

ZYGOPHYLLACEAE

蒺藜科 ji li ke

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Shrubs, shrublets, or perennial herbs, rarely annuals. Stipules distinct or connate, often persistent. Leaves opposite or sometimes alternate, simple or pinnate, often fleshy. Inflorescences axillary or terminal, solitary, racemose, or cymose. Flower bisexual, actinomorphic or zygomorphic. Sepals 4 or 5, imbricate or valvate. Petals 4 or 5, imbricate or valvate. Stamens 4 or 5 or up to 3 × as many as petals, with or without appendages. Ovary usually (2 or)3–5(–12)-locular. Fruit a drupe, capsule, or schizocarp, leathery or fragile.

Twenty-six genera and ca. 284 species: temperate, tropical, and subtropical areas of Africa, America, Asia, Australia, and Europe; three genera (one endemic) and 22 species (three endemic) in China.

Liou Yingxin. 1998. Zygophyllaceae (excluding *Nitraria* and *Peganum*). In: Xu Langran & Huang Chengchiu, eds., Fl. Reipubl. Popularis Sin. 43(1): 116–145.

- 1a. Fruit a capsule 1. *Zygophyllum*
- 1b. Fruit a schizocarp.
 - 2a. Schizocarp with 5 carpels; sepals and petals 5; stamens 5, base with glands 2. *Tribulus*
 - 2b. Schizocarp with 4 carpels; sepals and petals 4; stamens 8, base with membranous appendages 3. *Tetraena*

1. ZYGOPHYLLUM Linnaeus, Sp. Pl. 1: 385. 1753.

霸王属 ba wang shu

Sarcozygium Bunge.

Shrubs, perennial herbs, or rarely annuals. Leaves opposite, even-pinnate or rarely simple; petiole herbaceous or membranous; leaflet blades plane or sticklike, fleshy. Flowers axillary, solitary or paired. Sepals 4 or 5, sometimes caducous. Petals as many as sepals, orangish red, white, or yellow, sometimes with an orange claw or pale along margin, rarely apetalous. Stamens 8–10, abaxially with scale-form appendages. Ovary 3–5-locular. Capsule winged or not, dehiscent or indehiscent, with 1 to several seeds per carpel.

More than 100 species: arid and semiarid regions of N Africa, C, N, and W Asia, Australia, S Europe; 19 species (two endemic) in China.

- 1a. Fruit conspicuously winged.
 - 2a. Shrubs; sepals and petals 4.
 - 3a. Capsule nearly spherical, 1.8–4 cm 2. *Z. xanthoxylon*
 - 3b. Capsule narrowly ovoid to obovoid, 1–1.6 cm 3. *Z. kaschgaricum*
 - 2b. Herbs; sepals and petals 5.
 - 4a. Leaflets 1 pair; capsule spherical, ca. 1 cm 14. *Z. fabagoides*
 - 4b. Leaflets 1–5 pairs; capsule not spherical, or if spherical larger than 1 cm.
 - 5a. Capsule spherical, width of wings more than 5 mm.
 - 6a. Leaves with 2 or 4 leaflets; leaflet blades 1–2.5 × 0.5–2 cm 15. *Z. potaninii*
 - 6b. Leaves with 6–10 leaflets; leaflet blades 0.5–1.2 × 0.2–0.8 cm 16. *Z. macropterum*
 - 5b. Capsule not spherical, width of wings less than 3 mm.
 - 7a. Stamens ca. 2 × as long as petals; leaflet blades ovate to rotund 17. *Z. iliense*
 - 7b. Stamens shorter than petals; leaflet blades linear, linear-oblong, or lanceolate.
 - 8a. Capsule lanceolate, base cuneate, apex acuminate 18. *Z. oxycarpum*
 - 8b. Capsule oblong-ovoid to ovoid, both ends obtuse 19. *Z. pterocarpum*
 - 1b. Fruit sometimes ridged but not conspicuously winged.
 - 9a. Fruit not more than 2 × as long as wide, indehiscent 1. *Z. gobicum*
 - 9b. Fruit more than 2 × as long as wide, dehiscent.
 - 10a. Leaves with more than 2 leaflets at least for majority of leaves.
 - 11a. Plants prostrate to ascending; leaflet blades 1–3 mm wide 13. *Z. mucronatum*
 - 11b. Plants erect or spreading; leaflet blades 3–15 mm wide.
 - 12a. Perennial herbs; leaflet blades 3–5 mm wide; sepals 7–8 mm; capsule 2.5–4 cm, falcately curved 11. *Z. jaxarticum*
 - 12b. Annual or biennial herbs; leaflet blades 4–15 mm wide; sepals 5–6 mm; capsule 1.6–2.5 cm, straight or slightly curved but not falcate 12. *Z. loczyi*

