

## 2. BALANOPHORA J. R. Forster & G. Forster, Char. Gen. Pl. 50. 1775.

蛇菰属 she gu shu

*Balania* Tieghem; *Polyplethia* (Griffith) Tieghem.

Plants monoecious or dioecious. Rhizome branched or unbranched, containing sticky wax (balanophorin), smooth or rugose with small scaly warts and/or stellate lenticels. Leaves opposite, alternate and distichous or spiral, or whorled, sessile, fleshy or scale-like. Inflorescences spadixlike, cylindric, ellipsoid, ovoid-globose, or globose, enlarged after anthesis. Male flowers: pedicellate or sessile, subtended by U-shaped or variously reduced bracts. Perianth 3–6-lobed; lobes ovate, lanceolate, or orbicular, concave, isomorphic or heteromorphic, valvate, reflexed at anthesis. Stamens in a hemispheric or  $\pm$  elongated synandrium; anthers bilocular, usually as numerous as perianth lobes, straight or sometimes U-shaped with a bend near apex of synandrium, occasionally variously fused or interrupted into locelli, transversely or longitudinally dehiscent; pollen white, subconical or globose, smooth or bullate. Spadicles minute, subclavate to clavate, very numerous, congested on female inflorescence. Female flowers: composed of a pistil, congested on main axis or also on basal stipe of spadicles. Ovary ellipsoid to fusiform, 1-loculed, attenuate toward both ends; ovules anatropous, shortly stiped. Style elongated, persistent. Fruit exocarp crustaceous.

About 19 species: mainly in tropical Africa and Australia, temperate to tropical Asia, and the Pacific Islands; 12 species (one endemic) in China.

### Key to plants with a male inflorescence

- 1a. Bracts subtending flowers fused side by side into a hexagonal alveolus.
  - 2a. Leaves verticillate and connate into a sheathlike whorl ..... 9. *B. involucrata*
  - 2b. Leaves subopposite or spiraled ..... 11. *B. harlandii*
- 1b. Bracts subtending flowers free or not developed.
  - 3a. Bracts rudimentary or not developed.
    - 4a. Inflorescences ovoid to ellipsoid; flowers actinomorphic with isomorphic perianth lobes ..... 1. *B. fungosa*
    - 4b. Inflorescences cylindric to narrowly conic; flowers zygomorphic with heteromorphic perianth lobes ..... 8. *B. laxiflora*
  - 3b. Bracts developed and stout.
    - 5a. Flowers pedicellate; anther cells transversely divided into small locelli ..... 7. *B. polyandra*
    - 5b. Flowers long pedicellate; anther cells usually U-shaped.
      - 6a. Perianth lobes ovate, less than 2 mm; synandria hemispheric (doubtful in China) ..... 3. *B. dioica*
      - 6b. Perianth lobes lanceolate, more than 3 mm; synandria elongated.
        - 7a. Flowers actinomorphic with isomorphic perianth lobes; anther locules U-shaped, usually as many as perianth lobes ..... 4. *B. indica*
        - 7b. Flowers zygomorphic with heteromorphic perianth lobes; anther locules straight, much more numerous than perianth lobes (usually 20–30) (doubtful in China) ..... 5. *B. elongata*

### Key to plants with an androgynous inflorescence

- 1a. Male flowers scattered between spadicles and female flowers ..... 12. *B. tobiracola*
- 1b. Male flowers basal to female flowers.
  - 2a. Flowering shoot creamy white to grayish; male flowers zygomorphic ..... 6. *B. abbreviata*
  - 2b. Flowering shoot yellow to red; male flowers actinomorphic or nearly so.
    - 3a. Leaves verticillate and connate into a sheathlike whorl; spadicles obovoid to subglobose, shortly stiped ... 10. *B. fargesii*
    - 3b. Leaves alternate; spadicles elongated, capitate.
      - 4a. Male flowers larger; perianth lobes more than 3 mm ..... 1. *B. fungosa*
      - 4b. Male flowers smaller; perianth lobes less than 1.5 mm ..... 2. *B. subcupularis*

