

NYMPHAEACEAE

睡蓮科 shui lian ke

Fu Dezhi (傅德志)¹; John H. Wiersema²

Herbs perennial or rarely annual, aquatic. Stems rhizomatous; rhizomes erect or repent, branched or unbranched. Leaves arising from rhizome, simple, alternate, floating, emersed, or submersed, long petiolate but short petiolate on submersed vernal ones; leaf blade undivided, usually with a basal sinus, often peltate. Flowers solitary, axillary, long pedunculate, bisexual, hypogynous to epigynous, actinomorphic, entomophilous, mostly emergent. Sepals 4–7, usually green, occasionally petaloid. Petals numerous (rarely absent), distinct, usually showy, often transitional to stamens. Stamens numerous; anthers introrse, dehiscent by longitudinal slits; connective sometimes appendaged. Pistil 1, compound; carpels 5–many, partially or completely united, surrounding a sometimes projecting floral axis. Ovary multilocular; placentation laminar; ovules numerous. Styles absent or modified into abaxially projecting carpellary appendages. Stigmas radiate on distal surface, often dislike. Fruit berrylike, many seeded, irregularly dehiscent. Seeds mostly arillate; endosperm little, perisperm abundant; embryo small; cotyledons 2, fleshy.

Six genera and ca. 70 species: widespread in temperate and tropical regions; three genera and eight species in China.

Kuan Ke-chien. 1979. Nymphaeaceae subfam. Nymphaeoidae. Fl. Reipubl. Popularis Sin. 27: 6–15.

1a. Leaf venation primarily pinnate; sepals yellow or orange, petaloid; ovary superior; seeds not arillate ... 1. *Nuphar*

1b. Leaf venation primarily palmate or radiate; sepals greenish, not petaloid; ovary semi-inferior or inferior; seeds arillate.

2a. Leaves and fruit not spinulose; petiole inserted near apex of prominent sinus; ovary semi-inferior 2. *Nymphaea*

2b. Leaves and fruit spinulose; leaf blade centrally peltate, base only slightly indented; ovary inferior 3. *Euryale*

1. NUPHAR Smith in Sibthorp & Smith, Fl. Graec. Prodr. 1: 361. 1809, nom. cons.

萍蓬草属 ping peng cao shu

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Nymphozanthus Richard, nom. rej.

Herbs perennial. Rhizomes repent, branched. Leaves dimorphic, either floating with thick leathery blades and long petioles or submersed with thin, papery blades and short petioles; leaf blade ovate to elliptic, venation primarily pinnate, base cordate, margin entire, not peltate. Flowers hypogynous, emergent, perianth ± upright. Sepals (4–)5(–7), yellow or orange, petaloid, oblong to obovate, persistent. Petals numerous, yellow, small, stamenlike. Stamens nearly as long as sepals, inserted at base of ovary; filament strap-like; anthers yellow, connective unappendaged. Carpels completely united. Style absent. Stigma sessile and radiate on flattened stigmatic disc, lacking marginal appendages. Fruit ovoid to urceolate, irregularly dehiscent. Seeds smooth, not arillate.

About ten species: widespread in N temperate regions; two species in China.

1a. Floating leaf blades 6–17 cm; stigmatic disc deeply lobed, 4–7.5 mm in diam. 1. *N. pumila*

1b. Floating leaf blades 15–30 cm; stigmatic disc entire, 7–19 mm in diam. 2. *N. lutea*

1. *Nuphar pumila* (Timm) de Candolle, Syst. Nat. 2: 61. 1821.

萍蓬草 ping peng cao

Nymphaea lutea Linnaeus var. *pumila* Timm, Mag. Naturk. Oekon. Mecklenburgs 2: 250. 1795; *Nuphar shimadae* Hayata; *Nymphaea lutea* subsp. *pumila* (Timm) Bonnier & Layens; *Nymphaea pumila* (Timm) Hoffmann.

Rhizomes stout, 1–3 cm in diam. Petiole 20–50 cm, pubescent; floating leaf blade broadly ovate to ovate, seldom elliptic, 6–17 × 6–12 cm, abaxially glabrous to densely pubescent, adaxially glabrous, base cordate and basal lobes remote from each other. Flower 1–4.5(–6) cm in diam. Peduncle 40–50 cm, pubescent. Sepals yellow, oblong to elliptic, 1–2.5 cm. Petals narrowly cuneate to broadly linear, 5–7 mm, apex emarginate. Anthers yellow, 1–6 mm. Stigmatic disc deeply lobed, 4–7.5 mm in diam., rays 8–13(–14). Fruit 1–2 cm in diam. Seeds brown, oblong to ovoid, 3–5 mm. Fl. May–Sep. $2n = 34$.