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- 10b. Leaves with only 2 leaflets.
- 13a. Stamens shorter than petals.
- 14a. Plants 7–15 cm tall; petiole scabrous; pedicel 1–3 mm 4. *Z. kansuense*
- 14b. Plants 30–80 cm tall; petiole not scabrous; pedicel 10–18 mm 5. *Z. obliquum*
- 13b. Stamens longer than petals.
- 15a. Plants 10–20 cm tall; capsule apex acuminate 10. *Z. rosowii*
- 15b. Plants 20–60(–100) cm tall; capsule apex not acuminate.
- 16a. Capsule more than 6 mm in diam.; leaflet blades 1.5–3 cm wide.
- 17a. Capsule cylindric, both ends not slender, 0.7–1 cm in diam.; seed surface smooth, margin entire; plants 40–80 cm tall 6. *Z. macropodum*
- 17b. Capsule oblanceolate to oblong, 1–1.5 cm in diam.; seed surface with pores, margin irregular; plants 20–25 cm tall 7. *Z. sinkiangense*
- 16b. Capsule less than 5 mm in diam.; leaflet blades 0.7–1 cm wide.
- 18a. Leaflet blades oblong to oblanceolate; plants erect 8. *Z. brachypterum*
- 18b. Leaflet blades obovate to oblong-obovate; plants spreading or prostrate 9. *Z. fabago*

1. *Zygophyllum gobicum* Maximowicz, Enum. Pl. Mongolia, 298. 1889.

戈壁霸王 ge bi ba wang

Herbs, perennial, glaucous, reddish in autumn. Stems much branched, prostrate, 10–20 cm. Stipules distinct, ovate, 2–7 mm. Leaves with 2 leaflets; petiole 2–7 mm; leaflet blades obliquely ovate, 5–20 × 3–8 mm, larger basally on stem. Flowers paired. Pedicel 2–3 mm. Sepals 5, green or orange, elliptic to oblong, 4–6 mm. Petals pale green or orange, smaller than sepals. Stamens 6–8 mm, longer than petals. Capsule ellipsoid, 8–14 × 6–7 mm, pendulous, indehiscent, both ends obtuse. Fl. Jun, fr. Aug.

Gravel deserts. N Gansu, W Nei Mongol, Qinghai, E Xinjiang [Kazakhstan, Mongolia].

2. *Zygophyllum xanthoxylon* (Bunge) Maximowicz, Fl. Tangut. 103. 1889.

霸王 ba wang

Sarcozygium xanthoxylum Bunge, Linnaea 17: 7. 1843; *Zygophyllum ferganense* (Drobow) Borissova.

Shrubs, 50–100 cm tall. Branches arching, zigzag, spreading spiny-pointed; bark bright gray; xylem yellow. Leaves on old branches fascicled and on current year branchlets opposite, with 2 leaflets; petiole 0.8–2.5 cm; leaflet blades long spatulate, linear-oblong, or linear, 8–24 × 2–5 mm, apex obtuse. Flowers axillary on old branches. Sepals 4, green, obovate, 4–7 mm. Petals 4, light yellow, obovate to nearly rotund, 8–11 mm. Stamens 8, longer than petals. Capsule nearly spherical, 1.8–4 cm, 3-valved, wings 5–9 mm wide. Seeds 6–7 × ca. 2.5 mm. Fl. Mar, fr. Jul–Sep. $2n = 22$.

Sandy gravel terraces, hilly slopes, gravel dunes, pediments in desert and semidesert areas; 1600–2600 m. W Gansu, Hebei, W Nei Mongol, W Ningxia, Qinghai, Xinjiang [Mongolia].

3. *Zygophyllum kaschgaricum* Borissova in Komarov, Fl. URSS 14: 728. 187. 1949.

喀什霸王 ka shi ba wang

Sarcozygium kaschgaricum (Borissova) Y. X. Liou.