### Key to plants with a female inflorescence

- 1a. Spadicles obovate to subglobose, shortly stiped; female flowers only on main axis of inflorescence.
  - 2a. Leaves verticillate and connate into a sheathlike whorl; apical cells of spadicles with distinct cuticular ridges 9. *B. involucrata*
  - 2b. Leaves alternate; apical cells of spadicles smooth ..... 11. *B. harlandii*
- 1b. Spadicles elongated, capitate to subcapitate; female flowers on basal stipe of spadicles and on main axis of inflorescence.
  - 3a. Spadicles apically papillate (doubtful in China) ..... 3. *B. dioica*
  - 3b. Spadicles apically not papillate.
    - 4a. Apical leaves larger than basal leaves; female inflorescence broadly ellipsoid, obovoid, or subspheroid.
      - 5a. Rhizomes usually clustered into a mass; flowering inflorescence not concealed by leaves; cuticular ridges of apical cells of spadicle short, not labyrinthlike ..... 4. *B. indica*
      - 5b. Rhizome with elongated cylindric branches; flowering inflorescence partly concealed by upper

- leaves; cuticular ridges of apical cells of spadicle labyrinthlike (doubtful in China) ..... 5. *B. elongata*  
 4b. All leaves usually same size; female inflorescences ellipsoid, oblong-ellipsoid, or oblong-ovoid.  
 6a. Spadicles to 2.3 mm ..... 7. *B. polyandra*  
 6b. Spadicles less than 1.5 mm ..... 8. *B. laxiflora*

**1. *Balanophora fungosa*** J. R. Forster & G. Forster, Char. Gen. Pl. 50. 1775.

蛇菰 she gu

Plants monoecious or rarely dioecious. Rhizome yellowish brown, unbranched or in a mass, surface with granular warts and scattered yellow stellate lenticels; branches subglobose, depressed, ca. 1.5 × 2.5 cm. Scapes pink, reddish orange, or occasionally yellowish, 3–8 × 0.6–1.5 cm at anthesis, to 12 cm in fruit. Leaves 15–30, spirally arranged or rarely opposite, imbricate, broadly ovate, 1–1.5 × 1.5–1.7 cm, apex obtuse. Inflorescences ellipsoid, ovoid, or conically ovoid, 1–3 × 1–2 cm. Male flowers: basally on androgynous inflorescences, actinomorphic, subtended by short rudimentary bracts. Pedicel 4–5 mm. Perianth lobes 4 or 5, ovate-elliptic, apex acute. Synandria subglobose, stipe 0.5–1 mm; anthers 4 or 5, U-shaped. Spadicles subclavate, apical 1/2 ellipsoid; cuticular ridges of apical cells short but distinct and congested. Female flowers: yellowish, basally on spadicles and main axis of inflorescence. Fl. Dec.

Coastal forests; near sea level to 900 m. Taiwan [Indonesia, Japan (Ryukyu Islands), New Guinea, Philippines; Australia, Pacific Islands].

**2. *Balanophora subcupularis*** P. C. Tam, Fl. Fujian. 1: 602. 1982.

杯茎蛇菰 bei jing she gu

Plants monoecious. Rhizome yellowish brown, unbranched or in a small mass, subglobose, depressed, ca. 1.5 × 2.0 cm, surface with granular warts and scattered yellow stellate lenticels. Scapes reddish, 2–6 × 0.3–0.5 cm at anthesis. Leaves 5–8, spirally arranged or rather opposite, broadly ovate, 0.6–1.2 × 0.8–1.0 cm, apex obtuse. Inflorescences ellipsoid, 0.8–2 × 0.5–0.8 cm. Male flowers: basally on androgynous inflorescences, nearly actinomorphic, subtended by variously shaped bract(s). Pedicel ca. 0.8 mm. Perianth lobes usually 4, elliptic to widely ovate, apex acute or truncate. Synandria subglobose, subsessile; anthers ?4. Spadicles subclavate, apical 1/2 ellipsoid. Female flowers: yellowish. Fl. Sep–Nov.

• Forests; 800–1500 m. Guangdong, Guangxi, Guizhou, Jiangxi, Hunan, Yunnan.

