

# TAMARICACEAE

怪柳科 cheng liu ke

Yang Qiner (杨亲二)<sup>1</sup>; John Gaskin<sup>2</sup>

Shrubs, subshrubs, or trees. Leaves small, mostly scale-like, alternate, estipulate, usually sessile, mostly with salt-secreting glands. Flowers usually in racemes or panicles, rarely solitary, usually hermaphroditic, regular. Calyx 4- or 5-fid, persistent. Petals 4 or 5, free, deciduous after anthesis or sometimes persistent. Disk inferior, usually thick, nectarylike. Stamens 4, 5, or more numerous, usually free, inserted on disk, rarely united into fascicle at base, or united up to half length into a tube. Anthers 2-thecate, longitudinally dehiscent. Pistil 1, consisting of 2–5 carpels; ovary superior, 1-loculed; placentation parietal, rarely septate, or basal; ovules numerous, rarely few; styles short, usually 2–5, free, sometimes united. Capsule conic, abaxially dehiscent. Seeds numerous, hairy throughout or awned at apex; awns puberulous from base or from middle; endosperm present or absent; embryo orthotropous.

Three genera and ca. 110 species: steppe and desert regions of the Old World; three genera and 32 species (12 endemic) in China.

*Myrtama* has been placed alternatively in *Myricaria*, *Tamarix*, or treated as a separate genus (see Gaskin et al., Ann. Missouri Bot. Gard. 91: 402–410. 2004; Zhang et al., Acta Bot. Boreal.-Occid. Sin. 20: 421–431. 2000).

Zhang Pengyun & Zhang Yaojia. 1990. Tamaricaceae. In: Li Hsiwen, ed., Fl. Reipubl. Popularis Sin. 50(2): 142–177.

- 1a. Dwarf shrubs or subshrubs; flowers solitary on main branch or at apices of shortened lateral branches, with 2 appendages inside petals; seeds hairy throughout, apex awnless, with endosperm ..... 1. *Reaumuria*
- 1b. Larger shrubs or trees; flowers clustered into racemes or spikes, without appendages inside petals; seeds with hairy awns at apex, without endosperm.
  - 2a. Stamens 4 or 5, as many as and ca. as long as petals, equal in length, filaments separate; styles 3 or 4, short; awns at apex of seeds shorter, villous at base; leaves scale-like, very small, 1–7 mm ..... 2. *Tamarix*
  - 2b. Stamens 10, ca. 2 × as long as petals, unequal in length, filaments united into tube at base or in lower half; styles absent; awns at apex of seeds villous only in upper half; leaves compressed-flat, oblong or linear, to 1.5 cm ..... 3. *Myricaria*

## 1. REAUMURIA Linnaeus, Syst. Nat., ed. 10, 2: 1069, 1081, 1374. 1759.

红砂属 hong sha shu

*Hololachna* Ehrenberg.

Subshrubs or shrubs, to 80 cm tall, with numerous zigzag branchlets. Leaves subsessile, scale-like, shortly terete or linear, small, margin entire, often fleshy or leathery, with salt-secreting glands. Flowers solitary on lateral branches or on shortened branchlets, or clustered in lax racemes, hermaphroditic, 5-merous; bracts imbricate, slightly longer or shorter than corolla. Calyx subcampanulate. Petals deciduous or persistent, inside with 2 scale-like appendages in lower half, margin laciniate, serrate, or entire. Stamens 5 to numerous, free or filaments united into 5 fascicles at base, opposite to petals. Ovary orbicular or broadly ellipsoid; styles 2–5. Capsule cartilaginous, 3–5-septical; seeds long brown hairy.

Twelve species: N Africa, Asia, S Europe; four species (one endemic) in China.

- 1a. Leaves compressed-flat, shortly petiolate ..... 4. *R. alternifolia*
- 1b. Leaves subterete, thick, sessile.
  - 2a. Leaves 1–5 mm, shortly terete, scale-like; petals 3–4.5 mm; stamens 7–10; styles 6–8(–12); capsule narrowly ellipsoid ..... 1. *R. soongarica*
  - 2b. Leaves 4–15 mm, sublinear, terete; petals 5–8 mm; stamens 15 or more, often united into 5 fascicles at base; capsule globose, broadly ellipsoid, or oblong.
    - 3a. Bracts enlarged at base, broadly ovate, mucronate; flowers yellow; styles 3; capsule oblong, 3-septical .... 2. *R. trigyna*
    - 3b. Bracts the same shape as leaves, narrowly linear; flowers pink; styles 5; capsule globose or oblong-ovoid, 5-septical ..... 3. *R. kaschgarica*

**1. *Reaumuria soongarica*** (Pallas) Maximowicz, Fl. Tangut. 1: 97. 1889. Petrop. Hist. Acad. 10: 374. 1797; *Hololachna soongarica* (Pallas) Ehrenberg.

红砂 hong sha

*Tamarix soongarica* Pallas, Nova Acta Acad. Sci. Imp.

Shrubs, small, 10–30(–70) cm tall, much branched. Old branches gray-brown; branchlets reddish, usually zigzag, longi-

<sup>1</sup> Institute of Botany, Chinese Academy of Sciences, 20 Nanxincun, Xiangshan, Beijing 100093, People's Republic of China.

<sup>2</sup> USDA-ARS-NPARRL, P.O. Box 463, Sidney, Montana 59270, U.S.A.

tudinally cracked. Leaves often 4–6 clustered on shortened branches, grayish blue, sometimes turning purple-red at anthesis, shortly terete, scale-like, slightly thicker in upper part, 1–5 × 0.5–1 mm, often slightly curved, fleshy, with dotlike salt-secreting glands, apex obtuse. Flowers solitary, axillary (actually at apices of extremely shortened branchlets), or clustered into few flowered racemes in upper part of young branches, sessile, ca. 4 mm in diam.; bracts 3, lanceolate, 0.5–0.7 mm, apex acute. Calyx campanulate, united in lower part, 1.5–2.5 mm; lobes triangular, margin scarious, with dotlike glands. Petals white, tinged reddish, oblong, ca. 4.5 × 2.5 mm, base cuneate, attenuate, apex obtuse, open, reflexed in upper part; inside with 2 appendages in lower half oblanceolate, laminar, apex lacinate, inserted on two lateral sides of midribs of petals. Stamens 6–8(–12), free; filaments dilated at base, subequaling petals. Ovary ellipsoid; styles 3; stigmas narrowly acute. Capsule narrowly ellipsoid or fusiform, or triqueter-conic, 4–6 × ca. 2 mm, 2–3 × exceeding calyx, 3-angled, 3(or 4)-septical, usually 3- or 4-seeded. Seeds oblong, 3–4 mm, black-brown hairy throughout, base attenuate, apex acuminate. Fl. Jul–Aug, fr. Aug–Sep.

Deserts, margins of lowlands. Gansu, Nei Mongol, Ningxia, Qinghai, Xinjiang [Mongolia].

*Reaumuria minfengensis* D. F. Cui & M. J. Zhong (Acta Bot. Bo-real.-Occid. Sin. 19: 552. 1999), described from Xinjiang, is very similar to *R. soongarica* judging from the protologue. However, because we have not seen the type, it must remain a dubious species in the present treatment.

**2. *Reaumuria trigyna*** Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 27: 425. 1881.

黄花红砂 huang hua hong sha

Subshrubs, small, 10–30 cm tall, much branched. Old branches gray-yellow or brown-gray; branchlets slightly spreading, produced from old branches, greenish, slender, smooth. Leaves often 2–5 clustered, semiterete-linear, 5–10(–15) mm, unequal in length, slightly thickening toward upper part, fleshy, base attenuate, apex obtuse, ± arching when dry. Flowers solitary, axillary (mostly at apices of branchlets), 5–7 mm in diam. Pedicels 8–10 mm, slender; bracts ca. 10, broadly ovate, shorter than or ca. same size as calyx, mucronate, imbricate, closely contacting calyx. Sepals united at base, ca. same size as bracts. Petals revolute in bud, yellow, oblong-obovate, slightly oblique, ca. 5 mm, inside with 2 appendages in lower half. Stamens 15, free; filaments subulate. Ovary ovoid-orbicular or obovoid-orbicular; styles 3, rarely 4 or 5, 3–5 mm, longer than ovary, persistent. Capsule oblong, to 1 cm, 3-septical. Fl. unknown.

- Deserts. N Gansu, Nei Mongol, N Ningxia.

**3. *Reaumuria kaschgarica*** Ruprecht, Mém. Acad. Imp. Sci. Saint Pétersbourg, Sér. 7, 14(4): 42. 1869.

五柱红砂 wu zhu hong sha

*Reaumuria kaschgarica* var. *nanschanica* Maximowicz; *R. kaschgarica* var. *przewalskii* Maximowicz.