Shrubs, 30–50 cm tall. Branches zigzag, spiny-pointed; bark grayish green; xylem yellow. Stipules small, membra-

nous. Leaves on old branches fascicled and on current shoots opposite, with 2 leaflets; petiole 0.6–1.5 cm; leaflet blades linear, equal in length to petiole, fleshy. Flowers axillary, solitary or paired. Pedicel 6–10 mm. Sepals 4, elliptic, fleshy, often persistent. Petals 4. Capsule linearly ovoid, spindlelike, or obovoid, 1–1.6(–2.4) × 0.8–1.6 cm, pendulous, wings 2–3 mm wide. Fr. Jul.

Hillsides, deserts, alluvial fans, saline serozem soil. Xinjiang [Kazakhstan, Mongolia].

4. *Zygophyllum kansuense* Y. X. Liou, Acta Phytotax. Sin. 18: 484. 1980.

甘肃霸王 gan su ba wang

Herbs, perennial, 7–15 cm tall, much branched, papillose or bristled when young. Roots thick, woody. Stipules distinct, rotund-lanceolate, margin membranous. Leaves with 2 leaflets; petiole 2–4 mm, papillose-bristled, narrowly winged; leaflet blades obovate to oblong, 6–15 × 3–5 mm, apex obtuse. Flowers axillary, solitary or paired. Pedicel 1–3 mm, papillose, later deciduous. Sepals 5, obovate to elliptic, ca. 5 mm, margin white. Petals 5, white or slightly orangish red, as long as sepals. Stamens shorter than petals, with scale-form appendages. Capsule lanceolate, 1.5–2 × ca. 0.5 cm, slightly ribbed, apex acuminate. Fl. May–Jul, fr. Jun–Sep.

• Deserts, plains. Gansu.

5. *Zygophyllum obliquum* Popov, Bjull. Sredne-Aziatsk. Gosud. Univ. 11: 113. 1925.

长梗霸王 chang geng ba wang

Herbs, perennial, 30–80 cm tall. Roots numerous, thick. Branches ascending to spreading. Stipules connate on basal stems, distinct on apical stems. Leaves with 2 leaflets; petiole winged; leaflet blades obliquely ovate, 1–2 × 0.7–1 cm, glaucous, base cuneate, apex acute. Flowers axillary, solitary or paired. Pedicel 1–1.8 cm. Sepals 5, ovate to oblong, 5–8 mm. Petals orange at base, 6–10 mm. Stamens shorter than petals; appendages oblong, half as long as stamens. Capsule cylindric, ca. 3 cm × 5–8 mm, both ends obtuse. Seeds ovoid, 5-angular. Fl. Jun–Aug, fr. Jul–Sep.

Hillsides, sandy gravel beach, valleys. Gansu, Xinjiang [Kazakhstan, Kyrgyzstan, Tajikistan].

6. *Zygophyllum macropodum* Borissova, Fl. URSS 14: 724. 1949.

大叶霸王 da ye ba wang

Herbs, perennial, 40–80 cm tall. Roots thick, woody. Stems ribbed. Leaves with 2 leaflets; petiole with angular wings; leaflet blades obliquely ovate to oblong, 2–4 × 1.5–3 cm, apex slightly rounded. Flowers axillary, paired. Pedicel 5–12 mm. Sepals 5, ca. 8 mm, 3 broadly ovate and ca. 5 mm wide, 2 ovate. Stamens 10, 5 longer than others; scales as long as half of filament or longer. Capsule cylindrical, 2.5–3.8 × 0.7–1 cm, erect, 5-angular, both ends obtuse. Seeds numerous, black, ovoid, ca. 3 × 2.5 mm, surface and margin smooth. Fl. May, fr. Jul–Sep.

Wastelands, farmland margins, saline sandy areas. Xinjiang [Kazakhstan].

7. *Zygophyllum sinkiangense* Y. X. Liou, Acta Phytotax. Sin. 18: 484. 1980.

新疆霸王 xin jiang ba wang

Herbs, perennial, 20–25 cm tall. Roots thick, woody. Stems thick, internodes to 4 cm. Stipules distinct, triangular, margin membranous. Leaves with 2 leaflets; petiole 0.8–1.8 cm, connected; leaflet blades obovate to nearly rotund, 2–4 × 1.5–3 cm, slightly fleshy, flat, apex rounded. Flowers axillary, paired. Pedicel ca. 5 mm. Sepals obovate. Petals slightly angular. Stamens longer than petals; appendages on middle part of filaments. Capsule oblanceolate to oblong, 2.5–4 × 1–1.5 cm, slightly ridged, dehiscent. Seeds 4 or 5 per carpel, ovoid, bony, margin irregular. Fl. May–Jun, fr. Jul.

