

8. GONIOTHALAMUS (Blume) J. D. Hooker & Thomson, Fl. Ind. 1: 105. 1855.

哥纳香属 *ge na xiang shu*

Li Bingtao (李秉滔 Li Ping-tao); Michael G. Gilbert

Polyalthia sect. *Goniothalamus* Blume, Fl. Javae, Annonaceae, 71, 79. 1830.

Trees or erect shrubs. Petiole short; leaf blade large, secondary veins arcuately looped near margin. Inflorescences axillary or extra-axillary, 1-flowered or several flowers in fascicles. Pedicel bracteolate at base. Sepals 3, valvate. Petals 6, in 2 whorls, with each whorl valvate; outer petals flat, thick; inner petals small, base shortly clawed, apex forming a cap. Stamens many; anther locules linear or oblong, extrorse; connectives oblong or clavate, 3-angular, apex truncate or rarely rounded. Carpels many; ovules 1–10 per carpel, ± basal; styles elongate; stigmas entire or apex 2-lobed. Fruit apocarpous; monocarps subsessile to shortly stipitate, oblong-ellipsoid or ovoid. Seeds 1–10 per monocarp.

About 130–140 species: tropical and subtropical Asia; 11 species (five endemic) in China.

A record of *Goniothalamus macrophyllus* (Blume) J. D. Hooker & Thomson from the Flora area (X. L. Hou, <http://www.abclunwen.com/lunwen-free-387606/>; accessed on 25 Nov 2010) was based on a misidentification of *Polyalthia simiarum*.

- 1a. Leaf blade margin and midvein abaxially densely rust-colored hirsute.
 - 2a. Leaf blade 56–76 × 13–19 cm; monocarps 6–9 × ca. 2 cm 1. *G. cheliensis*
 - 2b. Leaf blade 20–41 × 5.5–11.5 cm; monocarps 2–3 × 0.6–0.8 cm 2. *G. donnaiensis*
- 1b. Leaf blade glabrous throughout.
 - 3a. Inflorescences 3- or 4-flowered; leaf blade abaxially grayish green; inner petals ca. 2 × as long as outer petals 11. *G. laoticus*
 - 3b. Inflorescences 1- or 2-flowered; leaf blade abaxially green, sometimes drying brownish; inner petals much shorter than outer petals.
 - 4a. Leaf blade narrowly lanceolate to oblong-lanceolate.
 - 5a. Branchlets and petioles pubescent; stigmas deeply 2-cleft 3. *G. chinensis*
 - 5b. Branchlets and petioles glabrous; stigmas entire or shallowly 2-cleft.
 - 6a. Ovaries pubescent; ovules 2 per carpel 4. *G. gardneri*
 - 6b. Ovaries glabrous; ovules 1 per carpel 5. *G. gabriacianus*
 - 4b. Leaf blade oblong, oblong-elliptic, elliptic, or obovate.
 - 7a. Leaf blade thinly papery, secondary veins adaxially flat to depressed; inflorescences 2-flowered.
 - 8a. Pedicel ca. 4 mm; styles ca. 2 × as long as ovaries; ovules basal; leaf blade secondary veins 7–9 on each side of midvein 6. *G. yunnanensis*
 - 8b. Pedicel 9–15 mm; styles 1–1.5 × as long as ovaries; ovules lateral; leaf blade secondary veins 9–21 on each side of midvein 7. *G. leiocarpus*
 - 7b. Leaf blade papery to leathery, secondary veins adaxially raised; inflorescences 1-flowered.
 - 9a. Petioles and monocarps pubescent to puberulent 8. *G. amuyon*
 - 9b. Petioles and monocarps glabrous.
 - 10a. Flowers to 7 cm, ca. 5.5 cm in diam.; outer petals oblong-lanceolate; ovules 2 per carpel; monocarps ca. 1.5 × 1.3 cm 9. *G. calvicarpus*
 - 10b. Flowers to 2.5 cm, ca. 2.5 cm in diam.; outer petals broadly ovate; ovules 6 per carpel; monocarps 3–6 × 2–2.5 cm 10. *G. howii*

1. *Goniothalamus cheliensis* Hu, Bull. Fan Mem. Inst. Biol. 10: 122. 1940.