Dwarf subshrubs, to 20 cm tall, cushionlike, with numerous zigzag slender branches. Old branches gray-brown; branches of current year green, later reddish to reddish brown, produced from old branches, 4–9(–15) cm; flowering branches produced from old branches at first, later from leaf axils of new branches of current year. Leaves slightly compressed, basal ones scale-like, those in upper part becoming longer, linear or subterete, often slightly curved, 4–10 × 0.6–1 mm, fleshy, attenuate toward base, apex obtuse or acutish. Flowers solitary at apices of branchlets, subsessile; bracts few, with same shape as leaves, 3–4 mm, ca. as long as or slightly longer than calyx, surrounding calyx. Sepals slightly united at base, exerted, 3–4 mm, ovate-lanceolate, base dilated, margin membranous, subentire, apex subacuminate. Petals pink, elliptic, 1/3–1/2 longer than calyx, inside with 2 long orbicular appendages. Stamens 15(–18), slightly shorter than or as long as petals; filaments dilated in lower part, margin lacinate or denticulate, base united. Ovary ovoid-orbicular, ca. 3 mm; styles 5; stigmas narrowly acute. Capsule oblong-ovoid, ca. 7 × 3–4 mm, 5-septical. Seeds oblong-ellipsoid, minute, brown hairy throughout. Fl. Jul–Aug.

Salty deserts, steppes, rocky mountain slopes. Gansu, Qinghai, Xinjiang, N Xizang [C Asia].

**4. *Reaumuria alternifolia*** (Labillardière) Britten, J. Bot. 54: 110. 1916.

互叶红砂 hu ye hong sha

*Hypericum alternifolium* Labillardière, Icon. Pl. Syr. 2: 17. 1791.

Dwarf subshrubs, 10–30 cm tall, much branched; branches erect or obliquely ascending. Leaves dense, compressed-flat, not fleshy, those of winter elliptic or lanceolate to sublinear, 0.7–2 cm × 1–3 mm, base attenuate, subsessile, apex acute; those of summer smaller. Flowers terminal, to 1.3 cm in diam.; bracts erect, linear, nearly as long as or slightly longer than calyx, apex apiculate. Calyx 6–7 mm; sepals united in lower 1/4, upper free part ovate-lanceolate, apex acuminate, apiculate. Petals pink, 0.9–1.1 cm, apex truncate, inside with 2 long, scale-like appendages. Filaments dilated in lower part, margin inconspicuously crenate. Capsule shorter than calyx. Seeds long hairy. Fl. May–Jun.

Deserts in mountains. Xinjiang [Afghanistan; SW Asia (Iran, Syria)].

## 2. TAMARIX Linnaeus, Sp. Pl. 1: 270. 1753.

柽柳属 cheng liu shu

Shrubs or trees, much branched. Young branches usually glabrous; two types of branches present: ligneous growing branches, not deciduous in winter vs. green vegetative branchlets, deciduous in winter. Leaves alternate, sessile, amplexicaul or vaginate, small, scale-like, glabrous, rarely hairy, mostly with salt-secreting glands. Flowers in racemes or panicles, blooming in spring;

racemes lateral on growing branches of previous or current year and clustered in terminal panicles, or two types of flowering habits present in some species. Flowers bisexual, rarely unisexual, 4- or 5(or 6)-merous, usually pedicellate; bract 1. Calyx herbaceous or fleshy, 4- or 5-fid; lobes entire or faintly denticulate. Petals as many as calyx lobes, deciduous or persistent after anthesis. Disk variously shaped, mostly 4- or 5-lobed; lobes entire, or apex retuse or even deeply divided. Stamens 4 or 5, opposite to calyx lobes, or numerous, outer series opposite to calyx lobes; filaments often free, inserted between lobes of disk or at apices of lobes; anthers cordate, versatile, 2-thecate, longitudinally dehiscent. Pistil consisting of 3 or 4 carpels; ovary mostly conic, many seeded; placentation basal-parietal; styles 3 or 4; stigmas capitate, short. Capsule conic, abaxially 3-septical. Seeds numerous, minute; apical awns villous.

About 90 species: Africa, Asia, Europe; 18 species (seven endemic) in China.

*Tamarix tenuissima* Nakai (J. Jap. Bot. 14: 292. 1938), described from Japan and Korea, was recorded from Liaoning (Dalian) and said to have ten stamens, but the *Tamarix* plants known in this region all have five stamens, so the identity of the record cannot yet be determined. Further study is required.

- 1a. Leaves reduced, totally amplexicaul and vaginate on branches of current year.
  - 2a. Filaments between disk lobes; flowers usually blooming in summer and autumn, rarely in spring ..... 16. *T. aphylla*
  - 2b. Filaments at apex of disk lobes; flowers blooming only in summer and autumn.
    - 3a. Leaves (nearly all) amplexicaul and vaginate; flowers 4–4.5(–7) mm in diam.; petals deciduous after anthesis; racemes 5–7(–15) cm ..... 17. *T. taklamakanensis*
    - 3b. Leaves amplexicaul and vaginate, but sheaths not totally closed; flowers less than 4 mm in diam.; petals persistent after anthesis; racemes 2–5(–8) cm ..... 18. *T. sachensis*
- 1b. Leaves not amplexicaul, nor vaginate.
  - 4a. Racemes in spring lateral on growing branches of previous year; flowers 4- or 5-merous.
    - 5a. Flowers 4-merous.
      - 6a. Racemes 6–15(–25) cm ..... 1. *T. elongata*
      - 6b. Racemes usually 4–6(–7) cm.
        - 7a. Bracts less than 1/2 as long as pedicels ..... 2. *T. laxa*
        - 7b. Bracts ca. as long as pedicels.
          - 8a. Racemes and short vegetative branches appearing simultaneously from growing branches of previous year; flowers white, less than 3 mm in diam. .... 3. *T. androssowii*
          - 8b. Racemes appearing not simultaneously with vegetative branches; flowers pink, 4(–5) mm in diam. .... 4. *T. gracilis*
      - 5b. Flowers 5-merous.
        - 9a. Flowers mostly 5-merous, but mixed with 4-merous ones on same raceme, blooming only in spring ..... 5. *T. gansuensis*
        - 9b. Flowers all 5-merous, blooming in spring, and also in summer and autumn (blooming 2 or 3 times).
          - 10a. Petals completely open, deciduous after anthesis ..... 6. *T. arceuthoides*
          - 10b. Petals not completely open, persistent at fruiting stage, surrounding base of capsule.
            - 11a. Racemes often 2- or 3-clustered; petals contacting each other, apex incurved, and thus corolla globose ..... 7. *T. hohenackeri*
            - 11b. Racemes usually singular; petals nearly straight and ascending, or slightly open, apex recurved ..... 8. *T. chinensis*
    - 4b. Racemes on branches of current year, forming a panicle; flowers all 5-merous; flowers blooming in summer and autumn.
      - 12a. Flowers blooming in spring, then also in summer and autumn (blooming 2 or 3 times).
        - 13a. Petals completely open, deciduous after anthesis.
          - 14a. Flowers blooming in spring 4-merous (occasionally 5-merous); those blooming in summer and autumn 5-merous, large and completely open, 4(–5) mm in diam.; filaments at apex of disk lobes; capsule 4–7 × 1–2 mm ..... 4. *T. gracilis*
          - 14b. Flowers all 5-merous, small, less than 3 mm in diam.; filaments between disk lobes; capsule less than 3 × 1 mm ..... 6. *T. arceuthoides*
        - 13b. Petals not completely open, persistent in fruit, surrounding base of capsule.
          - 15a. Petals not open, apically often incurved, contacting each other, and thus corolla globose ..... 7. *T. hohenackeri*
          - 15b. Petals slightly open, nearly straight and ascending, apically often recurved, and corolla not globose.
            - 16a. Branches soft, slender, long, pendulous; young branches with deep green leaves, slender, pendulous; leaves on upper branches half adnate, subulate to ovate-lanceolate, apex acuminate, incurved ..... 8. *T. chinensis*

- 16b. Branches rigid, erect or obliquely ascending; young branches often with gray-green leaves; leaves oblong or oblong-lanceolate, apex acuminate, mostly recurved ..... 9. *T. austromongolica*
- 12b. Flowers blooming only in summer or autumn.
- 17a. Young branches and leaves hispid and puberulous ..... 11. *T. hispida*
- 17b. Young branches and leaves glabrous or sparsely papillose.
- 18a. Petals persistent after anthesis.
- 19a. Filaments between disk lobes; petals straight, ascending, contacting each other, corolla cup-shaped ..... 10. *T. ramosissima*
- 19b. Filaments at apex of disk lobes; petals abaxially raised, contacting each other, corolla globose ..... 12. *T. jintaensis*
- 18b. Petals deciduous or partly so.
- 20a. Petals all deciduous; racemes dense, forming a dense panicle; branches also dense ..... 13. *T. leptostachya*
- 20b. Petals partly deciduous; racemes turning outward, forming a spreading panicle; branches also turning outward.
- 21a. Young branches and leaves sparsely papillose; racemes 4–7(–15) cm; flowers dense, ca. 22 within 1 cm ..... 14. *T. karelinii*
- 21b. Branches and leaves not papillose; racemes 3–5 cm; flowers lax, ca. 5 within 1 cm ..... 15. *T. tarimensis*