**3. *Balanophora dioica*** R. Brown ex Royle, Ill. Bot. Himal. Mts. 1: 330. 1839.

鹿仙草 lu xian cao

Plants dioecious. Rhizome ochre yellow, brown, or reddish purple, unbranched or several together in a mass, surface with granular warts or scattered yellow stellate lenticels; branches subglobose, 0.5–2.5 cm in diam. Scapes purple to pink, cylindrical, 2–10 cm. Leaves 3–10, distichous, rarely spirally arranged, imbricate, broadly ovate to ovate-oblong, 1.5–4 × 1.5–2.5 cm, apex obtuse to emarginate. Male inflorescences broadly ovoid to ellipsoid, 3–3.5 × 2.5–3 cm. Male flowers: very numerous, actinomorphic, each subtended by a

single truncate bract. Pedicel 4–9 mm. Perianth lobes 4 or 5, ovate, ca. 2 mm, reflexed. Synandria hemispheroidal, 0.5–1 × 1–1.5 mm; anthers 4 or 5, 2-celled, U-shaped, longitudinally dehiscent. Female inflorescences ellipsoid to narrowly ovoid, 2–5 cm. Spadicles ca. 1 mm, subclavate, apical 1/3 subglobose, apex truncate and papillate; cuticular ridges of apical cells longitudinally slender and congested. Female flowers: on basal stipe of spadicles and main axis of inflorescence. Fl. Aug–Oct.

Dense forests; 1100–2600 m. Hunan, Xizang, Yunnan [Bhutan, NE India, Myanmar, Nepal, Sikkim].

One of us (Murata) considers it doubtful that this Himalayan species actually occurs in China. Chinese specimens under this name are possibly misidentified.

This species is used medicinally.

**4. *Balanophora indica*** (Arnott) Griffith, Trans. Linn. Soc. London 20: 95. 1946.

印度蛇菰 yin du she gu

*Langsdorffia indica* Arnott, Nat. Hist. 2: 37. 1838; *Balanophora cryptocaudex* S. Y. Chang & P. C. Tam; *B. saxicola* F. W. Xing & Z. X. Li; *B. simaoensis* S. Y. Chang & P. C. Tam; *B. splendida* P. C. Tam & D. Fang.

Plants dioecious. Rhizome yellowish orange to brown, unbranched or branched from base, surface coarsely tessellated and with stellate warts; branches subglobose, 0.5–5.6 cm in diam., rarely cylindrical. Scapes yellow, 7.2–20 cm. Leaves 10–20, yellowish orange, spirally arranged, imbricate, broadly ovate to oblong-ovate, to 3 × 2 cm, apex obtuse and ± hoodlike. Male inflorescences red, ovoid-ellipsoid, 5–10 × 2–6 cm. Male flowers: reddish, actinomorphic, each subtended by a single stout and truncate bract. Perianth lobes 4–6, elliptic-lanceolate, 3–7 × 1–2.5 mm. Synandria elliptic-ovate, 2.5–5 mm, stalked; anthers 4 or 5, U-shaped, longitudinally dehiscent. Female inflorescences globose, 1–5 × 1–5 cm. Spadicles subclavate, to 2 mm, apical 1/2 to 2/3 ellipsoid-obovoid; cuticular ridges of apical cells short but distinct and congested all over. Female flowers: basally on spadicles and main axis of inflorescence. Fl. Oct–Dec.

Broad-leaved evergreen forests; 900–1500 m. SE Guangxi, Hainan, Yunnan [India, Indonesia, Laos, Malaysia, Myanmar, Philippines (Luzon), Thailand, Vietnam; Pacific Islands (Guam)].

