

## LYTHRACEAE

千屈菜科 qian qu cai ke

Qin Haining (覃海宁)<sup>1</sup>; Shirley Graham<sup>2</sup>, Michael G. Gilbert<sup>3</sup>

Herbs, shrubs, or trees; young stems often quadrangular. Leaves opposite, often decussate, or whorled, rarely subalternate to alternate, simple, entire; pinnately veined, secondary veins typically joined in a series of intramarginal arches; stipules vestigial or absent. Inflorescences racemes, cymes, or panicles; flowers axillary or terminal, usually 4-, 6- or 8-merous, sometimes 3- or 5-merous, bisexual, regular or irregular. Floral tube perigynous, hemi-epigynous, or epigynous, persistent in fruit, membranous to leathery, often 6–12-ribbed; sepals valvate, equal to much shorter than floral tube, membranous to thickly leathery, persistent; epicalyx alternating with sepals or absent. Petals inserted at rim of floral tube, alternating with sepals, crinkled, clawed or not, frequently caducous, rarely absent. Stamens usually biseriate and  $2 \times$  as many as sepals, sometimes uniseriate, inserted near base of floral tube or higher, or numerous, multiseriate, with at least some inserted at floral rim just below sepals (*Punica*, *Sonneratia*, and some *Duabanga*); anthers versatile [rarely basifixed]. Ovary superior, half-inferior, or inferior, 2–6- or multi-loculed, with many ovules per locule; style simple; stigma capitate, conic-peltate, or punctiform; placentation axile, sometimes free central at fruit maturity. Fruit partly or completely surrounded by persistent floral tube, loculicidally dehiscent or irregularly dehiscent capsules, infrequently indehiscent, leathery, or berrylike. Seeds usually numerous, without endosperm; embryo straight, cotyledons flat or convolute.

About 31 genera and 625–650 species: widespread in tropical regions, less common in temperate regions; ten genera and 43 species (ten endemic, four introduced) in China.

From the morphological standpoint, the Lythraceae sensu lato (including Trapaceae) have a very generalized morphology, without a single unique, defining character, i.e., there is no morphological synapomorphy that defines the family. At the same time, the genera are distinct. The position of the ovary in *Duabanga*, *Punica*, *Sonneratia*, and *Trapa* is variable: superior to partly inferior in *Sonneratia*; partly inferior in *Duabanga*; and partly, nearly, or completely inferior in *Punica* and *Trapa*. Several other features ally these genera to the Lythraceae sensu stricto, including opposite and simple leaves, commonly held wood anatomical characters (true for the Myrtales generally), development of a persistent floral tube, valvate sepals, 4- or 6-merous flowers, introrse and versatile anthers, axile placentation, and seeds without endosperm. Of the four genera, *Trapa* is the most divergent, but still sufficiently similar to the Lythraceae and Onagraceae to have been considered for membership within either family, or as a closely related family (as has been done in the present Flora). The inclusion of *Sonneratia*, *Duabanga*, and *Punica* in the Lythraceae adds some additional derived features to the definition of the family, but at the same time, brings together taxa that we know, from molecular sequence data, represent a single historical lineage. That knowledge of evolutionary relationship is lost if the genera are maintained as separate families, whereas the taxonomic utility of the Flora is not affected by their inclusion in an expanded Lythraceae.

The molecular data from four genes (three chloroplast and one nuclear) unquestionably place not only *Duabanga*, *Punica*, and *Sonneratia*, but also *Trapa*, within the Lythraceae. *Punica* is well supported as a member of a clade of genera that includes *Capuronia* Lourteig, *Galpinia* N. E. Brown, and *Pemphis* (from East Africa and Madagascar). *Duabanga* and *Lagerstroemia* are sister genera, and *Sonneratia* and *Trapa*, as unlikely as it may seem morphologically, are also sister genera. *Duabanga*, *Lagerstroemia*, *Sonneratia*, and *Trapa* together form one of seven clades in the family.

In addition to the species described below, several species have been recorded as introduced or cultivated in China. *Cuphea carthagenensis* (Jacquin) J. F. Macbride (*C. balsamona* Chamisso & Schlechtendal), of South American origin, is an introduced weed in many places in the Pacific, although it has never been cultivated. *Cuphea viscosissima* Jacquin (*C. petiolata* (Linnaeus) Koehne 1882, not Pohl ex Koehne 1877), native to the E United States, has never been cultivated but misidentifications of cultivated *C. lanceolata* in botanical gardens as *C. viscosissima* (or *C. petiolata*) have put its name in records of cultivated plants. Several other species have been recorded as cultivated in China, including *C. hookeriana* Walpers, *C. hyssopifolia* Kunth, *C. ignea* A. Candolle (*C. platycentra* Lemaire, 1846, not Bentham, 1839), *C. lanceolata* W. T. Aiton, *C. micropetala* Kunth, and *C. procumbens* Ortega, as well as *Heimia myrtifolia* Chamisso & Schlechtendal, *Lafonesia vandelliana* Chamisso & Schlechtendal, and *Lawsonia inermis* Linnaeus. Of these, however, only *C. hyssopifolia*, *C. ignea*, and *L. inermis* (henna) are really widely grown as ornamentals.

Lee Shu-kang & Lau Lan-fang; Ko Wan-chueng; Lo Hsien-shui. 1983. Lythraceae; Sonneratiaceae; Punicaceae. In: Fang Wen-pei & Chang Che-yung, eds., Fl. Reipubl. Popularis Sin. 52(2): 67–111; 111–118; 120–121.

1a. Herbs, terrestrial or amphibious.

2a. Floral tubes elongate, cylindrical, ca.  $2 \times$  longer than wide or more; capsules enclosed within floral tube; perennials to 1 m tall ..... 4. *Lythrum*

2b. Floral tubes campanulate to globose; capsules equaling or extending beyond floral tube; annuals ca. 50 cm tall or less.

3a. Flowers usually 6-merous, solitary, axillary; sepals and alternating epicalyx segments longer than floral tube, epicalyx segments linear-subulate ..... 6. *Peplis*

3b. Flowers 4- or 5(or 6)-merous, solitary, axillary or in racemes or cymes; sepals and epicalyx segments much shorter than floral tube, epicalyx sometimes absent.

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- 4a. Capsule wall smooth, dehiscence irregular; flowers usually 3 or more per axil ..... 1. *Ammannia*  
 4b. Capsule wall transversely finely striated (10 × magnification), dehiscence septical; flowers usually  
 solitary, axillary ..... 8. *Rotala*
- 1b. Trees or shrubs.
- 5a. Stamens all or in part inserted at rim of floral tube just below sepals; stamens usually many, seldom as few as 12.  
 6a. Floral tubes epigynous, orange-red or yellow, completely enveloping fruit; fruit red or yellow, leathery,  
 berrylike, crowned by persistent sepals; seeds with translucent, juicy sarcotesta ..... 7. *Punica*  
 6b. Floral tubes perigynous or hemi-epigynous, green, half-enveloping fruit or flattened, saucer-shaped; seeds dry.  
 7a. Flowers 1–3(–5), in terminal clusters; petals narrowly lanceolate, very small, or absent; fruit  
 indehiscent, globose, leathery berries; seeds irregularly angular or falcate ..... 9. *Sonneratia*  
 7b. Flowers (3–)5 to many, in lax terminal corymbs; petals oblong to ovate; fruit loculicidally dehiscent  
 capsules; seeds 2-tailed, filiform ..... 2. *Duabanga*
- 5b. Stamens all inserted at or near base of floral tube or somewhat above, but never at rim of floral tube; stamens  
 usually 4–12, seldom numerous.
- 8a. Leaves abaxially black glandular and tomentose; floral tube elongate, cylindric, red-orange; petals  
 small or absent ..... 10. *Woodfordia*  
 8b. Leaves abaxially without black glands, glabrous or pubescent to tomentose; floral tube turbinate or  
 campanulate, green; petals present.  
 9a. Flowers solitary or paired; stamens 12; capsule circumscissile; seeds not winged ..... 5. *Pemphis*  
 9b. Flowers in panicles; stamens 6–100+, usually 18 or more; capsule loculicidally dehiscent; seeds  
 unilaterally winged ..... 3. *Lagerstroemia*

## 1. AMMANNIA Linnaeus, Sp. Pl. 1: 119. 1753

水菟菜属 shui xian cai shu

Qin Haining (覃海宁); Shirley Graham

Herbs, annual, tending to become anthocyanic with age. Stems erect, glabrous; young branches often 4-angled or narrowly winged. Leaves opposite, usually decussate, sessile or subsessile, membranous. Inflorescences cymose, with small, white, membranous bracteoles. Flowers 4(–6)-merous, actinomorphic. Floral tube campanulate or urceolate, becoming globose or nearly so in fruit, 4(–6)-lobed, noticeably 4–8-veined; sepals short, less than 1/3 length of floral tube; epicalyx segments between sepals small or absent. Petals absent to 4, caducous. Stamens 2–8. Ovary incompletely [1 or]2–4-loculed, globose; ovules numerous; style much shorter to much longer than ovary, style base persistent in fruit; stigma capitate. Capsule globose, hyaline, smooth walled, not finely striated, irregularly dehiscent from apex. Seeds many, golden-brown, obovoid, concave-convex, ca. 1 mm.  $2n = 18, 24, 26, 28, 30, 32, 34, 36, 40, 48, 66$ .

About 25 species: widely distributed in tropical and subtropical areas, mainly in Africa and Asia; four species (one naturalized) in China.

- 1a. Leaves basally attenuate to truncate; petals absent; style shorter than ovary ..... 1. *A. baccifera*  
 1b. Leaves basally ± auriculate, often clasping; petals present.  
 2a. Style ca. 1/2 as long as ovary or shorter; capsule ca. 1.5 mm in diam. .... 2. *A. multiflora*  
 2b. Style ca. as long as ovary or longer; capsule 1.5–3.5 mm in diam.  
 3a. Capsule 1.5–3.5 mm in diam.; flowers 3–15, commonly 7, in axillary cymes ..... 3. *A. auriculata*  
 3b. Capsule 3.5–5 mm in diam.; flowers 3–5, commonly 3, in axillary cymes ..... 4. *A. coccinea*

### 1. *Ammannia baccifera* Linnaeus, Sp. Pl. 1: 120. 1753.

水菟菜 shui xian cai

*Ammannia baccifera* subf. *contracta* Koehne; *A. baccifera* subsp. *viridis* (Willdenow ex Hornemann) Koehne; *A. discolor* Nakai; *A. indica* Lamarck; *A. vescicatoria* Roxburgh; *A. viridis* Willdenow ex Hornemann.

Herbs, annual, 10–50[–100] cm tall. Stem with numerous, ascending branches. Leaves opposite on basal stem portion, opposite or alternate toward stem apices, narrowly elliptic or oblanceolate to linear, 5–60 × 3–10 mm, base attenuate, truncate, or subcordate. Flowers 3 to many in dense axillary cymes; pedicels subsessile, to 1 mm; peduncle absent to 1 mm; bracteoles minute, not reaching floral tube. Floral tube campanulate, tapering at base, 1–2 mm; sepals 4, ca. 0.5 mm, deltate; epicalyx ab-

sent. Petals absent. Stamens 4. Style absent to 0.3 mm, much shorter than ovary. Capsules 1–2 mm in diam., 1/4–1/2 exserted. Fl. Aug–Oct, fr. Sep–Dec.  $2n = 24, 26$ .

Wet places, farmland. Anhui, Fujian, Guangdong, Guangxi, Hebei, Hubei, Hunan, Jiangsu, Jiangxi, Shanxi, Taiwan, Yunnan, Zhejiang [Afghanistan, Bhutan, Cambodia, India, Laos, Malaysia, Nepal, Philippines, Thailand, Vietnam; tropical Africa, Australia, Caribbean islands].

### 2. *Ammannia multiflora* Roxburgh, Fl. Ind. 1: 447. 1820.

多花水菟菜 duo hua shui xian cai

*Ammannia australasica* F. Mueller; *A. japonica* Miquel; *A. parviflora* Candolle; *A. multiflora* var. *parviflora* (Candolle) Koehne; *Suffrenia dichotoma* Miquel.