• Hillsides, valleys. Xinjiang.

8. *Zygophyllum brachypterum* Karelin & Kirilov, Bull. Soc. Imp. Naturalistes Moscou 14: 397. 1841.

细茎霸王 xi jing ba wang

Zygophyllum fabago Linnaeus subsp. *brachypterum* (Karelin & Kirilov) Popov.

Herbs, perennial, 15–20 cm tall. Roots numerous, thick, woody. Stems much branched, tender. Leaves with 2 leaflets; petiole equal to or shorter than leaflets, with linear wings; leaflet blades oblong to oblanceolate, 1.5–2.5 cm × 5–6 mm, thin, apex obtuse. Flowers axillary, solitary or paired. Pedicel 1–1.5 cm. Sepals 5, unequal, 0.7–1.5 cm. Petals 5, ovate, 4–5 mm. Stamens 1–1.2 cm, obviously longer than petals; appendages dissected. Capsule cylindrical to oblong, 10–16 × ca. 5 mm, with 5 ridges, apex obtuse. Seeds reniform, ca. 3 × 1.5–2 mm. Fl. May–Jun, fr. Jul.

Slopes, valleys in deserts. W Gansu, Xinjiang [Kazakhstan, Mongolia].

9. *Zygophyllum fabago* Linnaeus, Sp. Pl. 1: 385. 1753.

豆型霸王 dou xing ba wang

Zygophyllum fabago subsp. *dolichocarpum* Popov; *Z. fabago* subsp. *orientale* Borissova.

Herbs, perennial, 30–80 cm tall. Roots thick. Stems much branched, woody at basal parts, spreading to prostrate, smooth.

Stipules ovate, elliptic, or lanceolate, 4–10 mm, connate on basal stems, distinct and smaller on apical stems. Leaves with 2 leaflets; petiole shorter than leaflets; leaflet blades obovate to oblong-obovate, 1.5–3.3 × 0.6–2 cm, thick, apex rounded. Flower axillary. Pedicel 4–10 mm. Sepals ovate to elliptic, 6–8 × 3–4 mm, margin white and membranous, apex obtuse. Petals basally orangish red and apically white, obovate, as long as sepals. Stamens longer than petals, 1.1–1.2 cm; appendages oblong, half as long as anthers. Capsule oblong to cylindrical, 2–3.5 × 0.4–0.5 cm, pendulous, with 5 ridges. Seeds numerous, ca. 3 × 2 mm, surface with dots. Fl. May–Jun, fr. Jul–Sep. 2n = 22, 28.

Alluvial plains, oases, wet sand, wastelands. NW Gansu, W Nei Mongol, Qinghai, Xinjiang [Afghanistan, Kazakhstan, Pakistan, Russia, Turkmenistan; N Africa, W Asia, SE Europe].

10. *Zygophyllum rosowii* Bunge, Linnaea 17: 5. 1845.

石生霸王 shi sheng ba wang

Herbs, perennial, 10–20 cm tall. Roots to 3 cm thick, woody. Stems much branched, spreading, glabrous, with ribs. Stipules distinct, ovate, 2–3 mm, white membranous. Leaves with 2 leaflets; petiole 2–7 mm; leaflet blades ovate, rotund, or oblong, 0.8–2.5 × 0.5–0.8 cm, apex acuminate to obtuse. Flowers axillary, solitary or paired. Pedicel 5–6 mm. Sepals elliptic to obovate-oblong, 5–8 × 2–3 mm, margin membranous. Petals 5, white but orange at base, obovate, nearly same size as sepals. Stamens orange, longer than petals; appendages oblong, apex toothed or entire. Capsule linear-lanceolate, 1.8–5 × 0.5–0.7 cm, pendulous, slightly curved or falcate, apex acuminate. Seeds grayish blue, oblong-ovoid. Fl. Mar–Jun, fr. Jun–Jul.

Gravel hills, alluvial gravel slopes, rocky steep slopes, rocky areas with gravel and sand; 400–1000 m. Gansu, Nei Mongol, Xinjiang [Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan].

- 1a. Leaflets ovate, 0.8–1.8 cm; capsule 1.8–2.5 cm 10a. var. *rosowii*
 1b. Leaflets rotund to oblong, 1.5–2.5 cm; capsule 3–5 cm 10b. var. *latifolium*

10a. *Zygophyllum rosowii* var. *rosowii*

石生霸王(原变种) shi sheng ba wang (yuan bian zhong)

Plants 10–15 cm tall. Leaflet blades ovate, 0.8–1.8 cm, apex acuminate to obtuse. Capsule 1.8–2.5 × ca. 0.5 cm.

