

RUTACEAE

芸香科 yun xiang ke

Zhang Dianxiang (张奠湘)¹; Thomas G. Hartley², David J. Mabberley³

Shrubs, trees, or sometimes herbs, sometimes scrambling or scandent, sometimes armed, with aromatic volatile oils contained in glands visible at surface of at least leaves, young branchlets, inflorescences, flower parts, fruit, or cotyledons in seed. Stipules absent [or stipular excrescences rarely present]. Leaves alternate, opposite [or whorled], simple (petiole neither apically swollen nor articulate with leaf blade), 1-foliolate (in individual specimens at least some 1-foliolate leaves with petiole apically swollen and/or articulate with leaf blade), or variously compound. Flowers bisexual or unisexual, usually 3–5-merous, actinomorphic or rarely zygomorphic, hypogynous [or rarely perigynous]. Perianth in 2 series, with clearly differentiated calyx and corolla or sometimes in 2 irregular series or 1 series, with \pm undifferentiated tepals. Sepals distinct or connate to their full length. Petals distinct [or rarely coherent or connate for part of their length]. Stamens usually as many as or $2 \times$ as many as petals or sometimes more numerous; filaments distinct or sometimes coherent or connate for at least part of their length; anthers introrse or sometimes latrorse, longitudinally dehiscent. Disk [rarely lacking] within androecium, nectariferous, flattened, annular, cup-shaped, pulvinate, or sometimes columnar, bell-shaped, conic, or hour-glass-shaped. Gynoecium of 1–5 distinct 1-loculed carpels or 2 to many partially to completely connate carpels; placentation axile [very rarely becoming parietal]; ovules 1 to many per locule. Fruit of 2–5 follicles [drupes or samaras] or a single follicle, capsule, or berry [or samara]. Seeds with relatively large embryo; endosperm present and fleshy or lacking.

About 155 genera and ca. 1600 species: nearly cosmopolitan but mainly tropical and subtropical; 22 genera (one endemic, one introduced) and 126 species and hybrid species (49 endemic, at least two introduced) in China.

Oil glands of Rutaceae, when viewed from the surface of plant parts they occupy, are usually pellucid. They also appear to be \pm isodiametric and to have \pm definite patterns of distribution. In blades of leaves, for example, where they are most commonly observed, they are usually \pm evenly scattered throughout, or sometimes they are restricted to the margins. Rarely they are alleged to occur only along the secondary veins of the blades.

In a cladistic analysis of selected genera of Rutaceae and related families based on *rbcL* and *atpB* molecular data (but only on *rbcL* data for *Harrisonia*), M. W. Chase, C. M. Morton, and J. A. Kallunki (Amer. J. Bot. 86: 1191–1199. 1999) recommended the placement of *Harrisonia* (traditionally Simaroubaceae) in Rutaceae. We do not agree with this classification, particularly because *Harrisonia* appears to lack oil glands, and suggest that the genus is most correctly placed in Cneoraceae, in which it is treated herein.

Several taxa of cultivated Rutaceae treated by C. C. Huang (Fl. Reipubl. Popularis Sin. 43(3). 1997) are not treated here: *Casimiroa edulis* La Llave, which is native to Mexico, has been introduced as a cultivated plant to the Xishuangbanna Botanical Garden in Yunnan; *Limonia acidissima* Linnaeus (*Feronia limonia* (Linnaeus) Swingle), which is native to India and Sri Lanka, has been reported as cultivated in Taiwan by C. C. Huang (Fl. Reipubl. Popularis Sin. 44(3): 212. 1997) but was not reported as a cultivated plant by T. C. Huang in A Checklist of the Vascular Plants of Taiwan (Fl. Taiwan 6: 81–83. 1979); *Flindersia amboinensis* Poiret, which is native to Indonesia and New Guinea, is cultivated in S China; *Ptelea trifoliata* Linnaeus, which is native to North America, is cultivated in Beijing and Liaoning; and *Ruta graveolens* Linnaeus, which is native to the Mediterranean region, is widely cultivated in China.

Huang Chengchiu. 1997. Rutaceae. In: Huang Chengchiu, ed., Fl. Reipubl. Popularis Sin. 43(2): ii–viii, 1–250.

1a. Leaves opposite.

2a. Leaves mostly odd-pinnate; inflorescences terminal or terminal and axillary; plants dioecious.

3a. Axillary buds exposed; ovary in female flowers with carpels connate at base, otherwise contiguous; fruit of 1–5 follicles 3. *Tetradium*

3b. Axillary buds concealed in excavated base of petioles; ovary in female flowers syncarpous; fruit a drupaceous berry 10. *Phellodendron*

2b. Leaves digitately 3-foliolate or 1-foliolate; inflorescences axillary or basal to leaves; plants usually monoclinal or dioecious.

4a. Leaves digitately 3-foliolate or 1-foliolate; ovary in bisexual and female flowers with carpels connate at base, otherwise contiguous; fruit of 1–4 basally connate follicles 4. *Melicope*

4b. Leaves 1-foliolate; ovary in bisexual and female flowers syncarpous or rarely (*Acronychia*) separated apically by septicial fissures; fruit a drupaceous berry.

5a. Flowers male or female; stamens glabrous, similar in male and female flowers but lacking pollen in latter; gynoecium rudimentary and minute in male flowers, \pm as long as petals in female flowers; seed coat with thick inner layer of dense black sclerenchyma and spongy outer layer bounded externally by a shiny black pellicle 12. *Maclurodendron*

5b. Flowers bisexual; staminal filaments with an indumentum; gynoecium \pm half as long as petals; seed coat with thick inner layer of dense black sclerenchyma and an outer layer of compact dull to \pm shiny parenchymatous tissue 11. *Acronychia*

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- 1b. Leaves alternate.
- 6a. Plants herbaceous perennials.
- 7a. Leaves mostly simple 6. *Haplophyllum*
- 7b. Leaves mostly compound.
- 8a. Flowers zygomorphic, 5-merous; stamens 10; fruit of 5 basally connate follicles, 1–2 cm 8. *Dictamnus*
- 8b. Flowers actinomorphic, 4-merous; stamens usually 8; fruit follicular or capsular, to 0.5 cm.
- 9a. Leaves pinnately to ternately decompose; fruit of 4 distinct follicles 5. *Boenninghausenia*
- 9b. Leaves mostly digitately 3-foliolate; fruit a capsule 7. *Psilopogonum*
- 6b. Plants woody.
- 10a. Fruit follicular or drupaceous; endocarp cartilaginous or leathery; seeds with endosperm; flowers male, female, or sometimes bisexual; functional stamens as many as petals except in plants of *Zanthoxylum* with undifferentiated perianth which have 5–9 tepals and 3–8(–10) functional stamens; functional gynoecium 1–7-loculed, syncarpous or with distinct or only basally connate carpels.
- 11a. Leaves mostly compound; plants usually armed.
- 12a. Leaves odd-pinnately 3- to many foliolate or sometimes digitately 3-foliolate (occasional leaves even-pinnate, 2-foliolate, or 1-foliolate); functional gynoecium 1–5-loculed, with distinct carpels or carpels basally connate; fruit of 1–5 distinct or basally connate follicles 1. *Zanthoxylum*
- 12b. Leaves digitately 3-foliolate (occasional leaves 1- or 2-foliolate); functional gynoecium 4–7-loculed, syncarpous; fruit a 4–7-loculed drupaceous berry 9. *Toddalia*
- 11b. Leaves simple; plants unarmed.
- 13a. Inflorescences axillary, between leaves, or basal to leaves; flowers male or female; functional gynoecium 4-loculed; ovaries basally connate; fruit of 1–4 basally connate follicles 2. *Orixa*
- 13b. Inflorescences terminal; flowers male, female, or sometimes bisexual; functional gynoecium 2–5-loculed, syncarpous; fruit drupaceous berry, with 1–5 1-seeded leathery pyrenes 13. *Skimmia*
- 10b. Fruit baccate; endocarp membranous or fleshy; seeds without endosperm; flowers bisexual or bisexual and male; stamens at least 2 × as many as petals or rarely fewer; functional gynoecium 2- to many loculed, syncarpous.
- 14a. Flowers bisexual or bisexual and male; stamens more than 2 × as many as petals; gynoecium 2- to many loculed; ovules 2 to many per locule; fruit with stalked or rarely sessile pulp vesicles; leaves odd-pinnately 3(or 5)-foliolate, digitately 3-foliolate, 1-foliolate, or simple.
- 15a. Plants evergreen, rarely deciduous (*Citrus trifoliata*); fruit with leathery (or rarely soft) exocarp and spongy mesocarp; seeds embedded in pulp vesicles; leaves 1-foliolate, simple, or rarely digitately 3-foliolate 21. *Citrus*
- 15b. Plants deciduous; fruit with thin, parenchymatous exocarp and woody mesocarp; seeds embedded in a clear glutinous substance; leaves odd-pinnately 3(or 5)-foliolate 22. *Aegle*
- 14b. Flowers bisexual; stamens 2 × as many as petals or rarely fewer; gynoecium 2–5-loculed; ovules 1 or 2 per locule; fruit either without pulp vesicles or with sessile pulp vesicles; leaves odd-pinnately 3- to many foliolate, digitately 3-foliolate, 1-foliolate, or simple (occasional leaves 2-foliolate).
- 16a. Radial walls of locules in gynoecium becoming curved after anthesis; cotyledons in seed thin and flat, convolute, and/or folded 14. *Micromelum*
- 16b. Radial walls of locules in gynoecium straight; cotyledons in seed plano-convex, neither convolute nor folded.
- 17a. Terminal and axillary buds and usually young inflorescences with a rust-colored villosulous indumentum (sometimes partly bleached); style persistent in fruit 15. *Glycosmis*
- 17b. Terminal and axillary buds and young inflorescences without a rust-colored villosulous indumentum; style or at least its distal portion usually deciduous in fruit.
- 18a. Leaves 1-foliolate or simple.
- 19a. Fruit without pulp vesicles; stamens distinct; flowers axillary, solitary or in few-flowered fascicles; petiole 0.4–2.5 cm, usually bent and/or twisted and ± apically swollen; erect or scrambling shrubs or woody climbers, usually armed 19. *Paramignya*
- 19b. Fruit usually with pulp vesicles; stamens distinct or with filaments variously connate or coherent; flowers in terminal and/or axillary inflorescences, in fascicles, racemes, or panicles; petiole 0.2–1.3 cm, usually not bent, twisted, or swollen; shrubs or trees, armed or unarmed 20. *Atalantia*
- 18b. Leaves, or most of them, compound.
- 20a. Leaves mostly digitately 3-foliolate; woody climbers, armed 18. *Luvunga*
- 20b. Leaves odd-pinnate; shrubs or trees, unarmed.

- 21a. Flower buds globose, pyriform, or rarely ovoid; staminal filaments \pm abruptly dilated toward base, \pm straight or geniculate; style 0.5–2.5 \times as long as ovary; disk columnar, conic, bell-shaped, or \pm hourglass-shaped; seeds glabrous 16. *Clausena*
- 21b. Flower buds ellipsoid to obovoid or narrowly so or subcylindric; staminal filaments linear or sublinate, \pm straight; style 3–7 \times as long as ovary; disk annular, pulvinate, or columnar; seeds glabrous or villous 17. *Murraya*

1. ZANTHOXYLUM Linnaeus, Sp. Pl. 1: 270. 1753.

花椒属 hua jiao shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Shrubs sometimes scrambling, trees, or woody climbers, evergreen or deciduous, dioecious, rarely monoecious or polygamo-monoecious [or monoclinal], usually armed [or exclusively unarmed]. Leaves alternate, odd-pinnately 3- to many foliolate or sometimes digitately 3-foliolate (occasional leaves even-pinnate, 2-foliolate, or 1-foliolate). Inflorescences terminal, axillary, or basal to leaves, paniculate, thyriform, corymbiform, racemose, or umbelliform. Perianth in 2 series and differentiated with 4 or 5 sepals and 4 or 5 petals or grading to 1 series and undifferentiated with 5–9 tepals. Sepals distinct or basally connate. Petals valvate or imbricate in bud. Stamens distinct, 4 or 5 in plants with sepals and petals, 3–8(–10) in plants with tepals, rudimentary or lacking in female flowers. Disk flattened, pulvinate, or columnar. Gynoecium 1–5-carpelled, rudimentary or lacking in male flowers; ovaries basally connate, otherwise \pm contiguous or distinct, 1-loculed; ovules 2 per locule. Styles in compound gynoecium apical or subapical, coherent or contiguous to spreading-ascending or recurved; stigmas capitate, coherent or distinct. Style in simple gynoecium off-centered, erect or variously curved or bent; stigma capitate to peltate. Fruit follicles 1–5, distinct or basally connate, apex often with a stylar beak; abortive carpels, if any, often persistent. Seeds globose to ovoid, persistent in dehiscent fruit; seed coat with a thick or rarely \pm thin inner layer of dense black sclerenchyma and spongy-fleshy outer layer bounded externally by a shiny black or reddish pellicle; endosperm copious or rarely scant; embryo straight or \pm curved; cotyledons \pm orbicular to broadly elliptic, flattened or rarely plano-convex; hypocotyl superior.

Two hundred or more species: pantropical and extending to temperate latitudes in E Asia and E North America; 41 species (25 endemic) in China.

- 1a. Perianth in 2 irregular series or 1 series, with 5–9 \pm undifferentiated tepals; stamens in male flowers 4–8(–10).
- 2a. Gynoecium in female flowers 1(or 2)-carpelled and leaf rachises not winged but canaliculate with sides of channel rarely slightly spreading at apex of rachis 32. *Z. wutaiense*
- 2b. Gynoecium in female flowers 2–5-carpelled or if 1-carpelled then leaf rachises with wing to 6 mm wide on each side.
- 3a. Fruit follicles stipitate.
- 4a. Leaflet blades 0.7–1.3 cm wide 41. *Z. stipitatum*
- 4b. Leaflet blades usually at least 1.5 cm wide.
- 5a. Leaves 3–5(–11)-foliolate; follicles apically shortly beaked 29. *Z. dimorphophyllum*
- 5b. Leaves 5–15-foliolate; follicles not apically beaked 40. *Z. simulans*
- 3b. Fruit follicles not stipitate.
- 6a. Leaf rachises usually conspicuously winged.
- 7a. Wings of leaf rachis extending to as much as 3 mm on each side; secondary veins of leaflet blades evident, 10–28 on each side of midvein; anthers in male flowers reddish purple prior to anthesis; gynoecium in female flowers 2–5-carpelled 30. *Z. acanthopodium*
- 7b. Wings of leaf rachis extending to as much as 6 mm on each side; secondary veins of leaflet blades generally faint especially adaxially, 7–15 on each side of midvein; anthers in male flowers yellow prior to anthesis; gynoecium in female flowers 1–3-carpelled 31. *Z. armatum*
- 6b. Leaf rachises not conspicuously winged but sometimes with a distinct margin.
- 8a. Fruit follicles pubescent; branchlets covered with setiform prickles and compressed pseudostipular prickles decurrent along branchlet and forming a wing joining them between nodes 39. *Z. pteracanthum*
- 8b. Fruit follicles glabrous; branchlets without compressed pseudostipular prickles joined by a wing.
- 9a. Leaflet blades to 3 \times 1.5 cm.
- 10a. Leaflet blades reddish brown to blackish brown when dry 37. *Z. piasezkii*
- 10b. Leaflet blades grayish green to yellowish green when dry 38. *Z. pilosulum*
- 9b. Leaflet blades usually larger than 3 \times 1.5 cm.
- 11a. Leaf near inflorescence on fertile branchlet 3-foliolate, with terminal leaflet 4–6 cm wide 36. *Z. motuoense*
- 11b. Leaf near inflorescence on fertile branchlet more than 5-foliolate, with terminal leaflet less than 3.5 cm wide.

- 12a. Leaf rachises terete, glabrous 35. *Z. austrosinense*
 12b. Leaf rachises with a distinct margin or pubescent.
 13a. Leaflet blades abaxially flocculent along midvein and adaxially glabrous or both surfaces
 pubescent 33. *Z. bungeanum*
 13b. Leaflet blades abaxially glabrous and adaxially hirsutulous to sparsely puberulent 34. *Z. undulatifolium*
- 1b. Perianth in 2 series, with 4 or 5 sepals and 4 or 5 petals; stamens in male flowers 4 or 5.
 14a. Flowers 5-merous; trees or rarely shrubs.
 15a. Shrubs; leaflet blades rarely wider than 2 cm, adaxially with trichomes and abaxially glabrous 28. *Z. schinifolium*
 15b. Trees; leaflet blades wider than 2 cm, adaxially glabrous or both surfaces with trichomes.
 16a. Fertile branchlets unarmed, with small pith; leaf rachises winged.
 17a. Gynoecium in female flowers 2(or 3)-carpelled; leaflet blades asymmetric, oblique at base 23. *Z. avicennae*
 17b. Gynoecium in female flowers 3(or 4)-carpelled; leaflet blades at base rounded to broadly cuneate,
 symmetric or asymmetric 24. *Z. micranthum*
 16b. Fertile branchlets armed, with large pith; leaf rachises not winged.
 18a. Leaflet blades glabrous.
 19a. Leaflet blades dark green to light yellowish green when dry, abaxially glaucous 25. *Z. ailanthoides*
 19b. Leaflet blades reddish brown to blackish brown, abaxially not glaucous 26. *Z. myriacanthum*
 18b. Leaflet blades abaxially and/or adaxially with trichomes.
 20a. Leaflet blades abaxially and adaxially with trichomes 26. *Z. myriacanthum*
 20b. Leaflet blades abaxially with trichomes, otherwise glabrous.
 21a. Leaflet blades abaxially with a soft woolly villous indumentum 27. *Z. molle*
 21b. Leaflet blades abaxially pubescent 25. *Z. ailanthoides*
- 14b. Flowers 4-merous; woody climbers, shrubs, or rarely trees.
 22a. Gynoecium in female flowers 2- or 3-carpelled and styles usually recurved; follicles stipitate 29. *Z. dimorphophyllum*
 22b. Gynoecium in female flowers 1-carpelled or if 2–4-carpelled then styles usually erect to
 spreading-ascending; follicles not stipitate.
 23a. Inflorescences terminal, cymose-corymbiform; pedicel at least 1 cm in fruit and purplish red like follicles.
 24a. Fruit pedicel 1–1.5 cm, ca. 1 mm wide; leaflet blades with numerous oil glands, midvein adaxially
 impressed and puberulent, margin of blade serrulate 20. *Z. oxyphyllum*
 24b. Fruit pedicel 1.5–4.5 cm, less than 1 mm wide; leaflet blades with inconspicuous oil glands, midvein
 adaxially ridged, plane, or impressed, margin of blade crenulate or entire toward base.
 25a. Midvein on adaxial surface of leaflet blades ridged or plane toward apex, petiolules pubescent
 adaxially 21. *Z. stenophyllum*
 25b. Midvein on adaxial surface of leaflet blades impressed, petiolules glabrous 22. *Z. esquirolii*
- 23b. Inflorescences axillary and terminal, thyrsiform; pedicel rarely to 1 cm in fruit and not purplish red.
 26a. Fruit follicles with prickles and/or trichomes.
 27a. Fruit follicles with prickles and trichomes 19. *Z. echinocarpum*
 27b. Fruit follicles with trichomes, without prickles.
 28a. Leaflets opposite; leaflet blades 7–19 × 5–8 cm 17. *Z. collinsiae*
 28b. Leaflets alternate to opposite; leaflet blades 6–8 × 2.5–3.5 cm 18. *Z. liboense*
- 26b. Fruit follicles with neither prickles nor trichomes.
 29a. Fruit follicles 1–1.5 cm; outer part of pericarp (exocarp and mesocarp) wider than endocarp 16. *Z. dissitum*
 29b. Fruit follicles to 0.9 cm; outer part of pericarp not wider than endocarp.
 30a. Leaflets opposite.
 31a. Trees; leaflet blades asymmetric 3. *Z. integrifolium*
 31b. Woody climbers or shrubs; leaflet blades symmetric.
 32a. Leaflet blades abaxially without oil glands along secondary veins, apex retuse at tip; petiolules
 obsolete or to 5 mm 1. *Z. nitidum*
 32b. Leaflet blades abaxially with oil glands along secondary veins, apex not retuse at tip;
 petiolules ca. 1 mm 2. *Z. xichouense*
- 30b. Leaflets alternate or partly opposite.
 33a. Leaflet blades abaxially, leaf rachises, and inflorescences tomentulose 4. *Z. tomentellum*
 33b. Leaflet blades abaxially, leaf rachises, and inflorescences glabrous or puberulent.
 34a. Leaves with numerous oil glands which project outward when dry.
 35a. Fruit follicles not apically beaked; leaflet blade oil glands light yellow to brown when dry,
 pellucid 5. *Z. glomeratum*
 35b. Fruit follicles usually apically beaked; leaflet blade oil glands brown or blades blackish
 brown when dry.
 36a. Leaves 3- or 7(or 9)-foliolate; leaflet blades at least 5 cm, lustrous when dry 6. *Z. macranthum*

- 36b. Leaves 7–51-foliolate; leaflet blades rarely to 5 cm, dull when dry.
 37a. Leaves 7–15-foliolate; leaflet blades symmetric or subsymmetric, midvein adaxially impressed 7. *Z. rhombifoliolatum*
 37b. Leaves 17–51-foliolate; leaflet blades asymmetric, midvein adaxially plane to ridged 13. *Z. multijugum*
 34b. Leaves with few oil glands or oil glands inconspicuous.
 38a. Leaf rachises with straight prickles 5–10 mm 8. *Z. leiboicum*
 38b. Leaf rachises unarmed or with curved prickles rarely to 5 mm.
 39a. Fruit follicles 7–8 mm; margin of leaflet blades entire 9. *Z. laetum*
 39b. Fruit follicles 5–6 mm; margin of leaflet blades crenate at least near apex or rarely entire.
 40a. Pedicel of fruit and rachis of infructescences glabrous or sparsely puberulent 10. *Z. scandens*
 40b. Pedicel of fruit and rachis of infructescences puberulent or pubescent.
 41a. Leaflet blades abaxially pubescent at least on midvein toward base or secondary veins 11. *Z. kwangsiense*
 41b. Leaflet blades abaxially glabrous.
 42a. Fruit pedicel 7–10 mm; petiolules 4–10 mm, leaflet blade apices caudate 12. *Z. khasianum*
 42b. Fruit pedicel rarely more than 5 mm; petiolules 1–4 mm, leaflet blade apices acute, shortly acuminate, or shortly caudate.
 43a. Leaflet blades 2–5 × 0.7–2.5 cm, apex acute or shortly acuminate; inflorescences to 3 cm; innovations glaucous 14. *Z. calcicola*
 43b. Leaflet blades 6–10 × 2.5–4 cm, apex shortly caudate; inflorescences to 26 cm; innovations not glaucous 15. *Z. yuanjiangense*

1. *Zanthoxylum nitidum* (Roxburgh) Candolle, Prodr. 1: 727. 1824.