**5. *Balanophora elongata*** Blume, Enum. Pl. Javae 1: 87. 1827.

长枝蛇菰 chang zhi she gu

Plants dioecious, reddish yellow to dark red. Rhizome repeatedly branched, surface densely covered with warts and scattered stellate lenticels; branches obovoid-globose to cylindrical. Scapes 5–15 cm, shorter on female shoot. Leaves 10–20, red, spirally arranged, imbricate, scaly, longitudinally striate when dry; basal leaves on scape broadly ovate, ca. 1 cm; middle leaves oblong, ca. 2 cm; apical leaves subspatulate, 3–3.5 cm,

subtending inflorescence. Male inflorescences narrowly ovoid, 3–6 cm. Male flowers: subtended by truncate bract, pedicellate, dark red, zygomorphic, 4- or 5-merous, 8–10 mm in diam. Perianth lobes 4–4.5 mm, revolute at anthesis; upper and lower lobes broadly ovate, ca. 3 mm wide, apex truncate; lateral lobes lanceolate, apex acute. Synandria subspheroid to broadly ovoid, 2.5–4 mm in diam., stalked; anthers isomorphic, linear, with 20–30 parallel locelli, longitudinally dehiscent. Female inflorescences reddish yellow to reddish brown, ellipsoid to narrowly ellipsoid, 3–5 cm. Spadicles clavate, apical 1/3 ellipsoid to obovoid; cuticular ridges of apical cells labyrinthlike. Female flowers: basally on spadicles and main axis of inflorescence. Fl. Nov–Dec.

Broad-leaved evergreen forests; 900–1600 m. Yunnan [Indonesia].

One of us (Murata) considers it doubtful that this Indonesian species actually occurs in China. Chinese specimens under this name are possibly misidentified. Wu Zhengyi (editor's note) concurs.

**6. *Balanophora abbreviata*** Blume, Enum. Pl. Javae 1: 87. 1827.

短穗蛇菰 duan sui she gu

*Balanophora cavaleriei* H. Léveillé; *B. kainantensis* Masamune.

Plant monoecious, creamy white to grayish. Rhizome branched or unbranched, surface granular, with pale stellate lenticels; branches subcupular to subglobose, attenuate toward base. Scapes erect, 4–6 cm. Leaves 4 to 7, alternate, oblong to ovate, 1.2–1.5 × 0.9–1.2 cm, lustrous, base asymmetric, apex obtuse to emarginate. Inflorescences ca. 1–2 × 0.6–1 cm, globose to ellipsoid, apex obtuse to rounded. Male flowers: zygomorphic, 10–30 basally on inflorescences or occasionally apically (in Hainan material), subtended by indistinct rudimentary bracts. Perianth lobes 4 or 5, imbricate, rounded, ca. 2 × 2 mm. Synandria subdiscoid, laterally expanded; anthers with 16–20 parallel loculi, dehiscent by short slits. Spadicles clavate, apical 1/3 subglobose; cuticular ridges of apical cells labyrinthlike. Female flowers: mostly on basal stipe of spadicles. Fl. Nov–Dec.

Dense forests; 600–1500 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Yunnan, Zhejiang [Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Thailand; Africa, Madagascar, Pacific Islands].

**7. *Balanophora polyandra*** Griffith, Proc. Linn. Soc. London 1: 220. 1844.

多蕊蛇菰 duo rui she gu

Plants dioecious, yellowish orange to dark red. Rhizomes clustered into a mass; branches 2–3.5 cm in diam., densely covered with granular warts and scattered grayish white stellate lenticels. Scapes reddish orange, 2.8–8 × 0.5–1 cm. Leaves 4–12, decussate but spirally arranged apically on scape, ovate-oblong, ca. 2 × 1–1.2 cm. Male inflorescences narrowly ellipsoid, 3–7 cm. Male flowers: zygomorphic, ca. 1 cm in diam., pedicelled, each subtended by a single stout and truncate bract. Perianth lobes 4–6, reflexed; lateral lobes deltoid to ovate, apex acute; apical and lower lobes oblong, 3–4 × 2–2.5 mm, apex

truncate. Synandria subdiscoid, 4–5 mm in diam.; anthers broken up into 20–60 locelli, dehiscent by short slits. Female inflorescences ellipsoid to oblong-ovoid, 2–3 × 1–2.5 cm; spadicles clavate, 1.5–2.3 mm, apical 1/2 to 2/3 ellipsoid to obovoid; cuticular ridges of apical cells short but distinct and congested. Female flowers: on basal stipe of spadicles and on main axis of inflorescence. Fl. Aug–Oct.