Herbs, annual, 8–65 cm tall. Stems with numerous, ascend-

ing, short branches. Leaves opposite, narrowly elliptic, broadly linear, or lanceolate-oblong, 1–2.5 cm × 3–12 mm, base attenuate to cordate. Flowers 3–7(–20) in dense axillary cymes; pedicels 1–2[–6] mm; peduncle 1–2 mm; bracteoles linear, not reaching floral tube. Floral tube campanulate, ca. 1.5 mm, 4-ribbed; sepals 4, deltate. Petals 4, pink to whitish, obovate, minute. Stamens 4, rarely 6–8. Style 1/3–1/2 as long as ovary. Capsules red-brown or red-wine colored, ca. 1.5 mm in diam., ca. 1/2 exerted. Fl. Jul–Aug, fr. Sep.  $2n = 18$ .

Wet places, farmland. S China (including Taiwan) [tropics and subtropics of Africa, Asia, and Australia].

The differences between this species and *Ammannia auriculata* are minor or overlapping.

### 3. *Ammannia auriculata* Willdenow, Hort. Berol. 1: 7. 1803.

耳基水菹 er ji shui xian

*Ammannia arenaria* Kunth; *A. auriculata* Willdenow var. *arenaria* (Kunth) Koehne.

Herbs, 15–60 cm tall. Stems branched. Leaves opposite, narrowly lanceolate or oblong-lanceolate, 1.5–7.5 cm × 3–15 mm, base cordate-auriculate, clasping. Flowers (1–)3–15, commonly ca. 7, in axillary cymes; pedicels 1–3(–6) mm; peduncle 3–9 mm, commonly ca. 5 mm; bracteoles linear, not reaching

floral tube. Floral tube campanulate to urceolate, 1.5–2 mm, conspicuously 4–8-ribbed; sepals 4, broadly deltate; epicalyx segments minute, thickened. Petals 4, rose-purple, suborbicular, ca. 1.5 mm, sometimes absent. Stamens 4–8, long-exserted. Style ca. as long as or longer than ovary. Capsules 1.5–3(–3.5) mm in diam., equal to surpassing floral tube. Fl. Aug–Dec, fr. Aug–Dec.  $2n = 30, 32$ .

Wet places, rice farms. Anhui, Fujian, Gansu, Guangdong, Hebei, Henan, Hubei, Jiangsu, Shanxi, Yunnan, Zhejiang [pantropical].

### 4. *Ammannia coccinea* Rottbøll, Descr. Icon. Rar. Pl. 7. 1773.

长叶水菹菜 chang ye shui xian cai

Herbs, annual, to 60[–100] cm tall. Stems branched. Leaves opposite, sessile, linear-lanceolate, 1.6–8 cm × 3[–15] mm, glaucescent, base cordate to auriculate, clasping. Flowers (1–)3–5 in axillary cymes; pedicels ca. 2 mm; peduncle absent to 9 mm; bracteoles reaching floral tube. Floral tube urceolate, 3–5 mm; sepals 4(or 5), broadly deltate; epicalyx segments thickened, ca. as long as sepals. Petals 4(or 5), rose-purple, obovate, ca. 2 mm. Stamens 4(–7), slightly exerted. Style ca. as long as or longer than ovary, well-exserted. Capsules 3.5–5 mm in diam., equal to or exceeding floral tube, rarely included. Fl. Jul–Oct, fr. Aug–Nov.  $2n = 66$ .

Naturalized. SW Taiwan (Tainan) [native to North America].

## 2. *DUABANGA* Buchanan-Hamilton, Trans. Linn. Soc. London 17: 177. 1837.

八宝树属 ba bao shu shu

Qin Haining (覃海宁); Shirley Graham

Trees 8–45 m tall, buttressed. Branchlets 4-angled, becoming terete with age; ultimate branches pendulous. Leaves shortly petiolate, opposite, oblong to ovate or lanceolate, leathery to papery, glabrous, secondary vein pairs numerous, joined in a series of intramarginal arches, base rounded to cordate, apex acute to acuminate. Inflorescence of few to many flowers in a lax, terminal corymb. Flowers actinomorphic, bisexual, usually 4- or 6-merous, but variably 4–8-merous on same or different individuals. Floral tube obovate or broadly campanulate, persistent in fruit; sepals 4–8, triangular-ovate, thick. Petals 4–8, broad, crinkled, shortly clawed. Stamens 12 or 24–50+; filaments filiform-subulate from a broadened base, long; anthers recurved or replicate over one end of connective. Ovary semi-inferior; ovules numerous; style long-exserted, slender; stigma capitate to slightly 4-lobed. Fruit indurate capsules, partially surrounded by persistent floral tube, oblong to ovoid-globose, loculicidally deeply dehiscent, 4–9-valved. Seeds numerous, filiform, fragile, 2-tailed.  $2n = 48$ .

Two or three species: evergreen rain forests of SE Asia; two species (one cultivated) in China.

The species are trees of lowland rain forests.

- 1a. Stamens biseriate, 50 or more; flowers usually 6-merous; capsules 3–6 × 3.2–3.5 cm ..... 1. *D. grandiflora*  
 1b. Stamens uniseriate, 24–45; flowers usually 4- or 5-merous; capsules 1.5–2.5 × 1.7–2.5 cm ..... 2. *D. ×taylorii*

### 1. *Duabanga grandiflora* (Roxburgh ex Candolle) Walpers, Repert. Bot. Syst. 2: 114. 1843.

八宝树 ba bao shu

*Lagerstroemia grandiflora* Roxburgh ex Candolle, Mém. Soc. Hist. Nat. Genève 32: 84. 1826; *Duabanga sonneratioides* Buchanan-Hamilton.

Trees, medium to tall, 30[–40] m tall, glabrous. Leaves rigid, distichous; petiole to 1.2 cm; leaf blade abaxially pale green, adaxially dark green, ovate to oblong, broad, 12–15 × 5–7 cm, abaxially glaucous, lateral veins [12–]20–24 pairs,

base cordate, apex shortly acuminate. Corymbs 3–20-flowered, drooping at ends of branches; pedicels 3–4 cm, stout. Floral tube broadly campanulate, 1.6–2.5 × 1.8–3 cm; sepals (5 or)6, green, thick, enlarged in fruit. Petals 6, white, obovate, 2.5–3 × 1.5–2 cm. Stamens numerous, ca. 50 or more, white, surpassing petals. Capsules subglobose, 3–4 × [3–]4–4.5 cm, 6–9-valved. Seeds 4–6 mm. Fl. spring.  $2n = 48$ .

Valley forests, open places, especially on river banks; 900–1500 m. S Yunnan [Cambodia, E India (including Andaman Islands), Laos, Malaysia, Myanmar, Thailand, Vietnam].

This species is used for timber. The flowers have an unpleasant odor.

**2. Duabanga ×taylorii** Jayaweera, J. Arnold Arbor. 48: 93. 1967.

细花八宝树 xi hua ba bao shu

Trees, large, to 45 m tall, 70–100 cm d.b.h.; buttresses absent. Leaves distichous, sessile; petiole to 2 cm; leaf blade oblong to ovate, broad, largest leaves 13–18 × 7–8 cm, smaller at bases and apices of branchlets, lateral veins [5–]15–18[–25] pairs, base cordate, apex abruptly acuminate. Corymbs 5- to many flowered; pedicels 1–1.2 cm. Floral tube broadly campanulate, ca. 3 × 3 cm; sepals 4 or 5, rarely 6–8, 1.5–2 × 1.2–1.8 cm. Petals 4 or 5, yellowish white, obovate, 2–2.5 × 1.5–2 cm.

Stamens 24–45, uniseriate. Capsules ovoid-oblong, 1.5–2.5 × 1.7–2.5 cm, 4-valved. Seeds ca. 5.5 mm.

Cultivated. Hainan [possibly native to Indonesia (Java)].

This species is used for timber. It was described from trees cultivated at the Royal Botanic Gardens, Peradeniya, Sri Lanka. The trees were grown from seed from an unknown source but are suspected to have come from Java. The designation as a hybrid is somewhat uncertain because the two other known species of *Duabanga* do not have overlapping ranges. It might well be a multistaminate form of *D. moluccana* Blume or maybe, if *D. grandiflora* and *D. moluccana* were cultivated together in Java, the seed was from a garden hybrid that occurred there.

### 3. LAGERSTROEMIA Linnaeus, Syst. Nat., ed. 10, 2: 1068, 1076, 1372. 1759.

紫薇属 zi wei shu

Qin Haining (覃海宁); Shirley Graham

Trees or shrubs. Young stems terete to frequently 4-angled or subulate, glabrous, puberulous, pubescent, or tomentose, often glabrescent. Leaves variably subopposite to subalternate or alternate, rarely opposite or truly alternate, sessile or petiolate; stipules minute, caducous. Inflorescences terminal and axillary paniculate cymes. Flowers actinomorphic, campanulate to turbinate, flexibly 5–7-merous. Floral tube leathery, smooth walled with 6–12(–14) veins visible as dark lines, or with broad to narrow ribs or ridges; sepals narrowly to broadly deltate, sometimes subtended within by a narrow annulus; epicalyx segments alternating with sepals, small to prominent, or absent. Petals 6(–12), rose, purple, or white, crinkled, slenderly clawed. Stamens (6–)12–100+, inserted at or near base of floral tube, exserted, dimorphic in most species, 6 solitary in front of sepals with thick filaments and large anthers, 12–100+ in clusters in front of petals with thin filaments and small anthers, rarely monomorphic, then all filaments thin, subequal. Ovary globose to oblong, 3–6-loculed; style long-exserted; stigma capitate. Fruit dry, indurate capsules, surrounded at base by persistent floral tube, loculicidally dehiscent, 3–6-valved. Seeds numerous, obpyramidal, unilaterally winged from raphe; cotyledons rolled.

About 55 species: tropical and subtropical Asia to Australia, north to Japan; 15 species (eight endemic) in China.

*Lagerstroemia* is in need of more extensive gatherings and study in order better to understand the extent of variability among and within the species.

The flowers are typically 6-merous, but can be 5–7-merous on the same plant. The floral tubes contract ± abruptly below the base of the ovary (campanulate) or taper gradually to the paired bracteoles of the pedicel (turbinate). The length of the floral tube is measured from the base of the ovary to the apex of the sepals; the pedicellate base (epipodium) extending from the base of the ovary to the bracteoles is not included.

A specimen of *Lagerstroemia micrantha* Merrill (J. Arnold Arbor. 21: 378. 1940, described from Vietnam) was reported by Furtado and Montien (Gard. Bull. Singapore 24: 276. 1969) from Taiwan (*Faurie 8076*, A) but without further information. One of us (Graham) saw this specimen, and another so named, at US from Hong Kong, but without collector or further data. Inclusion of *L. micrantha* in this Flora is deferred until the taxonomic status of the species is better understood.

In addition to the species mentioned below as being cultivated in China, the following have also been recorded as cultivated: *Lagerstroemia siamica* Gagnepain (native to Malaysia, Myanmar, and Thailand) in Taiwan (1950, no further data, A); *L. reginae* Roxburgh (native to India, Myanmar, and New Guinea) in Guangzhou (*Hooker s.n.*, E); and *L. floribunda* var. *brevifolia* Craib (native to Cambodia and Thailand) without locality (*Macartney s.n.*, BM).

- 1a. Leaves, panicles, and flowers densely tomentose; trichomes dendritic, golden- to red-brown.
  - 2a. Ovary and adaxial surface of sepals densely tomentose; floral tube smooth walled, densely tomentose, 10–12 mm ..... 1. *L. balansae*
  - 2b. Ovary densely tomentose, adaxial surface of sepals completely glabrous; floral tube 12-ribbed, 8–10 mm ..... 2. *L. tomentosa*
- 1b. Leaves, panicles, and floral tubes glabrous, variously pubescent, or puberulous (grayish tomentose in *L. suprareticulata*); trichomes simple, grayish white or yellow-brown.
  - 3a. Floral tubes prominently undulate-winged from sinus of sepals, wings attenuate on pedicellate floral base; floral tubes densely white pubescent; epicalyx absent ..... 3. *L. villosa*
  - 3b. Floral tubes smooth walled or 6–12(–14)-ribbed; ribs broad and flat or sharply ridged, without undulate wings; floral tubes glabrous or pubescent; epicalyx present or absent.
    - 4a. Epicalyx prominent at sinus between sepals.
      - 5a. Epicalyx segments broad, flat, auriculate, ca. 1/2 as long as sepals; sepals deltate with caudate apex ..... 4. *L. limii*
      - 5b. Epicalyx segments linear or deltate and keeled, ca. as long as sepals; sepals deltate with acute to shortly acuminate apex.