**1. *Tamarix elongata*** Ledebour, Fl. Altaic. 1: 421. 1829.

长穗怪柳 chang sui cheng liu

Shrubs large, 1–3(–5) m tall. Branches of previous year grayish yellow or grayish brown; vegetative branchlets yellowish green and tinged with gray-blue. Leaves of growing branches spreading toward outside, enlarged in lower part, lanceolate, linear-lanceolate, or linear, 4–9(–10) × (0.3–)1–3 mm, abaxially raised, base broadly cordate, semiamplexicaul, auriculate, apex acuminate or acute; those of vegetative branchlets cordate-lanceolate or lanceolate, semiamplexicaul, shortly decurrent, faintly auriculate, upward attenuate. Flower buds yellowish, to 5 mm, produced from leaf axils of growing branches in autumn. Racemes lateral in branches of previous year, appearing in spring before or when leaves occur, solitary, robust, 6–15(–25) cm, usually ca. 12 cm, 4–8(–15) mm in diam.; peduncles 1–2 cm; bracts linear-lanceolate or broadly linear, 3–6 mm, conspicuously exceeding calyx (including pedicels) or equaling calyx, 0.3–0.7 mm wide, greenish or membranous, apex acuminate, slightly curved toward outside at anthesis, reflexed after anthesis. Pedicels slightly shorter than or ca. as long as calyx. Flowers larger, 4-merous. Calyx deeply campanulate, base slightly united; sepals ovate, margin membranous, dentate, apex obtuse or acute. Petals open and reflexed when flowers in full bloom, pink, ovate-elliptic or oblong-obovate, inequilateral, 2–2.5 × 1–1.3 mm, apex obtuse, immediately deciduous after anthesis. Disk pseudo-terminal, thin, 4-lobed. Stamens 4, rarely 6 or 7, equaling or slightly exceeding petals; filaments dilated at base, gradually transitional to disk lobes; anthers pink, obtuse or with small protrusions at apex. Ovary ovoid-conic, 1.3–2 mm; styles nearly absent; stigmas 3. Capsule reddish or orange-yellow, ovoid-conic, 4–6 × ca. 2 mm. Fl. Apr–May, occasionally in autumn for second time. Flowers blooming in autumn 5-merous.  $2n = 24^*$ .

Salty soils of river valleys, river banks, sand dunes in desert regions. Gansu, Nei Mongol, Ningxia, Qinghai, Xinjiang [Kazakhstan, Mongolia, Russia, Turkmenistan, Uzbekistan].

**2. *Tamarix laxa*** Willdenow, Abh. Königl. Akad. Wiss. Berlin 1812–1813: 82. 1816.

短穗怪柳 duan sui cheng liu

Shrubs, 1.5(–3) m tall. Branchlets straight, short, fragile. Leaves yellow-green, lanceolate or ovate-oblong to rhombic, 1–2 × ca. 0.5 mm, base attenuate and slightly decurrent, margin narrowly membranous, apex acuminate or acute, mucronate. Racemes lateral in old branches of previous year, blooming in early spring, to 4 cm × 5–7(–8) mm, laxly flowered or flowers congested apically and umbel-like, with sparse, brown, oblong scales; bracts brownish or greenish, ovate or narrowly elliptic, less than 1/2 as long as pedicels, margin membranous, cartilaginous in upper half, often incurved, obtuse. Pedicels ca. 2 mm. Flowers 4-merous. Calyx ca. 1 mm; sepals 4, ovate, margin broadly membranous, apex obtuse or acuminate, recurved at fruiting stage, outer 2 carinate. Petals 4, strongly spreading and reflexed, pink, rarely whitish pink, oblong-elliptic to oblong-obovate, ca. 2 mm, deciduous after anthesis. Disk dark red, fleshy, 4-lobed. Stamens 4, equaling or slightly exceeding petals; filaments dilated at base, inserted at apex of disk lobes; anthers red-purple, capitulate or apiculate. Styles 3; stigmas capitate. Capsule 3–4 mm, narrow. Fl. Apr–May, occasionally in autumn on current year's branches for second time. Flowers blooming in autumn 5-merous.  $2n = 24^*$ .

Salty soils of river banks, lake basins, sand dunes in desert regions. Nei Mongol, Ningxia, Qinghai, Shaanxi, Xinjiang [Afghanistan, Kazakhstan, Mongolia, Russia, Turkmenistan; SW Asia (Iran)].

- 1a. Racemes to 4 cm, laxly flowered ..... 2a. var. *laxa*  
 1b. Racemes 0.5–2 cm, apex congested and umbel-like, 3–6-flowered ..... 2b. var. *polystachya*

**2a. *Tamarix laxa* var. *laxa***

短穗怪柳(原变种) duan sui cheng liu (yuan bian zhong)

Racemes long, to 4 cm, laxly flowered.

Salty soils of river banks, lake basins, sand dunes in desert re-

gions. Nei Mongol, Ningxia, Qinghai, Shaanxi, Xinjiang [Afghanistan, Kazakhstan, Mongolia, Russia, Turkmenistan; SW Asia (Iran)].

**2b. *Tamarix laxa* var. *polystachya*** (Ledebour) Bunge, Tent. Gen. Tamaric. 35. 1852.

伞花短穗怪柳 san hua duan sui cheng liu

*Tamarix polystachya* Ledebour, Fl. Ross. 2: 133. 1842.

Racemes short, 0.5–2 cm, congested apically and umbel-like, 3–6-flowered.

Salty soils of river banks, lake basins, sand dunes in desert regions. Nei Mongol, Ningxia, Qinghai, Shaanxi, Xinjiang [Afghanistan, Mongolia, Russia; SW Asia (Iran)].

**3. *Tamarix androssowii*** Litvinov, Sched. Herb. Fl. Ross. 5: 41. 1905.

白花怪柳 bai hua cheng liu

Shrubs or small trees, 2–4(–5) m tall. Growing branches of current year reddish green, straight, more than 1.5 m tall, ligneous; vegetative branchlets ascending from growing branches nearly at right angle. Leaves of growing branches greenish, subamplexicaul, faintly auriculate; those of vegetative branches ovate, base obtuse and decurrent, 2/3 of leaf adnate to stem, margin membranous, apex apiculate. Racemes 2–3(–5) cm × 3–4(–5) mm, solitary or 1–3 clustered, lateral in growing branches of previous year, and vegetative branchlets appearing simultaneously and clustered; peduncles 5–10 mm, with sparse, scale-like bracts; bracts oblong-ovate, 0.7–1 mm, shorter than or ca. as long as pedicels, apex obtuse, slightly incurved. Pedicels 1–1.5 mm. Flowers 4-merous, small, less than 3 mm in diam. Calyx 0.7–1 mm, ca. 1/3 shorter than petals; sepals 4, ovate, margin membranous, denticulate, apex acute, carinate, spreading after anthesis. Petals 4, white or whitish, obovate, 1–1.5 × ca. 0.7 mm, slightly spreading after anthesis, mostly persistent at fruiting stage. Disk purple-red, small, thick, 4-lobed; lobes attenuate upward into base of filaments. Stamens 4; filaments equaling or slightly exceeding petals, base dilated, inserted at apex of disk lobes; anthers purple-red or yellow, apex apiculate. Ovary narrowly conic; styles 3, rarely 4, clavate, short, 1/4–1/3 as long as ovary. Capsule narrowly conic, small, 4–5 × ca. 1 mm; seeds yellow-brown. Fl. Apr–May, occasionally in autumn at apices of new branches. Flowers blooming in autumn 5-merous.

Sandy places, margins of mobile sands in desert regions. Gansu, Nei Mongol, Ningxia, Xinjiang [Mongolia; C Asia].

**4. *Tamarix gracilis*** Willdenow, Abh. Königl. Akad. Wiss. Berlin 1812–1813: 81. 1816.

翠枝怪柳 cui zhi cheng liu

Shrubs, 1.5–3(–4) m tall. Branches gray-green, robust. Leaves of growing branches lanceolate, larger, more than 4 mm, amplexicaul; those of vegetative branches lanceolate to ovate-lanceolate or ovate-orbicular, unequal in size, 1–4 mm, base decurrent, amplexicaul, auriculate, imbricate, apex acuminate. Racemes in spring lateral in branches of previous year, 1–4(–5) cm × ca. 9 mm; those in summer 2–5(–7) cm, at apices of growing branches of current year forming a lax panicle. Flow-

ers in spring 4-merous, those in summer 5-merous, 4- and 5-merous flowers mixed in same inflorescence in transitional period from spring to summer. Pedicels 0.5–1.5(–2) mm. Corolla 4(–5) mm in diam., those in spring slightly larger than those in summer; bracts of spring flowers spatulate, 1.5–2 mm, subequaling or slightly exceeding pedicels, abaxially slightly raised, base dilated, apex acuminate. Sepals triangular-ovate, ca. 1 mm, base slightly united, outer 2 larger, green, margin membranous, denticulate, apex obtuse, rarely acutish. Petals ovate-orbicular or elliptic, 2.5–3 mm, completely open and recurved when flowers in full bloom, pink or purplish, deciduous after anthesis. Disk purple-red, thick, 4- or 5-lobed. Stamens 4 or 5; filaments equaling or ca. 1/2 exceeding petals, broadly linear, gradually dilated toward base, inserted at apex of disk lobes, occasionally between disk lobes; anthers purple or pink, apex apiculate, obtuse, or retuse. Styles 3, 1/5–1/2 as long as ovary. Capsule large, 4–7 × ca. 2 mm. Fl. May–Aug.

Banks of river and lakes, sandy places, sand dunes in deserts and dry steppe regions. Gansu, Nei Mongol, Qinghai, Xinjiang [Kazakhstan, Mongolia, Russia, Tajikistan, Turkmenistan; SW Asia (Turkey)].

