

2. MYRIOPHYLLUM Linnaeus, Sp. Pl. 2: 992. 1753.

狐尾藻属 hu wei zao shu

Burshia Rafinesque; *Enydria* Vellozo.

Herbs perennial, aquatic, submerged or shortly emergent, monoecious or dioecious. Stem soft, few to many branched, rhizomatous. Submerged leaves 3- or 4-whorled, rarely alternate, pectinate, ovate to oblong in outline; segments filiform; emergent leaves smaller, sometimes uppermost ones undivided, reducing to bracts of inflorescence. Inflorescence usually emergent, a terminal spike with flowers 4-whorled, or in axils of emergent leaves. Flowers subtended by a primary bract and 2 bracteoles, sessile, usually 4-merous, minute, lowermost ones female, uppermost ones male, sometimes middle ones bisexual. Male flowers: calyx deeply 2-4-lobed; petals 2–4, boat-shaped, often pink; stamens 2–8, epipetalous. Female and bisexual flowers: calyx tube united with ovary; lobes 4, minute; petals minute, often caducous or absent; ovary (2–)4-celled; style absent; stigmas 4, sessile, recurved, plumose, papillose. Fruit a schizocarp, separating into (2–)4 mericarps. Seed 1 per mericarp.

About 35 species: aquatic or wet habitats worldwide, mostly in Australia; 11 species (one endemic, one introduced) in China.

Myriophyllum has economic importance in the purification of water, as feed for pigs, ducks, and fish, and in polishing wood. The plants are used medicinally to reduce fever and as an anti-diarrheal.

Myriophyllum aquaticum (Vellozo) Verdcourt (*Enydria aquatica* Vellozo) is a commonly cultivated, and nearly naturalized, species in Taiwan, characterized as follows: plants dioecious (only female plants known in China); aerial leaves glaucous or light bluish green; all leaves whorled, never entire, pinnately divided with linear segments; bracteoles subulate with 1 (or 2) lateral lobes. This species was possibly introduced by the aquarium trade.

1a. Upper flowers alternate.

2a. Leaves all alternate or pseudowhorled; floral bracts conspicuous 5. *M. dicoccum*

2b. Leaves whorled; floral bracts inconspicuous.

3a. Stamens 8; inflorescence terminal; mericarps abaxially rounded 1. *M. alterniflorum*

3b. Stamens 4; inflorescence axillary; mericarps abaxially acute 6. *M. tuberculatum*

1b. All flowers whorled.

4a. Emergent leaves pectinate-pinnatifid.

5a. Floral leaves glaucous or light bluish green; turions 6–8 cm 11. *M. oguraense*

5b. Floral leaves light to dark green; turions 1–3 cm 2. *M. verticillatum*

4b. Emergent leaves or at least upper ones undivided, margin entire or serrate.

6a. Bracts not longer than wide, ovate to orbicular, shorter than or equaling flower.

7a. Mericarps abaxially smooth or finely tuberculate; bracteoles reniform to suborbicular, broader than long 4. *M. sibiricum*

7b. Mericarps abaxially tuberculate or aculeate; bracteoles ovate, as long as or longer than broad 3. *M. spicatum*

6b. Bracts longer than wide, obovate and subtire to elongate and pinnatisect, extending beyond flower.

8a. Plants dioecious; bracts elliptic; male flowers distinctly stalked 8. *M. ussuriense*

8b. Plants monoecious; bracts lanceolate to spatulate; male flowers not stalked.

9a. Bracteoles digitate; sepals triangular 9. *M. tetrandrum*

9b. Bracteoles ovate; sepals orbicular.

10a. Stamens 4; mericarps beaked 7. *M. heterophyllum*

10b. Stamens 8; mericarps not beaked 10. *M. exasperatum*

1. *Myriophyllum alterniflorum* Candolle, Fl. Franç. 5: 529. 1815.