- 6a. Epicalyx segments linear, ca. as long as or surpassing sepals; branchlets and panicles glabrous; floral tubes prominently sharply 6-ribbed ..... 5. *L. guilinensis*
- 6b. Epicalyx segments deltate, abaxially keeled, slightly incurved in bud; branchlets and panicles densely gray puberulous; floral tubes 6- or 7-ribbed; ribs rounded or obscure ..... 6. *L. venusta*
- 4b. Epicalyx absent or minute at sinus between sepals.
- 7a. Floral tubes 7–15 mm from apex of sepals to base of ovary.
- 8a. Floral tubes glabrous, smooth walled or obscurely to decidedly 6-ribbed; leaves, at least some, suborbicular to obovate, 2.5–7(–10) × 1.5–4 cm ..... 7. *L. indica*
- 8b. Floral tubes gray or yellow-brown puberulous or pubescent, obscurely to distinctly 12-ribbed or dark veined; leaves ovate-elliptic or lanceolate.
- 9a. Floral tubes yellow-brown puberulous, (8–)12–15 mm; sepals adaxially glabrous; leaves 7–18 × 4–8 cm, apex shortly acuminate; stamens 70 to ca. 130 ..... 8. *L. intermedia*
- 9b. Floral tubes gray pubescent or tomentose, 9–11 mm; sepals adaxially sparsely to densely gray-pubescent or tomentose; leaves 3–10 × 2.5–4 cm, apex shortly to long acuminate or caudate; stamens 25–40.
- 10a. Floral tubes distinctly 10–12-ribbed; leaves (3–)6–10 × 2.5–4 cm, adaxial venation not raised, apex acuminate to caudate; sepals adaxially sparsely pubescent in distal half ..... 9. *L. fordii*
- 10b. Floral tubes ± smooth walled with (10–)12 dark veins; leaves 4–6.2 × 2.5–3.5 cm, adaxial venation distinctly raised, apex shortly acuminate; sepals adaxially densely gray tomentose ..... 10. *L. suprareticulata*
- 7b. Floral tubes 2–5 mm from apex of sepals to base of ovary.
- 11a. Branchlets yellow-brown pubescent; floral tubes distinctly 8–12-ribbed; sepals adaxially densely pubescent ..... 11. *L. anhuiensis*
- 11b. Branchlets glabrous or gray puberulous to pubescent; floral tubes smooth walled with 10–12(–14) dark veins or obscurely 12-ribbed; sepals adaxially glabrous or sparsely puberulous.
- 12a. Stamens 6–12; sepals adaxially sparsely puberulous at apex ..... 12. *L. excelsa*
- 12b. Stamens 15–30, mostly more than 20; sepals adaxially glabrous.
- 13a. Petals broadly ovate, claw ca. as long as blade, 7–10 mm including claw 3.5–6 mm, white, pink, or purple, base rounded to obtuse; leaves ovate to lanceolate, or elliptic, or less often obovate, 2–9(–11) × 1–5 cm ..... 13. *L. subcostata*
- 13b. Petals lanceolate, oblong, or elliptic, claw shorter than blade, 6–9 mm including claw 1.5–3 mm, white, base acute; leaves broadly elliptic or ovate to elliptic or lanceolate, 4.5–12 × 2.2–5 cm.
- 14a. Leaves ovate-elliptic or ovate-lanceolate, 4.5–6.5(–11) × 2–3(–4) cm; petiole 2–5 mm; ultimate branches of inflorescence glabrous; petals 6–7 mm; capsules 6–8 × 4–5 mm ..... 14. *L. glabra*
- 14b. Leaves broadly elliptic, 7–12 × 3–5.5 cm; petiole 6–10 mm; ultimate branches of inflorescence puberulous; petals ca. 9 mm; capsules 8–11 × 6–9 mm ..... 15. *L. caudata*

**1. Lagerstroemia balansae** Koehne, Bot. Jahrb. Syst. 23(Beibl. 57): 35. 1897.

毛萼紫薇 mao e zi wei

Shrubs to small or tall trees, 5–25 m tall. Bark yellowish, smooth; young branches, leaves, petioles, inflorescences, and floral tubes golden to red-brown tomentose; trichomes dendritic, partially to completely glabrescent. Petiole 4–8 mm; leaf blade oblong-lanceolate or elliptic, 6–12[–15] × 2–5.5[–6] cm, thickly papery to thinly leathery, abaxially glabrescent except on veins, lateral veins 5–8 pairs, base acute to subrounded, apex acute or shortly acuminate. Panicles 6–15[–20] cm, open, few flowered, sometimes interrupted by leaves, densely red-brown tomentose. Floral tube 6-merous, 1–1.2 cm, smooth walled, densely golden-brown tomentose; sepals 5–6 mm, adaxially densely tomentose; annulus absent; epicalyx absent. Petals purple-red, orbicular to obovate, ca. 1.8 cm including claw 2–4 mm. Stamens 60–70, dimorphic, antepetalous stamens mostly included. Ovary densely tomentose. Capsules ovoid, 1.2–1.5

cm, 5- or 6-valved, apex tomentose. Seeds including wing ca. 1.1 cm. Fl. Jun–Jul, fr. Oct–Nov.

Common in mixed forests; low elevations. Hainan [Laos, Thailand, Vietnam].

**2. Lagerstroemia tomentosa** C. Presl, Bot. Bemerk. 142. 1844.  
绒毛紫薇 rong mao zi wei

*Lagerstroemia tomentosa* var. *caudata* Koehne; *Murtughas tomentosa* (C. Presl) Kuntze.

Trees, 20–30[–35] m tall. Bark gray, fibrous, to 1 cm thick; stem, petioles, leaves, floral tubes, and ovaries densely golden tomentose; trichomes dendritic. Petiole 4–8 mm; leaf blade oblong-lanceolate or ovate, 8–18 × 4–6.5 cm, abaxially tomentose, glabrescent except on midvein, lateral veins 9–11 pairs, base rounded, apex acute to shortly acuminate. Panicles 8–20 cm, relatively open. Floral tube 6-merous, 8–10 mm, 12-ribbed, densely golden tomentose; sepals 3–4 mm, adaxially completely glabrous; annulus absent; epicalyx absent. Petals white, pale

pink, or purple, ovate, 1–1.6 cm including claw 3–5 mm, base obtuse. Stamens 24–70, dimorphic. Ovary densely golden tomentose. Capsules globose to ovoid-oblong, 1–1.5 × 0.8–1.1 cm, 6-valved, apex tomentose. Seeds 6–7 mm including wing. Fl. May, fr. Aug–Nov.

Mixed forests; 600–1200 m. Yunnan [Laos, Myanmar, Thailand, Vietnam].

**3. Lagerstroemia villosa** Wallich ex Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42: 234. 1873.

毛紫薇 mao zi wei

*Murtughas villosa* (Wallich ex Kurz) Kuntze.

Trees, 10–15[–30] m tall. Bark dark, roughly fissured; branchlets, both surfaces of leaves, and inflorescence white pubescent. Petiole 2–4[–6] mm; leaf blade ovate to broadly lanceolate or elliptic, 6–10 × 2.5–4 cm, papery to leathery, abaxially soft whitish puberulous when young, glabrescent except on veins, lateral veins [5 or]6[–8] pairs, base subacute to rounded, apex acute to shortly acuminate, sometimes mucronate. Panicles 3[–8] cm, nearly globose, densely flowered. Floral tube 5- or 6-merous, 4–5 mm, densely white pubescent, with 5 or 6 prominent undulate winged ribs; wings attenuate on pedicellate floral base; sepals 1.5–2.5 mm, glabrous or slightly granular at apex; annulus absent; epicalyx absent. Petals white, lanceolate, 1.5–3 mm, not crumpled, much shorter than floral tube, possibly sometimes missing, not or scarcely clawed. Stamens ca. 25, dimorphic. Ovary glabrous. Capsules subglobose to narrowly ovoid-oblong, 1.5(–2.2) × ca. 1.1 cm, 3- or 4-valved. Seeds including wing (3.5–)9–10 mm. Fl. and fr. autumn and winter.

Forests; 700–1000 m. SW Yunnan [Myanmar, Sri Lanka, Thailand].

**4. Lagerstroemia limii** Merrill, Philipp. J. Sci. 27: 165. 1925.

福建紫薇 fu jian zi wei

*Lagerstroemia chekiangensis* Cheng.

Shrubs or small trees, ca. 4 m tall, much branched. Branchlets terete, densely gray or yellow-brown pubescent. Petiole 2–5 mm, pubescent; leaf blade elliptic or oblong-elliptic, 4.5–3 × 2.5–6 cm, leathery, abaxially puberulous on midvein and lateral veins, lateral veins 10–17 pairs, base attenuate to subrounded, apex shortly acuminate or acute. Panicles 8–18 cm, open, densely pubescent. Floral tube (5 or)6-merous, 5–8 mm, 12–14-deeply ribbed to sharply ridged, densely yellow-brown pubescent to nearly glabrous at anthesis; sepals deltate, 2–3.5 mm, adaxially glabrous, caudate, pubescent at apex; annulus subtending sepals thickened; epicalyx segments conspicuous, typically spreading, broad, flattened, ca. 1/2 as long as sepals, auriculate. Petals reddish to pink, ovate to suborbicular, 9–12 mm including claw 4–6 mm, base obtuse. Stamens ca. 35, dimorphic. Ovary glabrous. Capsules 8–12 × 5–8 mm, 4- or 5-valved. Seeds including wing ca. 8 mm. Fl. May–Jun, fr. Jul–Aug.

• Mixed forests, low mountains. Fujian, Hubei, Zhejiang.

**5. Lagerstroemia guilinensis** S. K. Lee & L. F. Lau, Bull. Bot. Res., Harbin 2(1): 143. 1982.

桂林紫薇 gui lin zi wei

Shrubs, ca. 2 m tall. Branchlets terete, glabrous. Petiole ca. 2 mm; leaf blade ovate-lanceolate or elliptic-lanceolate, 4.5–7 × 1.5–2.5 cm, papery, glabrous, lateral veins 5 or 6 pairs, base broadly cuneate to subrounded, apex long acuminate. Panicles 5–8 × 2–3 cm, slender, glabrous. Floral tube 6-merous, 1–1.2 cm, prominently sharply 6-ribbed, glabrous; sepals ca. 2 mm, adaxially glabrous; annulus absent; epicalyx segments prominent, linear, to 3 mm, ca. as long as or surpassing sepals. Petals white, suborbicular, ca. 1.4 cm including claw ca. 6 mm. Stamens ca. 36, dimorphic. Ovary glabrous. Capsules subglobose or oblong, ca. 7 mm, 4-valved, smooth walled. Seeds unknown. Fl. May–Jun, fr. Sep.

• Scrub on limestone mountains. Guangxi.

**6. Lagerstroemia venusta** Wallich ex C. B. Clarke in J. D. Hooker, Fl. Brit. India 2: 576. 1879.

西双紫薇 xi shuang zi wei

*Lagerstroemia colletii* Craib; *L. corniculata* Gagnepain.

Trees, to 8[–17] m tall. Branchlets terete, densely gray puberulous. Petiole 3–6 mm; leaf blade oblong or oblong-elliptic, 10–14 × 3–5.5 cm, gray puberulous, glabrescent, lateral veins [5–]8 or 9 pairs, base usually oblique, apex obtuse. Panicles 11–27(–45) cm, densely gray puberulous, open, sparsely flowered. Floral tube 6(or 7)-merous, 5–9 mm, gray puberulous, 6- or 7-ribbed or ribs rounded, obscure; sepals ca. 3 mm, adaxially glabrous; annulus absent; epicalyx segments deltate, ca. as long as sepals, abaxially keeled, slightly incurved in bud. Petals pink-purple, oblong, 7–9 mm including claw 2–3 mm. Stamens numerous, dimorphic. Ovary glabrous. Capsules ovoid, ca. 1.3 × 1.2–2 cm, 5-valved, finely wrinkled at maturity. Seeds including wing ca. 1.8 cm. Fl. Oct, fr. Dec–Nov.