**5. *Tamarix gansuensis*** H. Z. Zhang ex P. Y. Zhang & M. T. Liu, Acta Bot. Boreal.-Occid. Sin. 8: 259. 1988.

甘肃怪柳 gan su cheng liu

Shrubs, 2–3(–4) m tall. Branches lax. Leaves lanceolate, 2–6 × 0.5–1 mm, base semiamplexicaul, auriculate. Racemes lateral in branches of previous year, solitary, 6–8(–12) cm × ca. 5 mm; bracts ovate-lanceolate or broadly lanceolate, 1.5–2 mm, thinly membranous, apex acuminate. Pedicels 1.2–2 mm. Flowers mostly 5-merous, mixed with numerous 4-merous flowers, rarely mostly 4-merous mixed with numerous 5-merous flowers. Calyx slightly united at base; sepals ovate-orbicular, ca. 1 × 0.5 mm, margin membranous, apex acuminate. Petals purplish or pink, ovate-oblong, ca. 2 × 1–1.5 mm, apex obtuse, deciduous after anthesis. Disk purple-brown, 5-lobed; lobes obtuse or retuse. Stamens 5; filaments to 3 mm, mostly exceeding corolla, slender, inserted between disk lobes, or at apex of disk lobes; disk of 4-merous flowers 4-lobed. Filaments inserted at apex of disk lobes. Ovary narrowly conic; styles 3; stigmas capitate. Capsule conic; seeds 25–30. Fl. Apr–May.

• River banks, lakesides, margins of sand dunes in desert regions. Gansu, Nei Mongol, Qinghai, Xinjiang.

**6. *Tamarix arceuthoides*** Bunge, Beitr. Fl. Russl. 119. 1852.

密花怪柳 mi hua cheng liu

Shrubs or small trees, 2–4(–5) m tall. Branchlets spreading, dense; branches of current year mostly ascending. Leaves of vegetative branches subamplexicaul, ovate, ovate-lanceolate, or nearly triangular-ovate, 1–2 × ca. 0.6 mm, base slightly decurrent, margin often cartilaginous, apex long acuminate or acute; those of growing branches semiamplexicaul, narrowly ovate, base subrounded or decurrent, faintly auriculate, apex shortly acuminate. Racemes mostly in branches of current year, 3–6(–9) cm × 2.5–4 mm; flowers small and dense, usually clustered in fascicles, sometimes in lax terminal panicles, appearing in early summer and lasting to September, sometimes (in mountain areas) racemes appearing in spring on branches of previous

year; bracts ovate-subulate or linear-lanceolate, 1–1.5 mm, equaling or exceeding calyx, apex acuminate. Pedicels 0.5–0.7 mm, shorter than or subequaling calyx. Calyx 5-fid; sepals ovate-triangular, 0.5–0.7 × ca. 0.3 mm, ca. 1/2 shorter than petals, margin membranous, subentire, apex slightly obtuse; outer 2 more obtuse than inner 3, tightly enveloping ovary after anthesis. Petals 5, completely open, white or pink to purple, obovate or elliptic, 1–1.7(–2) × ca. 0.5 mm, deciduous after anthesis. Disk often purple-red, 5-fid; lobes often retuse at apex or deeply subdivided into 10 lobules. Stamens 5; filaments long, often 1.2–2 × exceeding petals, slender, usually inserted between disk lobes; anthers small, apex obtuse or sometimes mucronate. Ovary narrowly conic, 0.7–1.3 mm; styles 3, short, 1/3–1/2 as long as ovary. Capsule small, ca. 3 mm, narrow. Fl. May–Sep.  $2n = 24^*$ .

River banks in Gobi Desert. Gansu, Xinjiang [Afghanistan, Mongolia, Pakistan; C and SW Asia].

**7. *Tamarix hohenackeri*** Bunge, Tent. Gen. Tamaric. 44. 1852.

多花怪柳 duo hua cheng liu

Shrubs or small trees, 1–3(–6) m tall. Branches of previous year dark red-purple. Leaves of vegetative branches linear-lanceolate or ovate-lanceolate, small, 2–3.5 mm, base semiamplexicaul, margin scarios, slightly dentate, apex long acuminate or acute, mucronate, incurved; those of growing branches nearly amplexicaul, ovate-lanceolate, base enlarged, decurrent, apex acuminate. Flowers blooming from spring to summer (to autumn). When blooming in spring, racemes lateral in growing branches of previous year, mostly several clustered, 1.5–9 cm × 3–5(–8) mm, without peduncles or peduncles ca. 2 cm; when blooming in summer, racemes terminal in young branches of current year, clustered in lax or dense short panicles; bracts linear-oblong, linear, or obovate-oblong, slightly carinate, 1–2 mm, slightly exceeding pedicels, or equaling calyx, rarely slightly longer, often thinly membranous, apex acute. Pedicels equaling or slightly exceeding calyx. Flowers 5-merous. Sepals ovate-orbicular, ca. 1 mm, margin membranous, dentate, apex obtuse; inner 3 slightly more obtuse than outer 2. Petals rose or pink, ovate or ovate-elliptic, 1.5–2(–2.5) × 0.7–1 mm, ca. 2 × as long as calyx, carinate at least in lower half, apex subrounded, often contacting each other and thus corolla globose, persistent in fruit. Disk purple-red, thick, 5-fid; lobes obtuse or retuse at apex. Stamens 5, equaling or ca. 1/3 exceeding petals; filaments gradually narrowing and slender, inserted between disk lobes; anthers cordate, apex obtuse or mucronate. Styles 3, clavate-spatulate, ca. 1/2 or rarely 1/3–3/5 as long as ovary. Capsule 4–5 mm, ca. 4 × exceeding calyx. Fl. May to early Jun, autumn.  $2n = 24^*$ .

Forests on river banks in deserts, salty soils of river banks, lakesides in deserts. Gansu, Nei Mongol, Ningxia, Qinghai, Xinjiang [Mongolia; C and SW Asia].

Baum (Gen. *Tamarix*, 44. 1978) considered this species to be conspecific with *Tamarix smyrnensis* Bunge.

**8. *Tamarix chinensis*** Loureiro, Fl. Cochinch. 1: 182. 1790.

怪柳 cheng liu

*Tamarix juniperina* Bunge.

Trees or shrubs, 3–6(–8) m tall. Branchlets dense, often pendulous, red-purple, slender. Leaves green, those of vegetative branches slightly spreading, oblong-lanceolate or narrowly ovate, 1.5–1.8 mm, abaxially carinate at base, often thinly membranous, apex acute; those of vegetative branches in upper part subulate or ovate-lanceolate, 1–3 mm, abaxially carinate, base attenuate, apex acuminate, incurved. Flowers blooming 2 or 3 times each year. When blooming in spring, racemes lateral in pendulous, ligneous, growing branchlets of previous year, 3–6 cm × 5–7 mm, few flowered, lax, and pendulous; peduncles short or nearly absent, with or without bracts; bracts linear-oblong or oblong, equaling or slightly exceeding pedicels, apex acuminate; pedicels shorter than calyx, slender; flowers 5-merous; sepals 5, narrowly ovate, 0.8–1.3 mm, slightly shorter than petals, outer 2 carinate abaxially, margin slightly entire, apex mucronate; petals 5, pink, usually ovate-elliptic or elliptic-obovate, rarely obovate, ca. 2 mm, slightly exceeding calyx, persistent in fruit; disk purple-red, fleshy, 5-fid; lobes obtuse or retuse at apex; stamens 5, exceeding petals; filaments inserted between disk lobes; ovary conic; styles 3, clavate, ca. 1/2 as long as ovary. Capsule conic. When blooming in summer and autumn, racemes 3–5 cm, smaller than those in spring, forming terminal large panicles on branches of current year; flowers 5-merous, slightly smaller than those in spring, dense; bracts green, linear to linear-conic or narrowly triangular, smaller and narrower than those of spring flowers, longer than pedicels, abaxially raised at base, base attenuate, margin entire, apex acuminate; calyx triangular-ovate; petals pink, straight or slightly oblique outward, much exceeding calyx; disk 5-lobed, or subdivided into 10 lobules; stamens 5, equaling or ca. 2 × as long as petals; anthers obtuse; filaments inserted between disk lobes; styles clavate, 2/5–3/4 as long as ovary. Fl. Apr–Sep.  $2n = 24^*$ .

• Plains along rivers, seashores, moist salty places, sandy places. Anhui, Hebei, Henan, Jiangsu, Liaoning, Shandong; also widely cultivated in S and SW provinces.

**9. *Tamarix austromongolica*** Nakai, J. Jap. Bot. 14: 291. 1938.

甘蒙怪柳 gan meng cheng liu

*Tamarix chinensis* Loureiro subsp. *austromongolica* (Nakai) S. Q. Zhou.

Shrubs or trees, 1.5–4(–6) m tall. Young branches straight, not pendulous, hard in texture. Leaves gray-green, 2–3 mm, base turgid; those in lower part of growing branches broadly ovate, apex acute; those in upper part ovate-lanceolate, apex acute. Flowers blooming in spring, summer, and autumn. When blooming in spring, racemes lateral in ligneous branches of previous year; inflorescence axis straight, ascending, 3–4 × ca. 0.5 cm, hard in texture, densely flowered; peduncles short or absent; bracts whitish or purple-green, linear-lanceolate; pedicels very short. When blooming in summer and autumn, racemes smaller than those in spring, forming terminal large panicles on young branches of current year, mostly straight and ascending; flowers 5-merous; sepals 5, green, ovate, margin membranous and pellucid, apex acute; petals 5, purplish red, obovate-oblong, apex reflexed, persistent after anthesis; disk purple-red, 5-lobed; lobes emarginate at apex; stamens 5, exerted; filaments fili-

form, inserted between disk lobes; anthers red; ovary triquetero-ovoid, red; styles ca. as long as ovary; stigmas 3, recurved. Capsule narrowly conic, ca. 5 mm. Fl. May–Sep.