Lakes, ponds. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Jiangsu, Jiangxi, Jilin, Nei Mongol, Taiwan, Xinjiang, Zhejiang [Japan, Korea, Mongolia, Russia; N Europe].

The description of *Nuphar shimadae* clearly indicates that this taxon is conspecific with *N. pumila*; however, it remains unclear as to which subspecies the plants in Taiwan should be referred, since no specimens were examined from that region.

1a. Anthers 1–2.5 mm; flowers 1–2.5 cm in diam. 1a. subsp. *pumila*

1b. Anthers 3.5–6 mm; flowers 2–4.5(–6) cm in diam. 1b. subsp. *sinensis*

1a. *Nuphar pumila* subsp. *pumila*

萍蓬草(原亚种) ping peng cao (yuan ya zhong)

Nuphar bornetii H. Léveillé & Vaniot; *N. minima* (Willdenow) Smith; *Nymphaea lutea* var. *minima* Willdenow.

Rhizomes 2–3 cm in diam. Petiole 20–50 cm; floating leaf blade broadly ovate to ovate, seldom elliptic, 6–17 × 6–12 cm, abaxially glabrous to densely pubescent.

Flower 1–2.5 cm in diam. Pedicel 40–50 cm, pubescent. Sepals yellow, oblong to elliptic, 1–2 cm. Petals 5–7 mm. Anthers 1–2.5 mm. Stigmatic disc 4–7.5 mm in diam., rays 8–13. Fruit 1–2 cm in diam. Seeds oblong, ca. 5 mm. Fl. and fr. May–Sep. $2n = 34$.

Lakes, ponds. Anhui, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Jiangsu, Jiangxi, Jilin, Nei Mongol, Xinjiang, Zhejiang [N Japan, Korea, Mongolia, Russia; N Europe].

1b. *Nuphar pumila* subsp. *sinensis* (Handel-Mazzetti) D. Padgett, Sida 18: 825. 1999.

中华萍蓬草 zhong hua ping peng cao

Nuphar sinensis Handel-Mazzetti, Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Kl., Anz. 63: 8. 1926.

Rhizomes 1–3 cm in diam. Petiole ca. 40 cm; floating leaf blade ovate, 9–15 × 7–12 cm, abaxially margin densely pubescent. Flower 2–4.5(–6) cm in diam. Sepals yellow, oblong to obovate, to 2.5 cm. Petals ca. 7 mm. Anthers 3.5–6 mm. Stigmatic disc 5–6 mm in diam., rays 8–13. Fruit 1.5–2 cm in diam. Seeds ovoid, ca. 3 mm. Fl. and fr. May–Sep.

• Ponds. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Zhejiang.

2. *Nuphar lutea* (Linnaeus) Smith in Sibthorp & Smith, Fl. Graec. Prodr. 1: 361. 1809.

欧亚萍蓬草 ou ya ping peng cao

Nymphaea lutea Linnaeus, Sp. Pl. 1: 510. 1753.

Rhizomes stout, 3–8 cm in diam. Petiole ca. 50 cm, glabrous; floating leaf blade elliptic, 15–30 × 10–22 cm, leathery, abaxially glabrous or pubescent, adaxially glabrous, base cordate and basal lobes spreading. Flower 4–5 cm in diam. Peduncle to ca. 50 cm, glabrous. Sepals yellow, broadly ovate to orbicular, 2–3 cm. Petals linear, 1–1.5 cm, apex truncate to rounded. Anthers yellow, 4–7 mm. Stigmatic disc entire, 7–19 mm in diam., rays 5–25. Fruit ca. 2.5 cm in diam. Seeds olive green, ovoid, ca. 5 mm. Fl. Jul–Aug. $2n = 34$.

Lakes and ponds. Xinjiang [Kazakhstan, Russia (Siberia)]; Africa, SW Asia, Europe].