互花狐尾藻 hu hua hu wei zao

Plants mostly monoecious, rarely with bisexual flowers. Perennating turions absent. Stem few branched, 50–100 cm, sparsely brown oval warty, densely leafy, shoot tips knoblike with crowded leaves; internodes 5–10 mm. Submerged leaves 4- or 5-whorled, pectinate, broadly lanceolate in outline, 1–4 × 0.5–1.2 cm; segments in 8–10 pairs, filiform, 0.5–1.5 cm. Inflorescence a terminal spike, nodding before flowering, to 3–7(–12) cm; bracts ovate or linear, margin entire to serrate. Male flowers alternate; bracteoles shorter than flower; calyx campanulate, ca. 0.3 mm, apex 3-toothed; petals yellow, red streaked,

oblong-obovate, 1.5–2 mm, 5–6 × as long as calyx; stamens 8. Female flowers opposite or whorled; bracteoles longer than flowers; calyx campanulate, 0.7–1 mm, apex 3-toothed. Fruit 4-loculed, subcylindric, 1.5–2 × ca. 1.5 mm; mericarps sparsely verrucose. $2n = 14$. Fl. and fr. Apr–Sep.

Stagnant waters, lakes; 500–1500 m. Anhui, Gansu, Hubei, Jiangsu [Russia; C Asia, Europe, North America (Alaska, NE United States)].

2. *Myriophyllum verticillatum* Linnaeus, Sp. Pl. 2: 992. 1753.

狐尾藻 hu wei zao

Myriophyllum limosum Hectot ex Candolle.

Plants mostly monoecious, rarely with bisexual flowers. Perennation by clavate turions. Stem robustly branched or un-

branched, 50–150 cm; internodes often shorter than leaves. Submerged leaves 4–6-whorled, pectinate, narrowly ovate in outline, 3–5 × 1.5–2.5 cm; segments in 10–20 pairs, filiform, 1–2.5 cm. Inflorescence a terminal spike of 4-whorled flowers, 7–20 cm; bracts pectinate or absent. Male flowers: bracteoles lanceolate-lobed; calyx broadly campanulate, ca. 1 mm, 4-parted nearly 1/2 of way to base; petals white or greenish, obovate, 2–2.5 mm; stamens 8. Female flowers: bracteoles pectinate, 1–5 × as long as flower; calyx tubular, shortly lobed; petals greenish or white, minute. Fruit 4-loculed, subglobose, ca. 3 mm; mericarps smooth or sparsely verrucose along margins. Fl. and fr. Apr–Sep.

Stagnant waters, lakes, ditches, slow streams, occasionally drying ponds; near sea level to 3500 m. Throughout China [Africa, Asia, Europe, North America].

In its terrestrial form this species may fully develop as small plants, with few leaf segments, and often set fruit better than the aquatic form.

3. *Myriophyllum spicatum* Linnaeus, Sp. Pl. 2: 992. 1753.

穗状狐尾藻 sui zhuang hu wei zao

Plants mostly monoecious, rarely with bisexual flowers. Stem much branched, 100–250 cm, densely leafy in upper part, sparsely light green warty; internodes ca. 3 cm. Submerged leaves 4- or 5-whorled, pectinate, broadly ovate in outline, 3–3.5 × 1–2.5 cm; segments in 13–16 pairs, filiform, 1–1.5 cm. Inflorescence a terminal spike of 4-whorled flowers, 6–10 cm; bracts reniform or suborbicular, shorter than flowers, broader than long. Male flowers: bracteoles rhombic to elongate, margin entire; calyx broadly campanulate, 0.5–1 mm, 4-parted nearly to middle; petals 4 (or 5), pale pink, elliptic, 1.5–2.5 mm; stamens 8, without androphore. Female flowers: bracteoles pectinate, lanceolate in outline; calyx tubiform, 0.7–1 mm, margin shortly lobed; petals absent or minute and caducous. Fruit 4-loculed, subcylindric, ca. 2 × 1.5 mm; mericarps abaxially rounded, smooth or sparsely verrucose along margins. Fl. and fr. Apr–Sep.