Dense forests; 1000–2500 m. Guangxi, Hubei, Hunan, Xizang, Yunnan [Bhutan, Myanmar, Nepal, Sikkim].

**8. *Balanophora laxiflora*** Hemsley, J. Linn. Soc., Bot. 26: 410. 1894.

疏花蛇菰 shu hua she gu

*Balanophora formosana* Hayata; *B. hongkongensis* K. M. Lau et al.; *B. morrisonicola* Hayata; *B. oshimae* Yamamoto; *B. parvior* Hayata; *B. rugosa* P. C. Tam; *B. spicata* Hayata.

Plants dioecious, red to dark red, sometimes purplish. Rhizome branched; branches subspherical, 1–3 × 1–2.5 cm, surface densely covered with scabrous speckles and yellowish stellate warts. Leaves 8–14, alternate, elliptic-oblong, 1.5–2.5 × 1–1.5 cm, apex obtuse. Scapes 5–10 cm. Male inflorescences cylindrical, 3–18 × 0.5–2 cm, apex acuminate. Male flowers: subsessile, zygomorphic, subtended by two slender rudimentary or indistinct bracts. Perianth lobes 4–6, suborbicular to ovate, 2–3 mm, apex acute to obtuse. Synandria sessile, subdiscoid or sometimes expanded laterally, 4.5–6 mm in diam.; anthers broken up into many locelli, dehiscent by short slits. Female inflorescences ovoid-spheroid to oblong-ellipsoid, 2–6 × 0.8–2 cm, apex acuminate. Spadicles subclavate, to 1.5 mm, apical 2/3 obovate; cuticular ridges of apical cells short but distinct and congested. Female flowers: on basal stipes of spadicles and main axis of inflorescence. Fl. Sep–Nov.

Dense forests; (200–)600–1700 m. Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Laos, Thailand, Vietnam].

**9. *Balanophora involucrata*** J. D. Hooker, Trans. Linn. Soc. London 22: 30. 1859.

红菌 hong jun

Plants dioecious. Rhizome yellowish brown, rarely reddish brown, branched or unbranched, surface densely covered with granular warts and yellowish stellate lenticels; branches urceolate, 2.5–5.5 × 1.5–2 cm. Scapes yellow to orange, 3–10 × 0.6–1 cm, base subtended by distinct rhizome sheath. Leaves connate into a single sheathlike whorl, surrounding middle of scape. Male inflorescences ovoid-spheroid, 1.4–2.4 × 1.2–2 cm. Bracts truncate with expanded lili-like margin, fused side by side into a hexagonal alveolus. Male flowers: pedicellate, inserted basally in alveolus, usually 3-merous, ca. 4 mm in diam. Perianth lobes 3, rarely to 6, ovate to broadly deltoid, ca. 2 mm in diam. Synandria sessile, depressed discoid; anthers transversely dehiscent. Female inflorescence ovoid to ellipsoid. Spadicles obovate, shortly stiped, apically truncate; cuticular ridges of apical cells labyrinthlike. Female flowers: only on main axis of inflorescences. Fl. Jul–Aug.

Forests; 2300–3600 m. Guizhou, Henan, W Hubei, Hunan, S Shaanxi, Sichuan, Xizang, Yunnan [Bhutan, India, Nepal, Sikkim].

The hosts are usually species of *Rhododendron*. The species is used medicinally.

**10. *Balanophora fargesii*** (Tieghem) Harms in Engler & Prantl, Nat. Pflanzenfam., ed. 2, 16b. 332. 1935.

川藏蛇菰 chuan zang she gu

*Bivolva fargesii* Tieghem, Ann. Sci. Nat., Bot., sér. 9, 6: 206. 1907; *Balanophora involucrata* J. D. Hooker var. *rubra* J. D. Hooker.