景洪哥纳香 *jing hong ge na xiang*

Trees to 5 m tall. Branches dark gray hispid. Petiole 2–2.5 cm, stout, rust-colored hirsute; leaf blade obovate, 56–76 × 13–19 cm, papery, abaxially sparsely hispid, adaxially glabrous, midvein densely rust-colored hirsute, secondary veins 26–30 on each side of midvein and prominent on both surfaces, base cuneate, margin densely rust-colored hirsute, apex caudate with a ca. 5 cm acumen. Flowers not seen. Fruiting carpels oblong-elliptic, 6–9 × 1.5–2 cm, densely rust-colored hirsute, lenticellate, acuminate on both ends. Seeds 4, oblong, ca. 2.5 × 1.5 cm. Fl. Mar, fr. Apr–Sep.

• Forested slopes; ca. 1500 m. S Yunnan.

Goniothalamus cheliensis is listed as Endangered (EN A2c) by the IUCN Red List of Threatened Species (Version 2010.3; <http://www.iucnredlist.org>; accessed on 6 Oct 2010).

2. *Goniothalamus donnaiensis* Finet & Gagnepain, Bull. Soc. Bot. France 53(Mém. 4): 121. 1906.

田方骨 *tian fang gu*

Trees to 5 m tall, most parts densely rust-colored hirsute when young. Petiole 1–1.5 cm, stout; leaf blade obovate-lanceolate to oblong-lanceolate, 20–41 × 5.5–11.5 cm, papery, adaxially glabrous or hirsute along midvein, secondary veins 17–22 on each side of midvein, base cuneate, apex caudate with a 1–3 cm acumen. Flowers solitary. Pedicel short. Sepals

broadly ovate, ca. 8×6 mm, inside glabrous. Petals reddish; outer petals ovate-lanceolate to oblong-lanceolate, ca. 2.3×0.5 cm; inner petals ovate-triangular, ca. 1.5×0.5 cm, inside glabrous, base attenuate into a ca. 3 mm claw. Stamens oblong, ca. 2 mm; anther locule with transverse stripes; connectives apically rounded to subtruncate. Carpels cylindrical-ovoid, ca. 4.5 mm, hirsute; ovules 2 per carpel, subbasal; style oblong, \pm long as ovary, glabrous. Monocarps 4–12, connate, ovate-oblong, $2-3 \times 0.6-0.8$ cm, both ends acuminate. Seeds 1 or 2 per monocarp, yellowish, ovoid, ca. 1.5×5 mm, ribbed at bilateral plane. Fl. May–Sep, fr. Aug–Oct.

Densely forested slopes; 200–800 m. SW Guangxi, S Guizhou, SE Yunnan [Vietnam].

The bark of *Goniothalamus donnaiensis* is used as medicine for traumatic injuries and fractures.

3. *Goniothalamus chinensis* Merrill & Chun, Sunyatsenia 2: 6. 1934.

哥纳香 ge na xiang

Shrubs to 4 m tall. Branchlets pubescent when young, glabrescent. Petiole 5–12 mm, robust, pubescent or glabrous; leaf blade oblong-elliptic to oblong-lanceolate, $13-30 \times 3-8$ cm, papery, glabrous, secondary veins 12–14 on each side of midvein, base broadly cuneate, apex shortly acuminate to obtuse. Inflorescences axillary, 1- or 2-flowered. Pedicel ca. 1 cm, with several bracteoles at base. Sepals broadly ovate, $5-6 \times 5-6$ mm, puberulent. Petals yellowish green; outer petals narrowly lanceolate, $2.2-3 \times$ ca. 0.7 cm, outside puberulent; inner petals ovate, ca. 1.2 cm, apex acute to acuminate. Stamens linear-oblong, ca. 2 mm; connectives apically truncate. Carpels cylindrical, brown hispid; ovules 2 per carpel; styles as long as ovary; stigmas apically 2-cleft. Monocarps shortly stipitate, oblong-ellipsoid, $10-18 \times 5-6$ mm, sparsely hispid to glabrescent, apex obtuse. Fl. Jul–Sep, fr. Jul–Oct.

• Forested slopes; 300–600 m. S Guangxi, Hainan.

4. *Goniothalamus gardneri* J. D. Hooker & Thomson, Fl. Ind. 1: 107. 1855.