两面针 liang mian zhen

Shrubs, erect or scrambling, or sometimes woody climbers. Trunk winged. Stems, branchlets, and leaf rachises usually with prickles. Rachis of inflorescences and abaxial surface of leaflet blades glabrous or hirsutulous. Leaves (3 or)5–11-foliolate; petiolules obsolete or to 5 mm; leaflet blades opposite, broadly ovate, subcordate, elliptic, narrowly elliptic, or rarely ovate, 3–12 × 1.5–6(–8) cm, leathery, secondary and tertiary veins abaxially ridged when dry, margin crenate at least toward apex or entire, apex acuminate to caudate with a retuse tip. Inflorescences axillary. Flowers 4-merous. Perianth in 2 series. Sepals ca. 1 mm wide, apically purplish green. Petals pale yellowish green, ovate-elliptic to oblong, ca. 3 mm. Stamens in male flowers 5–6 mm; mature anthers ellipsoid to globose. Petals in female flowers broader than those in male flowers. Gynoecium in female flowers 4-carpelled; carpels globose. Styles stout, coherent at anthesis; stigma capitate. Fruit pedicel 2–5 mm; follicles reddish brown, (5–)5.5–7 mm in diam., apex beaked. Fl. Mar–May, fr. Sep–Nov or May.

Below 800 m. Fujian, Guangdong, Guangxi, S and SE Guizhou, Hainan, S Hunan, Taiwan, Yunnan, S Zhejiang [India, Indonesia, Japan (Ryukyu Islands), Malaysia, Myanmar, Nepal, New Guinea, Philippines, Thailand, Vietnam; Australia, SW Pacific islands].

- 1a. Rachis of inflorescences and abaxial surface of leaflet blades glabrous 1a. var. *nitidum*
 1b. Rachis of inflorescences and abaxial surface of leaflet blades hirsutulous .. 1b. var. *tomentosum*

1a. *Zanthoxylum nitidum* var. *nitidum*

两面针(原变种) liang mian zhen (yuan bian zhong)

Fagara nitida Roxburgh, Fl. Ind. 1: 439. 1820; *F. hamiltoniana* (Wallich ex J. D. Hooker) Engler; *F. hirtella* (Ridley)

Engler; *F. oblongifolia* Bakhuizen f.; *F. pendjaluensis* Bakhuizen f.; *F. torva* (F. Mueller) Engler; *F. warburgii* Perkins; *Zanthoxylum asperum* C. C. Huang var. *glabrum* C. C. Huang; *Z. hamiltonianum* Wallich ex J. D. Hooker; *Z. hirtellum* Ridley; *Z. torvum* F. Mueller.

Rachis of inflorescences and abaxial surface of leaflet blades glabrous. Petiolules 2–5 mm or leaflets sessile; leaflet blades broadly ovate, subcordate, or narrowly elliptic, 1.5–6 cm wide, margin crenate or entire, apex caudate with a retuse tip. Fruit follicles 5.5–7 mm in diam. Fr. Sep–Nov.

Below 800 m. Fujian, Guangdong, Guangxi, S and SE Guizhou, Hainan, S Hunan, Taiwan, Yunnan, S Zhejiang [India, Indonesia, Japan (Ryukyu Islands), Malaysia, Myanmar, Nepal, New Guinea, Philippines, Thailand, Vietnam; Australia, SW Pacific islands].

1b. *Zanthoxylum nitidum* var. *tomentosum* C. C. Huang, Guihaia 7: 5. 1987.

毛叶两面针 mao ye liang mian zhen

Rachis of inflorescences and abaxial surface of leaflet blades hirsutulous. Petiolules 1–3 mm; leaflet blades elliptic or rarely ovate, 3–5(–8) cm wide, margin revolute and entire or apically crenate, apex acuminate. Fruit follicles ca. 5 mm in diam. Fr. May.

- Hillside thickets. E Guangxi (Pingnan).

2. *Zanthoxylum xichouense* C. C. Huang, Acta Phytotax. Sin. 16(2): 83. 1978.

西畴花椒 xi chou hua jiao

Woody climbers, glabrous except for inflorescence rachises. Branchlets dark reddish purple when young, unarmed or spinose. Leaves 3–7-foliolate; petiolules ca. 1 mm; leaflet blades opposite, elliptic to obovate, 5–10 × 3–5 cm, thinly papery, oil glands inconspicuous, reticulate veinlets ridged when dry, base broadly cuneate, margin entire, apex acuminate. In-

fructescences axillary. Pedicel 4–7 mm in fruit. Fruit follicles crimson, globose, ca. 5.5 mm in diam., apex beaked; exocarp, mesocarp, and endocarp thin. Seeds 4–4.5 mm in diam. Fr. Oct.

- Forests; 1400–1500 m. SE Yunnan (Xichou).

3. *Zanthoxylum integrifolium* (Merrill) Merrill, Enum. Philipp. Fl. Pl. 2: 327. 1923.

兰屿花椒 lan yu hua jiao

Fagara integrifolia Merrill, Philipp. J. Sci. 1(Suppl. 1): 68. 1906.

Trees 13–20 m tall. Branchlets prickly. Leaves (13–)17–25-foliolate; rachis unarmed; petiolules 5–7 mm; leaflet blades opposite, oblong to obovate, 1.5–2 × 0.6–0.8 cm, papery, glabrous, adaxially lustrous when dry, oil glands inconspicuous, midvein adaxially impressed, secondary veins adaxially ridged, base oblique, margin entire, apex cuspidate with a blunt tip. Inflorescences terminal or axillary, to 25 cm. Flowers 4-merous. Perianth in 2 series. Petals white, ca. 3 mm. Male flowers: stamens 4; rudimentary gynoecium shortly conic. Female flowers 1-carpelled. Fruit pedicel 3–5 mm; follicle single, ca. 7 mm in diam. Seeds ca. 6 mm in diam.

- Taiwan (Lan Yu) [Philippines].

4. *Zanthoxylum tomentellum* J. D. Hooker, Fl. Brit. India 1: 493. 1875.

毡毛花椒 zhan mao hua jiao

Fagara tomentella (J. D. Hooker) Handel-Mazzetti; *F. tomentella* var. *mekongensis* Handel-Mazzetti.

Woody climbers. Young branchlets, leaf rachises, petiolules, abaxial surface of leaflet blades, and rachis of infructescences grayish yellow to grayish brown tomentulose. Leaves 7–15-foliolate; petiolules to 5 mm, thick; leaflet blades alternate, ovate to elliptic, 4–8 × 2–4 cm, leathery, midvein adaxially plane or ridged, base obliquely rounded, margin entire or apically crenate, apex mucronate to cuspidate. Inflorescences axillary. Flowers 4-merous. Perianth in 2 series. Petals pale yellowish white. Male flowers: stamens 4, longer than petals; connective with an oil gland at apex; rudimentary gynoecium shorter than petals. Female flowers: carpels globose. Infructescences 3–12 cm. Fruit pedicel 2–5 mm, thick; follicles reddish brown, becoming brownish black when dry, 5–6 mm in diam., oil glands slightly protruding, apex beaked. Seeds ca. 5 mm in diam. Fl. Apr–May, fr. Sep–Oct. $2n = 72$.

- Moist valleys; 2000–3000 m. NW and W Yunnan [Bhutan, NE India, Myanmar, Nepal].

5. *Zanthoxylum glomeratum* C. C. Huang, Acta Phytotax. Sin. 16(2): 82. 1978.

密果花椒 mi guo hua jiao

Shrubs. Branchlets and leaves glabrous, unarmed or with prickles. Leaves 5–9-foliolate; petiolules 4–8 mm; leaflet blades alternate, lanceolate, long elliptic, or rarely ovate, 6–12 × 2.5–5 cm, thickly papery, oil glands numerous, reticulate veinlets abaxially inconspicuous and adaxially ridged, margin entire,

apex acuminate to caudate with a rounded to retuse tip. Inflorescences axillary, thyriform. Female inflorescences 2–6 cm. Flowers 4-merous. Pedicel 1–2 mm. Perianth in 2 series. Petals pale yellowish green, ovate-elliptic, ca. 3 mm. Infructescences globose to conic. Fruit pedicel 5–8 mm; follicles pale yellow to brownish yellow when dry, ca. 7 mm, oil glands impressed, apex not beaked. Seeds dark brown, ca. 6 mm in diam. Fl. Apr, fr. Sep.

- Upland forests and thickets; ca. 1500 m. Guangxi (Damiao Shan), SE Guizhou (Rongjiang).

6. *Zanthoxylum macranthum* (Handel-Mazzetti) C. C. Huang, Acta Phytotax. Sin. 6: 70. 1957.

大花花椒 da hua hua jiao

Fagara macrantha Handel-Mazzetti, Sinensia 5: 17. 1934.

Woody climbers, unarmed or echinate on abaxial surface of leaf rachis. Branchlets dark gray, rugose. Leaves 3- or 7(or 9)-foliolate; leaflet blades opposite, ovate, elliptic, or oblanceolate, 5–10 × 1.5–4 cm, thickly leathery, abaxially lustrous when dry, oil glands visible and slightly protruding when dry, midvein impressed and puberulent, base symmetric or rarely oblique, margin entire or crenate and becoming revolute. Inflorescences axillary, thyriform. Female flowers sessile or with a pedicel to 1 mm, male flowers with a longer pedicel. Flowers 4-merous. Perianth in 2 series. Sepals purplish green. Petals pale yellowish green, broadly elliptic, ca. 3 mm. Male flowers: filaments ca. 4 mm; rudimentary gynoecium shortly club-shaped, apically 2-lobed. Female flowers: carpels 4. Infructescences 3–5 cm. Fruit pedicel 2–3 mm; follicles reddish brown, 5.6–6 mm in diam., with a flange, oil glands impressed, apex beaked. Seeds ca. 5 mm in diam. Fl. Apr–May, fr. Aug–Sep.

- Upland open forests and thickets; 500–3100 m. Chongqing (Nanchuan), Guizhou, SW Henan, W Hubei, Hunan, Sichuan (Emei Shan), S Yunnan (Xishuangbanna), SE Xizang.

7. *Zanthoxylum rhombifoliolatum* C. C. Huang, Acta Phytotax. Sin. 6: 67. 1957.

菱叶花椒 ling ye hua jiao

Shrubs 1–2 m tall, erect, glabrous. Branchlets and leaf rachises unarmed or prickly. Young branchlets purplish red. Leaves 7–15-foliolate; petiolules 1–5 mm; leaflet blades subopposite or alternate, rhombic, elliptic, or broadly ovate, 1.5–5 × 1–2.5 cm, leathery, oil glands numerous and slightly protruding when dry, midvein adaxially impressed, secondary veins 4–7 on each side of midvein, base oblique or symmetric and narrowly to broadly cuneate, margin crenate, apex mucronate to caudate. Inflorescences terminal or axillary, 4–10 cm. Flowers 4-merous. Perianth in 2 series. Sepals purplish green, ovate to broadly deltoid, ca. 0.3 mm. Petals 2–3 mm. Male flowers sessile; rudimentary gynoecium shortly club-shaped, 2-cleft to entire. Fruit pedicel 1–3 mm; follicles red when mature, ca. 5 mm in diam., oil glands numerous and slightly protruding. Seeds ca. 4 mm in diam. Fl. May, fr. Sep.

- Upland open forests; 500–1000 m. Chongqing (Nanchuan, Zhongxian), Guizhou (Zheng'an).

8. *Zanthoxylum leiboicum* C. C. Huang, Acta Phytotax. Sin. 16(2): 82. 1978.

雷波花椒 lei bo hua jiao

Zanthoxylum calcicola C. C. Huang var. *macrocarpum* C. C. Huang.

Shrubs to 2 m tall, erect. Branchlets and leaf rachises with prickles. Leaves 17–31-foliolate; petiolules 1–3 mm, puberulent; leaflet blades subopposite to alternate, broadly ovate to obovate with rounded or cuspidate apex, or ovate-obdeltoid with abrupt apex, 2–4 × 1.5–2.5 cm, thickly papery, oil glands inconspicuous, midvein impressed or apically plane, basally puberulent, margin apically crenulate. Inflorescences axillary, subracemously cymose, 4–10 cm. Fruit pedicel 1–3 mm; follicles dark blackish brown when dry, 0.5–1.5 cm in diam., rugulose, oil glands inconspicuous, apex beaked. Seeds ca. 5 mm in diam. Fr. Jul.

• Thickets on dry hill slopes, river valleys; 400–1500 m. SW Sichuan.

9. *Zanthoxylum laetum* Drake, J. Bot. (Morot) 6: 274. 1892.

拟蚬壳花椒 ni xian ke hua jiao

Zanthoxylum dissitoides C. C. Huang.

Woody climbers to 4 m tall. Trunk, branches, branchlets, and leaf rachises with prickles. Rachis of young leaves, petiolules, and midvein of leaflet blades puberulent. Leaves 5–13-foliolate; petiolules 2–6 mm; leaflet blades alternate, ovate, ovate-elliptic, or rarely oblong, 8–15 × 4–7 cm, adaxially lustrous, oil glands sparse, inconspicuous, and pellucid, midvein plane to adaxially impressed, secondary veins 9–14 on each side of midvein, base symmetric or rarely oblique, margin entire, apex acuminate. Inflorescences axillary. Flowers 4-merous. Pedicel ca. 4 mm. Perianth in 2 series. Sepals pale purplish green, narrowly ovate, to 1 mm. Petals yellowish green, broadly ovate, ca. 4 mm. Male flowers: filaments pale yellowish green, linear, 6–8 mm; rudimentary gynoecium terete, 4-lobed. Female flowers: staminodes shortly linear. Fruit pedicel 2–5 mm; follicles reddish brown with purplish red margin, 7–9 mm in diam., with a flange, oil glands impressed when dry, apex beaked. Seeds brownish black, subglobose, 6–7 mm in diam. Fl. Mar–May, fr. Sep–Dec.

Moist thickets and forests; 500–1300 m. Guangdong (Zhanjiang), SW Guangxi, Hainan, S Yunnan [N Vietnam].

10. *Zanthoxylum scandens* Blume, Bijdr. 249. 1825.

花椒筋 hua jiao le

Fagara chinensis Merrill; *F. cuspidata* (Champion ex Benth) Engler; *F. cyrtorhachia* Hayata; *F. laxifoliolata* Hayata; *F. leiorhachia* Hayata; *F. scandens* (Blume) Engler; *Zanthoxylum chinense* (Merrill) Chung; *Z. cuspidatum* Champion ex Benth; *Z. cyrtorhachium* (Hayata) C. C. Huang; *Z. laxifoliolatum* (Hayata) C. C. Huang; *Z. leiorhachium* (Hayata) C. C. Huang.

Shrubs or woody climbers. Trunks, branches, branchlets, and leaf rachises with prickles. Leaves 5–25-foliolate; leaflet

blades alternate or opposite on distal part of leaf rachis, ovate, ovate-elliptic, or obliquely oblong, 4–10 × 1.5–4 cm, both surfaces black or blackish brown when dry, abaxially lustrous, oil glands inconspicuous, midvein impressed and glabrous or plane and puberulent, base oblique to subsymmetric and obtuse to broadly cuneate, margin entire or apically crenulate, apex mucronate, caudate, cuspidate, or long acuminate and with an obtuse to retuse tip. Inflorescences terminal or axillary. Flowers 4-merous. Perianth in 2 series. Sepals pale purplish green, broadly ovate, ca. 0.5 mm. Petals pale yellowish green, 2–3 mm. Male flowers: stamens 4, 3–4 mm; connective with an oil gland at apex; rudimentary gynoecium subtended by pulvinate disk, 2–4-lobed. Female flowers: carpels 3 or 4; staminodes ligulate. Fruit follicles purplish red, grayish brown to black when dry, 4.5–5.5 mm in diam., oil glands slightly protruding, plane, or impressed, apex beaked. Seeds subglobose, 4–5 mm in diam. Fl. Mar–May, fr. Jul–Aug. $2n = 68$.

Lowland forests, open forests, thickets; near sea level to 1500 m. S Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [India, Indonesia, Japan (Ryukyu Islands), Malaysia, Myanmar].

11. *Zanthoxylum kwangsiense* (Handel-Mazzetti) Chun ex C. C. Huang, Acta Phytotax. Sin. 6: 71. 1957 [“*kwangsiensis*”].

广西花椒 guang xi hua jiao

Fagara kwangsiensis Handel-Mazzetti, Sinensia 3. 186. 1933.

Woody climbers. Young branchlets, leaf rachises, and inflorescences pubescent. Branchlets unarmed. Leaves 5–9-foliolate; leaflet blades subopposite or rarely alternate, lanceolate, ovate, or oblanceolate, 4–10 × 2–3 cm, papery, midvein abaxially pubescent and adaxially impressed and puberulent, base broadly cuneate, margin subentire or apically crenate, apex mucronate to caudate. Inflorescences axillary or terminal, thyriform, 2–15 cm. Fruit pedicel 5–10 mm; follicles ca. 5 mm, apex beaked. Seeds subglobose, ca. 4 mm in diam.

• Hillside thickets and open forests; 600–700 m. Chongqing (Fengjie, Wushan), N Guangxi, S Guizhou (Libo).

Hartley (J. Arnold Arbor. 47: 177. 1966) placed *Fagara kwangsiensis* in synonymy of *Zanthoxylum scandens*. *Zanthoxylum kwangsiense* was inadvertently omitted.

12. *Zanthoxylum khasianum* J. D. Hooker, Fl. Brit. India 1: 494. 1875.

云南花椒 yun nan hua jiao

Zanthoxylum yunnanense C. C. Huang.

Shrubs or trees, to 3 m tall. Branchlets gray, with prickles. Young branchlets, inflorescences, leaf rachises, and adaxial surface of leaflet blades with long grayish yellow trichomes. Leaves 5–13-foliolate; petiolules 4–10 mm, winged; leaflet blades alternate or rarely subopposite, ovate to elliptic, asymmetric, 3.5–9 × 2–4 cm, papery, midvein adaxially impressed, secondary veins 10–16 on each side of midvein, base cuneate, margin crenulate or apically crenulate-serrulate, apex caudate. Inflorescences terminal or axillary, thyriform; bracts minute. Flowers 4-merous. Perianth in 2 series. Sepals ovate, ca. 0.5 mm, margin ciliolate.

Petals long elliptic, 2–3 mm. Female flowers: staminodes ca. 1 mm. Fruit pedicel 7–10 mm, villous; follicles oblique, 5–6 mm, apex beaked. Fl. May, fr. Jul–Aug.

Hillside thickets and open forests; 1500–2500 m. W Yunnan [India].

Hartley (J. Arnold Arbor. 47: 177. 1966) placed *Zanthoxylum khasianum* and *Z. yunnanense* in synonymy of *Z. scandens*.

13. *Zanthoxylum multijugum* Franchet, Pl. Delavay. 124. 1889.

多叶花椒 duo ye hua jiao

Fagara mengzeana Hu; *F. multijuga* (Franchet) Hu; *Zanthoxylum multijugum* Hemsley.

Woody climbers. Young branchlets pale reddish brown, glabrous. Stems, branches, and leaf rachises with prickles. Leaves 19–51-foliolate; leaflet blades subsessile, subopposite to alternate, lanceolate, elliptic, or ovate, asymmetric, 1.5–5 × 0.5–2 cm, oil glands numerous and pellucid, midvein puberulent when young and adaxially slightly ridged to plane, margin crenate, apex blunt, rounded, or mucronate with a blunt tip. Inflorescences axillary. Flowers 4(or 5)-merous. Perianth in 2 series. Sepals ovate, to 1 mm, apex blunt to rounded. Petals pale yellowish green, oblong, ca. 2 mm. Male flowers: stamens 4; anthers broadly ovate; connective with an oil gland at apex; rudimentary gynoecium long conic. Female flowers: pedicel 2–5 mm, to 1 cm in fruit. Fruit follicles brownish red, ca. 5 mm in diam., apex beaked. Seeds 4–4.5 mm in diam. Fl. May–Jun, fr. Oct–Nov.

• Hillside thickets and open forests; 1500–2200 m. Guizhou, C and N Yunnan.

14. *Zanthoxylum calcicola* C. C. Huang, Acta Phytotax. Sin. 6: 65. 1957.

石山花椒 shi shan hua jiao

Shrubs or woody climbers, 2–3 m tall. Branchlets and leaf rachises with prickles. Branchlets lenticellate, puberulent. Leaves 9–31-foliolate; petiolules, leaf rachises adaxially, and leaflet blades adaxially on midvein puberulent to pubescent; petiolules 1–3 mm; leaflet blades lanceolate, obliquely oblong, or rarely ovate, 2–5 × 0.7–2.5 cm, oil glands inconspicuous, midvein adaxially plane or basally impressed, secondary veins 9–12 on each side of midvein, base oblique and subrounded to broadly cuneate, margin subapically crenulate, apex acute or shortly acuminate, glandular retuse at tip. Inflorescences axillary. Flowers 4(or 5)-merous. Perianth in 2 series. Sepals 0.5–1 mm. Petals 2–3 mm. Infructescences paniculate, 3–6 cm. Fruit pedicel ca. 5 mm; follicles 5–6 mm, oil glands impressed when dry. Seeds 3.5–4.5 mm in diam. Fl. Mar–Apr, fr. Sep–Nov.

• Upland open forests; 500–1600 m. W Guangxi, SW Guizhou, SE Yunnan.

