ex Sprengel, nom. illeg. superfl.; *V. spiralooides* Roxburgh.

Rhizome tuberous; stolons ca. 2 mm in diam., usually smooth. Leaves 0.2–2 m × 0.5–2 cm, veins 5–9, margin entire or inconspicuously serrulate, apex obtuse. Male spathe ovate-conic, 1.5–2 cm × 5–10 mm, with more than 200 male flowers;

sepals strongly convex; stamens 1, filaments sometimes 2-lobed at apex, with hairs at base. Female spathe 1.5–2 cm; peduncle 30–50 cm or longer, slender; sepals greenish purple, 2–4 × ca. 3 mm, apex obtuse; petals white, minute; staminodes 3. Fruit cylindrical, 5–30 cm × ca. 5 mm. Seeds narrowly obovoid, glandular hairy. $2n = 20$.

Rivers, streams, ponds, lakes. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Shaanxi, Shandong, Sichuan, Taiwan, Yunnan, Zhejiang [India, Japan (including Ryukyu Islands), Korea, Malaysia, Nepal, Russia (Far East), Vietnam; SW Asia, Australia].

2. *Vallisneria spinulosa* S. Z. Yan, J. Sci. Med. Jinan Univ. 2: 161. 1982.

刺苦草 ci ku cao

Rhizome tuberous; stolons with minute spines. Leaves 20–50(–200) cm × 4–10 mm, midvein prominent, with 1 row of minute spines, margin serrulate, apex obtuse or slightly acute. Male spathe conic, 1–1.5 cm × 5–8 mm, with more than 300 male flowers; sepals convex; petals 2, connected at base of filaments; stamens 2, filaments without hairs. Female spathe 1–2 cm, with very long slender peduncle; sepals ca. 4 × 2 mm, apex

obtuse; petals minute; staminodes 3. Fruit triangular-cylindric, 8–20 cm × 4–7 mm, with spines on angles. Seeds obovoid, 2–5-winged. Fl. and fr. Aug–Oct. $2n = 20^*$.

• Ponds, lakes. Guangxi, Hubei, Hunan, Jiangsu.

3. *Vallisneria denseserrulata* (Makino) Makino, J. Jap. Bot. 2: 19. 1921.

密刺苦草 mi ci ku cao

Vallisneria spiralis Linnaeus var. *denseserrulata* Makino, Bot. Mag. (Tokyo) 28: 27. 1914.

Rhizome erect, 1–6 cm, 4–6 mm in diam.; stolons with minute spines. Leaves 20–70 cm × 6–12 mm, veins 3, midvein with minute spines, margin densely serrulate, apex obtuse or acute. Male spathe triangular, 1–1.5 cm × ca. 6 mm, many flowered; sepals reflexed; stamens 2. Female spathe 1.5–2 cm, with slender and very long peduncle; sepals ca. 3 × 2 mm, apex acute. Fruit triangular-cylindric. Seeds not winged. Fl. and fr. Sep–Oct. $2n = 20$.

Streams, lakes. Anhui, Guangdong, Guangxi, Hubei, Liaoning, Zhejiang [Japan].

8. NECHAMANDRA Planchon, Ann. Sci. Nat., Bot., sér. 3, 11: 78. 1849.

虾子草属 xia zi cao shu

Herbs, submerged. Stems elongated, slender, much branched. Leaves alternate but usually opposite at base, densely crowded toward ends of stems, linear, lacking a prominent midvein, parallel veins present, slightly sheathing at base, margin minutely serrulate with teeth. Plants dioecious; flowers unisexual. Male inflorescence pedunculate, many flowered; spathe ovate, membranous, bifid at apex; male flowers minute; sepals 3, petaloid, white, ovate; petals 3, small, subequal to sepals; stamens 2 or 3, opposite to sepals; filaments slender, very short. Female spathe oblong, 1-flowered; female flowers similar to male ones; ovary oblong, elongated into a beak at apex; styles 3. Fruit ovoid-oblong or linear. Seeds numerous, oblong, minute.

One species: S and SE Asia.

1. *Nechamandra alternifolia* (Roxburgh ex R. Wight) Thwaites, Enum. Pl. Zeyl. 332. 1864.