长叶哥纳香 chang ye ge na xiang

Trees to 5 m tall, all parts glabrous. Branches brown when young, striate with age. Petiole 0.4–2 cm, swollen; leaf blade narrowly oblong-lanceolate, $10-39 \times 2.5-8$ cm, leathery, midvein adaxially depressed, secondary veins 14–20 on each side of midvein and inconspicuous, base cuneate, apex acuminate to acute. Inflorescences axillary, 1-flowered. Pedicel 5–10 mm, bracteolate at base. Sepals broadly ovate, ca. 1.5×1 cm. Petals green turning brownish yellow, leathery; outer petals oblong-lanceolate, $5-6 \times 1-1.5$ cm; inner petals elliptic, ca. 1.5×1 cm. Stamens linear but obconic when dry, ca. 1.8 mm; connectives apically flat to very slightly convex, puberulent. Carpels cylindrical, pubescent; ovules 2 per carpel; styles slender; stigmas entire. Monocarps to 20, ovoid, $1-1.7 \times 0.5-0.8$ cm. Seeds 1 or 2 per monocarp, pale reddish brown, ovoid, slightly compressed. Fl. May–Nov, fr. Nov–Feb.

Densely forested slopes; 200–700 m. Hainan [India, Sri Lanka, Vietnam].

R. M. K. Saunders (in litt.) believes that *Goniothalamus gardneri* is endemic to Sri Lanka and that the Chinese and other material so named has been misidentified. The Sri Lankan material differs by the sparsely puberulent stems, slightly smaller sepals (0.8–1.2 cm), and shorter petals (outer 2.4 to less than 5 cm, abaxially puberulent; inner 0.9–1.4 cm).

5. *Goniothalamus gabriacianus* (Baillon) Jovet-Ast [“Ast”] in Lecomte, Fl. Indo-Chine, Suppl. 1: 95. 1938.

保亭哥纳香 bao ting ge na xiang

Oxymitra gabriaciana Baillon, Adansonia 10: 106. 1871; *Goniothalamus saigonensis* Pierre ex Finet & Gagnepain.

Trees to 5 m tall, glabrous except for flowers. Petiole 5–8 mm; leaf blade narrowly oblong-lanceolate, $12.5-22 \times 2-4$ cm, leathery, midvein adaxially depressed, secondary veins obscure, base cuneate, apex obtuse. Inflorescences axillary, 1-flowered. Pedicel short, bracteolate at base. Sepals broadly ovate, outside puberulent, inside glabrous. Petals greenish; outer petals oblong-triangular, ca. 1.2 cm, hispidulous; inner petals ovate, ca. 1 cm, outside hispidulous, inside glabrous. Stamens oblong; anther locules longitudinally striate; connectives apically subcapitate, puberulent. Carpels cylindrical, glabrous; ovule 1 per carpel, basal; styles terete; stigmas apically shallowly 2-cleft. Monocarps oblong-ellipsoid to ellipsoid, $1-1.8 \times 0.5-0.8$ cm, glabrous. Seed 1 per monocarp. Fl. May–Jul, fr. May–Nov.

Densely forested slopes; 300–800 m. Hainan [Cambodia, Laos, Thailand, Vietnam].

6. *Goniothalamus yunnanensis* W. T. Wang, Acta Phytotax. Sin. 6: 209. 1957.

云南哥纳香 yun nan ge na xiang

Goniothalamus lii X. L. Hou & Y. M. Shui.

Trees to 5 m tall. Bark brown. Branches pale brown, glabrescent. Petiole 5–13 mm, drying blackish, slightly rugose; leaf blade oblong-elliptic, oblong, or sometimes obovate-oblong, $7-23 \times 2.8-7$ cm, thinly papery, glabrous, secondary veins 7–15(–21) on each side of midvein and adaxially depressed to slightly raised, base broadly cuneate, apex acute to acuminate. Inflorescences axillary, sometimes from leafless nodes, 1- or 2-flowered; peduncle 1–2 mm; bracts 2–4, ovate, 1–2 mm. Pedicel (2–)4–9(–13) mm, sparsely pubescent. Sepals broadly ovate-triangular, $5-8 \times 4-8$ mm, outside puberulent, inside glabrous. Petals reddish yellow; outer petals broadly lanceolate, $2-2.5 \times 0.7-1.3$ cm, rust-colored pubescent, inside densely rust-colored tomentulose; inner petals obovate to oblong-ovate, $7-11 \times 4-5$ mm, connate above middle, pubescent, base attenuate to a ca. 2 mm claw. Stamens many, (1.5–)2.2–3 mm; connectives apically truncate. Carpels ca. 14, ca. 3 mm, puberulent or glabrous; ovules 2 per carpel, basal; styles ca. $2 \times$ as long as ovaries. Monocarp stipes ca. 4 mm; monocarps 5–16, ellipsoid, $1.8-2.5 \times 0.8-0.9$ cm, glabrous, minutely punctate, apex shortly cuspidate. Seeds (1 or)2 per monocarp. Fl. Apr–Jun, fr. Nov.