2. NYMPHAEA Linnaeus, Sp. Pl. 1: 510. 1753, nom. cons.

睡莲属 *shui lian shu*

Herbs perennial. Rhizomes erect, ascending, or repent, branched or unbranched. Leaves mostly floating; leaf blade venation primarily palmate, base cordate to sagittate, margin entire to dentate, sometimes slightly peltate. Flowers perigynous, floating or emersed, perianth spreading. Sepals 4, greenish, not petaloid, inserted at base of ovary, sometimes persistent. Petals 8 to many, large and showy, inserted on lateral surface of ovary, often grading into stamens. Stamens shorter than sepals and petals, inserted on lateral surface of ovary; filament linear to ovate or obovate; anther connective appendaged or unappendaged. Carpels partially or completely united. Style absent or modified into abaxially projecting carpellary appendages. Stigma sessile, radiate on cup-shaped stigmatic disc rimmed by carpellary appendages. Fruit irregularly dehiscent. Seeds globose, ovoid, or ellipsoid, smooth or longitudinal ridges pubescent, arillate.

About 50 species: widespread in temperate and tropical regions; five species in China.

Many species of the genus *Nymphaea* are cultivated as ornamentals. In China, in addition to the native species, both *Nymphaea mexicana* Zuccarini and *N. alba* Linnaeus var. *rubra* Lönnroth are cultivated.

- 1a. Leaf blade abaxially densely pubescent, margin dentate and teeth acute to subspinose 4. *N. lotus*
1b. Leaf blade abaxially glabrous, margin entire, subentire, or deeply crenate.
2a. Petals white tinged with purple, blue, or purple-red; anther connective apically appendaged; leaf blade margin subentire to deeply crenate; sepals persistent 5. *N. nouchali*
2b. Petals white; anther connective apically unappendaged; leaf blade margin entire; sepals caducous or decaying after anthesis (persistent in *N. tetragona*).
3a. Flowers 3–6 cm in diam. when fully open; mature leaf blades mostly less than 10 cm; carpellary appendages ovate 3. *N. tetragona*
3b. Flowers more than 6 cm in diam. when fully open; mature leaf blades mostly more than 10 cm; carpellary appendages triangular-tapered.
4a. Rhizomes repent; insertion of calyx on receptacle circular; filaments of inner stamens \pm as wide as anthers 1. *N. alba*
4b. Rhizomes erect or ascending; insertion of calyx on receptacle \pm tetragonous; filaments of inner stamens wider than anthers 2. *N. candida*

1. *Nymphaea alba* Linnaeus, Sp. Pl. 1: 510. 1753.

白睡莲 *bai shui lian*

Rhizomes repent, sparsely branched, but not stoloniferous. Leaf blade suborbicular, 10–25 cm in diam., papery, abaxially glabrous, scarcely peltate, base deeply cordate and basal lobes subparallel or spreading, margin entire. Flower floating, (7–) 10–20 cm in diam. Calyx insertion on receptacle circular; sepals lanceolate, 3–5(–8) cm, obscurely veined, caducous or decaying after anthesis. Petals (12–)20–25(–33), white, ovate-oblong, 3–5.5(–8) cm, transition to stamens gradual. Filament of inner stamens \pm as wide as anther; connective apically unappendaged. Carpels completely united, walls between locules of ovary single. Stigma rays (8–)14–20(–25); carpellary appendages triangular-tapered. Fruit semiglobose, 2.5–3 cm. Seeds ellipsoid, 2–3(–5) mm, smooth. Fl. Jun–Aug. $2n = 56, 84, 112$.

Cultivated and naturalized in ponds. Hebei, Shaanxi, Shandong, Zhejiang [Kashmir, Russia (Caucasus)]; Africa, SW Asia, Europe].

This species is cultivated in additional Chinese provinces.

2. *Nymphaea candida* C. Presl in J. Presl & C. Presl, Delic. Prag. 224. 1822.

雪白睡莲 *xue bai shui lian*

Rhizomes erect or ascending, unbranched. Leaf blade suborbicular, 10–25 cm in diam., papery, abaxially glabrous, scarcely peltate, base deeply cordate and basal lobes contiguous or overlapping, margin entire. Flower floating, (6–)10–20 cm in diam. Calyx insertion on receptacle \pm tetragonous; sepals lanceolate, 3–5 cm, obscurely veined, caducous or decaying after anthesis. Petals 20–25, white, ovate-oblong, 3–5.5 cm, transition to stamens gradual. Filament of inner stamens wider than anther; connective apically unappendaged. Carpels completely united, walls between locules of ovary single. Stigma rays (5–) 6–14(–20); carpellary appendages triangular-tapered. Fruit semiglobose, 2.5–3 cm. Seeds ellipsoid, 3–4 mm, smooth. Fl. Jun–Aug. $2n = 112, 160$.

Ponds. Xinjiang [Kashmir, Kazakhstan, Russia (Siberia)]; SW Asia, Europe].

3. *Nymphaea tetragona* Georgi, Bemerk. Reise Russ. Reiche 1: 220. 1775.