Plants monoecious. Rhizome yellowish brown, branched or unbranched, surface with granular warts and yellow stellate lenticels; branches urceolate, 2–3 cm in diam. Scapes yellow to orange, 7–12 cm, base subtended by a distinct rhizome sheath. Leaves connate into a single sheathlike whorl, surrounding middle of scape. Inflorescences ovoid to subglobose, 1–3 cm in diam. Male flowers: clustered basally on inflorescence, ca. 3 mm in diam., pedicellate, subtended by rudimentary bracts. Perianth lobes 3, broadly deltoid, 1.5–2.5 mm, ± spreading. Synandria subdiscoïd; anthers 3, transversely dehiscent. Spadicles obconic, shortly stiped, apically truncate; cuticular ridges of apical cells labyrinthlike. Female flowers: only on main axis of inflorescences. Fl. Jul–Aug.

*Pinus* forests; 2700–3100 m. Sichuan, Xizang, Yunnan (Dali) [Bhutan].

**11. *Balanophora harlandii*** J. D. Hooker, Trans. Linn. Soc. London 22: 426. 1859.

葛菌 ge jun

*Balanophora esquirolii* H. Léveillé; *B. harlandii* var. *mutinoides* (Hayata) F. W. Xing; *B. henryi* Hemsley; *B. kawakamii* Valetton; *B. kudoii* Yamamoto; *B. lancangensis* Y. Y. Qian; *B. minor* Hemsley; *B. mutinoides* Hayata.

Plants dioecious. Rhizome yellowish to brownish, branched or unbranched, surface scabrous; branches flat spheroid or subglobose, 2.5–5 cm in diam. Scapes red (especially in females) to yellow, 2–5.5 cm. Leaves 6–12, yellow to reddish, usually clustered on base of scape, decussate, subopposite, or spiraled, scaly, oblong-ovate, 2.5–4.5 × 1.5–2.5 cm. Male inflorescences subspheroid to ovoid-ellipsoid, 1.8–2.5 × 1.5–2 cm. Bracts truncate with expanded liplike margin, fused side by side into a hexagonal alveolus. Male flowers: pedicellate, inserted basally in alveolus, 3-merous, 1.5–3 mm in diam. Perianth lobes broadly deltoid. Synandria subdiscoïd; anthers 3, transversely dehiscent. Female inflorescence ovoid to ellipsoid. Spadicles obovoid, shortly stiped; cuticular ridges of apical cells labyrinthlike. Female flowers: only on main axis of inflorescences. Fl. Sep–Nov.

Forests on shady moist mountain slopes; 600–2100 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangxi, Shaanxi, Sichuan, Taiwan, Yunnan, Zhejiang [India (Assam), Thailand].

The reports of *Balanophora japonica* Makino from Hainan (Tam, FRPS 24: 267. 1988) and elsewhere in China are incorrect, and collections reported as such belong to *B. harlandii* (Xing & Li, Bull. Bot. Res., Harbin 12: 380. 1992).

The hosts are usually species of *Cannabis* and *Pueraria*. The species is used medicinally.

**12. *Balanophora tobiracola*** Makino, Bot. Mag. (Tokyo) 24: 290. 1910.

海桐蛇菰 hai tong she gu

*Balanophora harlandii* J. D. Hooker var. *spiralis* P. C. Tam; *B. wrightii* Makino ex Makino & Nemoto.

Plants monoecious, creamy yellow to reddish. Rhizome branched, surface scabrous, densely covered with speckles and stellate lenticels; branches subspheroid to flat-spheroid, 1.5–2.2 cm wide. Leaves 5–10, scattered on scape, oblong-lanceolate, oblong ovate, or broadly ovate, 8–14 × 5–8 mm, scale-like. Scapes yellowish, 1–5.5 × 0.4–0.8 cm. Inflorescences androgynous, conic, ovoid-ellipsoid, or ovoid, 1.8–4 × 1–2 cm. Male flowers: scattered between spadicles and female flowers, shortly pedicellate, 2–3 mm in diam. Perianth lobes 3, spreading, ovate to subrounded. Synandria subdiscoïd; anthers 3, transversely dehiscent. Spadicles subglobose, shortly stiped; apical cells smooth. Female flowers: only on main axis of inflorescences. Fl. Aug–Dec.

Forests, moist mountain slopes; ca. 500 m. Guangdong, Guangxi, Hunan, Jiangxi, Taiwan [Japan].

The hosts are usually species of *Pittosporum* and *Rhaphiolepis*.