Gravel hills, alluvial gravel slopes, rocky steep slopes. Gansu, Xinjiang [Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan].

10b. *Zygophyllum rosowii* var. *latifolium* (Schrenk) Popov, Bjull. Sredne-Aziatsk. Gosud. Univ. 11: 118. 1925.

宽叶石生霸王 kuan ye shi sheng ba wang

Zygophyllum latifolium Schrenk, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 2: 198. 1844.

Plants 15–20 cm tall. Leaflet blades rotund to oblong, 1.5–2.5 cm, apex obtuse. Capsule 3–5 × 0.5–0.7 cm.

Rocky areas with gravel and sand. Gansu, Nei Mongol, Xinjiang [Kazakhstan, Mongolia].

11. *Zygophyllum jaxarticum* Popov, Fl. Uzbekistan. 4: 58. 1959.

长果霸王 chang guo ba wang

Herbs, perennial, 15–30 cm tall. Roots woody. Stems much branched, spreading or prostrate. Stipules widely triangular, membranous, margin serrate. Leaves with 2–6 leaflets; petiole 1–2 cm, compressed; leaflet blades narrowly oblong, oblong, or oblanceolate, 1–2.5 cm × 3–5 mm. Flowers axillary, solitary or paired. Pedicel 4–7 mm. Sepals oblong-obovate, 7–8 mm, margin membranous. Petals obovate, nearly as long as sepals. Stamens unequal, 5–10 mm; appendages only on apical part of stamens, oblong-linear. Capsule cylindric, 2.5–4 cm × 4–5 mm, pendulous, falcately curved, with acute ridges, apex acuminate to acute. Seeds oblong-lanceolate, 4–5 × ca. 1.5 mm, scabrous, apex acute. Fl. Apr–May, fr. Jun–Jul.

Saline plains, saline soil in deserts, sandy areas at lakeshores. Xinjiang [Kazakhstan, Tajikistan, Turkmenistan, Uzbekistan].

12. *Zygophyllum loczyi* Kanitz, Növényt. Gyűjtesek Eredm. Grof Szechenyi Bela Keletasziai Utjabol, 13. 1891.

粗茎霸王 cu jing ba wang

Herbs, annual or biennial, 5–25 cm tall. Stems spreading or erect, branched basally. Stipules membranous or herbaceous, connate and semirotund on basal stems, distinct and triangular on apical stems. Leaves with 2–6 leaflets, 4–6 basally on stems, usually 2 apically on stems; petiole shorter than leaflets, winged; leaflet blades elliptic to obliquely obovate, 0.6–2.5 × 0.4–1.5 cm, apex obtuse. Flowers axillary, solitary or paired. Pedicel 2–6 mm. Sepals green with white margin, elliptic, 5–6 mm, margin membranous. Petals orange with white margin, ovate, shorter or equal to sepals. Stamens shorter than petals. Capsule cylindric, 1.6–2.5 × 0.5–0.6 cm, apex acute to obtuse. Seeds numerous, ovoid, 3–4 mm, surface maculate, apex acute. Fl. Mar–Jul, fr. Jul–Aug.

Hills, alluvial plains, gravel deserts, saline sands; 700–3000 m. Gansu, W Nei Mongol, Qinghai, Xinjiang [Kazakhstan].

13. *Zygophyllum mucronatum* Maximowicz, Mélanges Biol. Bull. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 11: 175. 1881.

蝎虎霸王 xie hu ba wang

Herbs, perennial, 15–25 cm tall. Roots woody. Stems numerous, tender, much branched, prostrate or spreading, with ribs. Stipules minute, triangular, margin membranous and fringed. Leaves with 4 or 6 leaflets; petiole and rachis with flat wings sometimes as wide as leaflets; leaflet blades linear to linear-oblong, 8–10 × 1–3 mm, base obtuse, apex rounded and mucronate. Flowers axillary, solitary or paired. Pedicel 2–5 mm. Sepals 5, narrowly obovate to oblong, 5–8 × 3–4 mm. Petals 5, orangish red at base and white at apex, obovate, slightly longer than sepals. Stamens longer than petals; anthers orange, oblong-spherical; appendages ca. 1/2 as long as filament. Capsule lanceolate to cylindric, pendulous, with ridges, 5-locular, with 1–4 seeds per locule, apex acuminate to acute. Seeds

yellowish brown, ellipsoid to ovoid, surface with dense cavities. Fl. Jun–Aug, fr. Jul–Sep.