Rain forests, rain forest margins. S Yunnan [Cambodia, Laos, Myanmar, Thailand, Vietnam].

**7. Lagerstroemia indica** Linnaeus, Sp. Pl., ed. 2, 1: 734. 1762.

紫薇 zi wei

*Lagerstroemia chinensis* Lamarck; *Murtughas indica* (Linnaeus) Kuntze.

Shrubs or small trees, to 7 m tall. Branchlets slender, 4-angled or subulate, puberulous, glabrescent. Leaves sessile or with petiole to ca. 2 mm; leaf blade elliptic, oblong, obovate, or suborbicular, typically at least some suborbicular to obovate and mucronate, 2.5–7[–10] × 1.5–4 cm, papery to slightly leathery, glabrous or with slight indumentum on veins abaxially, lateral veins 3–7 pairs, base broadly cuneate to rounded, apex acute, obtuse with small mucro, or retuse. Panicles subpyramidal, 7–20 cm, puberulous, densely flowered. Floral tube 6-merous, 7–11 mm, smooth walled or obscurely to decidedly 6-ribbed, glabrous; sepals 3.5–5.5 mm, adaxially glabrous; annulus present; epicalyx absent. Petals purple, fuchsia, pink, or white, orbicular, 1.2–2 cm including claw 6–9 mm. Stamens 36–42, dimorphic. Ovary glabrous. Capsules ellipsoidal, 1–1.3 × 0.7–1.2 cm, 4–6-valved. Seeds including wing ca. 8 mm. Fl. Jun–Sep, fr. Sep–Nov.  $2n = 48, 50$ .

Semishaded places, rich fields, wild or cultivated. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangxi, Jilin, Shandong, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Bangladesh, Bhutan, Cambodia, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam; widely cultivated throughout these and other warm regions of the world].

**8. *Lagerstroemia intermedia*** Koehne in Engler, Pflanzenr. 17(IV. 216): 260. 1903.

云南紫薇 yun nan zi wei

*Lagerstroemia speciosa* (Linnaeus) Persoon var. *intermedia* (Koehne) Furtado & Montien.

Trees, 6–12 m tall. Branchlets terete, glabrous. Petiole 1.2–1.5 cm; leaf blade elliptic or oblong-elliptic, rarely elliptic-obovate, 7–18 × 4–8 cm, papery to thinly leathery, abaxially paler and conspicuously reticulate, lateral veins 10 or 11 pairs, base acute to attenuate, apex shortly acuminate. Panicles 10–15 cm, glabrous or puberulous. Floral tube 6-merous, 1.2–1.5 cm, smooth walled or with 12 shallow, broad ribs, densely yellow-brown puberulous; sepals narrowly deltate, 5.5–8 mm, ca. 1/2 as long as floral tube, adaxially glabrous; annulus absent; epicalyx segments absent or minute. Petals purple to bluish purple when dry, ovate, 2–2.5 cm including claw 5–7 mm. Stamens 75 to ca. 130, in 2 or 3 whorls, monomorphic. Ovary glabrous. Capsules oblong, 2.5–3.5 × ca. 2 cm, 6-valved. Seeds yellowish brown, ca. 10 mm including wing. Fl. May–Jun, fr. Oct–Dec.

Scrub forests, hillsides, roadsides; 800–1500 m. SW Yunnan [Myanmar].

This species is very similar to the widespread and commonly cultivated *Lagerstroemia speciosa* (Linnaeus) Persoon. The lectotype of *L. intermedia* differs in having slightly smaller, non-apiculate buds and smaller flowers that are very shallowly ribbed or smooth walled. In *L. speciosa*, the buds are typically apiculate and the floral tubes are more deeply and conspicuously ribbed, but it is uncertain if there is a continuum from shallow to deep ribbing. If there is a continuum, then *L. intermedia* is better considered a variety of *L. speciosa*. Epicalyx segments described by Koehne in the protologue of *L. intermedia* that might be a useful character are, in fact, not present on the lectotype.

*Lagerstroemia intermedia* is very local and of some conservation concern.

**9. *Lagerstroemia fordii*** Oliver & Koehne in Engler, Pflanzenr. 17(IV. 216): 262. 1903.

广东紫薇 guang dong zi wei

Shrubs or trees, 3–8 m tall. Branchlets gray-white pubescent. Petiole 3–12 mm; leaf blade broadly lanceolate or elliptic-lanceolate to elliptic-ovate, (3–)6–10 × 2.5–4 cm, papery, abaxially slightly pubescent to glabrescent, lateral veins 4 or 5(–8) pairs, adaxially venation not raised, base attenuate, apex long acuminate to caudate. Panicles terminal, 6–20 cm, gray-white pubescent. Floral tube 6-merous, 7–9 mm, distinctly 10–12-ribbed, gray-white pubescent; sepals ca. 2 mm, adaxially slightly pubescent on distal half; annulus absent; epicalyx absent. Petals ?color, ovate, 8–12 mm including claw 3–5 mm, base cordate. Stamens 25–30, dimorphic. Ovary glabrous. Capsules 1–1.2 cm × 7–9 mm. Seeds 6–8 mm including wing. Fr. Aug.

• Sparse forests on low mountains. Fujian, Hong Kong (Lantau Island).

**10. *Lagerstroemia suprareticulata*** S. K. Lee & L. F. Lau, Bull. Bot. Res., Harbin 2(1): 146. 1982.

网脉紫薇 wang mai zi wei

Small trees or shrubs, ca. 9 m tall. Branchlets gray-brown, terete, glabrous. Petiole 2–5 mm; leaf blade ovate or elliptic-ovate, 4–6.2 × 2.5–3.5 cm, thick, papery, lateral veins 4 or 5 pairs, abaxially reticulate veins obscure, adaxially venation distinctly raised and reticulate, base rounded or broadly cuneate, apex shortly acuminate. Panicles terminal, 11–13(–17) cm, whitish powdery-tomentose. Floral tube (5 or)6-merous, ca. 9 mm, with 10–12 dark veins, dense gray tomentose; sepals ca. 2 mm, adaxially densely gray tomentose; annulus unknown; epicalyx absent. Petals white, ovate, ca. 8 mm including claw ca. 3 mm, base cordate. Stamens 30–40, subequal, possibly monomorphic. Ovary ca. 1.5 mm in diam., glabrous. Fruit unknown.

• Stony mountains. SW Guangxi (Longzhou, Wuming).

**11. *Lagerstroemia anhuiensis*** X. H. Guo & S. B. Zhou, Bull. Bot. Res., Harbin 24: 392. 2004.

安徽紫薇 an hui zi wei

Shrubs or small trees, ca. 2 m tall. Branchlets terete to slightly 4-angular, yellow-brown pubescent. Petiole ca. 2 mm; leaf blade abaxially green, adaxially dark green, elliptic or narrowly elliptic, 2–5.5 × 1.5–2.5 cm, membranous, abaxially densely villous, adaxially densely pubescent, lateral veins 4 or 5 pairs, base broadly cuneate or rounded, apex acute or shortly acuminate. Panicles ca. 15 cm, densely villous. Floral tube (4–)6-merous, 3–4 mm, 8–12-ribbed; sepals ca. 1 mm, broadly deltate, adaxially densely pubescent; annulus thick, brown; epicalyx absent. Petals white, suborbicular, 5–6 mm including claw ca. 3 mm, base cordate. Stamens 16–30, dimorphic. Ovary glabrous. Young capsules dark brown, globose, ca. 1 mm in diam. Seeds unknown. Fl. Jul–Sep, fr. Aug–Oct.

• S Anhui (Guichi).

**12. *Lagerstroemia excelsa*** (Dode) Chun ex S. K. Lee & L. F. Lau, Fl. Reipubl. Popularis Sin. 52(2): 104. 1983.

川黔紫薇 chuan qian zi wei

*Orias excelsa* Dode, Bull. Soc. Bot. France 56: 232. 1909; *Lagerstroemia subcostata* Koehne var. *ambigua* Pampanini; *L. excelsa* var. *ambigua* (Pampanini) Furtado & Montien; *L. yangii* Chun.

Trees, 20–30 m tall. Branchlets terete, sparsely to densely gray pubescent, glabrescent. Leaves mostly opposite; petiole 4–8 mm, pubescent; leaf blade adaxially dark green, elliptic to broadly elliptic, 7–13 × 3.5–5 cm, membranous, abaxially pubescent on veins, adaxially glabrous, lateral vein 7–9 pairs, base acute, apex narrowly to broadly acuminate. Panicles 11–30 cm, densely gray-brown pubescent, densely flowered. Floral tube 6-merous, 2.5–3.5 mm, smooth walled, densely pubescent, glabrescent, with 12 dark veins; sepals 1.5–2 mm, adaxially sparsely puberulous at apex, glabrescent; annulus absent; epicalyx segments minute, ca. 0.3 mm, or absent. Petals yellowish white, ovate, 3–3.5 mm including claw 1–1.2 mm. Stamens (5 or)6–12, dimorphic, 6 antesealous, also sometimes up to 6 antepetalous. Ovary glabrous. Capsules subglobose to oblong, 3.5–5 ×

3–4 mm, (3 or)4-valved. Seeds including wing 3.5–4.8 mm. Fl. Apr, fr. Jul.

• Dense forests in mountain valleys; 1200–2000 m. Guizhou, Hubei, Sichuan.

**13. *Lagerstroemia subcostata*** Koehne, Bot. Jahrb. Syst. 4: 20. 1883.

南紫薇 nan zi wei

*Lagerstroemia subcostata* var. *hirtella* Koehne; *L. unguiculosa* Koehne.

Trees or shrubs, to 14 m tall. Branchlets glabrous to gray puberulous or pubescent. Petiole 2–4 mm; leaf blade oblong, ovate-lanceolate, elliptic, obovate-elliptic, or infrequently obovate, 2–9(–11) × 1–5 cm, papery, abaxially glabrous or slightly pubescent, lateral veins 3–10 pairs, base broadly cuneate to subrounded, apex acuminate. Panicles pyramidal, 7–16(–30) cm, gray-brown pubescent, densely flowered. Floral tube 6-merous, 3.5–4.5 mm, with (10 or)12(or 14) dark veins or obscurely (10 or)12(or 14)-ribbed, glabrous to densely gray pubescent; sepals 1–2 mm, adaxially glabrous; annulus thin or apparently absent; epicalyx absent. Petals white, pink, or purple, broadly ovate with obtuse base, 7–10 mm including claw 3.5–6 mm, claw ca. as long as blade. Stamens 15–30, dimorphic. Ovary glabrous. Capsules globose to mostly oblong, 6–9(–11) mm, 3–6-valved. Seeds including wing ca. 4 mm. Fl. Jun–Aug, fr. Jul–Oct.

Forest margins, streamsides; low to medium elevations. Anhui, Fujian, Guangdong, Guangxi, Hunan, Hubei, Jiangsu, Jiangxi, Qinghai, Sichuan, Taiwan, Zhejiang [Japan, Philippines].

It is difficult to separate the following two species, *Lagerstroemia glabra* (including *L. stenopetala*) and *L. caudata*, from the widespread *L. subcostata*. Further knowledge about the degree of development of indumentum and variability of leaf shape and size is needed. More abundant gatherings may erase apparent differences between the species.

**14. *Lagerstroemia glabra*** (Koehne) Koehne, Bot. Jahrb. Syst. 41: 102. 1907.

光紫薇 guang zi wei

*Lagerstroemia subcostata* Koehne var. *glabra* Koehne, Bot. Jahrb. Syst. 4: 20. 1883; *L. stenopetala* Chun.

Trees, small, 7–10 m tall. Branchlets 4-angled, glabrous.