• Forested slopes; 100–800 m. S Yunnan.

7. *Goniothalamus leiocarpus* (W. T. Wang) P. T. Li, Acta Phytotax. Sin. 14(1): 112. 1976.

金平哥纳香 jin ping ge na xiang

Mitrephora leiocarpa W. T. Wang, Acta Phytotax. Sin. 6: 207. 1957.

Trees to 5 m tall, glabrous except for flowers. Branches lenticellate. Petiole 6–10 mm, ca. 2 mm thick; leaf blade obovate-oblong to sometimes oblong, 6–29 × 4.5–9 cm, papery, secondary veins 9–18 on each side of midvein, base cuneate to broadly cuneate, apex shortly acuminate to acute. Inflorescences axillary, 2-flowered. Flowers ca. 1.6 cm. Pedicel ca. 1.5 cm, puberulent, bracteolate at base. Sepals broadly ovate, ca. 5 mm, outside sparsely puberulent, inside glabrous. Petals reddish yellow; outer petals ovate, 1.8–2.3 × 1.1–1.5 cm, thickly leathery, outside sparsely puberulent, inside rust-colored tomentulose, base shortly clawed, apex acute; inner petals obovate, ca. 1.3 × 0.8 cm, leathery, outside glabrous, inside pubescent, base with a ca. 3.5 mm claw, margin densely pubescent, apex acute. Stamens ca. 1.5 mm; connectives apically truncate. Carpels ca. 18, linear, ca. 4 mm, glabrous; ovules 10 per carpel, in 2 series; styles clublike, as long as ovaries. Monocarps solitary or several fasciculate, ovoid, 4–7 × 2.2–4.2 cm, glabrous. Seed 1 per monocarp, reniform, 2.5–3 × ca. 2 cm. Fl. May–Jul, fr. Aug–Nov.

- Forested slopes; 700–1600 m. S Yunnan.

8. *Goniothalamus amuyon* (Blanco) Merrill, Philipp. J. Sci., C, 10: 264. 1915.

台湾哥纳香 tai wan ge na xiang

Uvaria amuyon Blanco, Fl. Filip. 463. 1837; *Polyalthia sasakii* Yamamoto.

Shrubs or small trees, 2–5 m tall. Petiole 6–8 mm, sparsely pubescent; leaf blade oblong-elliptic to elliptic, 8–16 × 3–5.5 cm, papery, glabrous, abaxially with brown specks, secondary veins 8–11 on each side of midvein and adaxially slightly prominent, base broadly cuneate, apex obtuse. Inflorescences axillary. Pedicel ca. 6 mm. Sepals ovate-triangular, outside pubescent. Outer petals lanceolate, ca. 3.5 × 0.7 cm, thick, outside pubescent; inner petals ovate, smaller than outer petals. Stamens many; connectives broadly 3-angular. Carpels cylindrical; ovules 1–3 per carpel; styles linear, ca. 3.5 mm. Fruiting carpels ovoid to ellipsoid, 1–1.8 × 0.6–0.9 cm. Seeds 1 or 2 per monocarp. Fl. May–Jul, fr. Jul–Oct.

- Mixed woods; 300–500 m. S Taiwan [Philippines].

9. *Goniothalamus calvicarpus* Craib, Bull. Misc. Inform. Kew 1922: 227. 1922.