虾子草 xia zi cao

Vallisneria alternifolia Roxburgh ex R. Wight, Bot. Misc. 2: 344. 1831; *Lagarosiphon alternifolius* (Roxburgh ex R. Wight) Druce; *L. roxburghii* (Planchon) Benth; *Nechamandra roxburghii* Planchon.

Leaves 2–7 cm × 1–1.5 mm, midvein slightly distinct,

apex acute. Male inflorescence with 60–100 flowers; peduncle translucent; spathe translucent, ca. 5 × 4 mm; male flowers with slender pedicel ca. 0.6 mm; sepals transparent; filaments ca. 0.3 mm. Female spathe tubular, ca. 5 mm, sessile; sepals 0.5–1 × 0.4–0.7 mm; ovary 5–10 mm, flattened, margin serrulate on each side; styles retuse at apex, densely papillate. Fl. and fr. Sep–Oct. $2n = 14$.

Ponds, lakes, slow-moving rivers and channels. Guangdong, Guangxi [Bangladesh, India, Myanmar, Nepal, Sri Lanka, Vietnam].

9. HYDRILLA Richard, Mém. Cl. Sci. Math. Inst. Natl. France 1811(2): 9, 61, 76. 1814.

黑藻属 hei zao shu

Herbs, submerged. Stems elongated, branched. Leaves verticillate or lowermost opposite, sessile, linear to narrowly elliptic, margin serrate with 2 small, fringed nodal scales. Plants dioecious or monoecious; flowers unisexual, axillary. Male spathe subsessile, membranous, subglobose, with apical knob and corona of setae, 1-flowered; male flowers shortly pedicellate, free from spathe on water surface at anthesis; sepals 3, ovate or obovate, convex; petals 3, narrower than sepals; stamens 3. Female spathe tubular, sessile, bifid at apex, 1-flowered; sepals and petals similar to male ones; ovary cylindrical, attenuate into a filiform beak; styles (2 or)3; ovules few. Fruit cylindrical or linear.

One species: temperate to tropical regions.

1. Hydrilla verticillata (Linnaeus f.) Royle, Ill. Bot. Himal. Mts. 1: t. 376. 1839.

黑藻 hei zao

Leaves in whorls of 3–8, linear or narrowly strap-shaped, 0.7–1.7 cm × 1–4 mm, midvein distinct, margin conspicuously denticulate, apex acute. Male spathe green; sepals white, ca. 2.3 × 0.7 mm; petals reflexed, white or reddish, ca. 2 × 0.5 mm. Female spathe green; flowers similar to male ones. Fruit with 2–9 spinelike projections or smooth and without projections. Seeds (1 or)2–6. Fl. and fr. May–Oct. $2n = 16, 24$.

Ponds, running water. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Shaanxi, Shandong, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Afghanistan, Bangladesh, Bhutan, India, Indonesia, Japan, Kazakhstan, Korea, Malaysia, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Russia, Sri Lanka, Thailand, Vietnam; Africa, SW Asia, Australia, Europe; introduced in North America].

- 1a. Fruit with 2–9 spinelike projections;
seeds 2–6 1a. var. *verticillata*
1b. Fruit smooth, without spinelike
projections; seeds 1–3 1b. var. *roxburghii*

1a. Hydrilla verticillata var. *verticillata*

黑藻(原变种) hei zao (yuan bian zhong)

Serpicula verticillata Linnaeus f., Suppl. Pl. 416. 1782; *Elodea verticillata* (Linnaeus f.) F. Mueller; *Hydrilla dentata* Caspary; *Udora verticillata* (Linnaeus f.) Sprengel; *Vallisneria verticillata* (Linnaeus f.) Roxburgh.

Leaves 0.7–1.7 cm × 1–1.8 mm. Fruit with 2–9 spinelike projections. Seeds 2–6. $2n = 16$.

Ponds, running water. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Shaanxi, Shandong, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Indonesia, Japan, Malaysia, Philippines; Australia, Europe].

1b. Hydrilla verticillata var. *roxburghii* Caspary, Jahrb. Wiss. Bot. 1: 494. 1858.

罗氏轮叶黑藻 luo shi lun ye hei zao

Leaves 0.7–1.3 cm × 3–4 mm. Fruit smooth, without spinelike projections. Seeds 1–3, usually without embryo. $2n = 24$.

Ponds, running water. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Malaysia, Philippines; Australia, Europe].