Petiole 2–5 mm; leaf blade ovate-elliptic or elliptic-lanceolate, 4.5–6.5(–11.5) × 2.2–3(–4) cm, papery, glabrous, lateral veins 5–7 pairs, base cuneate to subrounded, apex shortly to long acuminate. Panicles pyramidal, 5–12 cm. Floral tube (4 or)5 or 6-merous, 4–5 mm, smooth walled, with 12 dark veins or obscurely 12-ribbed; sepals 1.5–2 mm, adaxially glabrous; annulus present, thin, scarcely developed; epicalyx absent. Petals white, oblong-lanceolate to elliptic, 6–7 mm including claw 1.5–3 mm. Stamens ca. 20, dimorphic. Ovary glabrous. Capsules ellipsoidal, 6–8 × 4–5 mm. Seeds including wing ca. 6 mm. Fl. Jul, fr. Oct.

• Guangdong, Guangxi, Hubei.

No consistent and taxonomically useful differences were found between *Lagerstroemia stenopetala* and *L. glabra*, although the lectotype of *L. stenopetala* was studied. The longer acuminate-caudate tip of the leaves of *L. stenopetala* seems to be the primary difference between the entities, and this condition can be found in some leaves of *L. glabra*. Given the variability of leaf shape generally found in *Lagerstroemia*, it is questionable whether this is significant at the species level. Petals of *L. glabra* and *L. stenopetala* are also similar and unusual for the genus, being lanceolate and not wrinkled in the proximal half. Furtado and Montien (Gard. Bull. Singapore 24: 185–334. 1969) also treated *L. stenopetala* as a synonym of *L. glabra*.

**15. *Lagerstroemia caudata*** Chun & F. C. How ex S. K. Lee & L. F. Lau, Bull. Bot. Res., Harbin 2(1): 144. 1982.

尾叶紫薇 wei ye zi wei

Trees, 18–30 m tall. Branchlets terete, glabrous. Leaves alternate, rarely subopposite; petiole 6–10 mm; leaf blade adaxially dark green, shiny, broadly elliptic, rarely ovate-elliptic, 7–12 × 3–5.5 cm, papery to slightly leathery, abaxially glabrous or pubescent on veins, lateral veins 5–7 pairs, base broadly cuneate to subrounded, apex acuminate to long acuminate. Panicles 3.5–8 cm; ultimate branches puberulous. Floral tube (5 or)6-merous, ca. 5 mm, with 10–12 dark veins; sepals ca. 2 mm, adaxially glabrous, annulus present; epicalyx absent. Petals white, oblong, ca. 9 mm including claw ca. 2 mm, base acute. Stamens 18–28, dimorphic. Ovary glabrous. Capsules oblong-globose, 8–11 × 6–9 mm, 5- or 6-valved. Seeds including wing 5–7 mm. Fl. Apr–May, fr. Jul–Oct.

• Forests, forest margins, limestone mountains. Guangdong, Guangxi, Jiangxi.

#### 4. LYTHRUM Linnaeus, Sp. Pl. 1: 446. 1753.

千屈菜属 qian qu cai shu

Qin Haining (覃海宁); Shirley Graham

Annual or perennial herbs or shrubs; young branches 4-angled. Leaves opposite, alternate, or 3-whorled, sessile or subsessile. Flowers in terminal spikes or racemes, whorled in cymes, paired, or solitary in axils, 6-merous, [mono-, di-, or] trimorphic, shortly pedicellate. Floral tube elongate, cylindrical [rarely broadly campanulate], 6–12-angled or -veined; sepals 6, generally short; epicalyx present, sometimes longer than sepals. Petals [absent to] 6, purple, rose, pink [or white]. Stamens [2–6 or]12, in two whorls of different lengths. Ovary 2-loculed; style of three lengths with capitate stigma below, above, or between two stamen whorls. Capsule elongated, included within persistent floral tube, 2-valved, valves often 2-lobed, dehiscence usually septical at apex. Seeds numerous, red-brown, elongate, bilaterally compressed, ca. 1 mm.

About 35 species: cosmopolitan; two species in China.

- 1a. Leaves ovate-lanceolate to broadly lanceolate, base rounded, truncate, or semiclasping; plants typically sparsely to densely pubescent; epicalyx segments much longer than sepals ..... 1. *L. salicaria*  
 1b. Leaves narrowly lanceolate to linear-lanceolate, base cuneate; plants glabrous; epicalyx segments shorter than to equaling sepals ..... 2. *L. virgatum*

**1. *Lythrum salicaria*** Linnaeus, Sp. Pl. 1: 446. 1753.

千屈菜 qian qu cai

*Lythrum anceps* (Koehne) Makino; *L. argyi* H. Léveillé; *L. intermedium* Ledebour ex Colla; *L. salicaria* var. *anceps* Koehne; *L. salicaria* var. *glabrum* Ledebour; *L. salicaria* var. *intermedium* (Ledebour ex Colla) Koehne; *L. salicaria* var. *mairei* H. Léveillé.

Perennial herbs or subshrubs, 0.3–1.5 m tall, scabrous or sparsely to densely gray pubescent [or tomentose], sometimes somewhat glabrescent. Stem erect, 4-angled. Leaves opposite or 3-whorled, sometimes alternate toward stem apex, ovate-lanceolate to broadly lanceolate, 2.5–10 × 0.5–1.5 cm, base rounded, truncate, or semiclasping, apex acute to subobtusate. Inflorescences terminal, spicate, 15–35 cm; bracts broadly lanceolate or deltoid-ovate. Flowers in 1- to multi-flowered whorled axillary cymes, shortly pedicellate. Floral tube 5–8 × 1.5–2 mm, 12-ribbed; sepals deltate, 0.5–1 mm; epicalyx segments erect, linear, 1.5–2 mm, much longer than sepals. Petals reddish purple to rose-purple, lanceolate-oblongate, 7–10 × 1.5–3 mm. Fl. Jul–Sep, fr. Oct.  $2n = 30, 50, 58, 60$ .

Damp grasslands, banks. Almost throughout China [widespread in northern latitudes worldwide, Afghanistan, India, Japan, Korea, Mongolia, E Russia; N Africa, Europe, North America].

Great variability, especially in degree of indumentum and leaf shape, has led to recognition of many microspecies and infraspecific taxa that are not satisfactorily separated when the species is investigated over its geographic range. Apparent hybridization between *Lythrum salicaria* and *L. virgatum* and among the many races of *L. salicaria* in E Europe and Asia have further confused the taxonomy. *Lythrum salicaria* is recognized here as a single species with localized variants. Formal names are not recognized for variants within the species until a biosystematic study of the species complex can be made.

**2. *Lythrum virgatum*** Linnaeus, Sp. Pl. 1: 447. 1753.

帚枝千屈菜 zhou zhi qian qu cai

Herbs, perennial, less robust than *L. salicaria*, 50–100 cm tall, glabrous throughout. Stem erect, 4-angled. Leaves opposite, sometimes alternate, narrowly lanceolate to linear-lanceolate, 3–13 × 0.3–1.6 cm, base narrowly cuneate, apex acute-acuminate. Inflorescences terminal, spicate, 13–25 cm; bracts linear-lanceolate. Flowers in 1–3(–7)-flowered axillary cymes, solitary or in sparse whorls, shortly pedicellate. Floral tube 4–6 × 1–1.5 mm, 12-ribbed; sepals deltate, 0.8–1 mm; epicalyx segments erect, linear to awl-shaped, shorter than or equaling sepals. Petals purple to pink, elliptic-lanceolate or oblongate, 5.5–7 × 2.5–4 mm. Fl. Apr–Aug, fr. Jul–Sep.  $2n = 30, 40$ .

Damp places. Hebei, Xinjiang [E Europe to SE Siberia].

**5. PEMPHIS** J. R. Forster & G. Forster, Char. Gen. Pl. 34. 1775.

水茺花属 shui yuan hua shu

Qin Haining (覃海宁); Shirley Graham

Shrubs to densely branched, small trees, maritime; all parts densely covered by grayish silky trichomes. Leaves opposite, sessile or subsessile. Flowers axillary, solitary or paired, 6-merous, actinomorphic, distylous. Floral tube turbinate, 12-ribbed; sepals short; epicalyx segments present, ca. 1/2 as long as or equaling sepals. Petals white or pale pink. Stamens 12, scarcely biserial, inserted somewhat above base of floral tube, 6 exserted in short-styled flowers, all included in long-styled flowers. Ovary vestigially 3- or 4-locular, appearing 1-loculed with free, central placentation. Capsule dry, circumscissile, slightly exserted at maturity. Seeds irregularly obpyramidal, wingless.

One species: E Africa west across Indian Ocean to Marshall Islands in Pacific Ocean, north to China (Taiwan) and Japan (Ryukyu Islands).

*Pemphis* is now regarded as unispecific. See Graham et al., *Koehneria*, a new genus of Lythraceae from Madagascar (Ann. Missouri Bot. Gard. 73: 788–809. 1986).

**1. *Pemphis acidula*** J. R. Forster & G. Forster, Char. Gen. Pl. 34. 1775.

水茺花 shui yuan hua

Shrubs to densely branched, spreading trees, maritime, small, to 11 m tall, but often ca. 1 m. Stems and branchlets ascending; branchlets, young leaves, and inflorescences densely silky grayish white strigose. Leaves opposite, sessile or subsessile; petiole to 2 mm; leaf blade narrowly elliptic to lanceolate, 1–3 cm × 5–15 mm, thick, succulent, base attenuate, apex often terminating in a minute circular hydathode. Flowers solitary or paired, axillary, 6-merous, actinomorphic, heteromorphic, distylous; pedicel 5–13 m. Floral tube 4–5 mm, turbinate, 12-ribbed, thick walled, densely grayish white strigose; sepals

short, ca. 1/4 as long as floral tube; epicalyx segments equaling sepals or ca. 1/2 as long. Petals 6, white or pale pink, obovate to suborbicular, 3–5 mm. Stamens 12, scarcely biserial, 6 exserted in short-styled thrum flowers, all included in long-styled pin flowers. Ovary vestigially 3- or 4-loculed, appearing 1-loculed with free central placentation at maturity; ovules ascending on short placenta; style long-exserted in pin flowers, included in thrum flowers; stigma capitate. Capsules dry, circumscissile, obovoid, ca. 6 mm, slightly exserted at maturity. Seeds ca. 20, irregularly obpyramidal, not winged, 2–3 mm.  $2n = 32$ .

Tropical sandy shores, inlets in mangrove forests. S Taiwan [E Africa west across Indian Ocean to Marshall Islands in Pacific Ocean, north to Japan (Ryukyu Islands)].

**6. PEPLIS** Linnaeus, Sp. Pl. 1: 332. 1753.葶艾属 *bi ai shu*

Qin Haining (覃海宁); Shirley Graham

Herbs, annual, decumbent or creeping, adventitiously rooting at nodes, glabrous. Stem  $\pm$  4-angled. Leaves opposite or alternate, sessile. Flowers solitary or infrequently paired, sessile or subsessile, 6-merous, actinomorphic. Floral tube broadly campanulate, broader than long, thinly membranous, 8–12-veined; sepals short; epicalyx segments linear, long. Petals 6 or absent, pale, small, caducous. Stamens (2–)6, deeply inserted. Ovary sessile,  $\pm$  globose, incompletely 2-loculed; style short; stigma capitate. Capsule dry, thin walled, splitting irregularly. Seeds numerous, obovoid, convex-concave, small.

One to three species, arguably distinct from *Lythrum*: mainly in Europe; one species in China.

**1. *Peplis alternifolia*** M. Bieberstein, Fl. Taur.-Caucas. 3: 277. 1819.

葶艾 *bi ai**Lythrum volgense* D. A. Webb.

Herbs, delicate, erect or decumbent, to 12 cm, spreading.

Leaves alternate, linear or narrowly spatulate, 3–14  $\times$  0.3–3 mm, apex mucronate or slightly obtuse. Flowers 6-merous; floral tube 1–1.5 mm; epicalyx segments linear, shorter than to as long as sepals. Stamens 2, inserted at base of calyx tube. Seeds to 1 mm.  $2n = 10$ .

Highlands. Xinjiang [C Asia; Europe].