Stagnant waters, lakes, ditches, slow streams, springs; near sea level to 4200 m, rarely to 5200 m in springs in Xizang. Throughout China [Asia, Europe].

4. *Myriophyllum sibiricum* Komarov, Repert. Spec. Nov. Regni Veg. 13: 168. 1914.

西伯利亚狐尾藻 xi bo li ya hu wei zao

Myriophyllum exalbescens Fernald; *M. spicatum* Linnaeus subsp. *exalbescens* (Fernald) Hultén; *M. spicatum* var. *exalbescens* (Fernald) Jepson; *M. spicatum* var. *muricatum* Maximowicz.

Plants monoecious. Stem loosely erect in water, often whitish, few branched above, base characteristically curved or U-shaped on young plants; internodes distinct, ca. 1 cm. Submerged leaves 4- or 5-whorled, pectinate, ovate to oblong in outline; segments in 5–12 pairs, filiform, 1–5 cm. Inflorescence a terminal spike of 2–4-whorled flowers, mostly 4–10 cm; bracts shorter than or rarely equaling fruits. Male flowers: brac-

teoles oblong-spatulate or ovate-oblong, margin entire; petals pinkish; stamens 8. Female flowers: bracteoles mostly serrate or somewhat pectinate-toothed at margin; perianth absent or sepals vestigial. Fruit 4-loculed, globose, ca. 2 mm; mericarps abaxially tuberculate or aculeate. Fl. and fr. Apr–Sep.

Heilongjiang, Jiangsu, Jilin, Nei Mongol, Qinghai, Sichuan, Xinjiang, Xizang, Yunnan [Russia; North America].

5. *Myriophyllum dicoccum* F. Mueller, Trans. Philos. Inst. Victoria 3: 41. 1859.

二分果狐尾藻 er fen guo hu wei zao

Plants monoecious and with bisexual flowers. Stem sparsely branched, 30–50(–80) cm; internodes 2–12 mm. Submerged leaves scattered or 2–5-whorled, pectinate, broadly ovate in outline, 2–3 × 1–2 cm; segments in 4–12 pairs, filiform, 5–10 mm, apex finely mucronate; emergent leaves alternate, linear to narrowly oblanceolate, 0.7–1.7 × 0.5–1.5 cm, margin entire or shortly toothed distally. Inflorescence of axillary, irregular dichasia of 1–5 flowers, female ones remaining submerged throughout development, male and bisexual ones borne on emergent part of stem; bracts leaflike; bracteoles deltoid, inconspicuous. Male flowers sessile, 4-merous; sepals deltoid, ca. 0.2 mm; petals red, ca. 1.8 mm, late caducous; stamens 4. Female flowers sessile or pedicellate, 2-merous; sepals deltoid, ca. 0.1 mm; petals absent or vestigial; ovary 2-loculed; styles clavate; stigmas red, capitate, not fimbriate. Bisexual flowers sessile, 4-merous; stigmas developing after pollen release, fimbriate. Fruit sessile or shortly pedicellate, olive-brown, 2-loculed (female flowers) or 4-loculed (bisexual flowers), ca. 1 mm; mericarps cylindric, smooth or sparsely tuberculate, apex truncate. Fl. and fr. May–Sep.

Fujian, Guangdong, Taiwan [E India, Indonesia (NE Java), Papua New Guinea, Vietnam; Australia].

Myriophyllum dicoccum was erroneously treated as *M. humile* (Rafinesque) Morong (*Burshia humilis* Rafinesque) in FRPS (53(2): 140. 2000). These taxa are separated by their fruit: *M. dicoccum* has 2-loculed fruit from female flowers and 4-loculed fruit from bisexual flowers on the same plant, whereas *M. humile* has only 4-loculed fruit.