15. *Zanthoxylum yuanjiangense* C. C. Huang, Acta Phytotax. Sin. 16(2): 81. 1978.

元江花椒 yuan jiang hua jiao

Woody climbers. Branchlets with prickles. Leaf rachises,

inflorescences, and adaxial surface of petiolules minutely puberulent but other parts glabrous. Leaves 7–15-foliolate; petiolules 2–4 mm; leaflet blades alternate to subopposite, elliptic, ovate, or rarely obovate, 6–10 × 2.5–4 cm, subleathery, oil glands inconspicuous on mature leaflets, midvein adaxially impressed, secondary and tertiary veins ridged on both surfaces, base rounded to broadly cuneate, margin entire, apex shortly caudate. Inflorescences terminal or axillary, thyriform, to 26 cm. Flowers 4-merous. Perianth in 2 series. Sepals purplish green, broadly ovate, ca. 1 mm. Petals oblong, 3–4 mm. Stamens 4; connective with an oil gland at apex. Infructescences ca. 12 cm wide. Fruit follicles dark brownish black, ca. 6 mm in diam., oil glands inconspicuous, apex beaked. Seeds 5–5.5 mm in diam. Fl. May, fr. Nov.

• Upland thickets and moist secondary forests; 400–600 m. S Yunnan.

16. *Zanthoxylum dissitum* Hemsley, J. Linn. Soc., Bot. 23: 106. 1886.

蚬壳花椒 xian ke hua jiao

Woody climbers. Stem grayish white. Branchlets, leaf rachises, and midvein of leaflet blades with brownish red prickles. Leaves (3 or)5–9-foliolate; petiolules 3–10 mm; leaflet blades alternate to subopposite, symmetric or rarely oblique, to 20 × 1–8 cm, thickly papery to subleathery, glabrous, oil glands inconspicuous, midvein adaxially impressed, margin entire, repand, denticulate, or serrate, apex acuminate to caudate. Inflorescences axillary, to 10 cm; rachis pubescent. Flowers 4-merous. Perianth in 2 series. Sepals purplish green, broadly ovate, less than 1 mm. Petals pale yellowish green, broadly ovate, 4–5 mm. Male flowers: pedicel 1–3 mm; stamens 4; filaments 5–6 mm; rudimentary gynoecium 4-lobed. Female flowers without staminodes. Fruit follicles brown, densely pressed together in infructescence, 1–1.5 cm; outer part of pericarp (exocarp and mesocarp) extended beyond endocarp on each side of suture in dehisced fruit, smooth. Seeds 8–10 mm in diam. Fl. Apr–May or Nov–Dec, fr. Sep–Nov.

• Upland thickets and open forests, forests; 300–2600 m. S Gansu, Guangdong, Guangxi, Guizhou, Hainan, SW Henan, Hubei, Hunan, S Shaanxi, Sichuan, Yunnan.

- 1a. Branchlets with congested straight spines 16c. var. *hispidum*
- 1b. Branchlets without congested straight spines.
 - 2a. Margin of leaflet blades acutely serrate 16d. var. *acutiserratum*
 - 2b. Margin of leaflet blades entire, repand, or denticulate.
 - 3a. Leaflet blades ca. 6 × as long as wide, margin entire 16a. var. *dissitum*
 - 3b. Leaflet blades 7–10 × as long as wide; margin repand or denticulate 16b. var. *lanceiforme*

16a. *Zanthoxylum dissitum* var. *dissitum*

蚬壳花椒(原变种) xian ke hua jiao (yuan bian zhong)

Fagara dissita (Hemsley) Engler; *Zanthoxylum bodinieri* H. Léveillé.

Branchlets without congested straight spines. Leaflet blades narrowly elliptic, broadly elliptic, or subrounded, margin entire. Fl. Apr–May, fr. Sep–Oct.

• Upland thickets; 300–2600 m. S Gansu, Guangdong, Guangxi, Guizhou, Hainan, SW Henan, Hubei, Hunan, S Shaanxi, Sichuan, Yunnan.

16b. *Zanthoxylum dissitum* var. *lanciforme* C. C. Huang, Acta Phytotax. Sin. 16(2): 82. 1978.

长叶蚬壳花椒 chang ye xian ke hua jiao

Leaflet blades narrowly linear-lanceolate, 10–20 × 1–2 cm, base attenuate, margin repand or denticulate, apex acuminate. Fl. Nov–Dec.

• Forests; ca. 1000 m. Guangxi (Damiao Shan), Guizhou.

16c. *Zanthoxylum dissitum* var. *hispidum* (Reeder & S. Y. Cheo) C. C. Huang, Acta Phytotax. Sin. 6: 78. 1957.

刺蚬壳花椒 ci xian ke hua jiao

Fagara dissita var. *hispidum* Reeder & S. Y. Cheo, J. Arnold Arbor. 32: 69. 1951.

Branchlets with congested straight spines. Inflorescence rachises with prickles. Fl. Apr–May, fr. Sep–Nov.

• Upland open forests; 1500–1800 m. C and SW Sichuan, NE Yunnan (Suijiang).

16d. *Zanthoxylum dissitum* var. *acutiserratum* C. C. Huang, Acta Phytotax. Sin. 16(2): 82. 1978.

针边蚬壳花椒 zhen bian xian ke hua jiao

Leaflet blades oblong, 6–10 × 2–3 cm, margin acutely serrate. Fl. Apr–May, fr. Aug–Sep.

• Upland open forests; ca. 2400 m. Sichuan (Ganluo).

17. *Zanthoxylum collinsiae* Craib, Bull. Misc. Inform. Kew 1926: 165. 1926 [*“collinsae”*].

糙叶花椒 cao ye hua jiao

Zanthoxylum asperum C. C. Huang; *Z. scabrum* Guil-laumin.

Woody climbers. Branchlets with prickles. Younger branchlets, leaf rachises, petiolules, and abaxial surface of leaflet blades villous. Leaves 5–9-foliolate; petiolules 2–4 mm; leaflet blades opposite, broadly ovate to ovate-elliptic, 7–19 × 5–8 cm, papery, black to blackish brown when dry, slightly lustrous, adaxially hirsutulous, midvein with prickles, secondary veins 8–12 on each side of midvein, base oblique and rounded to subcordate, margin entire to crenate, apex mucronate, caudate, or rarely acuminate and with a retuse tip and an oil gland. Inflorescences axillary, 3–5 cm. Flowers 4-merous. Pedicel puberulent. Perianth in 2 series. Sepals puberulent, ca. 1 mm. Petals ca. 3 mm. Male flowers: stamens 4; rudimentary gynoeceum ca. 1.5 mm. Fruit pedicel 2–4 mm; follicles ca. 6 mm in diam., pubescent, oil glands impressed when dry. Seeds 4.5–5 mm in diam. Fl. Apr–May, fr. Sep–Oct.

Hillside open forests and thickets; 500–1000 m. NW Guangxi, SW Guizhou, S Yunnan [Laos, NE Thailand, N Vietnam].

Hartley (J. Arnold Arbor. 47: 181. 1966) placed *Zanthoxylum collinsiae*, *Z. asperum*, and *Z. scabrum* in the synonymy of *Z. nitidum*.

18. *Zanthoxylum liboense* C. C. Huang, Guihaia 7: 6. 1987.

荔波花椒 li bo hua jiao

Shrubs or woody climbers, to 1.5 m tall or long. Branchlets and leaf rachises with prickles. Older branchlets brownish black, rugulose, pubescent. Leaf rachises, inflorescences, and petiolules pubescent. Leaves 5–9-foliolate; petiolules 2–5 mm; leaflet blades subopposite to alternate, ovate to elliptic, 6–8 × 2.5–3.5 cm, subleathery, abaxially pubescent, midvein adaxially plane or apically impressed and puberulent, secondary veins 10–13 on each side of midvein, base rounded, margin entire, apex mucronate to acuminate. Inflorescences axillary, 3–4 cm. Fruit pedicel 6–10 mm; fruit 4-carpelled, usually only 2 or 3 carpels developing; follicles dark brownish black when dry, 7–8 mm in diam., pubescent when young but perhaps only on undeveloped carpels, oil glands inconspicuous, apex beaked. Seeds 5–6 mm in diam. Fr. Aug–Sep.

• Forests, thickets; 700–800 m. S Guizhou (Libo).

19. *Zanthoxylum echinocarpum* Hemsley, Ann. Bot. (Oxford) 9: 149. 1895.

刺壳花椒 ci ke hua jiao

Woody climbers. Young branchlets, leaf rachises, petiolules, and leaflet blades abaxially on midvein pubescent. Branchlets and leaves with prickles. Leaves (3 or)5–11-foliolate; petiolules 2–5 mm; leaflet blades alternate or opposite, ovate, ovate-elliptic, or long elliptic, 7–13 × 2.5–5 cm, thickly leathery, base rounded to cordate, margin entire or subentire. Inflorescences axillary or terminal. Flowers 4-merous. Perianth in 2 series. Sepals pale purplish green. Petals 2–3 mm. Male flowers: stamens 4. Female flowers: carpels (3 or)4(or 5). Fruit pedicel obsolete or to 3 mm; follicles with prickles to 1 cm. Seeds 6–8 mm in diam. Fl. Apr–May, fr. Oct–Dec.

• Forests, hillside open forests and thickets; 200–1800 m. N Guangdong, Guangxi, Guizhou, W Hubei, Hunan, Sichuan, SE Yunnan.

1a. Abaxial surface of leaflet blades

glabrous except for pubescent

midvein 19a. var. *echinocarpum*

1b. Abaxial surface of leaflet blades

villous 19b. var. *tomentosum*

19a. *Zanthoxylum echinocarpum* var. *echinocarpum*

刺壳花椒(原变种) ci ke hua jiao (yuan bian zhong)

Fagara echinocarpa (Hemsley) Engler.

Leaflet blades abaxially glabrous except for pubescent midvein. Prickles of follicles pubescent.

• Forests; 200–1000 m. N Guangdong, Guangxi, Guizhou, W Hubei, Hunan, Sichuan, SE Yunnan.

19b. *Zanthoxylum echinocarpum* var. *tomentosum* C. C. Huang, Acta Phytotax. Sin. 16(2): 82. 1978.

毛刺壳花椒 mao ci ke hua jiao

Branchlets, leaf rachises, petioles, abaxial surface of leaflet blades, and inflorescence rachises villous. Prickles of follicles pilose when mature.

• Hillside open forests and thickets; 300–1800 m. NW Guangxi (Tian'e), SW Guizhou (Anlong), SE Yunnan.

20. *Zanthoxylum oxyphyllum* Edgeworth, Trans. Linn. Soc. London 20: 42. 1846.

尖叶花椒 jian ye hua jiao

Fagara oxyphylla (Edgeworth) Engler; *Zanthoxylum alpinum* C. C. Huang; *Z. taliense* C. C. Huang; *Z. tibetanum* C. C. Huang.

Shrubs or small trees. Branchlets and leaf rachises with prickles. Leaf rachises adaxially and midvein of leaflet blades adaxially pubescent. Old leaves subglabrous. Leaves 11–19-foliolate; petiolules to 2 mm; leaflet blades alternate or opposite, lanceolate or rarely ovate, 5–12 × 1.5–2.5 cm, abaxially gray when dry, oil glands numerous, midvein impressed adaxially, secondary veins anastomosing near margin, reticulate veinlets ridged when dry, base cuneate, margin serrulate, apex acuminate. Inflorescences terminal, cymose-corymbose, to 30-flowered. Perianth in 2 series. Sepals 4, purplish green. Petals ca. 3 mm. Male flowers: rudimentary gynoeceium 2–4-parted, lobes linear. Fruit pedicel 1–1.5 cm, 1–1.5 mm in diam.; follicles purplish red, 6–7 mm, oil glands impressed when dry, apex beaked. Seeds ca. 5 mm in diam. Fl. May–Jun, fr. Sep–Oct. $2n = 72$.

Open forests, forest margins; 1800–2900 m. S Xizang, W Yunnan [Bhutan, NE India, Myanmar, Nepal].

21. *Zanthoxylum stenophyllum* Hemsley, Ann. Bot. (Oxford) 9: 147. 1895.

狭叶花椒 xia ye hua jiao

Fagara stenophylla (Hemsley) Engler; *Zanthoxylum pashanense* N. Chao.

Shrubs or small trees. Stems and branches grayish white. Young branchlets pale purplish red. Branchlets and midvein of leaflet blades abaxially with prickles. Leaves 9–23-foliolate; petiolules 1–3 mm, adaxially pubescent; leaflet blades alternate, lanceolate and 2–11 × 1–4 cm, narrowly lanceolate and 2–3.5 × 0.4–0.7 cm, or ovate and 8–16 × 6–8 mm, oil glands inconspicuous, midvein adaxially ridged to plane and puberulent but glabrous in fruit, reticulate veinlets ridged on both surfaces, base cuneate to subrounded, margin crenulate, apex acuminate to mucronate. Inflorescences terminal, cymose-corymbiform, to 30-flowered. Flowers 4-merous. Perianth in 2 series. Sepals ca. 0.5 mm. Petals 2.5–3 mm. Male flowers: pedicel 2–5 mm; stamens 4; connective without an oil gland at apex; rudimentary gynoeceium disciform; styles coherent. Female flowers: pedicel 0.6–1.5 cm; staminodes absent. Fruit pedicel purplish red, 1–3 cm, glabrous; follicles pale purplish red to dark red, 4.5–5 cm in diam., oil glands impressed when dry, apex beaked. Seeds ca. 4 mm in diam. Fl. May–Jun, fr. Aug–Sep.

• Upland thickets; 700–2400 m. S Gansu (Chengxian, Huixian), W Henan, W Hubei, NE Hunan, SW Shaanxi, Sichuan.

22. *Zanthoxylum esquirolii* H. Léveillé, Repert. Spec. Nov. Regni Veg. 13: 266. 1914.

贵州花椒 gui zhou hua jiao

Fagara chaffanjonii (H. Léveillé) Handel-Mazzetti; *F. esquirolii* (H. Léveillé) Handel-Mazzetti; *Zanthoxylum chaffanjonii* H. Léveillé.

Shrubs or small trees. Branchlets and leaf rachises with prickles. Branchlets pale purplish red and glaucous when dry. Leaves 5–13-foliolate; petiolules 3–6 mm; leaflet blades alternate, ovate, lanceolate, or rarely broadly ovate, 3–10 × 1.5–4.5 cm, oil glands inconspicuous, midvein adaxially impressed, base subrounded to broadly cuneate, margin crenulate or entire toward base, apex obliquely caudate with a retuse tip. Inflorescences terminal, cymose-corymbiform, to 30-flowered. Flowers 4-merous. Perianth in 2 series. Petals ca. 3 mm. Female flowers (3 or) 4-carpelled. Fruit pedicel to 4.5 mm, 0.5–1 mm in diam.; follicles purplish red, ca. 5 mm in diam., oil glands impressed, apex beaked. Seeds ca. 4 mm in diam. Fl. May–Jun, fr. Sep–Nov.

• Upland open forests and thickets; 700–3200 m. Guizhou, Sichuan, Yunnan.

23. *Zanthoxylum avicennae* (Lamarck) Candolle, Prodr. 1: 726. 1824.

箭欖花椒 le dang hua jiao

Fagara avicennae Lamarck, Encycl. 2: 445. 1788; *Zanthoxylum avicennae* var. *tonkinense* Pierre; *Z. avicennae* var. *touranense* Pierre; *Z. lentiscifolium* Champion ex Benth.

Trees to 15 m tall, deciduous. Branchlets and leaves glabrous, with prickles. Leaves 11–21-foliolate; rachis winged; leaflet blades opposite or rarely subopposite, obliquely ovate, rhomboidal, obovate, or falcate, 2.5–7 × 1–3 cm, oil glands visible on fresh leaves or inconspicuous, margin entire or apically crenate, apex mucronate to blunt. Inflorescences terminal, many flowered; rachis purplish red. Flowers 5-merous. Pedicel purplish red. Perianth in 2 series. Sepals green, broadly ovate. Petals yellowish white, ca. 2.5 mm. Male flowers: stamens 5; rudimentary gynoeceium disciform, 2-lobed. Female flowers: carpels 2(or 3); staminodes small. Fruit pedicel 3–6 mm; follicles pale purplish red, 4–5 mm in diam., oil glands numerous, large, and slightly protruding, apex not beaked. Seeds 3.5–4.5 mm in diam. Fl. Jun–Aug, fr. Oct–Dec.

Secondary forests in lowland flat areas, hillsides, valleys; 400–700 m. S Fujian, Guangdong, Guangxi, Hainan, S Yunnan [India, Indonesia, Malaysia, Philippines, Thailand, Vietnam].

24. *Zanthoxylum micranthum* Hemsley, Ann. Bot. (Oxford) 9: 147. 1895.

小花花椒 xiao hua hua jiao

Fagara biondii Pampanini; *F. micrantha* (Hemsley) Engler.

Trees to 15 m tall, deciduous. Branchlets glabrous, with prickles. Leaves 9–17-foliolate; petiolules 1.5–5 mm; leaflet blades opposite or on basal part of rachis subopposite, lanceo-

late, 5–8 × 1–3 cm, oil glands numerous, midvein impressed, secondary veins 8–12 on each side of midvein, base symmetrically or obliquely rounded to broadly cuneate, margin crenate, apex acuminate. Inflorescences terminal, many flowered. Flowers 5-merous. Perianth in 2 series. Sepals broadly ovate, ca. 0.3 mm wide. Petals pale yellowish white, 1.5–2 mm. Male flowers: stamens 5, ca. 3 mm; rudimentary gynoecium disciform, 3-lobed or not divided. Female flowers 3(or 4)-carpelled. Fruit follicles pale purplish red but pale yellow to grayish brown when dry, ca. 5 mm in diam., oil glands small, apex not beaked. Seeds to 4 mm. Fl. Jul–Aug, fr. Oct–Nov.

• Hillside open forests; 300–1200 m. Guizhou, SW Henan, W Hubei, Hunan, Sichuan, Yunnan.

25. *Zanthoxylum ailanthoides* Siebold & Zuccarini, Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. 4(2): 138. 1845.

椿叶花椒 chun ye hua jiao

Trees to 15 m tall, deciduous. Branchlets and inflorescence rachises glabrous, with prickles. Leaves 11–27-foliolate; leaflet blades opposite, narrowly lanceolate but subovate basally on rachis, 7–18 × 2–6 cm, abaxially grayish green or glaucescent, oil glands numerous, midvein adaxially impressed, secondary veins 11–16 on each side of midvein, base symmetrically or subobliquely rounded, margin crenate, apex acuminate. Inflorescences terminal, many flowered. Flowers 5-merous, subsessile. Perianth in 2 series. Sepals broadly triangular, ca. 0.8 mm. Petals pale yellowish white, ca. 2.5 mm. Male flowers: stamens 5; rudimentary gynoecium disciform, 2- or 3-lobed. Female flowers (3 or)4-carpelled. Fruit pedicel 1–3 mm; follicles pale reddish brown but pale gray to brownish gray when dry, ca. 4.5 mm in diam., oil glands numerous, impressed when dry, apex not beaked. Seeds ca. 4 mm in diam. Fl. Aug–Sep, fr. Oct–Dec.

Upland thickets; 300–1500 m. Fujian, Guangdong, Guangxi, Guizhou, S Jiangxi, SE Sichuan, Taiwan, SE Yunnan, Zhejiang [Japan (including Bonin and Ryukyu Islands), Korea, Philippines].

- 1a. Leaflet blades glabrous on both surfaces 25a. var. *ailanthoides*
 1b. Leaflet blades abaxially pubescent 25b. var. *pubescens*

25a. *Zanthoxylum ailanthoides* var. *ailanthoides*

椿叶花椒(原变种) chun ye hua jiao (yuan bian zhong)

Fagara ailanthoides (Siebold & Zuccarini) Engler; *F. boninshimae* G. Koidzumii; *F. emarginella* (Miquel) Engler; *F. hemsleyana* (Makino) Makino; *Zanthoxylum ailanthoides* var. *inermis* Rehder & E. H. Wilson; *Z. emarginellum* Miquel; *Z. hemsleyanum* Makino.

Leaflet blades glabrous on both surfaces, abaxially glaucous.

Upland thickets; 300–1500 m. Fujian, Guangdong, Guangxi, Guizhou, S Jiangxi, SE Sichuan, Taiwan, SE Yunnan, Zhejiang [Japan (including Bonin and Ryukyu Islands), Korea, Philippines].

Zanthoxylum hemsleyanum Makino was based on *Z. emarginellum* sensu Hemsley (1895), not Miquel (1867).

25b. *Zanthoxylum ailanthoides* var. *pubescens* Hatusima, Acta Phytotax. Geobot. 4: 210. 1935.

毛椿叶花椒 mao chun ye hua jiao

Leaf rachises and abaxial surface of leaflet blades pubescent.

• Taiwan.

This taxon is not recognized as a separate variety in Fl. Taiwan, ed. 2, 3: 537. 1993.

26. *Zanthoxylum myriacanthum* Wallich ex J. D. Hooker, Fl. Brit. India 1: 496. 1875.

大叶臭花椒 da ye chou hua jiao

Trees to 15 m tall, deciduous. Branchlets toward apex and rachis of inflorescences with prickles. Leaves without prickles, 7–17-foliolate; leaflet blades opposite, broadly ovate, ovate-elliptic, or oblong, but suborbicular basally on rachis, 10–20 × 4–10 cm, both surfaces glabrous, oil glands numerous, large, turning red or blackish brown and slightly protruding when dry, midvein adaxially impressed, base symmetrically or obliquely rounded to broadly cuneate, margin crenulate-serrulate. Inflorescences terminal, to 35 × 30 cm, many flowered. Flowers 5-merous. Perianth in 2 series. Sepals broadly ovate, ca. 0.3 mm. Petals white, ca. 2.5 mm. Male flowers: stamens 5; rudimentary gynoecium disciform, 3-lobed. Female flowers: carpels (2 or)3(or 4); staminodes small. Fruit follicles reddish brown, ca. 4.5 mm in diam., oil glands numerous, apex not beaked. Seeds ca. 4 mm in diam. Fl. Jun–Aug, fr. Sep–Nov.