• Salty riversides and plains, salty sandy fields. Gansu, Hebei, Henan, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi.

**10. *Tamarix ramosissima*** Ledebour, Fl. Altaic. 1: 424. 1829.

多枝怪柳 duo zhi cheng liu

Shrubs or small trees, 1–3(–6) m tall. Old branches dark gray; growing branches of current year ascending, reddish or orange-yellow, long. Leaves of growing branches lanceolate, semiamplexicaul, slightly decurrent; those of vegetative branches broadly ovate-orbicular or triangular-cordate, 2–5 mm, base decurrent, nearly amplexicaul, apex acute. Racemes terminal on branches of current year, clustered into terminal panicles, (0.5–)3–5(–8) cm × 3–5 mm; peduncles 2–10 mm; bracts lanceolate, ovate-lanceolate, linear-subulate, or ovate-oblong, 1.5–2(–2.8) mm, equaling or exceeding calyx, apex acuminate. Pedicels 0.5–0.7 mm, shorter than or ca. as long as calyx. Flowers 5-merous. Calyx 0.5–1 mm; sepals broadly elliptic-ovate or ovate, apex acuminate or obtuse; inner 3 wider than outer 2, 0.5–0.7 × 0.3–0.5 mm, margin narrowly membranous, irregularly dentate, not carinate. Petals pink or purple, obovate to broadly elliptic-obovate, 1–1.7 × 0.7–1 mm, ca. 1/3 longer than calyx, apex emarginate, ascending, contacting each other and forming a cup-shaped corolla, persistent in fruit. Disk 5-lobed; lobes emarginate at apex. Stamens 5, equaling or ca. 1.5 × exceeding corolla; filaments not dilated at base, inserted between disk lobes; anthers obtuse or with obtuse protrusions at apex. Ovary conic, triquetar; styles 3, clavate, 1/4–1/3 as long as ovary. Capsule triquetar, conic, 3–5 mm, 3–4 × as long as calyx. Fl. May–Sep.  $2n = 24^*$ .

Riversides, river valleys, sandy or clayey salty plains, sand dunes. Gansu, Nei Mongol, Ningxia, Qinghai, Xinjiang, W Xizang [Afghanistan, Mongolia; C and SW Asia, E Europe].

**11. *Tamarix hispida*** Willdenow, Abh. Königl. Akad. Wiss. Berlin 1812–1813: 77. 1816.

刚毛怪柳 gang mao cheng liu

Shrubs or small trees, 1.5–4(–6) m tall. Young branches reddish or brown-gray, densely hispid throughout. Leaves of growing branches grayish yellow, ovate-lanceolate or narrowly lanceolate, abaxially raised, base broad and obtuse, auriculate, semiamplexicaul, apex acuminate; those of vegetative branches broadly cordate-ovate to broadly ovate-lanceolate, 0.8–2.2 × 0.5–0.7 mm, densely puberulous, abaxially raised, base auriculate, semiamplexicaul, apex acuminate, mucronate, incurved. Racemes 2–7(–17) cm × 3–5 mm, terminal on branches of current year in summer and autumn, clustered into terminal, large, dense panicles; bracts narrowly triangular-lanceolate or, narrowly lanceolate, 1–1.5 mm, subequaling or sometimes slightly exceeding calyx, abaxially raised at base, margin entire, apex acuminate. Pedicels 0.5–0.7 mm, shorter than or nearly as long as calyx. Flowers 5-merous. Calyx 5-fid, ca. 1/3 as long as petals; sepals ovate-orbicular, 0.7–1 × ca. 0.5 mm, margin membranous, nearly pellucid, denticulate, apex slightly obtuse

or acutish; outer 2 faintly carinate abaxially, apex acute. Petals 5, spreading, reflexed in upper part, purple-red or red, usually obovate to oblong-elliptic, 1.5–2 × 0.6–1 mm, caducous. Disk 5-lobed. Stamens 5, opposite to sepals, exerted, inserted at apex of disk lobes; filaments thickened at base, with nectary; anthers cordate, apex obtuse, often apiculate. Ovary narrowly bottle-shaped; styles 3, ca. 1/3 as long as ovary; stigmas very short. Capsule red to purple, conic, 4–5(–7) × ca. 1 mm, 4–5 × as long as calyx, ca. 15-seeded. Fl. Jul–Sep.  $2n = 24^*$ .

Riversides, lake basins, salty meadows and sand dunes in desert regions. Gansu, Nei Mongol, Ningxia, Qinghai, Xinjiang [Afghanistan, Mongolia; C and SW Asia].

**12. *Tamarix jintaensis*** P. Y. Zhang & M. T. Liu, Acta Bot. Boreal.-Occid. Sin. 8: 260. 1988 [*“jintaenaia”*].

金塔怪柳 jin ta cheng liu

Shrubs, 1–3(–4) m tall. Branchlets of current year deep red or deep purple-red. Leaves of vegetative branches lanceolate or ovate-lanceolate to triangular-ovate, ca. 1.5 mm, base decurrent, semiamplexicaul, apex acuminate to acute, incurved. Racemes terminal, 3–5 cm × ca. 5 mm; bracts broadly ovate, exceeding pedicels. Flowers 5-merous. Sepals 5, deep green, short, ca. 1 mm, less than 1/2 as long as petals, margin membranous, semi-pellucid. Corolla semispreading; petals 5, deep red or purple-red, oblong-ovate, ca. 1.5 mm, persistent. Disk purple-red, thick, fleshy, 5-lobed. Stamens 5; filaments filiform, inserted at apex of disk lobes; anthers cordate, apex often apiculate. Ovary bottle-shaped; styles 3. Capsule triangular-conic, ca. 0.6 mm; seeds black-purple, ca. 0.5 mm. Fl. Sep–Oct.

• Riversides, lakesides, sandy lowlands. Gansu (Jinta).

**13. *Tamarix leptostachya*** Bunge, Beitr. Fl. Russl. 117. 1852.

细穗怪柳 xi sui cheng liu

Shrubs, 1–3(–6) m tall. Growing branches of current year gray-purple or red. Leaves of growing branches narrowly ovate or ovate-lanceolate, base slightly decurrent, semiamplexicaul, apex acute; those of vegetative branches narrowly ovate or ovate-lanceolate, 1–4(–6) × 0.5–3 mm, base decurrent, apex acute. Racemes long, slender, 4–12 cm × 2–3 mm, terminal on branches of current year, clustered into terminal, dense, large, globose or ovoid panicles; peduncles 0.5–2.5 cm; bracts ascending, subulate, ca. 1.2 mm, equaling pedicels or subequaling calyx, apex acuminate. Pedicels equaling or slightly exceeding calyx. Flowers 5-merous, small. Calyx 0.7–0.9 mm; sepals ovate, 0.5–0.6 × ca. 0.4 mm, margin narrowly membranous, apex acuminate. Petals purplish red or pink, obovate, ca. 1.5 × 0.5 mm, ca. 2 × as long as calyx, apex obtuse, recurved, caducous. Disk 5-lobed, occasionally subdivided into 10 lobules. Stamens 5, opposite to sepals; filaments exerted, long, ca. 2 × as long as petals, base dilated, inserted at apex of disk lobes, or if disk lobes subdivided into lobules, then stamens inserted between lobes; anthers cordate, not apiculate. Ovary conic; styles 3. Capsule small, ca. 1.8 × 0.5 mm, ca. 2 × exceeding calyx. Fl. Jun–Jul.  $2n = 24$ .

Salty soils, riversides, lakesides, lowlands in desert regions. Gansu, Nei Mongol, Ningxia, Qinghai, Xinjiang [Mongolia; C Asia].

**14. *Tamarix karelinii*** Bunge, Mém. Acad. Imp. Sci. St.-Petersbourg Divers Savans 7: 294. 1851.

盐地怪柳 yan di cheng liu

*Tamarix hispida* Willdenow var. *karelinii* (Bunge) B. R. Baum.

Trees or large shrubs, 2–4(–7) m tall. Branches smooth, occasionally stiffly hairy, inconspicuously papillose. Leaves ovate, 1–1.5 × 0.5–1 mm, base obtuse, slightly decurrent, nearly semiamplexicaul, apex acute, incurved. Racemes 4–7(–15) cm × 2–4 mm, terminal on branches of current year, clustered into spreading, large panicles; bracts lanceolate, subulate, 1.7–2 mm, subequaling or exceeding calyx, base enlarged, apex acute. Pedicels 0.5–0.7 mm. Calyx ca. 1 mm; sepals 5, suborbicular, to 0.8 mm, margin membranous, semipellucid, subentire, apex obtuse. Petals deep red or purple-red, obovate-elliptic, ca. 1.5 mm, more than 2 × as long as calyx, abaxially raised, apex obtuse, incurved, partly deciduous after anthesis. Disk small, thinly membranous, 5-lobed. Stamens 5, exerted from corolla or often equaling corolla, with nectary at base of filaments; anthers mucronate. Styles 3, oblong-clavate. Capsule 5–6 mm, 5–6 × exceeding calyx. Fl. Jun–Sep.  $2n = 24^*$ .