Hilly slopes, plains, alluvial fans, terraces, sandy soil, loess hills; 800–3500 m. Gansu, W Nei Mongol, Ningxia, Qinghai, Xinjiang [Mongolia].

14. *Zygophyllum fabagoides* Popov, Bjull. Sredne-Aziatsk. Gosud. Univ. 11: 113. 1925.

拟豆叶霸王 ni dou ye ba wang

Herbs, perennial, 20–40 cm tall. Root woody. Basal stems yellow, woody, with ribs; apical stem bright green; internodes 6–7 cm. Stipules herbaceous, connate basally on stems, semirotund and 2–3 mm, distinct apically on stems, triangular-ovate and 1–2 mm. Leaves with 2 leaflets; petiole 0.8–2 cm; leaflet blades, obliquely oblong to ovate, 1–2.5 cm × 6–10 mm, apex obtuse. Flowers axillary, paired. Pedicel 6–10 mm, slender. Sepals 5, unequal in size, smaller one 6–8 × ca. 5 mm, larger one ca. 5 × 4 mm, ovate. Petals white but orange at base. Stamens 1–1.2 cm; appendages narrowly oblong, 3–4 mm. Capsule nearly globose, ca. 1 cm, pendulous, narrowly winged. Fl. May–Jul, fr. Aug.

Moving sands, sandy areas, riverbanks in desert zones. Gansu, Xinjiang [Kazakhstan].

15. *Zygophyllum potaninii* Maximowicz, Mélanges Biol. Bull. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg 11: 174. 1881.

大花霸王 da hua ba wang

Herbs, perennial, 10–25 cm tall. Stems thick, erect or spreading, basally much branched. Stipules connate, ca. 3 mm, herbaceous. Leaves with 2 or 4 leaflets; petiole 3–8 mm, winged; leaflet blades obliquely obovate, elliptic, or rotund, 1–2.5 × 0.5–2 cm, thick. Flowers axillary, paired or in threes, pendulous. Pedicel shorter than sepals, elongating after anthesis. Sepals yellowish, obovate, 6–11 × 4–5 mm. Petals white but orange at base, spatulate-obovate, shorter than sepals. Stamens longer than sepals; appendages linear-elliptic, half as long as filaments. Capsule ovoid-globose to globose, 1.5–2.5 × 1.5–2.6 cm, pendulous, 5-locular, with 5 wings, wings 5–7 mm, 4 or 5 seeds per locule. Seeds obliquely ovoid, ca. 5 × 3 mm. Fl. May–Jun, fr. Jun–Sep.

Deserts, gravel hills. Gansu, W Nei Mongol, Xinjiang [Kazakhstan, Mongolia].

16. *Zygophyllum macropterum* C. A. Meyer in Ledebour, Fl. Altaic. 2: 102. 1830.

大翅霸王 da chi ba wang

Herbs, perennial, 5–25 cm tall. Root thick, woody. Stems spreading to erect, scabrous. Stipules white, distinct, ovate to lanceolate, membranous, margin serrate or fringed. Leaves with 6–10 leaflets; petiole 1–2 cm; leaflet blades obovate to oblong, 5–12 × 2–8 mm. Flowers axillary, 1 or 2. Pedicel 2–7 mm, erect at anthesis but later pendulous. Sepals elliptic, 5–6 × 4–5 mm, apex obtuse to acute. Petals orange, obovate, longer than sepals, apex obtuse to emarginate. Stamens 10, 5 equal to petal length, 5 shorter than petal length; appendages oblong. Capsule globose to

ovoid-globose, 2–4.5 × 2–4 cm, wings 5–12 mm wide and membranous. Seeds yellow to grayish green, obliquely lanceolate, 5–9 × 2–3 mm, slightly compressed. Fl. Apr–May, fr. May–Aug.

Hills, river terraces. Xinjiang [Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenistan, Uzbekistan; W Asia].

17. *Zygophyllum iliense* Popov, Bjull. Sredne-Aziatsk. Gosud. Univ. 12: 112. 1926.