6. *Myriophyllum tuberculatum* Roxburgh, Fl. Ind. 1: 471. 1820.

刺果狐尾藻 ci guo hu wei zao

Myriophyllum spathulatum Blatter & Hallberg.

Plants monoecious. Stem much branched, to 150 cm. Submerged leaves 4- or 5-whorled, pectinate, ovate in outline, 2.5–4.0 × 1.0–1.5 cm; segments in 8–25 pairs, filiform, 1–2 cm; emergent, uppermost leaves alternate, spatulate to linear, 5–20 mm, margin shortly lobed to entire. Inflorescence of axillary flowers on emergent part of stem; bracts and bracteoles inconspicuous, ovate, margin entire. Flowers 4-merous. Sepals ovate, ca. 0.5 mm, margin finely serrate to entire. Petals white, broadly spatulate, 0.5–1.5 mm, persistent in fruit. Fruit 4-loculed, 4-angled, 2–3.5 mm; mericarps abaxially acute, spinose-verrucose, apices not spreading. Fl. and fr. May–Sep.

Stagnant and shallow waters; 100–400 m. Guangdong [India, Malaysia; Australia].

7. *Myriophyllum heterophyllum* Michaux, Fl. Bor.-Amer. 2: 191. 1803.

异叶狐尾藻 *yi ye hu wei zao*

Plants hermaphroditic, occasionally monoecious. Stem stout, to 100 cm; internodes crowded. Submerged leaves 4- or 5-whorled or scattered, pectinate, oblong in outline, (1.5–)2–4 × 1–3 cm; segments in 5–12 pairs, filiform, 0.5–1.5 cm. Inflorescence a terminal spike of 4-whorled flowers, 5–35 cm, in monoecious plants lowermost flowers female, uppermost ones male; bracts persistent, eventually reflexed, lanceolate to oblong or obovate, 4–18 × 1–3 mm, margin sharply serrulate; bracteoles ovate, ca. 1.2 × 0.6 mm, margin serrate. Petals 1.5–3 mm. Stamens 4. Fruit 4-loculed, subglobose, 1–1.5 mm; mericarps with 2 finely tuberculate ridges abaxially, apex beaked. Fl. and fr. May–Aug.

Introduced and naturalized. Guangdong [native to North America].

8. *Myriophyllum ussuriense* (Regel) Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 19: 182. 1873.

乌苏里狐尾藻 *wu su li hu wei zao*

Myriophyllum verticillatum Linnaeus var. *ussuriense* Regel, Mém. Acad. Imp. Sci. Saint-Petersbourg, Sér. 7, 4(4) [Tent. Fl.-Ussur.]: 60. 1861.

Plants dioecious, rarely monoecious or with bisexual flowers. Stem weak, 5–20 cm. Submerged leaves 3- or 4-whorled, pectinate, broadly lanceolate in outline, 5–10 × 2.5–5 cm; segments filiform, short, margin entire; emergent leaves 1 or 2, linear or lanceolate, minute, margin serrate to entire. Inflorescence of axillary flowers on emergent part of stem or a terminal spike; bracts and bracteoles elliptic, smaller than flowers, margin entire or serrate. Flowers 4-merous. Calyx tubular, shortly lobed. Petals pale reddish, obovate-oblong, ca. 2 mm. Stamens 8. Styles 4; stigmas white, long fimbriate. Fruit olive-brown, 4-loculed, subglobose, ca. 0.75 × 0.6 mm; mericarps finely tuberculate. Fl. May–Jun, fr. Jun–Aug.

Muddy waterside shallows; near sea level to 1800 m. Anhui, Guangdong, Guangxi, Hebei, Heilongjiang, Hubei, Jiangsu, Jilin, Jiangxi, Taiwan, Yunnan, Zhejiang [Japan, Korea, Russia].