**7. PUNICA** Linnaeus, Sp. Pl. 1: 472. 1753.石榴属 *shi liu shu*

Qin Haining (覃海宁); Shirley Graham

Shrubs or small trees; branches often terminating as spines. Leaves opposite or subopposite, sometimes crowded on short lateral shoots, simple, entire, stipulate. Flowers solitary, terminal or 1–5 in axillary or terminal clusters, actinomorphic, bisexual. Floral tube thick, leathery, adnate to ovary and produced above it; sepals thick, valvate, persistent. Petals showy, red [or white], strongly crumpled. Stamens numerous, covering inner surface of floral tube from rim to ovary. Ovary inferior, multiloculed; style exerted; stigma capitate. Fruit berrylike, with leathery rind, retaining a crown of sepals. Seeds many, with translucent, juicy sarcotesta; cotyledons spirally rolled.

Two species: one endemic to the Indian Ocean island of Socotra; one of uncertain native origin, probably from C and SW Asia, now widespread in cultivation.

**1. *Punica granatum*** Linnaeus, Sp. Pl. 1: 472. 1753.

石榴 *shi liu*

Shrubs or small trees, 2–3 m tall, glabrous. Branches and branchlets 4-angled, becoming terete with age, often terminating as indurate spines. Petiole 2–10 mm; leaf blade adaxially shiny, lanceolate, elliptic-oblongate, or oblong, 2–9  $\times$  1–2 cm, base attenuate, apex obtuse or mucronate. Floral tube red-orange or pale yellow, campanulate-urceolate, 2–3  $\times$  1–1.5 cm; sepals 5–9, erect, deltate. Petals 5–9, bright red-orange [or white], obovate, 1.5–3  $\times$  1–2 cm, apex rounded or obtuse. Stamens numerous, included to exerted. Ovary 8–13-loculed, in 2

or 3 superposed layers, lower locules with axile placentation, upper ones with apparent parietal placentation. Fruit globose, leathery berries, variable in color, red to yellow-green or red-brown, 5–12 cm in diam., crowned by persistent sepals, irregularly dehiscent. Seeds obpyramidal within juicy sarcotestal layer, ruby-red, pink, or yellowish white. Fl. Mar–Jul.  $2n = 16, 18$ .

Widely cultivated in China, and naturalized in W China [widespread in cultivation].

*Punica granatum* is grown for its showy flowers and edible fruit (pomegranate). It was probably introduced to China from C Asia or Europe during the Han dynasty (207 BCE to 220 CE).

**8. ROTALA** Linnaeus, Mant. Pl. 2: 143, 175. 1771.节节菜属 *jie jie cai shu*

Qin Haining (覃海宁); Shirley Graham

Herbs, annual or perennial, aquatic, amphibious, or terrestrial, often anthocyanic with age. Stems glabrous, simple or branched, commonly 4-angled or 4-winged. Leaves decussate or whorled, sessile or subsessile; bracts of inflorescences like foliage leaves or smaller and different in shape. Flowers actinomorphic, monomorphic [or dimorphic], (3 or)4(–)6-merous, solitary, sessile or shortly pedicellate, in axils of bracts on main stem, on spikelike lateral branchlets, or in terminal spikes. Floral tube campanulate or urceolate, generally globose in fruit; bracteoles 2, at base of floral tube; sepals 3–6, ca. 1/3 length of floral tube or less, deltate; epicalyx alternating with sepals or absent. Petals 3–6, pink-purple to whitish. Stamens 1–6, opposite the sepals. Ovary 2–4-loculed; style long

or short; stigma capitate, rarely more massive, discoid. Capsule finely transversely striate (10 × magnification), hyaline, septicidally dehiscent, 2–4-valved. Seeds numerous, brown or reddish brown, ovoid to ellipsoidal, concave-convex, less than 1 mm.

About 46 species: tropical and temperate regions of the world; ten species (one endemic, one naturalized) in China.

An additional species, *Rotala hippuris* Makino (Bot. Mag. (Tokyo) 12: 81. 1898), a popular aquarium plant considered endemic to Japan, is found in ornamental ponds in Taiwan. It was reported (Liu et al., Man. Taiwan Vasc. Pl. 3: 241. 2000) from ponds at Taoyuan, Taiwan. Whether it is native, naturalized, or cultivated there was not stated.

See also Cook, A revision of the genus *Rotala* (Lythraceae) (Boissiera 29: 1–156. 1979).

- 1a. Leaves whorled.
- 2a. Flowers in terminal racemes, pedicellate; petals present; stamens 4; aerial leaves 3–12-whorled, submerged leaves more numerous ..... 1. *R. wallichii*
- 2b. Flowers solitary, axillary, sessile; petals absent; stamens (1 or)2 or 3(or 4); aerial and submerged leaves 3–5[–8]-whorled ..... 2. *R. mexicana*
- 1b. Leaves decussate.
- 3a. Stipulelike outgrowths present at nodes; sepals 6 ..... 3. *R. hexandra*
- 3b. Stipulelike outgrowths absent at nodes; sepals 3–5.
- 4a. Flowers in 1 or more densely flowered terminal spikes; stigma massive, discoid; foliage leaves obovate-elliptic to orbicular or elliptic ..... 4. *R. rotundifolia*
- 4b. Flowers in axillary spikes (lateral branchlets) or sessile in bracts on main stem; stigma capitate to punctiform; foliage leaves various.
- 5a. Leaf margin translucent to opaque white cartilaginous; capsules 2-valved ..... 5. *R. indica*
- 5b. Leaf margin green, membranous; capsules 3- or 4-valved.
- 6a. Stems broadly 4-winged, wings running to or onto leaves; bracts of inflorescence distinctly smaller than foliage leaves; flowers in axillary spikes or less often sessile on main stem.
- 7a. Stem wings running onto the leaves; flowers in axillary spikes; sepals 4; epicalyx segments between sepals absent ..... 6. *R. cordata*
- 7b. Stem wings running to the leaves; flowers in axillary spikes or sessile on main stem; sepals 5; epicalyx segments between sepals setiform, ca. 1/2 as long as floral tube or longer ..... 7. *R. densiflora*
- 6b. Stems terete or 4-angled, not distinctly winged; bracts of inflorescence like foliage leaves; flowers sessile on main stem.
- 8a. Stamens 5; capsule 3-valved, well exerted from floral tube, red at apex ..... 8. *R. rosea*
- 8b. Stamens 4; capsule 4-valved, included in or slightly exerted from floral tube, golden brown.
- 9a. Leaves oblanceolate, narrowly oblanceolate, or elliptic, apex obtuse; capsule slightly exerted from floral tube ..... 9. *R. ramosior*
- 9b. Leaves obovate-oblong, apex acute or subacute; capsule included in floral tube .... 10. *R. taiwaniana*

**1. *Rotala wallichii*** (J. D. Hooker) Koehne, Bot. Jahrb. Syst. 1: 154. 1880.

瓦氏节节菜 wa shi jie jie cai

*Hydrolythrum wallichii* J. D. Hooker in Bentham & J. D. Hooker, Gen. Pl. 1: 777. 1867; *Ammannia myriophylloides* Dunn; *A. wallichii* (J. D. Hooker) S. Kurz.

Herbs, perennial, to 30 cm, aquatic with emergent inflorescence, amphibious, or terrestrial. Stem solitary, rarely branched, slender. Leaves whorled; aerial leaves 3–12-whorled, linear to oblong, apex obtuse or 2-cleft; submerged leaves typically more numerous, filiform, distinctly longer than aerial leaves, 1.5–2.5 cm, apex 2-cleft. Bracts much reduced in inflorescence, oblong or ovate, 2–3 mm. Flowers 5–8-whorled per node, shortly pedicellate in a bracteate raceme; bracteoles short, less than 1/2 length of floral tube. Floral tube 4-merous, campanulate, translucent, ca. 1.5 mm; sepals 4; epicalyx absent. Petals 4, showy, light red or pink, orbicular, longer than floral tube. Stamens 4; anthers reaching margin of floral tube. Ovary globose, ca. 1 mm in diam.; style included, shorter than ovary. Capsules globose,

ca. 1 mm in diam., 2-valved. Seeds ca. 0.7 mm. Fl. and fr. autumn and winter.

Ponds, wet places. Guangdong, Taiwan (Pingdong) [India, Indonesia, Malaysia, Myanmar, Thailand, Vietnam].

**2. *Rotala mexicana*** Chamisso & Schlechtendal, Linnaea 5: 567. 1830.

轮叶节节菜 lun ye jie jie cai

*Ammannia mexicana* (Chamisso & Schlechtendal) Bailon; *Hypobrichia spruceana* Bentham; *Rotala mexicana* var. *spruceana* (Bentham) Koehne; *R. pusilla* Tulasne; *R. verticillaris* Linnaeus var. *spruceana* (Bentham) Hiern.

Herbs, annual, aquatic, amphibious, or terrestrial. Stem 3–10 cm, creeping, floating, or erect and ascending, branching. Leaves 3–5(–8)-whorled; aerial leaves narrowly lanceolate to broadly linear [or ovate], 5–10 × 1.5–2 mm, base narrow, apex truncate and often 2-cleft; submerged leaves linear, to 15 × 0.5 mm. Flowers solitary, sessile, axillary; bracteoles linear, ca. as long as floral tube. Floral tube (3 or)4(or 5)-merous, campanu-

late, translucent, ca. 0.5 mm; sepals (3 or)4(or 5); epicalyx absent. Petals absent. Stamens (1 or)2 or 3(or 4), included. Ovary subglobose; style included, much shorter than ovary. Capsule ca. 1 mm in diam., (2 or)3-valved. Seeds ca. 0.3 mm. Fl. Sep–Dec.

Common in paddy fields and wet places. Henan, Jiangsu, Shanxi, Taiwan (Xinzhu), Zhejiang [tropics and warm-temperate regions of the world].

**3. *Rotala hexandra*** Wallich ex Koehne, Bot. Jahrb. Syst. 1: 167. 1880.

六蕊节节菜 liu rui jie jie cai

*Rotala kainantensis* Masamune.

Herbs, annual, amphibious, to 40 cm. Stem ultimately erect, distinctly 4-winged. Leaves decussate, lanceolate to oblong, 1–3 cm, base cuneate to cordate or auriculate, apex obtuse. Bracts like foliage leaves; stipular growths present on nodes near leaf bases, to 2 mm. Flowers solitary, shortly pedicellate, axillary. Floral tube 6-merous, campanulate, ca. 2 mm, distinctly ribbed; sepals 6; epicalyx absent; bracteoles linear, less than 1/2 as long as floral tube. Petals 6, ca. 1 mm, surpassing sepals. Stamens 6, nearly free from tube at base of ovary; anthers exerted. Ovary globose, 4-loculed; style exerted. Capsule subglobose, ca. 1.5 mm in diam., slightly exerted, possibly irregularly dehiscent. Seeds 0.6–1 mm. Fl. and fr. Jul–Dec.

Hainan [Indonesia, Myanmar, Philippines].

**4. *Rotala rotundifolia*** (Buchanan-Hamilton ex Roxburgh) Koehne, Bot. Jahrb. Syst. 1: 175. 1880.

圆叶节节菜 yuan ye jie jie cai

*Ammannia rotundifolia* Buchanan-Hamilton ex Roxburgh, Fl. Ind. 1: 446. 1820; *A. subspicata* Benth.

Herbs, perennial or possibly annual, to 30 cm. Stem creeping or floating, red-tinged; internodes of basal stem portion usually much longer than subtending leaves. Leaves decussate, obovate-elliptic to orbicular or elliptic, 5–13 × 3.5–15 mm, base obtuse, apex obtuse. Bracts distinctly smaller than foliage leaves, ca. 3 × 1.5 mm, ca. equal to floral tube. Flowers in 1–8 terminal, emergent spikes; spikes 1–4(–8) cm, lax in fruit; bracteoles slightly shorter than sepals, scarious. Floral tube 4-merous, campanulate, 1–1.5 mm; sepals 4; epicalyx absent. Petals 4, bright rose, surpassing sepals. Stamens 4; anthers reaching margin of floral tube. Ovary pyriform to globose; style included, shorter than ovary; stigma discoid, ca. 0.3 mm in diam. Capsules globose, ca. 1.5 mm in diam., 4-valved. Seeds ca. 0.5 mm. Fl. and fr. Nov–Jun.  $2n = 16^*$ ,  $2n = 28$ ,  $30$ .