Salty soils, margins of sand dunes, riversides, lakesides. Gansu, Nei Mongol, Qinghai, Xinjiang [Afghanistan, Mongolia, Russia; SW Asia (Iran)].

**15. *Tamarix tarimensis*** P. Y. Zhang & M. T. Liu, Acta Bot. Boreal.-Occid. Sin. 8: 263. 1988.

塔里木怪柳 ta li mu cheng liu

Shrubs, 2–4(–5) m tall. Leaves of vegetative branches sparse, not vaginate; those in upper part triangular-ovate or ovate-lanceolate, apex mucronate or acuminate; those in lower part ovate, ca. 1 mm, base decurrent, apex acute. Racemes 3–5 cm, laxly flowered, terminal on branches of current year, clustered into lax panicles; bracts ovate-lanceolate, subulate, exceeding pedicels but shorter than calyx, base decurrent, apex acuminate. Flowers 5-merous. Calyx 5-fid; sepals yellowish green, ovate, carinate, margin membranous. Petals semispreading or spreading, purplish red or pink, obovate-oblong, 1.5–2 mm, apex slightly incurved, mostly persistent after anthesis. Disk 5-lobed. Stamens 5; filaments inserted at apex of disk lobes; anthers red. Capsule purple-red or black-purple, ca. 4 mm, 3-septidial; seeds small, 0.4–0.5 mm. Fl. Jun–Sep.

• Margins of mobile sand dunes, sand dunes, sandy places at riversides. Xinjiang.

**16. *Tamarix aphylla*** (Linnaeus) H. Karsten, Deutschl. Fl. 641. 1882.

无叶怪柳 wu ye cheng liu

*Thuya aphylla* Linnaeus, Cent. I Pl. 32. 1755.

Trees or large shrubs. Young branches smooth. Leaves sessile, vaginate, ca. 2 mm, base amplexicaul, apex acute. Racemes 3–6 cm × 4–5 mm; when flowering in spring, racemes solitary; flowers blooming more commonly in summer, then racemes on new branches; flowers subsessile; bracts triangular or broadly triangular, exceeding pedicels, base slightly amplexicaul, apex acuminate. Pedicels much shorter than calyx.

Calyx 5-fid, ca. 1.5 mm, margin entire, apex obtuse; outer 2 lobes slightly smaller, broadly ovate or broadly elliptic, abaxially slightly carinate; inner 3 larger, broadly elliptic or suborbicular. Petals 5, elliptic, oblong, or ovate-elliptic, 2–2.3 mm, deciduous, sometimes 1 or 2 persistent in fruit. Disk 5-lobed; lobes emarginate at apex or deeply divided into 10 lobules. Stamens 5; filaments inserted between disk lobes. Fl. Sep–Oct and rarely in spring.  $2n = 24^*$ .

Cultivated. Taiwan [native to N Africa and SW Asia].

**17. *Tamarix taklamakanensis*** M. T. Liu, Acta Phytotax. Sin. 17(3): 120. 1979.

沙生怪柳 sha sheng cheng liu

Large shrubs or small trees, 3–5(–7) m tall. Branches often pendulous, slender. Leaves reduced, those in vegetative branches almost all amplexicaul, vaginate, slightly oblique outward, gray-green in spring, mostly yellow-green in summer, broadly triangular, only ca. 1 mm; those in growing branches ovate-lanceolate, base broad, semiamplexicaul, slightly decurrent, apex acuminate. Racemes at apices of growing branches in summer and autumn, laxly flowered, 5–7(–15) cm × 6–8 mm, clustered into terminal, large panicles; bracts broadly triangular-ovate, ca. 0.9 mm, ca. 1/2 as long as pedicels, base broad, semiamplexicaul. Pedicels ca. 2 mm. Flowers 5-merous. Sepals 5, yellowish green, ovate, shorter than pedicels. Petals 5, slightly reflexed, pink, obovate or narrowly obovate, 3–4 × 2–2.5 mm, deciduous after anthesis. Disk 5-lobed. Stamens 5; filaments straight, base slightly enlarged, inserted at apex of disk lobes; anthers cordate, apex obtuse. Styles 3, united at base; stigmas capitate, short. Capsule yellow, conic, 5–7 × ca. 2.5 mm, 3-septidial, 15–20-seeded; seeds black-purple, large, 2–2.5(–3) × ca. 0.7 mm. Fl. Jul–Sep(–Oct).  $2n = 24^*$ .

• Sand dunes. Gansu, Xinjiang.

**18. *Tamarix sachensis*** P. Y. Zhang & M. T. Liu, Acta Bot. Boreal.-Occid. Sin. 8: 262. 1988.

莎车怪柳 sha che cheng liu

Shrubs, 2–3(–4) m tall. Branchlets of current year brown or deep brown. Leaves on vegetative branchlets reduced, totally adnate to branches, gray-green, amplexicaul, vaginate, apex acute. Racemes at apices of branches of current year, clustered into terminal, lax, small panicles 2–5(–8) cm × 4–6 mm; bracts ovate-lanceolate, ca. 1.5 mm, subequaling or exceeding sepals, base amplexicaul, decurrent, slightly auriculate, apex acuminate. Pedicels very short, less than 1 mm. Sepals greenish, ovate-orbicular, longer than pedicels, margin membranous, semipellucid, apex acute. Petals open or half open, purplish or purple-red, obovate or narrowly elliptic, slightly oblique, 1.7–2 × 1.3–1.5 mm, ca. 2 × as long as calyx, persistent after anthesis. Disk 5-lobed. Stamens 5, slightly longer than corolla and ovary; filaments inserted at apex of disk lobes; anthers cordate, apex with conspicuous protrusions. Styles 3, 1/4–1/3 as long as ovary. Capsule 3-septidial, ca. 5 mm; seeds black-purple, 0.5–0.6 mm. Fl. Jul–Sep.

• Salty sandy places along margins of mobile sand dunes. Xinjiang.



### 3. MYRICARIA Desvaux, Ann. Sci. Nat. (Paris) 4: 349. 1825.

水柏枝属 shui bai zhi shu

*Myrtama* Ovczinnikov & Kinzikaëva; *Tamaricaria* Qaiser & Ali.

Shrubs, rarely subshrubs, deciduous, erect or prostrate. Leaves simple, alternate, sessile, usually densely arranged on green young branches of current year, margin entire. Flowers bisexual, shortly petiolate, clustered into terminal or lateral racemes or panicles; bracts broadly or narrowly membranous along margin. Calyx 5-fid; lobes often membranous along margin. Petals 5, pink, white, or purplish red, obovate, narrowly elliptic, or obovate-oblong, apex obtuse or emarginate, often incurved, usually persistent in fruit. Stamens 10: 5 long and 5 short; filaments ca. 1/2 or 2/3 united, rarely free; anthers 2-theate, longitudinally dehiscent, yellow. Pistils consisting of 3 carpels; ovary 3-angled; placentation basal; ovules numerous; stigmas capitate, 3-lobed. Capsule 3-septical. Seeds numerous, apex awned; awns white villous throughout or on more than half; endosperm absent.

About 13 species: Asia, Europe; ten species (four endemic) in China.

Because *Myricaria laxa* W. W. Smith (Notes Roy. Bot. Gard. Edinburgh 14: 123. 1923) was only very briefly described, its identity cannot yet be determined; it requires further study.

Many Chinese specimens in United States herbaria are determined as *Myricaria dahurica* (Willdenow) Ehrenberg (Linnaea 2: 278. 1827). However, further study is needed to ascertain if these identifications are correct and if this species actually occurs in China.

1a. Shrubs prostrate or decumbent.

2a. Branches prostrate; racemes 1–4-flowered ..... 1. *M. prostrata*

2b. Old branches decumbent, young ones erect; racemes many flowered ..... 2. *M. rosea*

1b. Shrubs erect.

3a. Leaves lax, usually 5–15 × more than 2 mm.

4a. Leaves lanceolate or oblong-lanceolate, base attenuate; filaments only united at base ..... 3. *M. elegans*

4b. Leaves broadly ovate, cordate, base dilated; filaments ca. 1/2 or 1/3 united.

5a. Leaves basally deeply cordate, amplexicaul; racemes usually terminal ..... 4. *M. pulcherrima*

5b. Leaves basally not cordate, nor amplexicaul; racemes usually lateral ..... 5. *M. platyphylla*

3b. Leaves dense, usually 1.5–5 × less than 2 mm.

6a. Sepals 1.5–2 mm; petals 3–4.5 mm; bracts lanceolate, 3–4 mm ..... 6. *M. wardii*

6b. Sepals 2–4 mm; petals 4–6 mm; bracts broadly ovate, elliptic, or ovate-lanceolate.

7a. Inflorescences lateral, or several clustered and axillary, base with numerous persistent imbricate scales ..... 7. *M. squamosa*

7b. Inflorescences usually terminal, or both terminal and axillary, base with or without imbricate scales.

8a. Inflorescences of two types; those in spring racemose, lateral, and those in summer and autumn paniculate, terminal, lax ..... 8. *M. paniculata*

8b. Inflorescences of one type, racemose, terminal.