睡莲 *shui lian*

Rhizomes erect, unbranched. Leaf blade cordate-ovate to ovate-elliptic, 5–12 \times 3.5–9 cm, papery, abaxially glabrous, scarcely peltate, base deeply cordate and basal lobes parallel to contiguous, margin entire. Flower floating, 3–6 cm in diam. Calyx insertion on

receptacle prominently tetragonous; sepals broadly lanceolate to narrowly ovate, 2–3.5 cm, obscurely veined, persistent. Petals 8–15(–17), white, broadly lanceolate, oblong, or obovate, 2–2.5 cm, transition to stamens gradual. Filament of inner stamens wider than anther, connective apically unappendaged. Carpels completely united, walls between locules of ovary single. Stigma rays 5–8(–10); carpellary appendages ovate. Fruit globose, 2–2.5 cm in diam. Seeds ellipsoid, 2–3(–4) mm, smooth. Fl. Jun–Aug. $2n = 112$.

Ponds, lakes; near sea level to 4000 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan, Zhejiang [India, Japan, Kashmir, Kazakhstan, Korea, Russia, Vietnam; North America, Europe].

The treatment of this species in E Asia is problematic. In North America and Europe *Nymphaea tetragona* is restricted to boreal regions above 50° N latitude, where the plants have a prominently tetragonous receptacle, flowers with a reddish to purplish center, and thinner leaves abaxially with raised veins. Plants in Korea, N Japan, and Russia, as depicted in Lee (Fl. Korea, 216. 1997) and Kadono (Aquatic Pl. Japan, 112. 1994), and observed on specimens, have these characteristics. Plants of N China and the Himalayas may belong here also, but to determine this will require further study of better material. However, plants of tropical and warm temperate China, Japan, and Vietnam appear to differ in having an only slightly tetragonous receptacle, flowers with a yellow center, and thicker leaves abaxially with impressed veins. Such plants are sometimes known in cultivation in Europe and North America as *N. tetragona* var. *angusta* Caspary, but were originally sent in 1805 by William Kerr from Guangdong Province and described under the name of *Castalia pygmaea* Salisbury (*N. pygmaea* (Salisbury) W. T. Aiton). Further study may indicate that much of the Chinese and Japanese material should be segregated as *N. pygmaea* or at some other rank. One might expect hybridization between the two taxa to occur where they coexist, as with other related *Nymphaea*, and the level of sterility displayed by such hybrids should be examined as evidence of the degree of their relationship.

An examination of the type of *Nymphaea esquirolii* H. Léveillé & Vaniot from Guizhou Province indicates that it belongs with *N. pygmaea*. The assignment of *N. crassifolia* (Handel-Mazzetti) Nakai (*Castalia crassifolia* Handel-Mazzetti; *N. tetragona* var. *crassifolia* (Handel-Mazzetti) Chu) to one of these two forms is unknown, as the type has not been examined. *Nymphaea acutiloba* de Candolle is of uncertain identity and lacks a type specimen. Although referred by Conard (Proc. Carnegie Inst. Wash. 4:170. 1905) to *N. tetragona*, the description cannot apply to this taxon and more closely matches *N. nouchali* or *N. lotus*.

4. *Nymphaea lotus* Linnaeus var. *pubescens* (Willdenow) J. D. Hooker & Thomson in J. D. Hooker, Fl. Brit. India 1: 114. 1872.

柔毛齿叶睡莲 rou mao chi ye shui lian
Nymphaea pubescens Willdenow, Sp. Pl. 2: 1154. 1799.
Rhizomes erect, producing slender stolons. Leaf blade ovate-elliptic to suborbicular, 15–26(–50) cm, papery, abaxially densely pubescent, peltate more than 5 mm from base of sinus, base deeply cordate and basal lobes

subparallel, margin dentate and teeth acute to subspinose. Flower emergent, (2–)5–8(–15) cm in diam. Calyx insertion on receptacle circular; sepals oblong, 5–8 cm, conspicuously veined, caducous or decaying after anthesis. Petals 12–14(–30), white, red, or pink, oblong, 5–9 cm, transition to stamens abrupt. Filament of inner stamens only slightly wider than anther; connective apically unappendaged. Carpels completely united, walls between locules of ovary single. Stigma rays 12–15(–30); carpellary appendages linear. Fruit ovoid to subglobose, 3.5–5 cm. Seeds ellipsoid to globose, 1–2 mm, with longitudinal ridges. Fl. Aug–Oct. $2n = 84$.