Hillside forests, forests; 200–1500 m. Fujian, Guangdong, Guangxi, SE Guizhou, Hainan, S Hunan, Jiangxi, S Yunnan, S Zhejiang [Bhutan, India, Indonesia, Malaysia, Myanmar, Philippines, Vietnam].

- 1a. Petiolules, leaflet blades, leaf rachises, and inflorescences not villous 26a. var. *myriacanthum*
 1b. Petiolules, leaflet blades, leaf rachises, and inflorescences villous 26b. var. *pubescens*

26a. *Zanthoxylum myriacanthum* var. *myriacanthum*

大叶臭花椒(原变种) da ye chou hua jiao (yuan bian zhong)

Euodia odorata H. Léveillé; *Fagara diabolica* (Elmer) Engler; *F. gigantea* Handel-Mazzetti; *F. myriacantha* (Wallich ex J. D. Hooker) Engler; *F. odorata* (H. Léveillé) Handel-Mazzetti; *F. rhetoides* (Drake) Reeder & S. Y. Cheo; *Zanthoxylum diabolicum* Elmer; *Z. giganteum* (Handel-Mazzetti) Rehder; *Z. odoratum* (H. Léveillé) H. Léveillé; *Z. rhetoides* Drake.

Leaf rachises, petiolules, leaflet blades, and inflorescence rachises not villous.

Hillside forests; 200–1500 m. Fujian, Guangdong, Guangxi, SE Guizhou, Hainan, S Hunan, Jiangxi, S Yunnan, S Zhejiang [Bhutan, India, Indonesia, Malaysia, Myanmar, Philippines, Vietnam].

26b. *Zanthoxylum myriacanthum* var. *pubescens* (C. C. Huang) C. C. Huang, Guihaia 11: 9. 1991.

毛大叶臭花椒 mao da ye chou hua jiao

Zanthoxylum rhetoides var. *pubescens* C. C. Huang, Acta Phytotax. Sin. 6: 48. 1957; *Z. utile* C. C. Huang.

Leaf rachises, petiolules, leaflet blades, and inflorescence rachises villous.

- Forests; ca. 1400 m. S Yunnan (Xishuangbanna).

27. *Zanthoxylum molle* Rehder, J. Arnold Arbor. 8: 150. 1927.

朵花椒 duo hua jiao

Euodia mollicoma Hu & F. H. Chen; *Fagara mollis* (Rehder) Reeder & S. Y. Cheo.

Trees to 10 m tall, deciduous. Bark brownish black. Young branches and rachis of inflorescences with prickles. Young branches dark purplish red. Leaves (5–)13–19-foliolate; rachis pubescent; leaflet blades opposite, subsessile, broadly ovate, elliptic, or rarely suborbicular, 8–15 × 4–9 cm, thickly leathery, abaxially with soft grayish white to grayish yellow woolly-villous indumentum, oil glands inconspicuous, midvein adaxially impressed, secondary veins 11–17 on each side of midvein, base symmetrically or rarely obliquely rounded to subcordate, margin entire or crenulate, apex acute. Inflorescences terminal, many flowered. Flowers 5-merous. Pedicel pale purplish red, pubescent. Perianth in 2 series. Petals white, 2–3 mm. Male flowers: rudimentary gynoecium 3-lobed. Female flowers: carpels 3; staminodes small. Fruit follicles pale purplish red but pale yellow to grayish brown when dry, 4–5 mm in diam., oil glands numerous and impressed when dry, apex not beaked. Seeds 3.5–4 mm in diam. Fl. Jun–Aug, fr. Oct–Nov.

- Upland open forests and thickets; 100–900 m. Anhui, Guizhou, Henan, Hunan, Jiangxi, Yunnan, Zhejiang.

28. *Zanthoxylum schinifolium* Siebold & Zuccarini, Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. 4(2): 137. 1845.

青花椒 qing hua jiao

Fagara pteropoda (Hayata) Y. C. Liu; *F. schinifolia* (Siebold & Zuccarini) Engler; *Zanthoxylum manschuricum* Bennett; *Z. pteropodum* Hayata.

Shrubs 1–2 m tall. Stems and branchlets with prickles. Young branchlets dark purplish red. Leaves 7–19-foliolate; petiolules obsolete or to 3 mm; leaflet blades opposite, or alternate toward base of rachis, broadly ovate, broadly ovate-rhombic, or lanceolate, 5–10(–70) × 4–6(–25) mm, papery, oil glands numerous or inconspicuous, midvein adaxially impressed, base symmetrically or sometimes obliquely rounded to broadly cuneate, margin serrate to subentire, apex mucronate to acuminate. Inflorescences terminal. Flowers 5-merous. Perianth in 2 series. Petals pale yellowish white, ca. 2 mm. Male flowers: rudimentary gynoecium 2- or 3-lobed. Female flowers: carpels 3(–5). Fruit follicles reddish brown but dark green to brownish black when dry, 4–5 mm in diam., oil glands small, apex not beaked. Seeds 3–4 mm in diam. Fl. Jul–Sep, fr. Sep–Dec.

Upland open forests and thickets; below 800 m. Anhui, Fujian, N Guangdong, N Guangxi, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Shandong, Taiwan, Zhejiang [Japan (including Ryukyu Islands), Korea].

29. *Zanthoxylum dimorphophyllum* Hemsley, Ann. Bot. (Oxford) 9: 150. 1895.

异叶花椒 yi ye hua jiao

Trees to 10 m tall, deciduous. Branches grayish black, with few prickles or unarmed; young branchlets and shoots rust-colored pubescent or glabrous; axillary buds rust-colored villosulous. Leaves 3–5(–11)-foliolate; leaflet blades ovate, elliptic, or sometimes obovate, (2–)4–9(–20) × (1–)2–3.5(–7) cm, oil glands numerous, midvein adaxially plane or impressed and puberulent, reticulate veinlets slightly ridged when dry, base symmetric, margin crenate and with or without spines, apex blunt, rounded, mucronate, or acuminate, usually with a retuse tip. Inflorescences terminal; bracts rust-colored villosulous. Perianth in 2 series with 4 sepals and 4 petals or grading to 2 irregular series or 1 series with 7 or 8 ± undifferentiated 2–3 mm tepals; when differentiated, sepals 0.2–0.5 mm and petals ca. 1.5 mm. Male flowers: stamens 4–6; disk pulvinate; rudimentary gynoecium obsolete or 2- or 3-carpelled. Female flowers: staminodes 4 or 5; rudimentary anthers without pollen; gynoecium 2- or 3-carpelled; styles recurved. Fruit follicles purplish red, 6–8 mm in diam., sparsely pubescent when young, with sparse oil glands, stipitate, apex shortly beaked. Seeds 5–7 mm in diam. Fl. Apr–Jun, fr. Sep–Nov. 2n = 36, 68.

Moist areas in upland forests, hillside open forests and thickets; 300–2400 m. S Gansu, N Guangdong, Guangxi, Guizhou, Hainan, SW Henan, W Hubei, Hunan, S Shaanxi, Sichuan, Taiwan, Yunnan [Thailand, Vietnam].

C. C. Huang (Fl. Reipubl. Popularis Sin. 43(2): 40. 1997) mistakenly placed *Zanthoxylum dimorphophyllum* in synonymy of *Z. ovalifolium* Wight, which ranges from India to NE Australia and is not known to occur in China.

- 1a. Margin of leaflet blades with spines
..... 29c. var. *spinifolium*
- 1b. Margin of leaflet blades without spines.
 - 2a. Leaves 3- or 5-foliolate
..... 29a. var. *dimorphophyllum*
 - 2b. Leaves (5 or)7–11-foliolate
..... 29b. var. *multifoliolatum*

29a. *Zanthoxylum dimorphophyllum* var. ***dimorphophyllum***

异叶花椒(原变种) yi ye hua jiao (yuan bian zhong)

Fagara dimorphophylla (Hemsley) Engler; *F. robiginosa* Reeder & S. Y. Cheo; *Zanthoxylum acanthopodium* Candolle var. *deminutum* (Rehder) Reeder & S. Y. Cheo; *Z. dimorphophyllum* var. *deminutum* Rehder; *Z. evodiifolium* Guillaumin; *Z. pistaciiflorum* Hayata; *Z. robiginosum* (Reeder & S. Y. Cheo) C. C. Huang.

Leaves 3- or 5-foliolate; margin of leaflet blades without spines.

Moist areas in upland forests; 300–2400 m. S Gansu, N Guangdong, Guangxi, Guizhou, Hainan, W Hubei, Hunan, S Shaanxi, Sichuan, Taiwan, Yunnan [Thailand, Vietnam].

29b. *Zanthoxylum dimorphophyllum* var. ***multifoliolatum*** C. C. Huang, Acta Phytotax. Sin. 16(2): 81. 1978.

多异叶花椒 duo yi ye hua jiao

Zanthoxylum ovalifolium Wight var. *multifoliolatum* (C. C. Huang) C. C. Huang.

Leaves (5 or)7–11-foliolate; margin of leaflet blades without spines.

- Hillside thickets. Yunnan (Kunming).

29c. *Zanthoxylum dimorphophyllum* var. *spinifolium* Rehder & E. H. Wilson in Sargent, Pl. Wilson. 2: 126. 1914.

刺异叶花椒 ci yi ye hua jiao

Zanthoxylum dissitum Hemsley var. *spinulosum* Z. M. Tan; *Z. ovalifolium* Wight var. *spinifolium* (Rehder & E. H. Wilson) C. C. Huang.

Leaves 3- or 5-foliolate; margin of leaflet blades with spines.

- Hillside open forests and thickets; 400–2100 m. Guizhou, SW Henan (Funiu Shan), W Hubei, Hunan, S Shaanxi (Qin Ling), Sichuan.

30. *Zanthoxylum acanthopodium* Candolle, Prodr. 1: 727. 1824.

刺花椒 ci hua jiao

Zanthoxylum acanthopodium var. *oligotrichum* Z. M. Tan; *Z. acanthopodium* var. *timbor* J. D. Hooker; *Z. acanthopodium* var. *villosum* C. C. Huang.

Shrubs, woody climbers, or trees to 6 m tall. Bark grayish black. Branchlets rust-colored pubescent to nearly glabrous, usually with prickles. Leaves 3–9-foliolate; rachis wings to 3 mm on each side; leaflet blades sessile, opposite, ovate-elliptic to lanceolate, 6–10 × 2–4 cm, papery, both surfaces glabrous to rust-colored pubescent, oil glands inconspicuous, secondary veins 10–28 on each side of midvein and evident, margin entire or crenate. Inflorescences axillary. Perianth in 2 irregular series or 1 series, with 6–8 ± undifferentiated tepals. Tepals pale yellowish green, narrowly lanceolate, ca. 1.5 mm. Male flowers: stamens 5 or 6; anthers reddish purple before anthesis; disk pulvinate; rudimentary carpels 2–5. Female flowers: rudimentary stamens lacking; carpels 2–5, sparsely hirsute to glabrous, abaxially often with a conspicuous oil gland; styles recurved. Fruit follicles usually purplish red, ca. 4 mm in diam., glabrous or sometimes with sparse trichomes, oil glands large and protruding. Seeds ca. 3 mm in diam. Fl. Apr–May, fr. Sep–Oct. $2n = 64$.

Upland open forests and thickets; 1400–3200 m. W Guangxi, Guizhou, Sichuan, Xizang, Yunnan [Bangladesh, Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Thailand, Vietnam].

31. *Zanthoxylum armatum* Candolle, Prodr. 1: 727. 1824.

竹叶花椒 zhu ye hua jiao

Shrubs, woody climbers, or trees to 5 m tall, deciduous. Branchlets and leaflet blades abaxially on midvein usually with prickles. Young branchlets and inflorescence rachises glabrous or rust-colored pubescent. Leaves 3–9(or 11)-foliolate; rachis glabrous or rust-colored pubescent, wings to 6 mm on each side; leaflet blades subsessile, opposite, lanceolate, ovate, or elliptic, 3–12 × 1–3 cm, base attenuate to broadly cuneate, secondary veins 7–15 on each side of midvein and generally faint, margin crenate or entire and often revolute when dry, apex acute to acuminate. Inflorescences terminal on short lateral branchlets

and sometimes axillary, 1–7 cm, with less than 30 flowers. Perianth in 2 irregular series or 1 series, with 6–8 ± undifferentiated 0.3–1.5 mm tepals. Male flowers: stamens 4–6; anthers yellow prior to anthesis; connective apex with oil gland; disk pulvinate; rudimentary carpels lacking. Female flowers: carpels 2 or 3, abaxially often with a conspicuous oil gland; styles recurved; staminodes ligulate or lacking. Fruit follicles usually purplish red, 4–5 mm in diam., with a few protruding oil glands. Seeds blackish brown, 3–4 mm in diam. Fl. Apr–May, fr. Aug–Oct. $2n = 66$.

Found in many habitats; below 3100 m. Anhui, Fujian, S Gansu, Guangdong, Guangxi, Guizhou, S Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, S Shaanxi, Sichuan, N Taiwan, Xizang, Yunnan, Zhejiang [Bangladesh, Bhutan, India, Indonesia, Japan (including Ryukyu Islands), Kashmir, Korea, Laos, Myanmar, Nepal, Pakistan, Philippines, Thailand, Vietnam].

Ohba (Fl. Jap. 22c: 37. 2001) treats the plants from Japan and most of China as *Zanthoxylum armatum* var. *subtrifoliolatum* (Franchet) Kitamura.

- 1a. Young branchlets and inflorescence rachises glabrous or young branches sparsely pubescent 31a. var. *armatum*
- 1b. Young branchlets and inflorescence rachises rust-colored pubescent 31b. var. *ferrugineum*

31a. *Zanthoxylum armatum* var. *armatum*

竹叶花椒(原变种) zhu ye hua jiao (yuan bian zhong)

Zanthoxylum alatum Roxburgh; *Z. alatum* var. *planispinum* (Siebold & Zuccarini) Rehder & E. H. Wilson; *Z. alatum* var. *subtrifoliolatum* Franchet; *Z. arenosum* Reeder & S. Y. Cheo; *Z. armatum* var. *subtrifoliolatum* (Franchet) Kitamura; *Z. planispinum* Siebold & Zuccarini.

Young branchlet apices and inflorescence rachises glabrous, or young branches sparsely pubescent. Leaflet blades abaxially flocculent on midvein.

Found in many habitats; below 3100 m. Anhui, Fujian, S Gansu, N Guangdong, Guangxi, Guizhou, S Henan, Hubei, Hunan, Jiangsu, Jiangxi, S Shaanxi, Shandong, S Shaanxi, Sichuan, N Taiwan, Xizang, Yunnan, Zhejiang [Bangladesh, Bhutan, India, Indonesia, Japan (including Ryukyu Islands), Kashmir, Korea, Laos, Myanmar, Nepal, Pakistan, Philippines, Thailand, Vietnam].

31b. *Zanthoxylum armatum* var. *ferrugineum* (Rehder & E. H. Wilson) C. C. Huang, Guihaia 7: 1. 1987.

毛竹叶花椒 mao zhu ye hua jiao

Zanthoxylum alatum f. *ferrugineum* Rehder & E. H. Wilson in Sargent, Pl. Wilson. 2: 215. 1914.

Young branchlet apices, inflorescence rachises, and sometimes leaf rachises rust-colored pubescent.

- Guangdong, Guangxi, Guizhou, Hunan, Shaanxi, Sichuan, Yunnan.

32. *Zanthoxylum wutaiense* I. S. Chen, Taiwan Sci. 26: 56. 1972.

屏东花椒 ping dong hua jiao

Shrubs. Branchlets with prickles or unarmed, glabrous. Leaves 5–13-foliolate; rachis canaliculate, sides of channel rarely slightly spreading apically; leaflet blades sessile, opposite, oblong to oblong-lanceolate, 2.5–10 × 0.6–2 cm, leathery, midvein narrowly ridged adaxially, secondary veins 7–16 on each side of midvein, base attenuate to cuneate, margin crenulate, apex acuminate at least in terminal blade. Inflorescences axillary, paniculate. Flowers yellow. Pedicel ca. 3 mm. Perianth in 2 irregular series or 1 series, with 5–8 ± undifferentiated tepals. Male flowers: stamens 5–8. Female flowers: pistil subtended by columnar disk, 1(or 2)-carpellid; carpel ovoid to ellipsoid, with a conspicuous lateral oil gland; style short; stigma capitate. Fruit follicle ovoid, ca. 5 mm in diam. Fl. Apr.

• Exposed slopes in secondary broad-leaved forests; 1300–1400 m. Taiwan (Pingdong).

33. *Zanthoxylum bungeanum* Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 16: 212. 1871.

花椒 hua jiao

Trees 3–7 m tall, deciduous. Stems and branchlets with prickles; stem prickles with a flat base. Young branchlets pubescent. Leaves 5–13-foliolate; rachis marginate; leaflet blades sessile, opposite, ovate, elliptic, or rarely lanceolate, sometimes suborbicular near leaf rachis base, 2–7 × 1–4.5 cm, both surfaces pubescent or abaxial surface flocculent along midvein, midvein adaxially impressed, margin crenate. Inflorescences axillary but terminal on lateral branchlets; rachis and pedicel pubescent or glabrous. Perianth in 2 irregular series or 1 series, with 6–8 yellowish green ± undifferentiated tepals. Male flowers: stamens 5–8; rudimentary gynoeceium 2-lobed. Female flowers 2–5-carpelled. Fruit follicles purplish red, 4–5 mm in diam., pustulose glandular, apex shortly beaked or beak lacking. Seeds 3.5–4.5 mm. Fl. Apr–May, fr. Aug–Oct.

Found in many habitats; below 3200 m. Anhui, Fujian, Gansu, Guangxi, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, SE Xinjiang, S and SE Xizang, Yunnan, Zhejiang [Bhutan].

The dried fruit follicles of *Zanthoxylum bungeanum* are used as a culinary spice and are particularly popular in Sichuan cuisine (Sichuan pepper). In Japan, *Z. piperitum* (Linnaeus) Candolle is sometimes similarly used.

- 1a. Leaflet blades pubescent on both surfaces or sometimes adaxial surface glabrous 33c. var. *pubescens*
 1b. Leaflet blades flocculent along midvein abaxially, otherwise glabrous.
 2a. Leaflet blades with oil glands only at margin 33a. var. *bungeanum*
 2b. Leaflet blades with scattered oil glands 33b. var. *punctatum*

33a. *Zanthoxylum bungeanum* var. *bungeanum*

花椒(原变种) hua jiao (yuan bian zhong)

Zanthoxylum bungei Hance; *Z. bungei* var. *imporforatum* Franchet; *Z. fraxinoides* Hemsley; *Z. simulans* Hance var. *imporforatum* (Franchet) Reeder & S. Y. Cheo.

Leaflet blades flocculent along midvein abaxially, otherwise glabrous, oil glands only at margin.

Found in many habitats; below 3200 m. Anhui, Fujian, Gansu, Guangxi, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, SE Xinjiang, S and SE Xizang, Yunnan, Zhejiang [Bhutan].

33b. *Zanthoxylum bungeanum* var. *punctatum* C. C. Huang, Acta Phytotax. Sin. 16(2): 81. 1978.

油叶花椒 you ye hua jiao

Leaf rachises, infructescences, and follicles reddish brown when dry. Leaflet blades with oil glands conspicuous, scattered. Fr. Jul–Aug.

• Open forests; 2000–2500 m. W Sichuan.

33c. *Zanthoxylum bungeanum* var. *pubescens* C. C. Huang, Acta Phytotax. Sin. 6: 24. 1957.

毛叶花椒 mao ye hua jiao

Young branchlets, rachis of leaves and inflorescences, and both surfaces of leaflet blades pubescent, or sometimes leaflet blades adaxially glabrous. Fl. May–Jun, fr. Oct–Nov.

• 1700–3200 m. Gansu, Qinghai (Xunhua), S Shaanxi, NW and W Sichuan, Yunnan.

34. *Zanthoxylum undulatifolium* Hemsley, Ann. Bot. (Oxford) 9: 148. 1895.

浪叶花椒 lang ye hua jiao

Trees to 3 m tall. Young branchlets and leaf rachises rust-colored pubescent, with few prickles or unarmed. Leaves 3–5(–7)-foliolate; terminal leaflet with petiolule 6–10 mm, lateral leaflets subsessile; leaflet blades opposite, ovate to ovate-lanceolate, 3–8 × 1.5–3.5 cm, abaxially glabrous, adaxially sparsely puberulent, midvein adaxially plane, secondary veins 6–10 on each side of midvein, base broadly cuneate to rounded, margin undulate and crenulate, apex mucronate to acuminate. Inflorescences terminal, corymbose. Perianth in 2 irregular series or 1 series, with 5–8 ± undifferentiated tepals. Fruit pedicel reddish brown, 0.7–1.4 cm; follicles reddish brown, ca. 5 mm in diam., oil glands large and impressed, apex not beaked. Seeds ca. 4 mm in diam. Fl. Apr–May, fr. Aug–Oct.

• Forests, thickets; 1600–3200 m. W Hubei, S Shaanxi, E Sichuan, NE Yunnan.

35. *Zanthoxylum austrosinense* C. C. Huang, Acta Phytotax. Sin. 6: 53. 1957.

岭南花椒 ling nan hua jiao

Shrubs or trees, rarely to 3 m tall, dioecious or rarely polygamo-monoecious, all parts glabrous. Branchlets blackish brown, unarmed. Leaves 5–11-foliolate; rachis terete; lateral leaflets opposite, sessile or subsessile; terminal leaflet with petiolule 1–3 mm; leaflet blades ovate to lanceolate, 6–11 × 3–5 cm, oil glands clear but dark reddish brown to blackish brown when dry, midvein adaxially impressed or plane, secondary veins 11–15 on each side of midvein, base rounded to subcordate or oblique, margin serrulate, apex acuminate. Inflorescences terminal, usually on lateral branchlets, to 30-flowered. Pedicel 5–8 mm. Perianth in 2 irregular series or 1 series, with 7–9 ±

undifferentiated tepals. Tepals basally pale yellowish green and apically dark purplish red, lanceolate to oblanceolate, ca. 1.5 mm. Bisexual flowers: stamens 3 or 4; carpels 4. Male flowers: stamens 6–8. Female flowers: carpels 3 or 4; styles recurved; stigmas capitate. Fruit pedicel dark purplish red, 1–2 cm; follicles dark purplish red, ca. 5 mm in diam., with sparse protruding oil glands, apex subrounded or shortly beaked. Seeds ca. $4 \times 3\text{--}4$ mm. Fl. Mar–Apr, fr. Aug–Sep.