9a. Racemes dense, nearly spikelike; bracts broadly ovate ..... 9. *M. bracteata*

9b. Racemes lax; bracts lanceolate to ovate-lanceolate ..... 10. *M. laxiflora*

**1. *Myricaria prostrata*** J. D. Hooker & Thomson in Bentham & J. D. Hooker, Gen. Pl. 1: 161. 1862.

匍匐水柏枝 pu fu shui bai zhi

*Myricaria germanica* (Linnaeus) Desvaux var. *prostrata* Dyer; *M. hedinii* Paulsen.

Shrubs prostrate, dwarf, 5–14 cm tall. Branches of previous year red-brown, slender, often rooting. Leaves clustered in branches of current year, oblong, narrowly elliptic, or ovate, 2–5 × 1–1.5 mm, margin narrowly membranous, apex obtuse. Racemes globose, lateral on branches of previous year, dense, often consisting of 1–3, rarely 4 flowers. Pedicels very short, 1–2 mm, with ovate or oblong imbricate scales at base; bracts ovate or elliptic, 3–5 × 1.5–3 mm, longer than pedicels, margin narrowly membranous, apex obtuse. Sepals ovate-lanceolate or oblong, 3–4 × 1–2 mm, margin narrowly membranous, apex obtuse. Petals purplish to pink, obovate or obovate-oblong, 4–6 × 2–4 mm; filaments ca. 2/3 united, rarely nearly free and united only at base. Ovary ovoid; stigmas capitate, sessile. Cap-

sule conic, 8–10 mm. Seeds oblong, ca. 1.5 mm, apex awned; awns stout, white villous throughout. Fl. and fr. Jun–Aug.

Sandy places in river valleys in high mountains, sandy places at lakesides, rocky mountain slopes, streamsides; 4000–5200 m. Gansu, Qinghai, Xinjiang, Xizang [India, Pakistan; C Asia].

**2. *Myricaria rosea*** W. W. Smith, Notes Roy. Bot. Gard. Edinburgh 10: 52. 1917.

卧生水柏枝 wo sheng shui bai zhi

Shrubs recumbent, ca. 1 m tall, much branched. Old branches recumbent, red-brown or purple-brown; young branches erect or oblique, ascending, greenish. Leaves lanceolate, linear-lanceolate, or ovate-lanceolate, falcately curved, 5–8(–15) × 1–2 mm, base slightly narrow, margin narrowly membranous, apex obtuse or acute; green branchlets often in leaf axils; leaves on such branchlets smaller. Racemes terminal, clustered into spikes; inflorescence branches yellow-green or purplish red, often exceeding leafy branches, robust, with sparse linear-lanceolate or ovate-lanceolate bracts in lower part;

bracts yellow-green, leaflike, 7–15 × ca. 2 mm; bracts under flowers lanceolate, 6–10 × ca. 2 mm, equaling or slightly exceeding petals. Pedicels ca. 2 mm. Sepals linear-lanceolate or ovate-lanceolate, 2–4(–6) × 1–1.5 mm, slightly shorter than petals, margin narrowly membranous, apex acute. Petals pink or purple-red, narrowly obovate or narrowly elliptic, 5–7 × 2–4 mm, withering and persistent. Filaments ca. 1/2 or 2/3 united, shorter than petals. Ovary conic, 3–6 mm. Capsule narrowly conic, 8–10(–15) mm, 3-septical. Seeds awned; awns white villous nearly throughout. Fl. May–Jul, fr. Jul–Aug.

Rocky mountain slopes, riversides in high mountains; 2600–4600 m. SE Xizang, NW Yunnan [Bhutan, India, Nepal].

**3. *Myricaria elegans*** Royle, Ill. Bot. Himal. Mts. 214. 1839.

秀丽水柏枝 xiu li shui bai zhi

Shrubs or small trees, ca. 5 m tall. Old branches red-brown or dark purple, branches of current year green or red-brown. Leaves usually in green branchlets of current year, sessile, narrowly elliptic, elliptic-lanceolate, or ovate-lanceolate, relatively large, 5–15 × 2–3 mm, base narrow, margin narrowly membranous, apex obtuse or acute. Racemes usually lateral, rarely terminal; bracts ovate or ovate-lanceolate, sometimes narrowly lanceolate, (3–)4–5 × 2–3 mm, margin broadly membranous, apex acuminate. Pedicels 2–3 mm. Sepals ovate-lanceolate, triangular-ovate, or ovate, (1–)2 × ca. 1 mm, ± united at base, margin broadly membranous, apex obtuse. Petals white, pink or purple-red, obovate, obovate-elliptic, or elliptic, or narrowly obovate or obovate-lanceolate, to 5–6 × 2–3 mm, base gradually narrowing, apex obtuse. Stamens slightly shorter than petals; filaments united at base; anthers oblong. Ovary conic, ca. 5 mm; stigmas capitate, sessile, 3-lobed. Capsule narrowly conic, ca. 8 mm. Seeds oblong, ca. 1 mm, apex awned; awns white villous throughout. Fl. Jun–Jul, fr. Aug–Sep.

River banks, riversides, sandy places at lakesides; 3000–4300 m. SW Xinjiang, NW and SE Xizang [India, Pakistan].

- 1a. Racemes usually lateral; bracts ovate or ovate-lanceolate, 4–5 mm; sepals ca. 2 mm; petals 5–6 mm ..... 3a. var. *elegans*  
 1b. Racemes usually terminal; bracts narrowly lanceolate, ca. 3 mm; sepals ca. 1 mm; petals less than 5 mm ..... 3b. var. *tsetangensis*

**3a. *Myricaria elegans* var. *elegans***

秀丽水柏枝(原变种) xiu li shui bai zhi (yuan bian zhong)

*Myrtama elegans* (Royle) Ovczinnikov & Kinzikaëva; *Tamaricaria elegans* (Royle) Qaiser & Ali; *Tamarix ladachensis* B. R. Baum.

Racemes usually lateral; bracts ovate or ovate-lanceolate, 4–5 mm. Sepals ca. 2 mm. Petals 5–6 mm.

River banks, sandy places at lakesides; 3000–4300 m. SW Xinjiang, NW Xizang [India, Pakistan].

**3b. *Myricaria elegans* var. *tsetangensis*** P. Y. Zhang & Y. J. Zhang, Bull. Bot. Res., Harbin 4(2): 73. 1984.

泽当水柏枝 ze dang shui bai zhi

Racemes usually terminal, large, 20–32 cm; bracts narrowly lanceolate, ca. 3 mm. Sepals ovate, small, ca. 1 mm, margin membranous. Petals narrowly obovate or obovate-lanceolate, less than 5 mm.

- Riversides; ca. 3500 m. SE Xizang.

**4. *Myricaria pulcherrima*** Batalin, Trudy Imp. S.-Peterburgsk. Bot. Sada 11: 483. 1891.

心叶水柏枝 xin ye shui bai zhi

Shrubs or subshrubs, 1–1.5 m tall. Stem usually simple, rarely much branched; old branches red-brown; branches of current year reddish or gray-green. Leaves lax, cordate or broadly ovate, relatively large, 5–10(–18) × 6–7 mm, abruptly narrowing upward from middle, base enlarged and deeply cordate, amplexicaul, apex acuminate; green branchlets often in leaf axils; leaves on such branchlets smaller and denser. Racemes usually terminal, 2–12 cm; bracts yellow-white, broadly ovate, 5–6 mm, equaling or slightly shorter than calyx, thickening at middle, margin broadly membranous and pellucid, apex acute or acuminate. Pedicels 2–3 mm. Sepals ovate-oblong or ovate-lanceolate, ca. 4 × 2 mm, margin narrowly membranous, apex obtuse. Petals purple-red or pinkish, obovate or narrowly elliptic, ca. 7 × 3 mm, apex obtuse. Filaments ca. 1/2 united. Ovary conic or narrowly ovate, ca. 6 mm; stigmas 3-lobed. Capsule conic, 1.5–1.6 mm, ca. 4 × exceeding calyx. Seeds awned; awns more than 1/2 white villous. Fl. and fr. Jun–Sep.

- Sandy places on river banks, lowlands among mountains. S Xinjiang.

**5. *Myricaria platyphylla*** Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 27: 425. 1881.

宽叶水柏枝 kuan ye shui bai zhi

Shrubs erect, ca. 2 m tall, much branched. Old branches red-brown or gray-brown; branches of current year gray-white or yellow-gray. Leaves lax, spreading, broadly ovate or elliptic, relatively large, 7–12 × 3–8 mm, base enlarged and rounded or broadly cuneate, not amplexicaul, apex acuminate; numerous green branchlets often in leaf axils; leaves on such branchlets smaller, ovate or narrowly elliptic, 5–7 × 3–4 mm. Racemes lateral, rarely terminal, 9–14 cm, with numerous imbricate scales at base; scales ovate, margin broadly membranous; bracts broadly ovate or elliptic, ca. 7 × 4 mm, slightly shorter than calyx, base narrow, cuneate, margin broadly membranous, apex obtuse. Pedicels ca. 2 mm. Sepals narrowly elliptic or ovate-lanceolate, 4–5 × 1.5–2.5 mm, slightly shorter than petals, margin narrowly membranous, apex obtuse. Petals reddish or pinkish, obovate, 5–6 mm, base narrow, apex obtuse. Filaments ca. 2/3 united. Ovary ovoid-orbicular, ca. 5 mm; stigmas capitate. Capsule conic, ca. 1 cm. Seeds numerous, oblong, apex awned; awns white villous throughout. Fl. Apr–Jun, fr. Jul–Aug.