10. HALOPHILA Thouars, Gen. Nov. Madagasc. 2. 1806.

喜盐草属 xi yan cao shu

Herbs, submerged marine. Stems slender, easily breaking, creeping, branched, rooting at nodes, with 2 scales at each node. Leaves usually opposite or binate, usually petiolate, margin entire or serrulate. Plants dioecious or monoecious; flowers unisexual. Spathes 2-valved, sessile, usually 1-flowered. Male flowers pedicellate; perianth segments 3; stamens 3, alternate with perianth segments, filament absent; anthers 2–4-theous, extrorse; pollen moniliform. Female flowers sessile or subsessile; ovary with an apical beak; beak expanded at apex into 3 minute perianth lobes; ovules 2 to numerous; styles (2 or)3–5, threadlike. Fruit with beak at apex; pericarp membranous. Seeds few to many, globose or subglobose.

About nine species: along the coasts of the W Indian and S Pacific Oceans; four species in China.

- 1a. Lateral shoots 1–1.5 cm, each with 6–10 leaves; leaves narrowly elliptic to lanceolate, without cross veins 4. *H. beccarii*
1b. Lateral shoots shorter than 1 cm, each with only 1 pair of leaves; leaves ovate to elliptic, with 3–25 pairs of cross veins.
2a. Leaves 0.5–1.2 cm, cross veins in 3–8 pairs and diverging from midvein at an angle of 70–90° 3. *H. minor*
2b. Leaves 1–4 cm, cross veins in 6–25 pairs and diverging from midvein at an angle of 45–60°.
3a. Leaves 1–4 cm, entire and smooth, cross veins in 12–25 pairs 1. *H. ovalis*
3b. Leaves 1–2.2 cm, margin finely serrulate, pubescent on both surfaces, cross veins in 6–9 pairs 2. *H. decipiens*

1. Halophila ovalis (R. Brown) J. D. Hooker, Fl. Tasman. 2: 45. 1858.

喜盐草 xi yan cao

Caulinia ovalis R. Brown, Prodr. 339. 1810; *Halophila euphlebica* Makino; *H. hawaiiiana* Doty & B. C. Strong; *Kerneria ovalis* (R. Brown) Schultes & J. H. Schultes.

Creeping stems elongated, internodes 1–5 cm; scales orbicular to obovate, keeled, 4–5.5 × 3–3.5 mm, membranous, transparent; lateral shoots scarcely developed. Leaves 1-paired at each node; petiole 1–4.5 cm; leaf blade transparent, oblong-elliptic or ovate, 1–4 × 0.5–2 cm, entire, with 12–16(–25) pairs of cross veins running from midvein to intramarginal veins and diverging from midvein at an angle of 45–60°. Male spathes

broadly lanceolate, ca. 4 mm; perianth segments elliptic, ca. 4 mm. Female spathes broadly lanceolate, with a neck at apex, inner one enclosed within outer one; ovary slightly triangular; styles long, slender; stigmas 3, 2–3 cm. Fruit ellipsoid-globose, 3–4 mm in diam.; beak 4–5 mm. Seeds numerous, ca. 1 mm. Fl. Nov–Dec. $2n = 18$.

Submerged in shallow seas. Guangdong, Hainan, Taiwan [India, Indonesia (Java), Japan, Malaysia, Myanmar, New Guinea, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam; Africa, SW Asia, Australia; Red Sea to W Pacific Ocean].

2. Halophila decipiens Ostenfeld, Bot. Tidsskr. 24: 260. 1902.

毛叶喜盐草 mao ye xi yan cao

Creeping stems with internodes 1–3.2 cm; scales membra-

nous, transparent. Petiole 1–2 cm; leaf blade oblong-elliptic, 10–22 × 3–7 mm, midvein prominent, with 1 diverging pair of intramarginal veins at base, with 6–9 pairs of cross veins. Plants monoecious. Spathes ovate, 3–3.5 mm, with abaxial hairs. Ovary ca. 1.4 mm; styles short, ca. 2 mm; stigmas 3. Fruit globose, ca. 2.5 × 1.5 mm. Seeds 10–15(–30), globose, 0.4–0.6 mm.

Submerged in shallow seas. Taiwan [Bangladesh, India, Indonesia, Myanmar, Sri Lanka, Thailand, Vietnam; Africa, Australia, Central and South America; tropical and subtropical seas of Caribbean, Indian Ocean, and Pacific Ocean].