• Hillside open forests and thickets, upland thickets; 300–1700 m. S Anhui, Fujian, N Guangdong, NE Guangxi, SW Hubei, Hunan, Jiangxi, Zhejiang.

- 1a. Leaflet blades dark reddish brown to blackish brown when dry, glabrous 35a. var. *austrosinense*
 1b. Leaflet blades dark grayish green when dry, adaxially hirsutulous 35b. var. *pubescens*

35a. *Zanthoxylum austrosinense* var. *austrosinense*

岭南花椒(原变种) ling nan hua jiao (yuan bian zhong)

Zanthoxylum austrosinense var. *stenophyllum* C. C. Huang.

Leaflet blades dark reddish brown to blackish brown when dry, glabrous.

• Hillside open forests and thickets; 300–900 m. S Anhui, Fujian, N Guangdong, NE Guangxi, SW Hubei, Hunan, Jiangxi, Zhejiang.

35b. *Zanthoxylum austrosinense* var. *pubescens* C. C. Huang, Acta Phytotax. Sin. 16(2): 82. 1978.

毛叶岭南花椒 mao ye ling nan hua jiao

Leaflet blades dark grayish green when dry, adaxially hirsutulous.

• Upland thickets; ca. 1700 m. Hunan (Sangzhi).

36. *Zanthoxylum motuoense* C. C. Huang, Acta Phytotax. Sin. 16(2): 83. 1978.

墨脱花椒 mo tuo hua jiao

Trees to 15 m tall, deciduous. Branchlets with prickles near leaf scars. Leaves 3- or 5-foliolate; rachis not winged, unarmed, with trichomes; leaflet blades broadly obovate to broadly elliptic, $3\text{--}6 \times 2\text{--}4$ cm but terminal one to 9×6 cm, both surfaces pubescent, oil glands inconspicuous, base subrounded to cuneate, margin crenulate, apex subrounded or rarely acuminate. Inflorescences paniculate, 4–8 cm. Fruit pedicel with short trichomes; follicles elliptic, ca. 4.5 mm in diam., with large protruding oil glands. Seeds ca. 4 mm in diam. Fr. Sep–Oct.

• Upland thickets; ca. 1100 m. SE Xizang (Mêdog).

37. *Zanthoxylum piasezkii* Maximowicz, Trudy Imp. S.-Peterburgsk. Bot. Sada 11: 93. 1889.

川陕花椒 chuan shan hua jiao

Shrubs or trees, 1–3 m tall, all parts glabrous. Stems and branches with brownish red prickles. Leaves 7–17-foliolate; rachis marginate; leaflet blades sessile, orbicular, broadly elliptic, or obovate-rhombic, $3\text{--}25 \times 3\text{--}8$ mm, thickly leathery, pale brown to blackish brown when dry, midvein impressed, secondary veins inconspicuous, base symmetric or slightly oblique,

margin apically crenate. Inflorescences terminal. Perianth in 2 irregular series or 1 series, with $6\text{--}8 \pm$ undifferentiated tepals. Tepals broadly deltoid, ca. 1.5 mm or longer. Male flowers: pedicel 5–8 mm; stamens 5 or 6; connective blackish brown when dry, with oil gland on tip; rudimentary gynoeceum projecting outward and cushion-shaped. Female flowers: carpels 2 or 3(or 4); styles recurved. Fruit follicles purplish red, 4–5 mm in diam., with a few protruding oil glands. Seeds 3–4 mm in diam. Fl. May, fr. Jun–Jul.

• 1700–2500 m. S Gansu, W Henan, S Shaanxi, Sichuan.

38. *Zanthoxylum pilosulum* Rehder & E. H. Wilson in Sargent, Pl. Wilson. 2: 123. 1914.

微柔毛花椒 wei rou mao hua jiao

Shrubs 1–2 m tall. Branchlets with prickles, puberulent when young. Leaves (5 or)7–11-foliolate; leaflet blades sessile, ovate to ovate-elliptic, $0.5\text{--}3 \times 0.4\text{--}1.5$ cm but terminal one to 5×2.5 cm, thinly papery, grayish green when dry, oil glands inconspicuous, base symmetric, margin irregularly and remotely crenulate, apex mucronate to acuminate. Inflorescences terminal; rachis with short trichomes. Perianth in 2 irregular series or 1 series, with $5\text{--}8 \pm$ undifferentiated tepals. Male flowers: tepals lanceolate, 1.2–1.5 mm; stamens 5 or 6. Female flowers: carpels (2–)4. Fruit follicles purplish red, 4–5 mm in diam., with sparse protruding small oil glands. Fl. Apr–May, fr. Jul–Aug.

• 2500–3100 m. S Gansu, S Shaanxi, NE and W Sichuan, Yunnan.

39. *Zanthoxylum pteracanthum* Rehder & E. H. Wilson in Sargent, Pl. Wilson. 2: 123. 1914.

翼刺花椒 yi ci hua jiao

Shrubs or trees, 2–3 m tall. Branchlets grayish green, glabrous, densely covered with setiform prickles and strongly compressed pseudostipular decurrent prickles forming a wing which joins them between nodes. Leaves 7–13-foliolate; rachis marginate, glabrous; leaflet blades subsessile, opposite or subopposite, lanceolate to ovate-oblong, $2\text{--}4 \times 0.8\text{--}1.5$ cm, oil glands inconspicuous, base slightly oblique and subrounded to broadly cuneate, margin apically crenulate, apex acuminate with a mucronate, obtuse, or emarginate tip. Inflorescences terminal; rachis base with prickles. Fruit pedicel 5–8 mm; developed follicles 1–3 with carpels in female flowers at least 3, ca. 5 mm, pubescent. Seeds 3–4 mm.

• Upland thickets; ca. 1000 m. W Hubei (Xingshan).

40. *Zanthoxylum simulans* Hance, Ann. Sci. Nat., Bot., sér. 5, 5: 208. 1866.

野花椒 ye hua jiao

Fagara podocarpa (Hemsley) Engler; *F. setosa* (Hemsley) Engler; *Zanthoxylum acanthophyllum* Hayata; *Z. argyi* H. Léveillé; *Z. bungei* Hance var. *inermis* Franchet; *Z. podocarpum* Hemsley; *Z. setosum* Hemsley; *Z. simulans* var. *podocarpum* (Hemsley) C. C. Huang.

Shrubs or small trees. Stems and branchlets with prickles. Young branchlets and leaflet blades abaxially on midvein pubescent, sometimes also secondary veins pubescent, sometimes

all parts glabrous. Leaves 5–15-foliolate; rachis winged; leaflet blades sessile or at base of leaf rachis with a short petiolule, opposite, ovate, ovate-elliptic, or lanceolate, $2.5\text{--}7 \times 1.5\text{--}4$ cm, adaxially with spines, oil glands numerous, translucent, and slightly protruding when dry, midvein impressed, base slightly oblique, margin crenate, apex acute to mucronate or with a retuse tip. Inflorescences terminal, 1–5 cm. Perianth in 2 irregular series or 1 series, with $5\text{--}8 \pm$ undifferentiated tepals. Tepals pale yellowish green, narrowly lanceolate, broadly ovate, or subdeltoïd, ca. 2 mm. Male flowers: stamens 5–8(–10); filaments pale green; connective with an oil gland at apex; rudimentary gynoeceium pale green. Female flowers: carpels 2 or 3; styles recurved. Fruit follicles reddish brown, ca. 5 mm in diam., base attenuate into a 1–2 mm stipe, oil glands numerous and slightly protruding. Seeds 4–4.5 mm. Fl. Mar–May, fr. Jul–Sep. $2n = \text{ca. } 132^*$.

• Plains or upland forests. Anhui, Fujian, Gansu, N Guangdong, NE Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Qinghai, Shaanxi, Shandong, Taiwan, Zhejiang.

41. *Zanthoxylum stipitatum* C. C. Huang, *Guihaia* 7: 2. 1987.

梗花椒 geng hua jiao

Shrubs or trees, 1–3 m tall, glabrous except for leaflet blades. Prickles to 1.5 cm. Branchlets blackish brown when dry. Leaves 7–17-foliolate; leaflet blades subsessile or with petiolule to 2 mm, opposite, lanceolate to ovate but suborbicular at base of leaf rachis, $1\text{--}5 \times 0.7\text{--}1.3$ cm, papery, abaxially purplish red when young, turning grayish green when mature, and reddish brown to dark blackish red when dry, oil glands sparse and protruding on both surfaces when dry, midvein abaxially rust-colored flocculent and adaxially impressed, margin serrulate. Inflorescences terminal. Perianth in 2 irregular series or 1 series, with $6\text{--}8 \pm$ undifferentiated tepals. Tepals usually lanceolate, 2–3 mm. Male flowers: stamens 5–8; connective with oil gland at tip. Female flowers: carpels 3 or 4; styles recurved. Rachis of infructescences purplish red. Fruit pedicel purplish red, 5–8(–10) mm; follicles purplish red, ca. 5×4 mm, base attenuate into a 1–3 mm stipe, oil glands slightly protruding when dry. Seeds ca. 4×3.5 mm. Fl. Apr–May, fr. Jul–Aug.

• Forests; 100–800 m. NW Fujian, N Guangdong, NE Guangxi, S Hunan.

2. *ORIXA* Thunberg, Nov. Gen. Pl. 3: 56. 1783.

臭常山属 chou chang shan shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Shrubs or small trees, deciduous, dioecious, unarmed. Buds with imbricate scales. Leaves alternate, simple. Inflorescences axillary, between leaves or basal to leaves, racemose or in female plants often reduced to solitary flowers. Sepals 4, basally connate. Petals 4, imbricate in bud. Stamens 4 but rudimentary in female flowers, distinct. Disk 4-lobed, broadly flattened in male flowers. Gynoeceium 4-carpelled but rudimentary or lacking in male flowers; ovaries basally connate, otherwise coherent, each with 1 ovule; style terminal, of 4 coherent styler elements; stigma capitate, 4-lobed. Fruit of 1–4 basally connate follicles each with a styler beak; endocarp cartilaginous, discharged elastically with seed at dehiscence. Seeds black, subglobose to broadly ellipsoid, glossy; seed coat sclerenchymatous, thin and brittle; endosperm \pm scant; embryo straight; cotyledons suborbicular, flattened; hypocotyl partly included between cotyledons.

One species: E Asia.

1. *Orixa japonica* Thunberg, Nov. Gen. Pl. 3: 57. 1783.

臭常山 chou chang shan

Celastrus orixa (Lamarck) Siebold & Zuccarini, nom. superfl.; *Euodia ramiflora* A. Gray; *Ilex orixa* (Lamarck) Sprengel; *Orixa racemosa* Z. M. Tan; *O. subcoriacea* Z. M. Tan; *Othera orixa* Lamarck; *Sabia cavaleriei* H. Léveillé; *S. feddei* H. Léveillé.

Shrubs or trees, to 3 m tall. Petiole 3–8 mm; leaf blade

obovate to elliptic, $4\text{--}15 \times 2\text{--}6$ cm, papery, base obtuse, cuneate, or attenuate, apex obtuse, acute, or acuminate. Sepals 1–1.5 mm. Petals greenish, 3–4 mm. Fruit follicles 8–10 mm, ribbed, apex usually with a styler beak. Seeds 4–4.5 mm in diam. Fl. Apr–May, fr. Sep–Nov.

Open or dense forests on sunny slopes; 500–1300 m. Anhui, Fujian, Guizhou, S Henan, Hubei, NW Hunan, Jiangsu, N Jiangxi, SE Shaanxi, Sichuan, NW Yunnan, Zhejiang [Japan, S Korea].

3. *TETRADIUM* Loureiro, Fl. Cochinch. 1: 91. 1790.

四数花属 si shu hua shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Boymia A. Jussieu; *Megabotrya* Hance ex Walpers; *Philagonia* Blume.

Shrubs or trees, evergreen or deciduous, dioecious or rarely polygamo-dioecious. Axillary buds exposed. Leaves opposite, odd-pinnate (occasional leaves even-pinnate); lateral leaflet blades often \pm inequilateral, especially at base. Inflorescences terminal or terminal and axillary, thyriform. Sepals 4 or 5, basally connate. Petals 4 or 5, narrowly imbricate in bud. Stamens 4 or 5, distinct. Male flowers: stamens to $1.5 \times$ as long as petals; disk conic to cylindrical or occasionally barrel-shaped; gynoeceium rudimentary, of 4 or 5 basally connate, divergent, and fingerlike carpels. Female flowers: stamens rudimentary, ligulate, much shorter than petals or some-

times lacking; disk pulvinate to barrel-shaped; gynoeceium 4- or 5-carpelled; ovaries basally connate, otherwise contiguous, each with 1 or 2 ovules; style apical, of 4 or 5 ± contiguous stylar elements; stigma peltate. Fruit of 1–5 basally connate follicles with abortive carpels, if any, persistent; outer part of pericarp (exocarp and mesocarp) dry or ± fleshy; endocarp cartilaginous. Seeds remaining attached in dehiscent fruit; seed coat (except in *Tetradium daniellii* and *T. calcicola*) with thick inner layer of dense black sclerenchyma and spongy outer layer bounded externally by a shiny black or reddish pellicle; endosperm copious; embryo straight; cotyledons broadly elliptic, ± flattened; hypocotyl superior.

Nine species: E, S, and SE Asia; seven species (one endemic) in China.

Euodia lyi H. Léveillé (Bull. Géogr. Bot. 24: 142. 1914) is a synonym of *Miliusa sinensis* Finet & Gagnepain in the Annonaceae (see Fl. China 7).

Euodia chaffanjonii H. Léveillé (Repert. Spec. Nov. Regni Veg. 13: 265. 1914) is a synonym of *Euscaphis japonica* (Thunberg) Dippel in the Staphyleaceae (see p. 498).

Euodia was long confused with *Tetradium* and *Melicope*. *Euodia* comprises seven species native to NE Australia, New Guinea, and SW Pacific islands.

1a. Plants flowering.

2a. Flowers 4(or 5)-merous.

3a. Leaflet blade secondary veins 13–22 on each side of midvein, margin crenulate or rarely entire; ovules 2 per carpel, subcollateral 1. *T. fraxinifolium*

3b. Leaflet blade secondary veins 11–14 on each side of midvein, margin entire; ovules 2 per carpel, collateral 5. *T. trichotomum*

2b. Flowers (4 or)5-merous.

4a. Ovules 1 per carpel; leaflet blades abaxially finely papillate 7. *T. austrosinense*

4b. Ovules 2 per carpel; leaflet blades not abaxially papillate.

5a. Ovules superposed.

6a. Petals white or whitish, drying whitish or pale brown, outside glabrous; leaflet blade margins subentire to crenulate 2. *T. daniellii*

6b. Petals purple, drying dull purplish red, outside sparsely to ± densely appressed pubescent; leaflet blade margins entire 3. *T. calcicola*

5b. Ovules collateral or subcollateral.

7a. Sepals ca. 0.5 mm; leaflet blades abaxially usually glaucous, reticulate veinlets dense and clearly defined 4. *T. glabrifolium*

7b. Sepals 0.5–1.2 mm; leaflet blades abaxially rarely slightly glaucous, reticulate veinlets ± loose and ± inconspicuous 6. *T. ruticarpum*

1b. Plants fruiting.

8a. Fruit (including abortive carpels, if any) 4(or 5)-carpelled.

9a. Seeds 2 per follicle, subtrigonal, attached in dehiscent follicle to a fleshy funiculate aril 1. *T. fraxinifolium*

9b. Seeds 1 per follicle, paired with an abortive seed, subglobose to broadly ovoid, attached in dehiscent follicle to an axile strip of pergamentaceous pericarp tissue 5. *T. trichotomum*

8b. Fruit (including abortive carpels, if any) (4 or)5-carpelled.

10a. Fruit follicles 2-seeded.

11a. Fruit follicles 5–11 mm, sparsely to densely spreading pubescent, apex beaked 2. *T. daniellii*

11b. Fruit follicles ca. 5 mm, sparsely to densely appressed pubescent laterally, otherwise glabrate, apex not beaked 3. *T. calcicola*

10b. Fruit follicles 1-seeded.

12a. Seed not paired with an abortive seed; follicles ca. 3.5 mm 7. *T. austrosinense*

12b. Seed paired with an abortive seed; follicles 3.5–6 mm.

13a. Fruit follicles trigonal, sparsely to densely appressed pubescent laterally, glabrous abaxially, endocarp sparsely to ± densely pubescent 4. *T. glabrifolium*

13b. Fruit follicles subglobose, glabrous or sometimes with sparse trichomes laterally and/or abaxially, endocarp glabrous 6. *T. ruticarpum*

1. *Tetradium fraxinifolium* (Hooker) T. G. Hartley, Gard. Bull. Singapore 34: 102. 1981.

Mazzetti; *E. impellucida* var. *macrococca* C. C. Huang; *E. poilanei* Guillaumin; *E. subtrigonosperma* C. C. Huang.

无腺吴萸 wu xian wu yu

Philagonia fraxinifolia Hooker, Icon. Pl. t. 710. 1845;
Euodia fraxinifolia (Hooker) Benth; *E. impellucida* Handel-

Trees to 12 m tall. Leaves 23–67 cm, 5–15-foliolate; leaflet blades lanceolate or occasionally ovate, elliptic-oblong, or elliptic, 9–25 × 3.5–8.5 cm, abaxially often glaucous and sometimes

subpapillate, secondary veins 13–22 on each side of midvein, reticulate veinlets abaxially usually inconspicuous, base in lateral leaflets rounded to narrowly cuneate and in terminal leaflet cuneate, margin crenulate or rarely entire, apex acuminate. Inflorescences 7–24 cm. Flowers 4(or 5)-merous. Sepals 0.5–1.5 mm. Petals green to pale yellow but drying brown, 3.5–6.5 mm, outside glabrous, inside glabrous to villous. Ovary glabrous or appressed pubescent; ovules 2 per carpel, subcollateral. Fruit (including abortive carpels, if any) usually 4-carpelled; follicles compressed subglobose, 5.5–10 mm, glabrous to sparsely pubescent, apex not beaked; endocarp glabrous or sparsely pubescent. Seeds 2 per follicle, subtrigonous, 4–5 mm, attached in dehiscent follicle to a fleshy funiculate aril; seed coat with thick inner layer of dense black sclerenchyma and spongy outer layer bounded externally by a reddish brown to brownish black shiny pellicle. Fl. May and Nov, fr. Jul–Nov.

Forests, thickets; 700–3000 m. SE Xizang, Yunnan [Bhutan, India, Myanmar, Nepal, Thailand, N Vietnam].

2. *Tetradium daniellii* (Bennett) T. G. Hartley, Gard. Bull. Singapore 34: 105. 1981.

臭檀吴萸 *chou tan wu yu*

Zanthoxylum daniellii Bennett, Ann. Mag. Nat. Hist., ser. 3, 10: 201. 1862; *Ampacus daniellii* (Bennett) Kuntze; *Euodia baberi* Rehder & E. H. Wilson, p.p. as to *E. H. Wilson 1164* p.p. Jul 1908 (see also synonymy of *Tetradium ruticarpum*); *E. daniellii* (Bennett) Hemsley; *E. daniellii* var. *delavayi* (Dode) C. C. Huang; *E. daniellii* var. *henryi* (Dode) C. C. Huang; *E. daniellii* var. *hupehensis* (Dode) C. C. Huang; *E. daniellii* var. *labordei* (Dode) C. C. Huang; *E. daniellii* var. *villicarpa* (Rehder & E. H. Wilson) C. C. Huang; *E. delavayi* Dode; *E. henryi* Dode; *E. henryi* var. *villicarpa* Rehder & E. H. Wilson; *E. hupehensis* Dode; *E. labordei* Dode; *E. sutchuenensis* Dode, p.p. as to *R. P. Farges 1284* p.p. (see also synonymy of *Phellodendron chinense* var. *chinense*); *E. velutina* Rehder & E. H. Wilson; *E. vestita* W. W. Smith; *Z. bretschnideri* Maximowicz.

Shrubs or trees, to 20 m tall. Leaves 15–44 cm, 5–9(or 11)-foliolate; leaflet blades broadly ovate to lanceolate or rarely elliptic or elliptic-oblong, 5–18.5 × 2.5–10.5 cm, abaxially sometimes ± glaucous and not papillate, secondary veins 7–14 on each side of midvein, reticulate veinlets abaxially usually inconspicuous, base in lateral leaflets narrowly cuneate, subtruncate, subrounded, or subcordate and in terminal leaflet narrowly cuneate, cuneate, or occasionally rounded, margin subentire to crenulate, apex acuminate. Inflorescences 3.5–19 cm. Flowers (4 or 5)-merous. Sepals 0.5–1.5 mm. Petals white or whitish but drying whitish or pale brown, (2.5–)3–5 mm, outside glabrous, inside sparsely or sometimes densely pubescent or villous. Ovary pubescent between carpels, otherwise ± densely pubescent to glabrous; ovules 2 per carpel, superposed. Fruit (including abortive carpels, if any) usually 5-carpelled; follicles narrowly pyriform, 5–11 mm, sparsely to ± densely spreading pubescent, apex beaked; endocarp glabrous. Seeds 2 per follicle, superposed, black, ovoid to ellipsoid, shiny, attached in dehiscent fruit to axile strip of pergamentaceous pericarp tissue; basal seed sterile, usually 1.5–3.5 mm, containing what appears to be en-

dosperm but no embryo; apical seed fertile, 2.5–4 mm; seed coat sclerenchymatous, lacking spongy tissue, in fertile seed thick and resistant to breakage, in sterile seed thin and brittle. Fl. Jun–Aug, fr. Aug–Nov. *2n* = 76, 78.

Forests, forest margins, open slopes; near sea level to 3200 m. Anhui, S Gansu, Guizhou, Hebei, Henan, Hubei, Jiangsu, Liaoning, S Ningxia, E Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, SE Xizang, Yunnan [Korea].