- Sandy places on river banks, sandy slopes, lowlands between mobile sand dunes; ca. 1300 m. Nei Mongol, Ningxia, NW Shaanxi.

**6. *Myricaria wardii*** Marquand, J. Linn. Soc., Bot. 48: 166. 1929.

小花水柏枝 xiao hua shui bai zhi

Shrubs erect, 1–2 m tall. Old branches red-brown or purple-brown; branches of current year red-brown. Leaves linear-lanceolate, ovate-lanceolate, or oblong, 1.5–3 × 0.5–1 mm, base slightly enlarged, margin narrowly membranous, apex obtuse or acute. Racemes lateral or terminal, lax; bracts usually purple, or only so in lower part, greenish in upper part, lanceolate or ovate-lanceolate, 3–4 × ca. 1 mm, margin narrowly membranous, apex acuminate. Flowers small, less than 5 mm. Pedicels 1–2 mm. Sepals lanceolate, 1.5–2 mm, less than 1/2 as long as petals, margin narrowly membranous. Petals purplish, narrowly obovate or narrowly elliptic, 3–4.5 × 1–2 mm, apex incurved. Stamens shorter than petals; filaments ca. 2/3 united. Ovary conic, 2.5–5 mm, apex attenuate; stigmas capitate, 3-lobed. Capsule conic, 9–11 mm. Seeds oblong, ca. 1.5 mm, awned; awns white villous throughout. Fl. and fr. May–Aug.

Sandy places at riversides; 3000–4000 m. SE Xizang [Nepal].

**7. *Myricaria squamosa*** Desvaux, Ann. Sci. Nat. (Paris) 4: 350. 1825.

具鳞水柏枝 *ju lin shui bai zhi*

*Myricaria germanica* (Linnaeus) Desvaux var. *squamosa* (Desvaux) Maximowicz.

Shrubs erect, 1–5 m tall, much branched in upper part. Old branches purple-brown, red-brown, or gray-brown; branches of current year yellowish green to red-brown. Leaves lanceolate, ovate-lanceolate, oblong, or narrowly ovate, 1.5–5(–10) × 0.5–2 mm, base slightly enlarged, margin narrowly membranous, apex obtuse or acute. Racemes lateral on old branches, solitary or several clustered in axils, dense before anthesis, later elongating and lax, with many imbricate scales at base; scales broadly ovate or elliptic, submembranous; bracts elliptic, broadly ovate, or obovate-oblong, 4–6(–8) × 3–4 mm, equaling or exceeding calyx, rarely shorter than calyx, base narrow, acuminate, margin broadly membranous or submembranous, apex obtuse or acute. Pedicels 2–3 mm. Sepals ovate-lanceolate, oblong, or narrowly elliptic, 2–4 × 0.5–1 mm, margin broadly or narrowly membranous, apex acute or obtuse. Petals purple-red or pink, obovate or narrowly elliptic, 4–5 × ca. 2 mm, base narrow, apex obtuse, often incurved. Filaments ca. 2/3 united. Ovary conic, 3–5 mm. Capsule conic, ca. 1 cm. Seeds narrowly elliptic or narrowly obovate, ca. 1 mm, apex awned; awns more than 1/2 white villous. Fl. and fr. May–Aug.  $2n = 24$ .

Riversides in mountains, sandy places at lakesides; 2400–4600 m. Gansu, Qinghai, Sichuan, Xinjiang, Xizang [Afghanistan, India, ?Nepal, Pakistan; C Asia].

**8. *Myricaria paniculata*** P. Y. Zhang & Y. J. Zhang, Bull. Bot. Res., Harbin 4(2): 75. 1984.

三春水柏枝 *san chun shui bai zhi*

Shrubs, 1–3 m tall. Old branches deep brown, red-brown, or gray-brown; branches of current year gray-green or red-brown. Leaves sessile, lanceolate, ovate-lanceolate, or oblong, 2–4(–6) × 0.5–1 mm, base slightly enlarged or not, margin narrowly membranous, apex obtuse or acute; green branchlets often in leaf axils, with dense leaflets. Flowers blooming 2

times per year, forming two types of inflorescences. Racemes in spring lateral on branches of previous year, with many imbricate scales at base; bracts elliptic or obovate, 3–5 × 3–3.5 mm, apex obtuse, base cuneate; pedicels 1–1.5 mm; sepals lanceolate or ovate-lanceolate, slightly shorter than petals; ovary conic, ca. 3 mm; capsule narrowly conic, ca. 1 cm. Large panicles terminal on branches of current year, 14–34 cm, dense before anthesis, lax after anthesis; bracts ovate-lanceolate or narrowly ovate, 4–6 mm, margin broadly membranous, apex usually abruptly elevated, rarely acuminate or caudate-acuminate; flowers 4–6 mm; pedicels 1–2 mm, shorter than calyx; sepals ovate-lanceolate or ovate-oblong, 3–4 mm, slightly shorter than petals, margin broadly membranous, apex acuminate, incurved; petals purplish red or pink, obovate or obovate-lanceolate, 4–5 mm, apex obtuse, often incurved, persistent in fruit; filaments ca. 1/2 or 2/3 united, shorter than petals; ovary conic, 3–4 mm; capsule narrowly conic, 8–10 mm, 3-septicidal. Seeds narrowly oblong, 1–1.5 mm, apex awned; awns more than 1/2 white villous. Fl. Mar–Sep, fr. May–Oct.

• Sandy places in river valleys in mountains, mountain slopes of river valleys; 1000–2800 m. Gansu, W Henan, SE Ningxia, Shaanxi, Shanxi, Sichuan, Xizang, NW Yunnan.

**9. *Myricaria bracteata*** Royle, Ill. Bot. Himal. Mts. 214. 1839.

宽苞水柏枝 *kuan bao shui bai zhi*

*Myricaria germanica* (Linnaeus) Desvaux var. *bracteata* (Royle) Franchet.

Shrubs, 0.5–3 m tall, much branched. Old branches gray-brown or purple-brown. Leaves dense on green branchlets of current year, ovate, ovate-lanceolate, linear-lanceolate, or narrowly oblong, 2–4(–7) × 0.5–2 mm, base slightly enlarged or not, margin often narrowly membranous, apex obtuse or acute. Racemes terminal on branches of current year, clustered into spike; bracts usually broadly ovate or elliptic, sometimes rhombic, 7–8 × 4–5 mm, base narrow, margin membranous, spreading or recurved, apex acuminate. Pedicels ca. 1 mm. Sepals lanceolate, oblong, or narrowly elliptic, ca. 4 × 1–2 mm, margin broadly membranous, apex obtuse or acute, often incurved. Petals pink, reddish, or purplish, obovate or obovate-oblong, 5–6 × 2–2.5 mm, base narrow, apex obtuse, often incurved, persistent in fruit. Stamens slightly shorter than petals; filaments ca. 1/2 or 2/3 united. Ovary conic, 4–6 mm; stigmas capitate. Capsule narrowly conic, 8–10 mm. Seeds narrowly oblong or narrowly obovate, 1–1.5 mm, apex awned; awns more than 1/2 white villous. Fl. Jun–Jul, fr. Aug–Sep.

Sandy places in river valleys, sandy places at lakesides, sandy places in Gobi Desert; 1100–3300 m. NW Gansu, Hebei, Nei Mongol, NW Ningxia, Qinghai, Shaanxi, Shanxi, Xinjiang, Xizang [Afghanistan, India, Kashmir, Mongolia, Pakistan; C Asia].

Qaiser (Pakistan J. Bot. 8: 201. 1976) treated this taxon as *Myricaria germanica* subsp. *alopecuroides* (Schrenk) Kitamura.

**10. *Myricaria laxiflora*** (Franchet) P. Y. Zhang & Y. J. Zhang, Bull. Bot. Res., Harbin 4(2): 76. 1984.

疏花水柏枝 *shu hua shui bai zhi*

*Myricaria germanica* (Linnaeus) Desvaux var. *laxiflora*  
Franchet, Nouv. Arch. Mus. Hist. Nat., sér. 2, 8: 205. 1886.

Shrubs, erect, ca. 1.5 m tall. Old branches red-brown or purple-brown; branches of current year green or red-brown. Leaves dense on green branchlets of current year, lanceolate or oblong, 2–4 × 0.8–1 mm, base slightly enlarged, margin narrowly membranous, apex obtuse or acute, often incurved. Racemes usually terminal, lax, 6–12 cm; bracts lanceolate or ovate-

lanceolate, ca. 4 × 1.5 mm, margin narrowly membranous, apex acuminate. Pedicels ca. 2 mm. Sepals lanceolate or oblong, 2–3 × ca. 1 mm, margin narrowly membranous, apex obtuse or acute. Petals pink or purplish, obovate, 5–6 × ca. 2 mm. Filaments ca. 1/2 or 1/3 united. Ovary conic, ca. 4 mm. Capsule narrowly conic, 6–8 mm. Seeds 1–1.5 mm, apex awned; awns more than 1/2 white villous. Fl. and fr. Jun–Aug.

- Riversides, roadsides. Hubei, Sichuan.