伊犁霸王 yi li ba wang

Herbs, perennial, 5–20 cm tall. Roots thick, woody. Stems much branched, herbaceous. Stipules distinct, ovate-triangular on basal stems, lanceolate on apical stems, membranous, margin serrate. Leaves with 2–6 leaflets; leaflet blades ovate to rotund, 10–12 × 5–7 mm. Flowers axillary, solitary or paired. Pedicel 5–7 mm. Sepals oblong, 5–6 mm, apex obtuse. Petals orange at base, obovate to oblong, as long as sepals, apex obtuse to rounded. Stamens ca. 2 × petal length; appendages shorter than filaments. Capsule cylindrical, oblong, or oblong-ovoid, ca. 2 × 0.6 cm, both ends obtuse, wings narrow; styles persistent. Seeds ovoid to reniform, ca. 3 mm. Fl. May, fr. Jul–Aug.

Dry rocky mountain slopes. Gansu, W Nei Mongol, E and N Xinjiang [Kazakhstan].

18. *Zygophyllum oxycarpum* Popov, Bjull. Sredne-Aziatsk. Gosud. Univ. 12: 112. 1926.

尖果霸王 jian guo ba wang

Herbs, perennial, 10–15 cm tall. Roots thick, woody. Stems much branched, spreading. Stipules rotund to lanceolate, membranous to herbaceous, margin serrate. Leaves with 4 or 6 leaflets; petiole 1–2 cm; leaflet blades linear-oblong, 5–20 × 1–3

mm, base cuneate, apex obtuse. Flowers axillary. Pedicel short. Sepals oblong-ovate, 3–5 × 2–3 mm, apex obtuse. Petals obovate, shorter or nearly equal to sepal length, base narrowly cuneate, apex obtuse. Stamens shorter than or as long as petals; appendages 1/4–1/3 as long as stamens, linear, with obtuse teeth at margin. Capsule lanceolate, 2–3 × 0.7–1 cm, membranous, with 5 narrow wings, apex gradually narrowed. Seeds obliquely ovoid, 3.5–4 × 1.5–2 mm, compressed on both sides, base slightly rounded, apex acuminate. Fl. Apr–Jan, fr. May–Jul.

Gravel areas, stony hills. Xinjiang [Kazakhstan].

19. *Zygophyllum pterocarpum* Bunge in Ledebour, Fl. Altaic. 2: 103. 1830.

翼果霸王 yi guo ba wang

Zygophyllum pterocarpum var. *microcarpum* Y. X. Liou.

Herbs, perennial, 10–20 cm tall. Roots thick, woody. Stems tender, much branched, spreading. Stipules ovate to lanceolate, 1–2 mm. Leaves with 4 or 6 leaflets; petiole 4–6 mm, flat, winged; leaflet blades linear-oblong to lanceolate, 5–15 × 2–5 mm, glaucous, apex acute to obtuse. Flowers axillary, solitary or paired. Pedicel 4–8 mm, elongated after anthesis. Sepals oblong, 5–7 × ca. 4 mm, apex obtuse. Petals basally orange and apically white, oblong-obovate, 7–8 mm, base cuneate, apex obtuse. Stamens shorter than petals; appendages 1/3 as long as filaments. Capsule oblong-ovoid to ovoid, 1–2 × 0.6–1.5 cm, with narrow wings to 2–3 mm, both ends obtuse. Fl. May–Jun, fr. Jun–Sep.

Gravel hills, alluvial fans, saline soil, under *Haloxylon ammodendron*. Gansu, W Nei Mongol, Xinjiang [Kazakhstan, Mongolia, Russia (Siberia)].

2. *TRIBULUS* Linnaeus, Sp. Pl. 1: 386. 1753.

蒺藜属 ji li shu

Herbs, annual or biennial, prostrate. Leaves opposite, pinnate. Flowers axillary, solitary. Sepals 5. Petals 5, yellow, imbricate. Disk ring-shaped. Stamens 10, with glands, outer 5 longer and opposite petals, inner 5 shorter and alternate with petals. Fruit a schizocarp of 4 or 5 indehiscent prickly carpels. Seeds obliquely pendulous; endosperm thinly membranous.

About 15 species; mainly in the temperate zone; two species in China.

- 1a. Annual herbs; flowers ca. 1 cm in diam.; pedicel shorter than leaves 1. *T. terrestris*
 1b. Perennial herbs; flowers ca. 3 cm in diam.; pedicel equal to or longer than leaves 2. *T. cistoides*

1. *Tribulus terrestris* Linnaeus, Sp. Pl. 1: 387. 1753.