3. *Tetradium calcicola* (Chun ex C. C. Huang) T. G. Hartley, Gard. Bull. Singapore 34: 108. 1981.

石山吴萸 *shi shan wu yu*

Euodia calcicola Chun ex C. C. Huang, Acta Phytotax. Sin. 6: 120. 1957.

Shrubs or trees, to 15 m tall. Leaves 9–19 cm, 5-foliolate; leaflet blades ovate to elliptic, 5–9.5 × 2.3–4.5 cm, abaxially ± glaucous and not papillate, secondary veins 10–14 on each side of midvein, reticulate veinlets abaxially usually inconspicuous, base in lateral leaflets and in terminal leaflet obtuse to rounded, margin entire, apex acuminate. Inflorescences 5.5–13 cm. Flowers 5-merous. Sepals 0.7–1 mm. Petals purple but drying dull purplish red, 3–4 mm, outside sparsely to ± densely appressed pubescent, inside villous. Ovary sparsely to ± densely appressed pubescent; ovules 2 per carpel, superposed. Fruit (including abortive carpels, if any) 5-carpelled; follicles pyriform, ca. 5 mm, laterally densely appressed pubescent, otherwise glabrate, apex not beaked; endocarp glabrous. Seeds 2 per follicle, superposed, black, ellipsoid, shiny, attached in dehiscent fruit to axile strip of pergamentaceous pericarp tissue; basal seed sterile, ca. 2 mm, containing what appears to be endosperm but no embryo; apical seed fertile, ca. 3 mm; seed coat sclerenchymatous, lacking spongy tissue, in sterile seed thin and brittle, in fertile seed thick and resistant to breakage. Fl. Jun–Sep, fr. Sep–Dec.

• Forests, thickets; 600–800 m. N and W Guangxi, S Guizhou, SE Yunnan.

4. *Tetradium glabrifolium* (Champion ex Benth) T. G. Hartley, Gard. Bull. Singapore 34: 109. 1981.

楝叶吴萸 *lian ye wu yu*

Boymia glabrifolia Champion ex Benth, Hooker's J. Bot. Kew Gard. Misc. 3: 330. 1851; *Ampacus meliifolia* (Hance ex Walpers) Kuntze; *Euodia ailantifolia* Pierre; *E. balansae* Dode; *E. fargesii* Dode; *E. glabrifolia* (Champion ex Benth) C. C. Huang; *E. glauca* Miquel; *E. meliifolia* (Hance ex Walpers) Benth; *E. taiwanensis* T. Yamazaki; *E. yunnanensis* C. C. Huang; *Eurycoma dubia* Elmer; *Megabotrya meliifolia* Hance ex Walpers; *Phellodendron burkillii* Steenis; *Tetradium glabrifolium* var. *glaucum* (Miquel) T. Yamazaki; *T. taiwanense* (T. Yamazaki) T. Yamazaki.

Shrubs or trees, to 20 m tall. Leaves 14–38 cm, (3 or 5)-foliolate; leaflet blades broadly ovate to lanceolate or less often elliptic or elliptic-oblong, 4–15 × 1.7–6 cm, abaxially usually glaucous and not papillate, secondary veins 8–18 on each side of midvein, reticulate veinlets abaxially clearly defined and dense, base in lateral leaflets narrowly cuneate to sub-

rounded to subtruncate and in terminal leaflet narrowly cuneate to cuneate, margin entire or \pm crenulate, apex acuminate. Inflorescences 9–19 cm. Flowers (4 or)5-merous. Sepals ca. 0.5 mm. Petals green, yellow, or white but drying whitish to brown, 2.7–4 mm, outside glabrous or sometimes with sparse appressed trichomes, inside nearly glabrous to villous. Ovary \pm densely pubescent between carpels, otherwise finely pubescent toward apex or glabrous; ovules 2 per carpel, collateral or subcollateral. Fruit (including abortive carpels, if any) usually 5-carpelled; follicles trigonous, 3.5–5 mm, laterally sparsely to densely appressed pubescent, otherwise glabrous, apex not beaked; endocarp sparsely to \pm densely pubescent. Seeds 1 per follicle but paired with an abortive seed, subglobose to ovoid to broadly ellipsoid, 2.5–4 mm, attached in dehiscent follicle to axile strip of pergamentaceous pericarp tissue; seed coat with thick inner layer of dense black sclerenchyma and spongy outer layer bounded externally by a shiny black pellicle. Fl. Jun–Sep, fr. Sep–Dec.

Forests, thickets, open places; near sea level to 1200 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangxi, S Shaanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Bhutan, India, Indonesia, Japan (including Ryukyu Islands), Malaysia, Myanmar, Philippines, Thailand, Vietnam].

5. *Tetradium trichotomum* Loureiro, Fl. Cochinch. 1: 91. 1790.

牛料吴萸 niu dou wu yu

Ampacus trichotoma (Loureiro) Kuntze; *Brucea trichotoma* (Loureiro) Sprengel; *Euodia colorata* Dunn; *E. hainanensis* Merrill; *E. lenticellata* C. C. Huang; *E. trichotoma* (Loureiro) Elmer; *E. trichotoma* var. *pubescens* C. C. Huang; *E. viridans* Drake.

Shrubs or trees, to 8 m tall. Leaves 12–37 cm, (3 or)5–11 (or 13)-foliolate; leaflet blades elliptic-oblong, lanceolate, or occasionally ovate, 3–16 \times 3–5 cm, abaxially neither glaucous nor papillate, secondary veins 11–14 on each side of midvein, reticulate veinlets abaxially inconspicuous, margin entire, base in lateral leaflets subrounded to cuneate and in terminal leaflet cuneate, apex acuminate. Inflorescences 5–30 cm. Flowers 4 (or 5)-merous. Sepals 0.5–1 mm. Petals green, yellow, or white but drying brown to whitish, 3–4 mm, outside glabrous, inside glabrous or sparsely villosulous. Ovary glabrous or with a few short trichomes between carpels toward base; ovules 2 per carpel, collateral. Fruit (including abortive carpels, if any) usually 4-carpelled; follicles subglobose to obovoid, 4–7 mm, glabrous or laterally with sparse pubescence toward base, apex not beaked; endocarp glabrous. Seeds 1 per follicle but paired with an abortive seed, subglobose to broadly ovoid, 3.7–6 mm, attached in dehiscent follicle to axile strip of pergamentaceous pericarp tissue; seed coat with thick inner layer of dense black sclerenchyma and spongy outer layer bounded externally by a shiny black pellicle. Fl. Apr–Aug, fr. Sep–Nov.

Forests, thickets; 300–1900 m. SE Guangdong, Guangxi, S Guizhou, Hainan, Hubei, Shaanxi, S Sichuan, Yunnan [Laos, Thailand, N Vietnam].

6. *Tetradium ruticarpum* (A. Jussieu) T. G. Hartley, Gard. Bull. Singapore 34: 116. 1981.

吴茱萸 wu zhu yu

Boymia ruticarpa A. Jussieu, Mém. Mus. Hist. Nat. 12: 507. 1825; *Ampacus ruticarpa* (A. Jussieu) Kuntze; *Euodia baberi* Rehder & E. H. Wilson, p.p. as *E. H. Wilson 1164* p.p. Oct 1908 (see also synonymy of *Tetradium daniellii*); *E. bodinieri* Dode; *E. compacta* Handel-Mazzetti; *E. compacta* var. *meionocarpa* Handel-Mazzetti; *E. hirsutifolia* Hayata; *E. officinalis* Dode; *E. rugosa* Rehder & E. H. Wilson; *E. ruticarpa* (A. Jussieu) Benth; *E. ruticarpa* var. *bodinieri* (Dode) C. C. Huang; *E. ruticarpa* var. *officinalis* (Dode) C. C. Huang.

Shrubs or trees, to 9 m tall. Leaves 15–40 cm, (3 or)5–13 (or 15)-foliolate; leaflet blades elliptic to ovate or sometimes lanceolate, oblanceolate, or obovate, 4.5–17 \times 2–8 cm, abaxially rarely slightly glaucous and not papillate, secondary veins 9–17 on each side of midvein, reticulate veinlets abaxially \pm inconspicuous and \pm loose, base in lateral leaflets obtuse to narrowly cuneate or sometimes rounded to cuneate or rarely attenuate, margin entire or irregularly crenulate, apex acuminate. Inflorescences 2.5–18 cm. Flowers (4 or)5-merous. Sepals 0.5–1.2 mm. Petals green, yellow, or white but drying brown to whitish, 3–5 mm, outside glabrous or with sparse short trichomes, inside nearly glabrous to villous. Ovary glabrous or with sparse trichomes; ovules 2 per carpel, collateral or subcollateral. Fruit (including abortive carpels, if any) usually 5-carpelled; follicles subglobose, 3.5–6 mm, glabrous or sometimes with sparse trichomes, apex not beaked; endocarp glabrous. Seeds 1 per follicle but paired with an abortive seed, ovoid or sometimes ellipsoid or subglobose, 3.5–5.5 mm, attached in dehiscent follicle to axile strip of pergamentaceous pericarp tissue; seed coat with thick inner layer of dense black sclerenchyma and spongy outer layer bounded externally by a shiny black pellicle. Fl. Apr–Jun, fr. Aug–Nov.

Forests, thickets, open places; 100–3000 m. Anhui, Fujian, S Gansu, Guangdong, Guangxi, Guizhou, Hebei, S Henan, Hubei, Hunan, S Jiangsu, Jiangxi, S Shaanxi, Sichuan, Yunnan, Zhejiang [Bhutan, NE India, Myanmar, Nepal].

7. *Tetradium austrosinense* (Handel-Mazzetti) T. G. Hartley, Gard. Bull. Singapore 34: 120. 1981.

华南吴萸 hua nan wu yu

Euodia austrosinensis Handel-Mazzetti, Sinensia 5: 1. 1934.

Trees to 20 m tall. Leaves 20–35 cm, 7–11-foliolate; leaflet blades broadly elliptic or sometimes ovate, lanceolate, obovate, or oblanceolate, 5.5–14.5 (–17) \times 2.5–7 (–8.5) cm, abaxially glaucous and finely papillate, secondary veins 9–12 on each side of midvein, reticulate veinlets abaxially usually \pm conspicuous and \pm loose, base in lateral leaflets obtuse to nearly rounded and in terminal leaflet cuneate, margin entire, apex acuminate. Inflorescences 11–18 cm. Flowers (4 or)5-merous. Sepals ca. 0.5 mm. Petals green to greenish yellow but drying brown, 2.5–3 mm, outside glabrous to sparsely puberulent, inside sparsely to densely villous. Ovary glabrous; ovules 1 per carpel. Fruit (including abortive carpels, if any) usually 5-carpelled; follicles trigonous to subtrigonous, ca. 3.5 mm, glabrous or rarely with a

few scattered trichomes, apex not beaked; endocarp glabrous. Seeds 1 per follicle and not paired with an abortive seed, ellipsoid to subreniform, 2.3–2.5 mm, attached in dehiscent follicle to axile strip of pergamentaceous pericarp tissue; seed coat with thick inner layer of dense black sclerenchyma and spongy outer

layer bounded externally by a shiny black pellicle. Fl. Jun–Jul, fr. Sep–Nov.

Forests; 300–1500 m. Guangdong, Guangxi, S Yunnan [N Vietnam].

4. MELICOPE J. R. Forster & G. Forster, Char. Gen. Pl. 28. 1775.

蜜茱萸属 mi zhu yu shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Shrubs, trees, rarely scandent, evergreen, usually dioecious or sometimes monoclinal or andromonoecious. Leaves opposite [or whorled], digitately 3-foliolate or 1-foliolate. Inflorescences axillary or basal to leaves, cymulose to thyriform [or reduced to solitary flowers]. Sepals 4, connate at base or to nearly their full length. Petals 4, valvate or narrowly imbricate in bud. Stamens 4 or 8 [or 4–8], rudimentary in female flowers. Disk pulvinate to annular to cup-shaped. Gynoecium 4-carpelled, rudimentary or lacking in male flowers; ovaries connate at base, otherwise contiguous [or connate up to their full length]; ovules [1 or] 2 per locule; style apical or subapical, of 4 contiguous, coherent, or connate styler elements; stigma usually punctiform, capitellate, or capitate. Fruit of 1–4 basally connate follicles [or grading to a syncarpous 4-loculed loculicidal capsule]; exocarp dry to fleshy; endocarp cartilaginous. Seeds remaining attached in dehiscent fruit; seed coat with thick inner layer of dense black sclerenchyma and spongy outer layer bounded externally by a shiny black pellicle; endosperm copious; embryo straight or slightly curved; cotyledons elliptic, flattened; hypocotyl superior.

About 233 species: E, S, and SE Asia, Australia, Indian Ocean islands (Mascarenes), Madagascar, Pacific islands; eight species (two endemic) in China.

As discussed by Hartley (Allertonia 8: 19, f. 5. 2001), two types of attachment of mature seed are seen in dehiscent fruit of *Melicope*. In Type A, the attachment is by a partially detached axile strip of pericarp tissue or by a partially detached raphe, or by both. In Type B, neither the axile pericarp tissue nor the raphe is detached, and the seed is connected to the axile placental region by a funiculus, which is simply the funiculus of the ovule enlarged.

1a. Stamens 8; seed attachment Type A.

2a. Leaves 1-foliolate; follicles ellipsoid to obovoid, ca. 6.5 mm 1. *M. patulinervia*

2b. Leaves mostly 3-foliolate; follicles subglobose, 3–4.5 mm 2. *M. triphylla*

1b. Stamens 4; seed attachment Type B.

3a. Inflorescences 0.7–1.8(–2) cm wide; apex of staminal filaments at least in male and bisexual flowers obtuse or narrowly so or sometimes acute; petals usually persistent in fruit; leaves 3-foliolate and/or 1-foliolate.

4a. Petioles sparsely puberulent to pubescent adaxially, otherwise glabrous or nearly so 7. *M. viticina*

4b. Petioles pubescent to velutinous all around 8. *M. glomerata*

3b. Inflorescences 1.5–16 cm wide; apex of staminal filaments at least in male and bisexual flowers subulate to filiform; petals usually deciduous in fruit; leaves mostly 3-foliolate.

5a. Young branchlets 4.5–10 mm wide in third internode; leaflet blades abaxially strigillose to ± appressed villosulous 4. *M. semecarpifolia*

5b. Young branchlets 2–4.5 mm wide in third internode; leaflet blades abaxially glabrous to puberulent.

6a. Larger primary branches of inflorescences usually spreading; leaflet blades ovate-elliptic, elliptic, or elliptic-obovate, or narrowly so; inflorescences 2–10 × 1.5–8 cm; pedicel sparsely puberulent to pubescent 6. *M. pteleifolia*

6b. Larger primary branches of inflorescences usually ascending; leaflet blades usually elliptic or narrowly so; inflorescences 4.5–32 × 3–16 cm; pedicel glabrous to tomentulose.

7a. Leaflet blades elliptic, sometimes ovate-elliptic, or rarely obovate; inflorescences 8–32 × 3–16 cm; pedicel nearly glabrous to tomentulose 3. *M. lunu-ankenda*

7b. Leaflet blades ± narrowly elliptic; inflorescences 4.5–9 × 3–4.5 cm; pedicel glabrous 5. *M. chunii*

1. *Melicope patulinervia* (Merrill & Chun) C. C. Huang, Acta Phytotax. Sin. 6: 132. 1957.

蜜茱萸 mi zhu yu

Euodia patulinervia Merrill & Chun, Sunyatsenia 5: 87. 1940.

Shrubs 1–3 m tall. Young branchlets 2–3 mm wide in third

internode. Leaves 1-foliolate, glabrous; petiole 0.2–3 cm; leaflets sessile; leaflet blades elliptic, narrowly elliptic, or elliptic-obovate, 5–15 × 1.5–6 cm, apex acute to acuminate. Inflorescences axillary, to 3 cm. Sepals most likely in female flowers, ca. 0.5 mm, outside sparsely puberulent, basally connate, deciduous in fruit. Petals ca. 1.5 mm, deciduous in fruit. Stamens 8, shorter than petals. Gynoecium glabrous; ovary globose; style very short. Infructescences 1–2 × 1.3–2.5 cm; peduncle 3–10

mm. Pedicel 2–3.5 mm, sparsely puberulent. Fruit follicles ellipsoid to obovoid, ca. 6.5 mm, glabrous. Seeds ellipsoid to obovoid, 4–5 mm, attachment Type A. Fl. Mar–Apr, fr. Sep–Oct.

- Dense or ± open forests; 700–900 m. Hainan.

2. *Melicope triphylla* (Lamarck) Merrill, Philipp. J. Sci., C, 7: 375. 1912.

三叶蜜茱萸 san ye mi zhu yu

Fagara triphylla Lamarck, Encycl. 2: 447. 1788; *Acronychia minahassae* (Teijsmann & Binnendijk) Miquel; *Ampacus incerta* (Blume) Kuntze; *A. triphylla* (Lamarck) Kuntze; *Bergera ternata* Blanco; *Euodia anisodora* Lauterbach & K. Schumann; *E. awadan* Hatusima; *E. glaberrima* Merrill; *E. incerta* Blume; *E. laxireta* Merrill; *E. microsperma* F. M. Bailey; *E. minahassae* Teijsmann & Binnendijk; *E. philippinensis* Merrill & L. M. Perry; *E. triphylla* (Lamarck) Candolle; *Melicope awadan* (Hatusima) Ohwi & Hatusima; *M. curranii* Merrill; *M. densiflora* Merrill; *M. gjellerupii* Lauterbach; ?*M. kanehirae* Hatusima; *M. luzonensis* Engler ex Perkins; *M. mahonyi* F. M. Bailey; *M. mindanaensis* Elmer; *M. monophylla* Merrill; *M. monophylla* var. *glabra* Elmer; *M. nitida* Merrill; *M. obtusa* Merrill; *M. odorata* Elmer; *M. rupestris* Lauterbach; *Zanthoxylum triphyllum* (Lamarck) G. Don.

Shrubs or trees, 1.5–6 m tall, dioecious or sometimes monochinous or andromonoecious. Young branchlets 3–4 mm wide in third internode. Leaves 3-foliolate (occasional leaves 1-foliolate), glabrous; petiole 2–6.5 cm; leaflet blades obovate, oblanceolate, or rarely elliptic, in terminal leaflet 5–12 × 2–4.5 cm, apex acuminate or rarely acute. Inflorescences axillary, 3–7 × 2–6 cm; peduncle obsolete or to 1.5 cm. Pedicel 1.5–3 mm and of similar length in fruit, glabrous. Sepals 0.5–0.8 mm, glabrous or with a few trichomes at apex, connate at base or to ± half their length, persistent in fruit. Petals 2.5–3.5 mm, deciduous in fruit. Stamens 8, in male and bisexual flowers those opposite sepals 2–4 mm and in female flowers 0.5–3.5 mm; filaments at least in male and bisexual flowers acute to subulate at apex. Gynoecium glabrous, in female and bisexual flowers 0.8–1.6 mm, in male flowers 0.3–0.5 mm. Fruit follicles subglobose, 3–4.5 mm, glabrous. Seeds ellipsoid to obovoid, 3–4.5 mm, attachment Type A.

Forests, thickets, open places; low elevations. Taiwan [Indonesia, Japan (Ryukyu Islands), New Guinea, Philippines; SW Pacific islands].

3. *Melicope lunu-ankenda* (Gaertner) T. G. Hartley, Sandakania 4: 61. 1994.

三刈叶蜜茱萸 san yi ye mi zhu yu

Fagara lunu-ankenda Gaertner, Fruct. Sem. Pl. 1: 334. 1788; *Ampacus aromatica* (Blume) Kuntze; *Euodia arborea* Elmer; *E. arborescens* D. D. Tao; *E. aromatica* Blume; *E. concinna* Ridley; *E. lucida* (Miquel) Miquel; *E. lunu-ankenda* (Gaertner) Merrill; *E. lunu-ankenda* var. *tirunelvelica* A. N. Henry & Chandrabose; *E. marambong* (Miquel) Miquel; *E. obtusifolia* Ridley; *E. punctata* Merrill; *E. roxburghiana* (Chamisso) Benth; *E. roxburghiana* var. *longipes* Craib; *E. triphylla* (Lamarck) Candolle var. *pubescens* Ridley; *Zanthoxylum*

aromaticum (Blume) Miquel; *Z. lucidum* Miquel; *Z. marambong* Miquel; *Z. roxburghianum* Chamisso.

Trees to 30 m tall, dioecious. Young branchlets 2.5–4.5 mm wide in third internode. Leaves 3-foliolate; petiole 2–12 cm, glabrous to tomentulose; leaflet blades elliptic, sometimes ovate-elliptic, or rarely obovate, in terminal leaflet 6–21 × 2.5–8.5 cm, glabrous or puberulent to sparsely puberulent on midvein especially abaxially and sometimes on secondary veins abaxially, apex acuminate. Inflorescences axillary, 8–32 × 3–16 cm; peduncle 4–15 cm; larger primary branches usually ascending. Pedicel 0.3–2.5 mm but 1–5 mm in fruit, nearly glabrous to tomentulose. Sepals 0.5–1 mm, connate at base or to ca. 1/4 their length, glabrous or outside puberulent, persistent in fruit. Petals 1.5–2.5 mm, deciduous or subpersistent in fruit. Stamens 4, in male flowers 2–4 mm, in female flowers 0.5–2.5 mm; filaments at least in male flowers subulate to filiform at apex. Gynoecium in female flowers 1–3 mm, in male flowers 0.2–0.5 mm; ovary nearly glabrous to shortly pubescent or ± sparsely villous. Fruit follicles ellipsoid, 4.5–5 mm, glabrous to sparsely puberulent. Seeds subglobose, ovoid, or ellipsoid, 3.5–4 mm, attachment Type B. Fr. Aug–Sep.

Montane forests; ca. 900 m. SE Xizang (Mèdog) [Bhutan, Cambodia, India, Indonesia, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam].

4. *Melicope semecarpifolia* (Merrill) T. G. Hartley, Fl. Taiwan, ed. 2, 3: 522. 1993.