大花哥纳香 da hua ge na xiang

Trees to 8 m tall. Branchlets pubescent, glabrescent. Petiole 0.7–1.5 cm, robust; leaf blade oblong, 17–35 × 5.5–9 cm, papery, glabrous, midvein stout and adaxially depressed, secondary veins 14–20 on each side of midvein and slightly elevated on both surfaces, base rounded to broadly cuneate, apex obtuse to shortly acuminate. Inflorescences axillary or extra-axillary, 1-flowered. Pedicel 1–1.5 cm, glabrous, many bracteolate at base. Sepals broadly ovate, 2–2.5 cm, glabrous. Outer petals oblong-lanceolate, 5–6.5 × ca. 1.5 cm, puberulent; inner

petals oblong-ovate, ca. 2 × 0.8 cm, puberulent. Stamens oblong, ca. 4 mm; connectives 3-angular. Carpels cylindrical, ca. 6 mm, pubescent; ovules 2 per carpel; styles elongate; stigmas apically 2-cleft. Monocarps fasciculate, subsessile, ovoid, ca. 1.5 × 0.8 cm, puberulent. Seed 1 per monocarp. Fl. Apr–Aug, fr. Aug–Nov.

- Forested slopes; 800–1500 m. S Yunnan [N Thailand].

Saunders and Chalermglin (Bot. J. Linn. Soc. 156: 359–363. 2008) regard the Chinese material identified as *Goniothalamus griffithii* J. D. Hooker & Thomson to be more correctly placed in *G. calvicarpus*, treating *G. griffithii* as a local species restricted to S Myanmar and adjacent W Thailand. The Chinese material is somewhat intermediate

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between the two, and clearly the situation needs more detailed investigation.

10. *Goniothalamus howii* Merrill & Chun, Sunyatsenia 5: 60. 1940.

海南哥纳香 hai nan ge na xiang

Trees to 15 m tall, glabrous except for flowers. Petiole 7–10 mm; leaf blade oblong to sometimes elliptic, 10–25 × 4–8 cm, papery, brownish when dry, secondary veins 10–15 on each side of midvein, base cuneate to rounded, apex shortly acuminate to obtuse. Inflorescences axillary, 1-flowered. Pedicel 1–2 cm, puberulent, several bracteolate at base. Sepals broadly ovate, ca. 5 mm, outside puberulent. Petals yellowish green; outer petals broadly ovate, 2.2–2.5 × 1.6–1.8 cm, leathery, sparsely pubescent; inner petals broadly ovate to subrhomboid, 1.3–1.5 cm, thickly leathery, densely hispid. Stamens oblong; connectives orbicular. Carpels 15–18, pubescent; ovules 6 per carpel, in 1 series; styles oblong, as long as ovary; stigmas apically 2-cleft. Monocarps ovoid to cylindrical-ovoid, 3–6 × 2–2.5 cm, glabrous. Fl. Mar–Sep, fr. May–Jan.

- Forested slopes; 300–800 m. Hainan, S Yunnan.

11. *Goniothalamus laoticus* (Finet & Gagnepain) Bân, Bot. Zhurn. (Moscow & Leningrad) 59: 554. 1974.

柄芽银钩花 bing ya yin gou hua

Mitrephora laotica Finet & Gagnepain, Bull. Soc. Bot. France 54(Mém. 5): 87. 1907.

Trees to 10 m tall, glabrous except for flowers. Branches robust. Petiole ca. 7 mm; leaf blade oblong, 13–18 × 3–5 cm, leathery, abaxially pale gray/glaucous, adaxially glossy, midvein adaxially concave, secondary and reticulate veins obscure, base attenuate, apex obtuse and shortly cuspidate. Inflorescences 3- or 4-flowered. Flowers ca. 1.2 cm. Pedicel 6–7 mm, robust, bracteolate at base. Sepals broadly ovate to suborbicular, erect, outside puberulent, inside glabrous. Outer petals lanceolate, suberect, both surfaces pubescent; inner petals obovate, ca. 2 × as long as outer petals, both surfaces pubescent, base clawed, margin ciliate. Stamens many; connectives semiorbicular, papillose. Carpels 10, cylindrical, glabrous; ovules 8–10 per carpel; stigmas fusiform, papillose. Fruit not seen. Fl. Apr–Jun, fr. Jul–Oct.

- Dense woods; ca. 700 m. S. Yunnan [Laos, C and N Thailand].

Weerasooriya and Saunders (Syst. Bot. 30: 262. 2005) follow Bân and exclude this species from *Mitrephora*.

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