Ponds in hills. S and SW Yunnan [Bangladesh, India, Indonesia, Myanmar, New Guinea, Pakistan, Philippines, Sikkim, Sri Lanka, Thailand, Vietnam].

The relationship between the Asiatic *Nymphaea lotus* var. *pubescens*, often treated as *N. pubescens*, and the var. *lotus* of Africa is in need of further study. Cultivated forms of var. *pubescens* with red flowers, originating from India, are known from Guangdong Province and perhaps elsewhere in S China. Although they are reportedly sterile, they have sometimes been segregated as *N. rubra* Roxburgh ex Andrews.

5. *Nymphaea nouchali* N. L. Burmann, Fl. Indica, 120. 1768.

延药睡莲 yan yao shui lian

Nymphaea stellata Willdenow.

Rhizomes erect, unbranched. Leaf blade elliptic-orbicular to orbicular, 7–15(–45) cm in diam., papery, abaxially glabrous, peltate a few mm from base of sinus, base cordate, basal lobes parallel to spreading, margin subentire to deeply crenate. Flower slightly emergent, 3–15 cm in diam. Calyx insertion on receptacle circular; sepals lanceolate to oblong-lanceolate, 2.5–8 cm, slightly veined, persistent. Petals 10–30, white tinged with purple, blue, or purple-red, linear-oblong to lanceolate, 4.5–5 cm, transition to stamens gradual. Filament of inner stamens ± as wide as anther; connective apically appendaged. Carpels only partially united, walls between locules of ovary double. Stigma rays (8–)10–30; carpellary appendages triangular-tapered. Fruit globose, 1.5–4.5 cm in diam. Seeds ellipsoid-globose, 0.5–1.3 mm, with longitudinal rows of hairs. Fl. Jul–Dec. $2n = 28, 56, 84$.

Ponds. Anhui, Guangdong, Hainan, Hubei, Taiwan, Yunnan [Afghanistan, Bangladesh, India, Indonesia, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam; Australia].

In FRPS and a number of other works this species is named *Nymphaea stellata*. An examination of the type of *N. nouchali* by Verdcourt (Kew Bull. 44: 179. 1989) indicated that the name should be applied to this species, not to *N. pubescens* as some have done. Much work remains to be done to improve our understanding of this wide-ranging and highly variable taxon and its relationship to related taxa in Africa.

3. EURYALE Salisbury in K. D. König & Sims, Ann. Bot. 2: 73. 1805.

芡属 qian shu

Herbs annual or short-lived perennial. Rhizomes erect, unbranched. Leaves submerged or floating; leaf blade broadly elliptic to orbicular, venation primarily radiate, juvenile ones with basal sinus, mature ones lacking sinus and only slightly indented basally, margin entire, centrally peltate. Flower epigynous, floating or often partially or entirely submerged, cleistogamous or perianth spreading. Sepals 4, greenish, not petaloid, persistent. Petals numerous, in ca. 5 series, showy, transition to stamens gradual. Stamens shorter than sepals and petals, inserted at apex of ovary; filament linear; anther connective unappendaged. Carpels 7–16, completely united. Style absent. Stigma sessile and radiate on cup-shaped stigmatic disc, lacking marginal appendages. Fruit irregularly dehiscent. Seeds smooth, arillate.

One species: E Asia.

1. *Euryale ferox* Salisbury in K. D. König & Sims, Ann. Bot. 2: 74. 1805.

芡实 qian shi

Submerged leaves not prickly; leaf blade sagittate or elliptic, 4–10 cm, base deeply cordate. Floating leaves prickly on petioles and along veins; leaf blade abaxially dark purple and adaxially green, to 1.3(–2.7) m in diam., subleathery, abaxially sparsely pubescent, adaxially glabrous, base emarginate or sinuate; veins abaxially strongly ribbed; primary veins prickly on both surfaces. Flower to 5 cm in diam. Peduncle stout, densely prickly. Sepals triangular-ovate, 1–1.5(–3) cm, abaxially densely prickly; prickles retrorse. Petals outer purple-violet fading to inner white, oblong-lanceolate, 1(–2.5) cm. Ovary 7–16-loculed, each locule with 6–8 or more ovules. Fruit dark purple, globose, 5–10 cm in diam., spongy, densely prickly. Seeds black, 8 to many, globose, 6–10 mm in diam.; testa thick, rigid. Fl. Jun–Aug.

Lakes, ponds. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Bangladesh, India, Japan, Kashmir, Korea, Russia (Far East)].

This species is cultivated for its starchy seeds.