台湾蜜茱萸 tai wan mi zhu yu

Euodia semecarpifolia Merrill, Publ. Bur. Sci. Gov. Lab. 35: 23. 1906; *E. camiguinensis* Merrill; *E. merrillii* Kanehira & Sasaki; *E. retusa* Merrill.

Small trees, dioecious. Young branchlets 4.5–10 mm wide in third internode. Leaves 3-foliolate; petiole 3.5–14 cm, ± appressed pilose or appressed villous when young; leaflet blades elliptic to obovate, in terminal leaflet 7.5–30 × 3–12 cm, both surfaces strigillose to ± appressed villosulous on midvein and often abaxially on secondary veins, apex acuminate or sometimes rounded or acute. Inflorescences axillary and sometimes basal to leaves, 3–9.5 × 2.5–8 cm; peduncle obsolete or to 3.5 cm; larger primary branches usually spreading. Pedicel obsolete or to 2.5 mm, but 0.5–3 mm in fruit, glabrous to villosulous. Sepals 0.8–1 mm, connate at base or to ca. 1/4 their length, nearly glabrous to outside sericeous, persistent in fruit. Petals 2–2.5 mm, deciduous or subpersistent in fruit. Stamens 4, in male flowers 3.5–4.5 mm, in female flowers 1–2 mm; filaments at least in male flowers subulate to filiform at apex. Gynoecium in female flowers ca. 1.5 mm, in male flowers 0.5–1 mm; ovary sericeous. Fruit follicles subglobose, 4–4.5 mm, nearly glabrous or sparsely pilose. Seeds subglobose to ovoid to ellipsoid, 3.5–4 mm, attachment Type B. Fl. Jun–Jul, fr. Nov–Dec.

Forests, thickets; lower and middle elevations. Taiwan [Philippines].

5. *Melicope chunii* (Merrill) T. G. Hartley, Allertonia 8: 237. 2001.

海南蜜茱萸 hai nan mi zhu yu

Euodia chunii Merrill, J. Arnold Arbor. 6: 132. 1925; *E. lepta* Merrill var. *chunii* (Merrill) C. C. Huang.

Shrubs or trees, 1.5–12 m tall, dioecious. Young branchlets 2–3 mm wide in third internode. Leaves 3-foliolate; petiole 2–6 cm, glabrous or sparsely puberulent; leaflet blades \pm narrowly elliptic, in terminal leaflet 5–12 \times 1.5–3.5 cm, glabrous, apex acuminate or sometimes acute. Inflorescences axillary, 4.5–9 \times 3–4.5 cm; peduncle 2–3.5 cm; larger primary branches ascending. Pedicel 2–3.5 mm but 3–4 mm in fruit, glabrous. Sepals 0.5–0.7 mm, connate at base or to ca. 1/4 their length, glabrous or margin irregularly ciliate, persistent in fruit. Petals 2–2.5 mm, deciduous in fruit. Stamens 4, in male flowers 2.5–3 mm, in female flowers 1.5–2.5 mm; filaments at least in male flowers subulate to filiform at apex. Gynoecium in female flowers 1.5–2 mm, in male flowers 0.2–0.5 mm; ovary sparsely hirsutulous. Fruit follicles ellipsoid or obovoid, 5–6 mm, glabrate. Seeds subglobose to ellipsoid, 2.5–3.6 mm, attachment Type B.

- Forests; below 400 m. Hainan.

6. *Melicope pteleifolia* (Champion ex Benth) T. G. Hartley, Fl. Taiwan, ed. 2, 3: 521. 1993.

三椏苦 san ya ku

Zanthoxylum pteleifolium Champion ex Benth, Hooker's J. Bot. Kew Gard. Misc. 3: 350. 1851; *Euodia gracilis* Kurz; *E. lepta* Merrill, nom. illeg. superfl.; *E. lepta* var. *cambodiana* (Pierre) C. C. Huang; *E. oreophila* Guillaumin (1945), not Guillaumin (1938); *E. pteleifolia* (Champion ex Benth) Merrill; *E. triphylla* (Lamarck) Candolle var. *cambodiana* Pierre; *Ilex lepta* Sprengel, nom. illeg. superfl.; *Lepta triphylla* Loureiro.

Shrubs or trees, rarely scandent, 1–14 m tall, dioecious or rarely monoclinal. Young branchlets 2.5–4 mm wide in third internode. Leaves 3-foliolate (occasional leaves 1-foliolate); petiole 1.5–14 cm, glabrous to pubescent; leaflet blades ovate-elliptic, elliptic, elliptic-obovate, or narrowly so, in terminal leaflet 6–22 \times 2–8 cm, glabrous or puberulent on midvein especially abaxially, apex acuminate or subcaudate. Inflorescences axillary and sometimes basal to leaves, 2–10 \times 1.5–8 cm; peduncle 0.4–5 cm; larger primary branches usually spreading. Pedicel 0.6–3 mm but 1.5–6 mm in fruit, sparsely puberulent to pubescent. Sepals 0.5–1(–1.5) mm, connate at base or to ca. 1/4 their length, glabrous or outside pubescent, persistent in fruit. Petals 1.3–2(–2.5) mm, deciduous or rarely persistent in fruit. Stamens 4, in male and bisexual flowers 1.5–3(–4) mm, in female flowers 0.4–1.5 mm; filaments at least in male and bisexual flowers subulate to filiform at apex. Gynoecium in female and bisexual flowers 1–2 mm, in male flowers 0.2–0.5 mm; ovary glabrous to pubescent. Fruit follicles subglobose to ellipsoid to obovoid, (3–)3.5–7.5 mm, glabrous or sparsely puberulent. Seeds subglobose to ovoid to ellipsoid, 2.5–4 mm, attachment Type B. Fl. Apr–Jun, fr. Jul–Oct.

Evergreen and mixed deciduous forests and forest margins, thickets, swamp forests, open places; near sea level to 2300(–2800) m. Fujian, Guangdong, SW Guangxi, Hainan, S Jiangxi, Taiwan, Yunnan, SE Zhejiang [Cambodia, Laos, Myanmar, Thailand, Vietnam].

7. *Melicope viticina* (Wallich ex Kurz) T. G. Hartley, Allertonia 8: 262. 2001.

单叶蜜茱萸 dan ye mi zhu yu

Euodia viticina Wallich ex Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 42: 64. 1873.

Shrubs or trees, 0.8–6 m tall, dioecious or sometimes monoclinal. Young branchlets 1–3 mm wide in third internode. Leaves 1- or 3-foliolate. Leaves 3-foliolate: petiole 1.5–7 cm, adaxially sparsely puberulent to pubescent, otherwise glabrous or nearly so; leaflet blades elliptic or elliptic-obovate, or narrowly so, or rarely obovate or oblanceolate, in terminal leaflet 5.5–21 \times 1.5–6.5 cm, glabrous or sparsely puberulent to shortly pubescent on midvein, apex acuminate or rarely acute. Leaves 1-foliolate: petiole 0.3–4.5 cm; leaflet blades elliptic or elliptic-obovate, or narrowly so, 2.2–22 \times 0.7–7.5 cm, otherwise similar to 3-foliolate leaves. Inflorescences axillary and sometimes basal to leaves, 0.5–5(–8.5) \times 0.7–1.8(–2) cm; peduncle obsolete or to 2.5 cm; larger primary branches spreading or ascending. Pedicel 0.5–1.5 mm but 1.5–3 mm in fruit, glabrous to sparsely puberulent. Sepals 1–1.8 mm, connate at base, glabrous or outside sparsely puberulent, persistent in fruit. Petals 2.5–3 mm, persistent or rarely deciduous in fruit. Stamens 4, in male and bisexual flowers 2.2–3 mm, in female flowers 0.8–1.5 mm; filaments at least in male and bisexual flowers obtuse or narrowly so at apex. Gynoecium in female and bisexual flowers 1.5–2 mm, in male flowers 0.3–0.6 mm; ovary glabrous or rarely sparsely pubescent. Fruit follicles subglobose to ellipsoid, 5–7 mm, glabrous. Seeds ovoid to ellipsoid, 4–6.5 mm, attachment Type B. Fl. Apr–May, fr. Aug–Oct.

Open forests; 500–1300 m. S Yunnan [Cambodia, Laos, Myanmar, Thailand, Vietnam].

Plants mistakenly treated as *Euodia simplicifolia* Ridley var. *simplicifolia* by C. C. Huang (Fl. Reipubl. Popularis Sin. 43(2): 58. 1997) belong here.

8. *Melicope glomerata* (Craib) T. G. Hartley, Allertonia 8: 263. 2001.

密果蜜茱萸 mi guo mi zhu yu

Euodia glomerata Craib, Bull. Misc. Inform. Kew 1918: 362. 1918; *E. simplicifolia* Ridley var. *pubescens* C. C. Huang.

Shrubs 0.5–1.5 m tall or rarely trees to 11 m tall, dioecious or rarely monoclinal. Young branchlets 2–4.5 mm wide in third internode. Leaves 1- or 3-foliolate. Leaves 3-foliolate: petiole 1.5–7 cm, pubescent to velutinous; leaflet blades elliptic to obovate, or narrowly so, in terminal leaflet 3.5–16 \times 1.3–6.5 cm, pubescent or sparsely so at least abaxially on midvein and secondary veins and adaxially on midvein, apex obtuse to acuminate. Leaves 1-foliolate: petiole 0.8–1.5 cm; leaflet blade elliptic to obovate, 4–9.5 \times 2–3.8 cm, otherwise similar to 3-foliolate leaves. Inflorescences axillary and sometimes basal to leaves, 0.8–6 \times 0.8–1.7 cm; peduncle 0.1–2.5 cm; larger primary branches spreading or ascending. Pedicel 0.6–2 mm but 2.5–4 mm in fruit, sparsely hispidulous to pubescent. Sepals 1–2 mm, connate at base, outside hirsutulous or sparsely so or rarely nearly glabrous, persistent in fruit. Petals 2–3.5 mm, persistent in fruit. Stamens 4, in male and bisexual flowers

1.5–2.5 mm, in female flowers 1.5–2 mm; filaments at least in male and bisexual flowers narrowly obtuse or sometimes acute at apex. Gynoecium glabrous, in female and bisexual flowers 1–1.5 mm, in male flowers ca. 0.3 mm. Fruit follicles obovoid,

5–8 mm, glabrous. Seeds ovoid, 4–5 mm, attachment Type B. Fr. Aug.

Open forests; 500–700 m. S Yunnan [Laos, Myanmar, Thailand].

5. BOENNINGHAUSENIA Reichenbach ex Meisner, Pl. Vasc. Gen. 1: 60; 2: 44. 1837, nom. cons., not *Boenninghausia* Sprengel (1826).

石椒草属 shi jiao cao shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Herbs, perennial. Leaves alternate, pinnately to ternately decompose. Inflorescences terminal and axillary, paniculate, with simple foliar bracts. Flowers bisexual, actinomorphic. Sepals 4, connate at base or to nearly their full length. Petals 4, imbricate in bud, margin entire. Stamens (6–)8, distinct. Disk annular to cup-shaped, surrounding and separate from a slender manifestly accrescent gynophore which often becomes apically 4-parted. Gynoecium 4-carpelled; ovaries coherent in \pm their basal half, otherwise contiguous; ovules several per locule; style lateral, of 4 coherent styler elements; stigma punctiform or capitellate. Fruit of 4 distinct apically dehiscent follicles; endocarp thinly cartilaginous, adnate to mesocarp in dehiscent fruit. Seeds reniform; seed coat leathery, tuberculate; endosperm \pm copious; embryo curved; cotyledons elliptic, flattened; hypocotyl superior.

One species: E, S, and SE Asia.

1. Boenninghausenia albiflora (Hooker) Reichenbach ex Meisner, Pl. Vasc. Gen. 2: 44. 1837.

臭节草 chou jie cao

Ruta albiflora Hooker, Exot. Fl. 1: t. 79. 1823; *Bodinieria thalictrifolia* H. Léveillé; *Boenninghausenia albiflora* var. *brevipes* Franchet; *B. albiflora* var. *pilosa* Z. M. Tan; *B. brevipes* (Franchet) H. Léveillé; *B. japonica* Siebold ex Miquel; *B. schizocarpa* S. Y. Hu; *B. sessilicarpa* H. Léveillé; *Podostaurus thalictroides* Junghuhn.

Plants to 1.2 m tall. Stems, branches, leaves, and inflorescences glabrous to pubescent. Larger leaves 4–16 cm; leaflet

blades elliptic to obovate to broadly obovate to suborbicular, 0.5–2.5 \times 0.4–1.5 cm. Inflorescences to 60 cm. Flowers globose to ovoid to ellipsoid to oblong in bud. Sepals 0.5–1.3 mm. Petals elliptic to obovate, or broadly so, 3.5–6 mm, apex acute to broadly rounded. Disk 0.3–0.5 mm. Gynophore in flowers at anthesis 0.3–1.5 mm, in fruit 0.6–5.5 mm. Fruit follicles 2.5–5 mm. Fl. and fr. May–Nov.

Open forests, grassy slopes; 500–2800 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Sichuan, Taiwan, SE Xizang, Yunnan, Zhejiang [Bhutan, India, Indonesia, Japan, Kashmir, Laos, Myanmar, Nepal, Pakistan, Philippines, Thailand, N Vietnam].

6. HAPLOPHYLLUM A. Jussieu, Mém. Mus. Hist. Nat. 12: 464. 1825 [*Aplophyllum*], nom. cons., not *Aplophyllum* Cassini (1824).

拟芸香属 ni yun xiang shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Herbs, perennial [or sometimes low shrubs]. Leaves alternate, simple [occasional leaves 3- or 5-parted]. Inflorescences terminal, cymose and often corymbiform, (1- or) few to many flowered. Flowers bisexual, actinomorphic. Sepals 5, distinct or connate to \pm half their length. Petals 5, imbricate in bud, margin entire. Stamens 10, distinct [or monadelphous]. Disk pulvinate. Gynoecium (2 or)3–5-carpelled; ovaries connate in \pm their basal half, otherwise contiguous; ovules few or several per locule; style lateral, of (2 or)3–5 contiguous or connate styler elements; stigma punctiform or capitellate. Fruit a (2 or)3–5-carpelled loculicidal capsule or rarely indehiscent, with carpels connate as in gynoecium; endocarp thinly cartilaginous, adnate to mesocarp in dehiscent fruit. Seeds reniform; seed coat leathery, rugose; endosperm copious; embryo curved; cotyledons elliptic-oblong, flattened; hypocotyl superior.

About 65 species: N Africa, Asia, S Europe; three species (one endemic) in China.

1a. Leaf blade ovate to lanceolate, 5–20 mm wide, secondary veins prominent 2. *H. acutifolium*

1b. Leaf blade elliptic, lanceolate, or linear, 1–5 mm wide, secondary veins not prominent.

2a. Inflorescences many flowered; gynoecium 2- or 3-carpelled 1. *H. dauricum*

2b. Inflorescences 1-flowered; gynoecium 4- or 5-carpelled 3. *H. tragacanthoides*

1. Haplophyllum dauricum (Linnaeus) G. Don, Gen. Hist. 1: 781. 1831.

北芸香 bei yun xiang

Peganum dauricum Linnaeus, Sp. Pl. 1: 445. 1753; *Haplophyllum lineare* (Candolle) G. Don; *Ruta daurica* (Linnaeus) Candolle.

Herbs, perennial. Underground part woody, above-ground part many branched; branchlets slender, 10–20 cm, puberulent when young. Leaves subsessile; leaf blade lanceolate to linear, 5–20 \times 1–5 mm, grayish green, with oil glands, base attenuate, apex acute. Inflorescences many flowered or very rarely 3-flowered; bracts linear, small. Sepals ca. 1 mm, basally connate, margin pubescent. Petals yellowish to pale yellowish

white, oblong, 6–8 mm, with scattered semipellucid oil glands. Staminal filaments enlarged in \pm their basal half; anthers elongately ellipsoid; connective with an apical oil gland. Ovary globose, (2 or)3(or 4)-loculed; style slender; stigma slightly enlarged. Fruiting carpels 2-seeded. Seeds brownish black, $2\text{--}2.5 \times 1\text{--}1.5$ mm. Fl. Jun–Jul, fr. Aug–Sep.

Hill slopes; low elevations. Gansu, Hebei, Heilongjiang, Jilin, Nei Mongol, Ningxia, Shaanxi, Xinjiang [Mongolia, Russia].

2. *Haplophyllum acutifolium* (Candolle) G. Don, Gen. Hist. 1: 780. 1831.

大叶芸香 da ye yun xiang

Ruta acutifolia Candolle, Prodr. 1: 711 1824; *Haplophyllum flexuosum* Boissier; *H. perforatum* Karelin & Kirilov; *H. sieversii* Fischer & C. A. Meyer; *R. flexuosa* (Boissier) Engler; *R. perforata* M. Bieberstein; *R. sieversii* (Fischer & C. A. Meyer) B. Fedtschenko.

Herbs, perennial, to 80 cm tall. Stem many branched; branches stout, spreading, glabrous, with oil glands; branchlets angular. Leaves glabrous; petiole 4–6 mm or leaf sessile; leaf blade ovate to rhombic but on basal part of branches lanceolate and on apical part of branches narrowly elliptic, $3\text{--}5 \times 0.5\text{--}2$ cm, thickly papery, with oil glands. Inflorescences many flowered; rachis pubescent when young; bracts linear to narrowly elliptic, margin ciliate. Flowers pedicellate. Sepals triangular-ovate, to 1 mm, basally connate. Petals yellow, ca. 3×1.5 mm, with scattered semipellucid oil glands. Staminal filaments flattened in \pm their basal half. Ovary globose; style ca. 0.5 mm; stigma slightly enlarged. Capsule 4- or 5-carpelled, 3–4 mm in diam. when mature, with protruding oil glands when young, 2-seeded. Fl. May, fr. Sep.

Grassy areas, riversides; ca. 700 m. Xinjiang [Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Tajikistan, Turkmenistan, Uzbekistan; SW Asia].

C. C. Huang (Fl. Reipubl. Popularis Sin. 43(2): 87. 1997) mistakenly called this species *Haplophyllum perforatum* (M. Bieberstein) Karelin & Kirilov. The *H. perforatum* Karelin & Kirilov (1841) is based on a different type than *Ruta perforata* M. Bieberstein (1800), and a combination of the *R. perforata* in *Haplophyllum* is a later homonym. The oldest specific epithet available for this species is *R. acutifolia* Candolle (1824).

3. *Haplophyllum tragacanthoides* Diels, Notizbl. Bot. Gart. Berlin-Dahlem 9: 1028. 1926.

针枝芸香 zhen zhi yun xiang

Herbs, perennial, 10–15 cm tall. Branches dichotomous from stem base. Leaves sessile; leaf blade shortly linear to narrowly elliptic, $3\text{--}9 \times 1\text{--}3$ mm, thickly papery, grayish green, with scattered oil glands, margin denticulate. Flowers terminal, solitary. Sepals ovate, to 1 mm, basally connate, margin ciliate. Petals yellow, oblong, $7\text{--}8 \times$ ca. 3 mm, with scattered semipellucid oil glands, margin irregular. Staminal filaments flattened in \pm their basal half, with trichomes. Ovary 4- or 5-carpelled; style ca. 2.5 mm; stigma slightly enlarged. Capsule 4- or 5-carpelled, with oil glands; carpels ca. 5 mm in diam., 1-seeded. Seeds reniform, $2\text{--}2.5 \times$ ca. 1.5 mm; seed coat shrunken. Fl. May–Jun, fr. Jul–Aug.

• Dry hill slopes; ca. 1500 m. Gansu, Nei Mongol, Ningxia.

Townsend (Hooker's Icon. Pl. 40: 35, t. 3902. 1986) placed *Haplophyllum tragacanthoides* in synonymy of *H. dauricum* (Linnaeus) G. Don.

7. **PSILOPEGANUM** Hemsley, J. Linn. Soc., Bot. 23: 103. 1886.

裸芸香属 lu yun xiang shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Herbs, perennial. Leaves alternate, digitately 3-foliolate (occasional leaves simple). Flowers bisexual, actinomorphic, axillary, solitary or in few-flowered racemes. Sepals 4, basally connate. Petals 4 or 5, imbricate in bud, margin entire. Stamens 8 or 10, distinct. Disk columnar. Gynoecium 2(or 3)-carpellate; ovaries connate in \pm their basal 2/3, otherwise contiguous to divergent; ovules several per locule; style lateral, of 2 or rarely 3 coherent styler elements; stigma capitellate. Fruit a loculicidal capsule, with carpels connate as in ovary; endocarp thinly cartilaginous, adnate to mesocarp in dehiscent fruit. Seeds reniform; seed coat leathery, tuberculate; endosperm copious; embryo curved; cotyledons elliptic, flattened; hypocotyl superior.

• One species: China.

1. *Psilopeganum sinense* Hemsley, J. Linn. Soc., Bot. 23: 103. 1886.

裸芸香 lu yun xiang

Plants 30–80 cm tall. Leaves 2.5–4.5 cm, glabrous, with citrus odor; petiole 0.8–1.5 cm; leaflet blades ovate-elliptic to

elliptic-obovate, in lateral leaflets $4\text{--}10 \times 2\text{--}6$ mm, in terminal leaflet $1.5\text{--}2.8 \times 0.6\text{--}1.2$ cm. Sepals ca. 1 mm. Petals ovate-elliptic, 4–6 mm. Stamens slightly shorter than petals. Ovary usually obovate; style to 2 mm. Capsule ca. 5 mm. Seeds ca. 1.5×1 mm. Fl. and fr. May–Aug.

• Hill slopes; ca. 800 m. Guizhou, Hubei, Sichuan.

8. **DICTAMNUS** Linnaeus, Sp. Pl. 1: 388. 1753.

白鲜属 bai xian shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Herbs, perennial. Leaves alternate, odd-pinnate. Inflorescences terminal. Flowers bisexual, zygomorphic. Sepals 5, basally

connate. Petals 5, 4 ascending and 1 descending, imbricate in bud. Stamens 10, distinct, declined. Disk thick, asymmetrically annular. Gynoecium 5-carpelled; ovaries basally connate, otherwise contiguous; ovules 3 per locule; style lateral, declined, of 5 basally coherent but apically connate stylar elements; stigma punctiform. Fruit of 5 basally connate follicles; endocarp cartilaginous, discharged elastically with seeds at dehiscence. Seeds black, subglobose, shiny; seed coat brittle, sclerenchymatous; endosperm copious; embryo straight; cotyledons broadly elliptic, flattened; hypocotyl partly included between cotyledons.