蒺藜 ji li

Herbs, annual, prostrate, glabrous, pubescent, or hispid. Branches 20–60 cm. Leaves opposite, even-pinnate, 1.5–5 cm, with 6–16 leaflets; leaflet blades oblong to obliquely oblong, 5–10 × 2–5 mm, base slightly oblique, margin entire, apex acute to obtuse. Flower ca. 1 cm in diam. Pedicel shorter than leaves. Sepals persistent. Stamens inserted on base of disk, with scale-form appendages. Ovary 5-angled, 5-locular, with 3 or 4 ovules per locule; stigma 5-parted. Schizocarp 4–6 mm, hard, pubescent or glabrous, with 5 carpels with 2 hardened 4–6 mm spines at

mid margin, surface spiny or prickly. Fl. May–Aug, fr. Jun–Sep. 2n = 24, 30, 36, 48.

Sandy areas, wastelands, hillsides, residential areas; below 3300 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan, Zhejiang [almost worldwide].

2. *Tribulus cistoides* Linnaeus, Sp. Pl. 1: 387. 1753.

大花蒺藜 da hua ji li

Tribulus taiwanensis T. C. Huang & T. H. Hsieh.

Herbs, perennial, prostrate to ascending. Stems 30–60 cm, densely pubescent; old branches with nodes, furrowed. Stipules opposite, 2.5–4.5 cm. Leaves with 8–14 leaflets; petiole very short; leaflet blades oblong to obovate-oblong, 6–15 × 3–6 mm, abaxially pilose, adaxially villous, base oblique, apex obtuse to acute. Flower ca. 3 cm in diam. Pedicel equal to or longer than leaves. Sepals lanceolate, ca. 8 mm, villous. Petals

obovate-oblong, ca. 2 cm. Ovary yellowish hispid. Schizocarp 0.8–1.2 cm, with 4 spines or murications. Fl. May–Jun. $2n = 12, 24, 36$.

Beaches, sandy areas along seashores or river margins; usually near sea level. Hainan, Taiwan, Yunnan (along Yuan Jiang) [throughout tropics].

3. **TETRAENA** Maximowicz, Enum. Fl. Mongolia, 129. 1889, nom. cons.

四合木属 si he mu shu

Petrusia Baillon.

Shrubs. Young branches and leaves with T-shaped trichomes. Stipules dry membranous. Leaves opposite or fascicled. Flowers axillary, solitary. Sepals 4. Petals 4. Stamens 8, in 2 whorls; filaments with white membranous appendages at base. Ovary 4-carpellate; stigma persistent. Fruit 4-valved. Seeds without endosperm.

- One species: China.

B.-A. Beier et al. (Pl. Syst. Evol. 240: 11–39. 2003) proposed a new phylogenetic system in the subfamily of Zygophylloideae based on molecular and morphological data. This treatment recognized 40 species under the genus *Tetraena*, most of which were new combinations transferred from the genus *Zygophyllum*. According to this concept, *Tetraena* is distributed from Africa to Asia in a very wide range, which contrasts with the traditional concept that recognizes *Tetraena* as a unispecific genus endemic to Nei Mongol.

1. *Tetraena mongolica* Maximowicz, Enum. Pl. Mongolia, 129. 1889.

四合木 si he mu

Shrubs 40–80 cm tall, much branched. Old branches dark purple to brownish red, glabrate; current branchlets yellowish white, with T-shaped trichomes. Stipules white, ovate, membranous. Leaves on old branches fascicled and on current branchlets nearly opposite, sessile; leaflet blades grayish blue, oblanceolate, 5–7 × 2–3 mm, both surfaces with T-shaped trichomes, margin entire, apex acute with short sharp tip. Flowers

axillary, solitary. Pedicel 2–4 mm. Sepals 4, grayish, ovate to elliptic, ca. 3 × 2.5 mm, with T-shaped trichomes. Petals 4, white, elliptic to rotund, ca. 2 × 1.5 mm. Stamens 8, in 2 whorls, outer ones shorter; filament with white membranous appendages at base. Ovary 4-carpellate. Fruit pendulous, 4-valved. Schizocarp linear-ovoid to crescent-shaped, 5–6 mm, with 4 carpels. Seeds oblong-ovoid, muriculate. Fl. May–Jan, fr. Jul–Oct.

- River terraces, low mountains in steppes, desert areas. Nei Mongol.