In FRPS (53(2): 135. 2000), this species was included in *Myriophyllum propinquum* A. Cunningham, which is separated on the size and shape of the bracteoles and flowers and is restricted to Australia and New Zealand.

9. *Myriophyllum tetrandrum* Roxburgh, Fl. Ind. 1: 470. 1820.

四蕊狐尾藻 *si rui hu wei zao*

Plants monoecious. Stem few branched, to 200 cm. Submerged leaves 5-whorled, pectinate, ovate to oblong in outline, ca. 4 × 10 cm; segments in 10–20 pairs, filiform, to 1.3 cm; emergent leaves narrower. Inflorescence a terminal spike of 5-whorled flowers; bracts entire at margin; bracteoles digitate at margin. Flowers 4-merous. Sepals triangular, ca. 1 mm, margin entire or finely serrate. Petals spatulate, ca. 1 mm, caducous. Fruit 4-loculed, subcylindric, ca. 3 mm; mericarps sparsely tuberculate to smooth. Fl. and fr. Mar–Sep.

Shallow waters; near sea level to 200 m. Hainan [India, Malaysia,

Thailand, Vietnam].

10. *Myriophyllum exasperatum* D. Wang et al., Ann. Bot. Fenn. 39: 268. 2002.

短喙狐尾藻 *duan hui hu wei zao*

Plants hermaphroditic. Stem sparsely branched, reddish brown, 60–135 cm, rooting only at base, upper part usually emergent. Submerged leaves (4 or)5- or 6-whorled, pectinate, broadly ovate to suborbicular in outline, 4.5–5.5(–6) × 4–4.5 cm; segments 2.2–2.8 cm, filiform; emergent leaves smaller, uppermost ones alternate to pseudowhorled, undivided, linear to spatulate, margin toothed distally. Inflorescence a terminal spike of (4 or)5- or 6-whorled flowers, 13–31 cm; bracts spatulate; bracteoles slightly brown, broadly lanceolate to ovate. Flowers 4-merous. Sepals orbicular. Petals white, pinkish at apex, hooded, 1.5–1.8 × 0.5–0.8 mm, caducous. Stamens 8. Stigmas pinkish to white after anthesis, shortly fimbriate. Fruit reddish brown to olive brown, cubic, 1.8–1.9 × 1.9–2 mm; mericarps separating late, finely tuberculate, longitudinal abaxial ridge tuberculate. Fl. Aug–Nov, fr. Oct–Dec.

• Slow-flowing rivers and streams, stagnant waters; near sea level to 200 m. S Guangxi (Dongxing).

11. *Myriophyllum oguraense* Miki, Bot. Mag. (Tokyo) 48: 335. 1934.

东方狐尾藻 *dong fang hu wei zao*

Plants monoecious. Stems branched mainly at base. Submerged leaves 4- or 5-whorled, pectinate, ovate to suborbicular in outline, 2.4–5.7 × 2.3–5.5 cm; segments in 9–13 pairs, filiform, 1–3 cm; emergent leaves smaller. Inflorescence a simple or sometimes 2–10-branched spike of 4-whorled flowers; main and lateral inflorescences 2.5–9.5 cm; bracts leaflike; bracteoles white, 3-fid to pectinate. Male flowers: sepals green, deltoid, 0.5–0.8 mm; petals white to pale green, hooded, weakly keeled at base, caducous; stamens 8. Female flowers: sepals green, deltoid, 0.4–0.6 mm; petals white, slightly hooded, caducous; stigmas pinkish after anthesis, shortly fimbriate. Fruit olive-brown, 4-loculed, shortly cylindrical; mericarps smooth with 2 abaxial, longitudinal ridges. Fl. and fr. Apr–Sep.

Slow-flowing tributaries of the Chang Jiang basin. Anhui, Heilongjiang, Hubei, Jiangsu, Jiangxi, Zhejiang [Japan].

Flora of China 13: 429–432. 2007.