Marshes, streamsides, paddy fields, mountains; below 2700 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangxi, Shandong, Sichuan, Taiwan, Yunnan, Zhejiang [Bangladesh, Bhutan, India, Japan, Laos, Myanmar, Nepal, Thailand, Vietnam].

**5. *Rotala indica*** (Willdenow) Koehne, Bot. Jahrb. Syst. 1: 172. 1880.

节节菜 jie jie cai

*Peplis indica* Willdenow, Sp. Pl. 2: 244. 1799; *Ameletia indica* (Willdenow) Candolle; *A. uliginosa* Miquel; *Rotala densiflora* (Roth) Koehne var. *formosana* Hayata; *R. elatinomorpha* Makino; *R. indica* var. *koreana* Nakai; *R. indica* var. *uliginosa* (Miquel) Koehne; *R. koreana* (Nakai) Mori; *R. uliginosa* (Miquel) Nakai.

Herbs, annual, terrestrial or amphibious, to ca. 40 cm. Stem creeping and branched at base, ascending, or erect, terete to weakly 4-angled. Leaves decussate, obovate-elliptic or obovate-oblong, 5–17 × 3–8 mm, base cuneate, margin translucent to opaque, white cartilaginous, apex obtuse. Bracts like foliage leaves or distinctly smaller on axillary spikes. Flowers in axillary spikes or sessile in bracts on main stem; bracteoles linear, reaching sepals or longer. Floral tube 4-merous, pink-red at anthesis, narrowly to broadly campanulate, 1.5–2.5 mm, 4-angled; sepals 4, lanceolate-deltate; epicalyx absent. Petals 4, pink, minute to ca. 1/2 as long as sepals. Stamens 4; anthers reaching sinus of sepals. Ovary ellipsoidal; style ca. 1/2 as long as ovary, slightly exerted. Capsule ellipsoidal, ca. 1 mm in diam., slightly exerted, 2-valved. Seeds ca. 0.4 mm. Fl. Sep–Oct, fr. Oct–Apr.  $2n = 32^*$ .

Wet places, paddy fields. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Bhutan, Cambodia, India, Indonesia, Japan, Korea, Laos, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam; C Asia; introduced in rice fields in Africa (Congo), Europe (Italy, Portugal), and North America (United States)].

The species is closely associated with rice cultivation. There are unbranched plants with flowers sessile at nodes of the main stem that do not form lateral spikelike inflorescences. Cook (1979) found that although the unbranched form was sometimes genetically fixed, in many geographically scattered populations it was not fixed but ecologically induced as a result of crowded growing conditions.

**6. *Rotala cordata*** Koehne, Bot. Jahrb. Syst. 1: 172. 1880.

异叶节节菜 yi ye jie jie cai

*Rotala diversifolia* Koehne.

Herbs, annual, terrestrial or amphibious, 8–30 cm. Stem branched, 4-winged; wings white, broad, extending into margins of leaves and bracts. Leaves decussate, narrowly oblong to lanceolate, 8–25 × 3–8 mm, base broad, cordate, clasping, apex obtuse. Bracts lanceolate to oblong, smaller on lateral inflorescences, 4–6 mm × 1.5–2 mm. Flowers solitary, subsessile, in bracts of axillary spikes; bracteoles minute, at base of floral tube, scarious. Floral tube 4-merous, broadly campanulate, 1–2 mm; sepals 4, pink-tinged, deltate, ca. 1/3 as long as floral tube, acuminate; epicalyx absent. Petals 4, obovate. Stamens 4, anthers reaching margin of floral tube. Ovary globose; style exerted. Capsules globose, ca. 1.5 mm in diam., 3-valved. Seeds ca. 0.5 mm. Fl. Nov.

Wet places by water. Guangxi, Hainan [NE India (Darjeeling), Laos, Thailand, Vietnam].

**7. *Rotala densiflora*** (Roth) Koehne, Bot. Jahrb. Syst. 1: 164. 1880.

密花节节菜 mi hua jie jie cai

*Ammannia densiflora* Roth in Roemer & Schultes, Syst. Veg. 3: 304. 1818; *Rotala densiflora* subsp. *uliginosa* (Roth) Koehne; *Sellowia uliginosa* Roth.

Herbs, annual, terrestrial or amphibious, 7–10[–40] cm. Stem usually creeping, sparsely to densely branched, 4-winged, wings not running into leaves. Leaves decussate, often alternate toward stem apex, narrowly elliptic, linear-lanceolate, oblong, or ovate, [2–]12–30 × 1.5–5 mm, base cordate to obtuse, apex obtuse, acute, or acuminate. Bracts of stem and lower branches like foliage leaves; bracts of axillary branchlets much smaller and broadly ovate, clasping. Flowers solitary in axils on main stem or in axillary spikes; bracteoles pink, lanceolate, equaling to surpassing floral tube. Floral tube (4 or)5-merous, campanulate, 1–2 mm; sepals (3–)5; epicalyx segments present between sepals, setiform, ca. 1/2 as long as longer than sepals. Petals (4 or)5, bright pink or white, equal to or surpassing sepals, persistent. Stamens (3–)5; anthers reaching margin of floral tube. Ovary globose; style shorter than ovary, slightly exerted. Capsules subglobose, ca. 1.5 mm in diam., included, 3-valved. Seeds ca. 0.5 mm. Fl. and fr. Aug.

Wet places. Guangdong, Jiangsu [India, Indonesia (Kalimantan), Nepal, Pakistan, Sri Lanka; C Asia, Australia].

The habit varies considerably depending on whether the flowers are sessile at nodes of the main stem or develop in the axils of lateral branchlets. If branchlets occur, the stem leaves are much larger than the bracts of the branchlets.

**8. *Rotala rosea*** (Poiret) C. D. K. Cook ex H. Hara, Enum. Fl. Pl. Nepal 2: 173. 1979.

五蕊节节菜 wu rui jie jie cai

*Ammannia rosea* Poiret, Encycl., Suppl. 1: 329. 1810; *A. leptopetala* Blume; *A. littorea* Miquel; *A. pentandra* Roxburgh; *Rotala leptopetala* (Blume) Koehne; *R. littorea* (Miquel) Nakai; *R. pentandra* (Roxburgh) Blatter & Hallberg.

Herbs, annual, terrestrial or amphibious, 8–30 cm. Stems ascending or erect, mostly unbranched. Leaves decussate, linear-lanceolate to lanceolate-oblong, 7–30 × 3–5 mm, base obtuse [to cuneate], apex obtuse to retuse. Bracts similar to foliage leaves, longer than flowers. Flowers 5-merous, solitary, sessile, axillary on main stem and branches; bracteoles linear, slightly shorter than floral tube. Floral tube campanulate, 1–1.5 mm; sepals (4 or)5, very short, ca. 0.25 mm, apex acuminate; epicalyx segments setiform, equaling sepals. Petals (absent to)5, ca. 0.25 mm, not persistent. Stamens 5; anthers reaching margin of floral tube. Ovary globose; shorter than ovary. Capsules globose, ca. 2 mm in diam., well exerted from floral tube, apex red, 3-valved.

Seeds ca. 0.3 mm. Fl. and fr. Aug–Oct in temperate regions, throughout year in tropical regions.

Paddy fields, wet places; lowlands. Fujian, Guangxi, Guizhou, Hainan, Jiangsu, Yunnan; naturalized in Taiwan (Nantou) [Bangladesh, Indonesia, Myanmar, Malaysia, Philippines, Thailand, Vietnam].

**9. *Rotala ramosior*** (Linnaeus) Koehne in Martius, Fl. Bras. 13(2): 194. 1877.

美洲节节菜 mei zhou jie jie cai

*Ammannia ramosior* Linnaeus, Sp. Pl. 1: 120. 1753; *A. monoflora* Blanco.

Herbs, annual, terrestrial or amphibious, to 20[–55] cm. Stem erect or ascending, usually branched, weakly 4-angled. Leaves decussate, oblanceolate, narrowly oblanceolate, or elliptic, 1–2.5[–5] × 0.5[–1] cm, base attenuate, apex obtuse. Bracts like foliage leaves. Flowers 4-merous, solitary, sessile, axillary on main stem and branches; bracteoles 1–2.5 mm, less than 1/2 as long as floral tube [or exceeding floral tube]. Floral tube green, tinged with red, narrowly campanulate to subglobose, 2–5 mm; sepals 4, shallowly deltate; epicalyx segments apiculate to deltate, ca. as long as or longer than sepals. Petals absent to 4, pale pink, minute to equaling sepals, caducous. Stamens 4; anthers included. Ovary globose; style shorter than ovary. Capsules globose, 2–3 mm in diam., (3 or)4-valved, slightly exerted from floral tube. Seeds ca. 0.5 mm. Fl. Jul–Sep, fr. Aug–Oct.  $2n = 16, 32$ .

Recently naturalized in paddy fields. Taiwan [native to North America].

**10. *Rotala taiwaniana*** Y. C. Liu & F. Y. Lu, Quart. J. Chin. For. 12(4): 86. 1979.

台湾节节菜 tai wan jie jie cai

Herbs, annual, terrestrial or amphibious, 15–20 cm. Stem procumbent at base; branches ascending, weakly 4-angled. Leaves decussate, obovate-oblong, 1.8–2.6 × 0.2–0.4 cm, base attenuate, apex acute or subacute. Bracts narrowly lanceolate, 6–7 mm. Flowers 4-merous, solitary, sessile, axillary on main stem and branches; bracteoles undescribed. Floral tube tubular-campanulate, ca. 3 mm; sepals 4, narrowly deltate; epicalyx segments deltate, ca. 1/2 as long as sepals. Petals 4, whitish, equaling sepals. Stamens 4; anthers included. Ovary obovoid; style ca. 0.4 mm. Capsules ovoid, tuberculate, included in floral tube. Seeds semioval, pale brown. Fl. undescribed, fr. Dec.

- Drained paddy fields, wet places. E Taiwan (Hualian).

This species is known only from the type (*F. Y. Lu & C. H. Ou 5511*, holotype NCUF, isotype TPCA).

## 9. SONNERATIA Linnaeus f., Suppl. Pl. 38, 252. 1782, nom. cons.

海桑属 hai sang shu

Qin Haining (覃海宁); Shirley Graham, Michael G. Gilbert

*Blatti* Adanson.

Trees, evergreen, glabrous, columnar or spreading, not buttressed, surrounded by pencil-like pneumatophores arising from long,

shallowly buried, horizontal roots. Leaves simple, opposite, borne in one plane, entire, leathery, apex often with a minute hydathode forming a thick mucro. Flowers 1–3 clustered at apex of ultimate, pendulous branchlets, actinomorphic, 4–8-merous, opening at night. Floral tube shallowly campanulate, at fruit maturity persistent, partly surrounding fruit or expanded and saucer-shaped with fruit fully exposed; sepals 4–8, adaxially green or red, thick, leathery. Petals red or white, lanceolate-linear, caducous, vestigial, or absent. Stamens numerous; filaments red or white; anthers reniform. Ovary superior to partly inferior, depressed, 10–20-carpellate. Fruit globose, berrylike, leathery, indehiscent, crowned by style base. Seeds numerous, embedded in foul-smelling pulp, irregularly angular or falcate; seed coat thickened, roughened, somewhat corky.  $2n = 24$ .

Nine species (including three natural hybrid species): mangrove communities from E Africa to Indo-Malesia, Australia, New Guinea, and the W Pacific islands; six species (one endemic, one introduced) in China.

Hybridization among species is reportedly common, although molecular studies on Chinese populations of *Sonneratia*  $\times$  *gulgai* and *S.*  $\times$  *hainanensis* concluded that these species exist only as repeatedly produced  $F_1$  hybrids. No evidence of  $F_2$  backcrossing or intercrossing among the hybrids led to the conclusion that *S.*  $\times$  *gulgai* and *S.*  $\times$  *hainanensis* should not be considered true hybrid species (see Zhou et al., Molec. Phylogen. Evol. 35: 595–601. 2005).