3. *Halophila minor* (Zollinger) Hartog, Fl. Males., Ser. 1, Spermat. 5: 410. 1957.

小喜盐草 xiao xi yan cao

Lemnopsis minor Zollinger, Syst. Verz. 1: 75. 1854; *Halophila lemnopsis* Miquel, nom. illeg. superfl.; *H. ovalis* (R. Brown) J. D. Hooker var. *minor* (Zollinger) Ascherson.

Creeping stems with internodes 1–3 cm; scales transparent, suborbicular or elliptic, 2–4 mm, membranous; lateral shoots scarcely developed. Leaves 1-paired at each node; petiole 0.5–3.5 cm; leaf blade transparent, narrowly elliptic or ovate, 5–12 × 3–5 mm, entire, with 3–8 pairs of cross veins running from midvein to intramarginal veins and diverging from midvein at an angle of 70–90°. Male spathes ovate or subor-

bicular, ca. 3 mm, keeled; perianth segments transparent, ca. 2.5 mm. Female spathes lanceolate, with a neck at apex, inner one enclosed within outer one; ovary ovoid, 1–2 mm; styles elongated; stigmas 3, 0.6–1.7 cm. Fruit ovoid or globose, 2–4 mm; beak 2–6 mm. Seeds ca. 20, ca. 0.5 mm in diam.

Submerged in shallow seas. Guangdong, Hainan, Taiwan [India, Indonesia (Java), Japan, Malaysia, New Guinea, Philippines, Thailand, Vietnam; Africa].

4. *Halophila beccarii* Ascherson, Nuovo Giorn. Bot. Ital. 3: 302. 1871.

贝克喜盐草 bei ke xi yan cao

Creeping stems with internodes 1–2 cm; scales membranous, transparent, outer one 2–3 × 2–2.5 mm, inner one 4–6 × 4–4.5 mm; lateral shoots erect, 1–1.5 cm. Leaves 6–10 at apex of each lateral shoot; petiole 1–2 cm; leaf blade narrowly elliptic or lanceolate, 6–11 × 1–2 mm, midvein prominent, with 1 diverging pair of intramarginal veins at base, without cross veins, sheath to 3–4 mm, margin entire. Plants dioecious. Spathes oblong or lanceolate, ca. 2.5 mm, keeled. Ovary ca. 1 mm; styles elongated; stigmas 2 or 3. Fruit ovoid, 0.5–1.5 mm, beaked. Seeds 2–4, small.

Submerged in shallow seas. Guangdong, Hainan, Taiwan [Borneo, India, Malaysia, Myanmar, Philippines, Sri Lanka, Vietnam].

11. *EGERIA* Planchon, Ann. Sci. Nat., Bot., sér. 3, 11: 79. 1849.

水蕴草属 shui yun cao shu

Herbs, perennial, freshwater. Rhizomes and stolons absent. Stems erect, rooted in substrate, branched or unbranched, elongate. Leaves cauline, in whorls of 5 or more, submersed, sessile; blade uniform in color throughout, linear, base sloping to stem, abaxial surface without prickles or aerenchyma, apex obtuse; midvein without rows of lacunae along sides; intravaginal squamules entire. Inflorescences 1-flowered, sessile; spathes not winged. Plants dioecious; flowers unisexual, projected to surface by slender, elongate floral tube base, pedicellate; petals white. Male flowers: filaments distinct; anthers linear; pollen in monads. Female flowers: ovary 1-locular; styles 3, not 2-fid. Fruit ovoid, smooth, dehiscing irregularly. Seeds fusiform, mucilaginous.

Three species: South America, introduced in Africa, Asia, Australia, Europe, and North America; one species (introduced) in China.

1. *Egeria densa* Planchon, Ann. Sci. Nat., Bot., sér. 3, 11: 80. 1849.

水蕴草 shui yun cao

Anacharis densa (Planchon) Victorin; *Eloдея densa* (Planchon) Caspary; *Philotria densa* (Planchon) Small.

Stems 1–3 mm diam. Leaves whorled, recurved, 10–40 ×

1.5–4.5 mm, margin minutely serrate. Male spathes 2–4-flowered, 7.5–12 mm; pedicel to 8 cm. $2n = 46$.

Known from a cultivated fish pond. Guangdong [native to South America].

This species is known to spread and become invasive in mild climates.