- 1a. Leaves narrowly elliptic to lanceolate, gradually tapering toward apex; calyx lobes 4(–6); stigma peltate, to 7 mm in diam., initially cone-shaped, spreading with age; petals absent; stamens white ..... 1. *S. apetala*
- 1b. Leaves elliptic to broadly ovate, oblong, obovate, or suborbicular; calyx lobes 5–8; stigma capitate, mostly up to 3 mm in diam.; petals present or absent; stamens red, white, or red and white.
  - 2a. Floral tubes flattened, saucer-shaped in mature fruit; mature flower buds and fruit wider than subtending persistent floral tube, mature fruit typically more than 4 cm in diam.; leaves broadly elliptic or oblong, base rounded, attenuate to petiole, apex rounded with minute mucro; petals and stamens red; sepals adaxially green or sometimes red-streaked ..... 2. *S. caseolaris*
  - 2b. Floral tubes campanulate and partially enclosing mature fruit; mature flower buds and fruit narrower than floral tube, mature fruit typically less than 4 cm in diam.; leaves various; petals and stamens white or red; sepals adaxially strongly tinged red.
    - 3a. Floral tubes finely verruculose, dull, 6-ribbed; leaves broadly ovate to suborbicular, 4–10  $\times$  3–9 cm, base rounded or subcordate, apex rounded, without thick mucro; petals mostly absent, rarely vestigial, white; staminal filaments white ..... 3. *S. ovata*
    - 3b. Floral tubes smooth, often shiny, sometimes 6-ribbed; leaves elliptic, suborbicular, ovate, or obovate, 5–11  $\times$  2.5–8 cm, base rounded or attenuate, apex rounded with or without thick, recurved mucro; petals present, white or red; staminal filaments white or red.
      - 4a. Leaves broadly elliptic or suborbicular, rarely broadly ovate, 6.5–8  $\times$  6–8 cm; petals and staminal filaments white ..... 4. *S.  $\times$ hainanensis*
      - 4b. Leaves elliptic to ovate or obovate, 5–11  $\times$  4–8 cm; petals and staminal filaments white or red.
        - 5a. Petals white, presence and number variable; staminal filaments white, sometimes pink at base; leaves adaxially pale, whitish when dry; seeds falcate ..... 5. *S. alba*
        - 5b. Petals red, always present; staminal filaments red; leaves adaxially dull green; seeds irregularly angular ..... 6. *S.  $\times$ gulgai*

**1. *Sonneratia apetala*** Buchanan-Hamilton in Symes, Embassy Ava, 477. 1800.

无瓣海桑 wu ban hai sang

Columnar trees to 15(–20) m tall. Pneumatophores to 1.5 m; ultimate branchlets pendulous. Petiole 5–10 mm; leaf blade narrowly elliptic to lanceolate, gradually tapering toward apex, 5–13  $\times$  1.5–4 cm, base attenuate, apex obtuse. Flowers 4(–6)-merous in a 3–7-flowered cyme. Floral tube 1.5–2.5 cm at anthesis, smooth; sepals green, slightly curving around base of fruit. Petals absent. Staminal filaments white. Stigma peltate, to 7 mm wide. Fruit 1–2  $\times$  2–2.5 cm in diam. Seeds typically U-shaped or falcate, 8–9.5 mm. Fl. May–Dec, fr. Aug–Apr.

Introduced as a fast-growing tree for reforestation of mangrove communities. Guangdong (Shenzhen), Hainan [native to Bangladesh, India, Myanmar, and Sri Lanka].

This species was introduced to China in the 1980s from Sundarbans, Bangladesh, initially to Hainan and subsequently to Shenzhen.

**2. *Sonneratia caseolaris*** (Linnaeus) Engler in Engler & Prantl, Nat. Pflanzenfam., Nachtr. 1: 261. 1897.

海桑 hai sang

*Rhizophora caseolaris* Linnaeus, Herb. Amboin. 13. 1754; *Sonneratia acida* Linnaeus f.; *S. evenia* Blume; *S. neglecta* Blume; *S. obovata* Blume; *S. ovalis* Korthals.

Trees, columnar, 5–20 m tall. Pneumatophores ca. 1 m, thin, pointed; ultimate branchlets pendulous, 4-angled. Petiole 2–9 mm; leaf blade elliptic to broadly elliptic or broadly oblong, 4–11  $\times$  2–7 cm, midrib prominent with inconspicuous lateral veins, base rounded, narrowly to broadly attenuate on petiole, apex rounded with minute, thick mucro. Flowers 5–7-merous. Floral tube 2.5–3 cm at anthesis, smooth, flattened in mature fruit; sepals adaxially green, often red-streaked, 1.4–1.9 cm. Petals red, linear, 1.8–2.9 cm  $\times$  1–3 mm. Staminal filaments red, sometimes white distally. Fruit [2–]4–5 cm in diam., broader than floral tube. Seeds irregularly angular, ca. 7 mm. Fl. winter, fr. spring–summer.  $2n = 22, 24$ .

Coastal mangrove communities, tidal creeks, in muddy soil. Hainan [Cambodia, India, Indonesia, Malaysia, N New Guinea, Sri Lanka, Thailand, Vietnam; N Australia, Pacific islands].

**3. *Sonneratia ovata*** Backer, Bull. Jard. Bot. Buitenzorg, sér. 3, 2: 329. 1920.

桑海桑 sang hai sang

Trees, columnar, to 10(–20) m tall. Pneumatophores ca. 20 cm, thin, pointed. Petiole 5–6 mm; leaf blade broadly ovate to suborbicular, 4–10 × 3–9 cm, base broadly rounded or subcordate, apex rounded, mucro absent. Flowers mostly 6-merous. Floral tube 2–3 cm at anthesis, finely verruculose, 6-ribbed, ribs decurrent along stipitate base; sepals adaxially strongly tinged red, ca. 1.5 cm, often appressed against mature fruit. Petals generally absent, rarely vestigial, white, linear. Staminal filaments white. Fruit 3–4.5 cm in diam., ca. equal to width of floral tube. Fl. Mar–Oct, fr. Apr–Oct.  $2n = 22, 24$ .

Landward edge of mangrove swamps in brackish water and muddy soil. Hainan [Indonesia, Malaysia, New Guinea, Thailand, Vietnam].

**4. *Sonneratia* × *hainanensis*** W. C. Ko et al., Acta Phytotax. Sin. 23: 311. 1985, pro sp.

海南海桑 hai nan hai sang

Trees, 4–8 m tall. Petiole 2–7 mm; leaf blade broadly elliptic or suborbicular, rarely broadly ovate, 6.5–8 × 6–8 cm, base shortly attenuate on petiole, apex rounded or obtuse. Flowers 6-merous. Floral tube 1.2–1.5 cm, smooth, 6-ribbed; sepals adaxially red, erect to spreading, ca. 1.5 cm, partially enclosing mature fruit. Petals white, lanceolate, 2.5–3 cm × 3–4 mm. Staminal filaments white. Fruit 5–6 cm in diam., ca. equal to width of floral tube. Seeds numerous.  $2n = 22^*$ .

- Mangrove communities. NE Hainan (Wenchang).

This taxon is the natural hybrid *Sonneratia alba* × *S. ovata*.

**5. *Sonneratia alba*** Smith in Rees, Cycl. 33: *Sonneratia* no. 2. 1816.

杯萼海桑 bei e hai sang

*Chiratia leucantha* Montrouzier; *Sonneratia iriomotensis* Masamune; *S. mossambicensis* Klotzch.

Trees, 3–15(–30) m tall, spreading, with broad, rather lax crown. Pneumatophores 30(–100) cm, thick, blunt. Petiole 5–15 mm; leaf blade adaxially pale, elliptic to ovate or obovate, 5–11 × 4–8 cm, base rounded, apex broad, rounded, with broad recurved mucro. Flowers 5–8-merous. Floral tube shiny, 3–3.5 cm at anthesis, smooth, often 6-ribbed; sepals adaxially strongly tinged red, 1.3–2 cm, ± erect at anthesis, recurved in fruit. Petals white, linear, 1.3–2 cm × ca. 1 mm, or variably semipetalous to absent. Staminal filaments white. Fruit 2–4.5 cm in diam., ca. equal to width of floral tube. Seeds falcate. Fl. common Oct–Nov, fr. ca. Feb.  $2n = 22, 24$ .

Shallow parts of calm seas and seashores, tidal creeks. Hainan [India (including Andaman Islands), Malaysia, Myanmar, Sri Lanka, Thailand, Vietnam; tropical E Africa (including Madagascar), N Australia, W Pacific islands, Seychelles].

**6. *Sonneratia* × *gulgai*** N. C. Duke & B. R. Jackes, Austrobaileya 2: 103. 1984.

拟海桑 ni hai sang

*Sonneratia paracaseolaris* W. C. Ko et al.

Trees 7–10[–25] m tall, spreading, with dense, dark green canopy. Pneumatophores ca. 80 cm, thin, pointed. Petiole 3–5 mm; leaf blade adaxially dull green, obovate, 5–9(–11) × 4–5(–6) cm, base broadly attenuate, apex acute to obtuse. Flowers 5–7-merous. Floral tube smooth, not ribbed; sepals adaxially usually strongly tinged red, 2–2.5 cm, erect at anthesis, erect to partially spreading in fruit. Petals red, linear, 4–5 cm × ca. 2 mm. Staminal filaments red. Fruit 3–5 cm in diam., ca. equal to width of floral tube. Seeds irregularly angular. Fl. Dec and Mar, fr. Mar and Aug.

Mangrove communities, where both *Sonneratia alba* and *S. caseolaris* are present, along lower to middle tidal contours. Hainan [Indonesia (NW Kalimantan), Malaysia; E Australia].

This taxon is the natural hybrid *Sonneratia alba* × *S. caseolaris*.

## 10. WOODFORDIA Salisbury, Parad. Lond. 1(2): t. 42. 1806.

虾子花属 xia zi hua shu

Qin Haining (覃海宁); Shirley Graham

Shrubs or small trees. Stems irregularly branching; branches pendulous. Leaves opposite, sessile or subsessile, pubescent to tomentose and abaxially orange to black glandular punctate. Inflorescences condensed axillary branchlets, rarely flowers solitary. Flowers 6-merous, slightly zygomorphic. Floral tube red-orange, cyathiform, slightly constricted at level of stamen insertion; sepals very short, alternating at sinus with minute, thickened epicalyx segments. Petals red, pink, or white, small. Stamens 12, in two whorls, alternating in length. Ovary ellipsoidal, sessile or shortly stipitate; style thicker than staminal filaments, ultimately long-exserted; stigma punctiform. Capsule thin walled, translucent at maturity, irregularly dehiscent, rarely loculicidally dehiscent. Seeds many, narrowly obpyramidal, small.  $2n = 16$ .

Two species: one in Africa and the Arabian peninsula, one in SE Asia including China.

**1. *Woodfordia fruticosa*** (Linnaeus) Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 40: 56. 1871.

虾子花 xia zi hua

*Lythrum fruticosum* Linnaeus, Syst. Nat., ed. 10, 2: 1045.

1759; *Grislea punctata* Buchanan-Hamilton ex Smith; *L. hunteri* Candolle.

Shrubs, 1–5 m tall. Stems and branches pendulous, long, pubescent when young, becoming glabrous. Leaves lanceolate

or ovate-lanceolate, 3–14 × 1–4 cm, leathery, abaxially sparsely to densely tomentose and orange to black glandular punctate, adaxially glabrous, base rounded to subcordate, apex acuminate. Inflorescences condensed axillary shoots of 1–15 flowers. Floral tube light red, red-orange, or deep red, greenish basally, narrowly cyathiform, 9–15 mm; sepals oblong-ovate or deltate, 2–3 mm; epicalyx segments scarcely present. Petals 6, thin, linear-lanceolate, 1–5 mm, ca. as long as sepals. Stamens 12,

inserted above ovary base, long-exserted. Ovary 2-loculed; ovules 100+. Capsules elongate, elliptic. Seeds reddish brown, ca. 1.5 mm. Fl. Jan–May (mainly Mar–Apr), fr. Apr–May.  $2n = 16$ .

Common in forests and on open slopes. Guangdong, Guangxi, Yunnan [Bhutan, India, Indonesia, Laos, Myanmar, Nepal, Pakistan, Thailand].