One to five species: Asia, Europe; one species in China.

1. *Dictamnus dasycarpus* Turczaninow, Bull. Soc. Imp. Naturalistes Moscou 15: 637. 1842.

白鲜 bai xian

Aquilegia fauriei H. Léveillé; *Dictamnus albus* Linnaeus subsp. *dasycarpus* (Turczaninow) L. Winter; *D. albus* var. *dasy-carpus* (Turczaninow) T. N. Liou & Y. H. Chang.

Plants 40–100 cm tall. Younger stems, leaves, and inflorescences pubescent or sparsely so; leaflet blades with scattered pellucid oil glands. Leaves 7–13-foliolate; rachis marginate to narrowly winged; leaflet blades ovate-elliptic, elliptic, or oblong, 3–12 × 1–5 cm, lateral ones opposite and sessile but ter-

minal one petiolulate, secondary veins ± inconspicuous, margin crenulate. Inflorescences, flowers, and follicles with opaque dark brown globose to ellipsoid sessile or stalked glands. Inflorescences compound racemose, to 30 cm. Pedicel 1–1.5 cm. Sepals 6–8 × 2–3 mm. Petals pinkish white to pink, with purplish stripes, oblanceolate, 2–2.5 × 0.5–0.8 cm. Stamens exerted. Fruit follicles 1–2 cm, usually with a stylar beak and apical abaxial beak. Fl. May, fr. Aug–Sep.

Hill slopes, flat areas in thickets, grassy open forests. Anhui, Gansu, Hebei, Heilongjiang, Henan, Hubei, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang [Korea, Mongolia, Russia (Far East)].

9. TODDALIA Jussieu, Gen. Pl. 371. 1789, nom. cons.

飞龙掌血属 fei long zhang xue shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Shrubs (usually sprawling) or woody climbers, dioecious, usually armed. Leaves alternate, digitately 3-foliolate (occasional leaves 1- or 2-foliolate). Inflorescences terminal and/or axillary, paniculate, racemose, or umbelliform. Sepals 4 or 5 (or 6), connate at base or to ± half their length. Petals 4 or 5 (or 6), valvate or narrowly imbricate in bud. Stamens 4 or 5 (or 6), distinct, rudimentary in female flowers. Disk pulvinate. Gynoecium 4–7-loculed, syncarpous, rudimentary in male flowers; ovules 2 per locule; stigma sessile or nearly so. Fruit a 4–7-loculed drupaceous berry; exocarp fleshy; mesocarp undifferentiated; endocarp cartilaginous. Seeds brown to black, reniform, dull to lustrous; seed coat with thick inner layer of dense black sclerenchyma surrounded by outer layer of compact parenchymatous tissue; endosperm copious; embryo curved; cotyledons elliptic, flattened; hypocotyl superior.

One species: Africa, E, S, and SE Asia, Madagascar, Mascarene Islands.

1. *Toddalia asiatica* (Linnaeus) Lamarck, Tabl. Encycl. 2: 116. 1797.

飞龙掌血 fei long zhang xue

Paullinia asiatica Linnaeus, Sp. Pl. 1: 365. 1753, typ. cons.; *Aralia labordei* H. Léveillé; *Toddalia asiatica* var. *floribunda* (Wallich) Kurz; *T. asiatica* var. *gracilis* Gamble; *T. asiatica* var. *obtusifolia* Gamble; *T. floribunda* Wallich; *T. tonkinensis* Guillaumin.

Shrubs (usually sprawling) or woody climbers, usually armed. Petiole 1–4 cm; leaflet blades usually sessile or subsessile, elliptic or narrowly elliptic to obovate to oblanceolate, 3–10 × 1–4 cm, base narrowly cuneate to attenuate, apex acuminate or

rarely acute to obtuse or rounded. Inflorescences to 17 cm. Sepals 0.3–0.5 mm. Petals cream-white, ovate to elliptic, 1–3.5 mm. Stamens in male flowers 3–4 mm, in female flowers ligulate and 0.2–0.8 mm. Disk 0.2–0.5 mm. Gynoecium in female flowers ovoid to ellipsoid and 1.5–2.5 mm, in male flowers subcylindric and 1–2 mm. Fruit 5–10 mm in diam. Seeds 5–6.5 mm. Fl. year-round but mostly in spring and summer, fr. autumn and winter.

Secondary forests, thickets; near sea level to 2000 m. Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan [Bangladesh, Bhutan, India, Indonesia, Japan (Ryukyu Islands), Laos, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam; Africa, Madagascar].

10. PHELLODENDRON Ruprecht, Bull. Cl. Phys.-Math. Acad. Imp. Sci.

Saint-Pétersbourg 15: 353. 1857.

黄檗属 huang bo shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Trees, deciduous, dioecious. Bark corky, fissured and gray or grayish brown at maturity; inner bark (phloem) yellow. Branchlets dark purplish. Leaves opposite, odd-pinnate; base of petiole excavated, concealing axillary bud; leaflet blades with oil glands restricted to margin, margin subentire to minutely crenulate or serrulate. Inflorescences terminal, thyriform. Sepals 5(–8), connate at base. Petals

5(–8), narrowly imbricate in bud. Stamens 5(–7), distinct. Disk columnar. Male flowers: stamens to $1.5 \times$ as long as petals; gynoecium rudimentary, of 5(or 6) fingerlike carpels, basally connate, apically \pm divergent. Female flowers: stamens rudimentary, ligulate, much shorter than petals; gynoecium 5(–10)-loculed, syncarpous; ovules 1 per locule; stigma peltate. Fruit a drupaceous berry, black or purplish black, 5(–10)-loculed; exocarp fleshy; mesocarp undifferentiated; endocarp thinly cartilaginous. Seeds brown or black, asymmetrically ellipsoid, dull, inconspicuously rugulose; seed coat with inner layer of dense black sclerenchyma and outer layer of compact parenchymatous tissue; endosperm \pm scant; embryo straight; cotyledons elliptic, flattened; hypocotyl superior.

Two to four species: E and SE Asia; two species (one endemic) in China.

- 1a. Inflorescences and infructescences \pm lax, rachis, branches, and pedicels slender; leaflet blades papery to thinly papery 1. *P. amurense*
 1b. Inflorescences and infructescences \pm compact, rachis, branches, and pedicels robust; leaflet blades papery 2. *P. chinense*

1. *Phellodendron amurense* Ruprecht, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 15: 353. 1857.

黄檗 *huang bo*

Trees 10–30 m tall, d.b.h. to 1 m. Leaves 7–13-foliolate; rachis glabrous to pubescent; leaflet blades ovate to ovate-lanceolate, 6–12 \times 2.5–4.5 cm, papery to thinly papery, apex acuminate. Inflorescences and infructescences \pm lax, rachis, branches, and pedicels slender. Fruit globose, ca. 1 cm in diam. Seeds ca. 6 \times 3 mm. Fl. May–Jun, fr. Sep–Oct.

Montane forests and thickets, river valleys. Anhui, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Shandong, Shanxi, Taiwan [Japan, Korea, Russia (Far East)].

This species is widely cultivated.

Phellodendron amurense var. *wilsonii* was accepted by C. E. Chang (Fl. Taiwan, ed. 2, 3: 527. 1993).

2. *Phellodendron chinense* C. K. Schneider, Ill. Handb. Laubholz. 2: 126. 1907.

川黄檗 *chuan huang bo*

Trees to 15 m tall. Leaves 7–15-foliolate; rachis glabrous, thinly pubescent, or rust-colored tomentose; leaflet blades ovate-elliptic to oblong-lanceolate, 8–15 \times 3.5–6 cm, papery, base cuneate to attenuate and oblique, apex mucronate to acuminate. Inflorescences and infructescence \pm compact, rachis, branches, and pedicels robust. Fruit subglobose to ellipsoid, 1–1.5 cm in diam. Seeds 6–7 \times 3–5 mm. Fl. May–Jun, fr. Sep–Nov.

- Mixed broad-leaved forests, open to dense forests; 800–1500

(–3000) m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Shaanxi, Sichuan, Yunnan, Zhejiang.

- 1a. Rachis of leaves rust-colored tomentose 2a. var. *chinense*
 1b. Rachis of leaves glabrous or thinly pubescent 2b. var. *glabriusculum*

2a. *Phellodendron chinense* var. *chinense*

川黄檗(原变种) *chuan huang bo* (*yuan bian zhong*)

Phellodendron fargesii Dode; *P. macrophyllum* Dode, p.p. as to *R. P. Farges 1284* p.p. altitude 1400 m (see also synonymy of *Tetradium daniellii*).

Rachis of leaves rust-colored tomentose.

- Mixed broad-leaved forests; above 900 m. Anhui, Henan, Hubei, Hunan, Sichuan, Yunnan.

2b. *Phellodendron chinense* var. *glabriusculum* C. K. Schneider, Ill. Handb. Laubholz. 2: 126. 1907.

秃叶黄檗 *tu ye huang bo*

Phellodendron chinense var. *falcatum* C. C. Huang; *P. chinense* var. *omeiense* C. C. Huang; *P. chinense* var. *yunnanense* C. C. Huang.

Rachis of leaves glabrous or thinly pubescent.

- Open to dense forests; 800–1500(–3000) m. Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Shaanxi, Sichuan, Yunnan, Zhejiang.

11. ACRONYCHIA J. R. Forster & G. Forster, Char. Gen. Pl. 27. 1775, nom. cons.

山油柑属 *shan you gan shu*

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Shrubs or trees, evergreen. Leaves opposite, 1-foliolate [or digitately 3-foliolate]. Inflorescences axillary or basal to leaves, cymulose to thyrsiform [or reduced to solitary flowers]. Flowers bisexual. Sepals 4, distinct or basally connate. Petals 4, valvate in bud. Stamens 8, distinct, ones opposite sepals nearly as long as petals; filaments with indumentum toward base [or rarely glabrous], gradually tapering from \pm broad base to subulate apex, becoming reflexed; anthers obtuse or obtusely mucronulate. Disk pulvinate. Gynoecium 4-loculed, \pm completely syncarpous [or grading to subapocarpous]; ovules 2 per locule; stigma punctiform or capitellate. Fruit a \pm completely syncarpous 4-loculed drupaceous berry [or grading to subapocarpous with 4 basally connate drupaceous berries]; exocarp \pm fleshy or dry; mesocarp, if evident, spongy-crustaceous or \pm woody; endocarp cartilaginous. Seeds ellipsoid to pyriform, dull to \pm shiny; seed coat with thick [to thin] inner layer of dense black sclerenchyma surrounded by outer layer of compact parenchymatous tissue; endosperm copious; embryo straight or nearly so; cotyledons ovate to elliptic, flattened; hypocotyl superior.

About 48 species: S and SE Asia, Australia, SW Pacific islands; one species in China.

1. *Acronychia pedunculata* (Linnaeus) Miquel, Fl. Ned. Ind., Eerste Bijv. 532. 1861.

山油柑 shan you gan

Jambolifera pedunculata Linnaeus, Sp. Pl. 1: 349. 1753; *Acronychia apiculata* Miquel; *A. arborea* Blume; *A. barberi* Gamble; *A. elliptica* Merrill & L. M. Perry; *A. laurifolia* Blume; *Clausena simplicifolia* Dalzell; *Cyminosma pedunculata* (Linnaeus) Candolle; *Gela lanceolata* Loureiro; *J. arborea* (Blume) Zollinger & Moritz; *J. resinosa* Loureiro; *Laxmannia ankenda* (Gaertner) Raeuschel; *Melicope conferta* Blanco; *Selas lanceolatum* (Loureiro) Sprengel; *Ximenia lanceolata* (Loureiro) Candolle.

Shrubs or small to large trees, to 28 m tall. Petiole glabrous to finely pubescent, 0.5–5 cm; leaflet blades usually elliptic to elliptic-oblong but grading to obovate, oblanceolate, or nearly oblong, 3.5–24.5 × 2–8.5 cm, base cuneate or sometimes rounded or attenuate, apex obtusely acuminate with an acumen

to 2 cm or sometimes obtuse or rounded. Inflorescences 2–25 cm, few to many flowered. Pedicel 2–12 mm. Sepals 0.6–1.5 mm. Petals 4–12 mm. Ovary completely pubescent or rarely pubescent only at apex, with or without apical septicidal fissures; style pubescent at base, otherwise glabrous. Fruit subglobose or sometimes grading to ellipsoid, pyriform, or broadly conic, 0.5–1.5 cm in diam., with or without apical septicidal fissures, usually ± sparsely pubescent with ring of dense appressed trichomes at base but grading to tomentose or glabrous, apex often apiculate; outer part of pericarp (exocarp and mesocarp) drying 0.5–3 mm thick; mesocarp woody or subwoody. Seeds reddish black to black, 3–7 mm. Fl. Apr–Aug, fr. Aug–Dec.

Secondary forests, woods or thickets on lower hills; near sea level to 900 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Yunnan [Bangladesh, Bhutan, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam].

Acronychia pedunculata is the dominant in some plant communities.

12. *MACLURODENDRON* T. G. Hartley, Gard. Bull. Singapore 35: 4. 1982.

贡甲属 gong jia shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Trees, evergreen, dioecious. Leaves opposite, 1-foliolate. Inflorescences axillary, thyriform or racemose. Sepals 4, basally connate. Petals 4, narrowly imbricate or valvate in bud. Stamens 8, distinct, ones opposite sepals nearly as long as petals in both male and female flowers; filaments sublinear, ± incurved, glabrous; anthers apiculate, lacking pollen in female flowers. Gynoecium 4-loculed, rudimentary and minute in male flowers; ovary syncarpous; ovules 2 per locule; style of 4 coherent styler elements; stigma capitate. Fruit a 4-loculed drupaceous berry; exocarp fleshy; mesocarp undifferentiated; endocarp thinly cartilaginous. Seeds ovoid to reniform; seed coat with thick inner layer of dense black sclerenchyma and spongy outer layer [rarely lacking] bounded externally by a shiny black pellicle; endosperm copious; embryo straight or slightly bent; cotyledons ovate to elliptic, flattened; hypocotyl superior.

Six species: SE Asia; one species in China.

1. *Maclurodendron oligophlebium* (Merrill) T. G. Hartley, Gard. Bull. Singapore 35: 13. 1982.

贡甲 gong jia

Acronychia oligophlebia Merrill, Philipp. J. Sci. 23: 246. 1923.

Trees to 13(–25) m tall. Petiole 0.8–2.5 cm, puberulent to finely pubescent especially adaxially, glabrescent; leaflet blades obovate, oblanceolate, or sometimes elliptic, 6–21.5 × 2.5–8.2

cm, base cuneate to attenuate, apex acuminate with a 5–10 mm acumen but sometimes obtuse or rounded. Inflorescences 3.5–10 cm. Pedicel 1.5–5 mm. Sepals 0.6–0.7 mm. Petals 2.5–3 mm. Gynoecium glabrous. Fruit globose or subglobose, 6–10 mm in diam., apex often apiculate. Seeds 4.5–5.5 mm; seed coat with spongy outer tissue bounded externally by a shiny black pellicle. Fl. Apr–Aug, fr. Aug–Dec.

Primary and secondary forests; 200–1400 m. Guangdong, Hainan [N Vietnam].

13. *SKIMMIA* Thunberg, Nov. Gen. Pl. 3: 57. 1783, nom. cons.

茵芋属 yin yu shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Shrubs or trees, evergreen, usually dioecious or monoclinal, unarmed. Leaves alternate, simple. Inflorescences terminal, thyriform. Sepals (3 or)4 or 5(–7), distinct or basally connate. Petals (3 or)4 or 5(–7), imbricate in bud. Stamens (3 or)4 or 5(–7), distinct, rudimentary in female flowers. Disk annular or pulvinate. Gynoecium 2–5-loculed, syncarpous, rudimentary in male flowers; ovules 1(or ?)2 per locule; style short or ± as long as ovary. Fruit a fleshy drupaceous berry, with 1–5 1-seeded leathery pyrenes. Seeds ovoid to ellipsoid; seed coat membranous; endosperm copious; embryo straight; cotyledons oblong to suborbicular, flattened; hypocotyl superior.

Five to six species: E, S, and SE Asia; five species (one endemic) in China.

1a. Leaf blade midvein puberulent.

- 2a. Fruit red 1. *S. reevesiana*
 2b. Fruit bluish black 2. *S. melanocarpa*
 1b. Leaf blade midvein glabrous.
 3a. Leaf blade secondary veins 12–20 on each side of midvein; rudimentary gynoecium in male flowers entire or nearly so; petals reflexed 5. *S. multinervia*
 3b. Leaf blade secondary veins fewer than 10 on each side of midvein; rudimentary gynoecium in male flowers 3- or 4-lobed; petals erect to spreading.
 4a. Shrubs to 2 m tall; fruit red 3. *S. laureola*
 4b. Trees to 12 m tall; fruit bluish black 4. *S. arborescens*

1. *Skimmia reevesiana* (Fortune) Fortune, J. Tea Countr. China 329. 1852.

茵芋 yin yu

Ilex reevesiana Fortune, Gard. Chron. 1851: 5. 1851; *Skimmia arisanensis* Hayata; *S. distinctevenulosa* Hayata; *S. fortunei* Masters; *S. hainanensis* C. C. Huang; *S. japonica* Thunberg var. *distinctevenulosa* (Hayata) C. E. Chang; *S. japonica* subsp. *reevesiana* (Fortune) N. P. Taylor & Airy Shaw; *S. japonica* var. *reevesiana* (Fortune) N. P. Taylor; *S. orthoclada* Hayata.

Shrubs 1–2 m tall. Branches with hollow pith; bark pale grayish green, smooth, cracked when dry. Leaves clustered at branch apex, with a citrus-leaf odor; petiole 5–10 mm; leaf blade elliptic, lanceolate, ovate, or oblanceolate, 5–12 × 1.5–4 cm, leathery, midvein adaxially puberulent, base cuneate, apex mucronate to obtuse or acuminate. Inflorescences puberulent, with condensed flowers. Flowers male, female, or bisexual, (3 or)4- or 5-merous, fragrant. Sepals rounded, 1–1.5 mm, margin ciliate. Petals yellowish white, 3–5 mm. Stamens (3 or)4 or 5. Male flowers: rudimentary ovary compressed globose, entire or shallowly 2–4-lobed, apex mucronate. Female flowers: ovary subglobose; style elongated; stigma capitate. Fruit red, globose to ellipsoid-obovoid, 0.8–1.5 cm, 2–4-seeded. Seeds compressed ovoid, 5–9 × 4–6 mm. Fl. Mar–May, fr. Sep–Nov. $2n = 60^*$.

Montane moss forests; 1200–2600 m. S Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, E Yunnan, Zhejiang [Myanmar, Philippines, S Vietnam].

Taylor (Kew Mag. 4: 182, 183. 1987) treated *Skimmia reevesiana* as *S. japonica* subsp. *reevesiana* and placed *S. arisanensis*, *S. distinctevenulosa*, *S. hainanensis*, and *S. orthoclada* in synonymy of *S. japonica* var. *reevesiana*.

2. *Skimmia melanocarpa* Rehder & E. H. Wilson in Sargent, Pl. Wilson. 2: 138. 1914.

黑果茵芋 hei guo yin yu

Shrubs 1–2 m tall, monoecious, dioecious, or monoclinalous. Branches with hollow pith; bark pale grayish green, smooth, cracked when dry. Petiole 5–10 mm; leaf blade elliptic to elliptic-lanceolate, 3–7 × 1.5–2.5 cm, midvein adaxially pubescent, apex acuminate to acute. Inflorescences to 4 cm, with condensed flowers; rachis puberulent; bracts ca. 1 mm. Flowers subsessile. Sepals broadly ovate, 1–1.5 mm, margin ciliate. Petals 5, yellowish white, oblanceolate to oblong, 3–4 mm, subequal, reflexed in male flowers. Male flowers: stamens as long as or slightly longer than petals. Female and bisexual flowers: stamens shorter than petals; ovary subglobose; style cylindrical. Fruit bluish black, subglobose, ca. 8 mm in diam., (4 or)5-loculed, apex with (4 or)5 stylar scars. Fl. Mar–May, fr. Sep–Nov.

• Dense or open forests; 2000–3000 m. S Gansu, W Hubei, S Shaanxi, Sichuan, SE Xizang, Yunnan.

Taylor (Kew Mag. 4: 189. 1987) placed *Skimmia melanocarpa* in synonymy of *S. laureola* subsp. *laureola*.

3. *Skimmia laureola* (Candolle) Siebold & Zuccarini ex Walpers, Repert. Bot. Syst. 5: 405. 1845–1846.

月桂茵芋 yue gui yin yu

Limonia laureola Candolle, Prodr. 1: 536. 1824.

Shrubs to 1.3 m tall. Branches grayish green, dichotomous or nearly whorled. Leaves nearly opposite or whorled, clustered near apex of branches, spreading, with a citrus-leaf odor; leaf blade oblong-lanceolate, (4–)7–10(–12) × 2–3 cm, adaxially dark green, shiny, and with translucent oil glands, midvein slender, secondary veins hardly distinguishable, base attenuate, margin entire, apex mucronate. Inflorescences 5–8 cm; rachis stout, angulate. Pedicel puberulent; bracteoles opposite near middle of pedicel, caducous. Sepals ovate, base pubescent, margin ciliate. Petals 5, yellowish, oblong, ca. 3 × as long as sepals, apex obtuse. Stamens 5, erect. Ovary ovoid, 2- or 3-loculed, glabrous, with oil glands; ovules 1(or ?2) per locule; style short; stigma small. Fruit ovoid, 8–10 mm in diam. Fl. Apr, fr. autumn. $2n = 30^*$, 60.

Evergreen forests; below 2800 m. S Xizang (Yadong) [Bhutan, NE India, Myanmar, Nepal].

4. *Skimmia arborescens* T. Anderson ex Gamble, J. Linn. Soc., Bot. 43: 491. 1916.

乔木茵芋 qiao mu yin yu

Skimmia euphlebia Merrill; *S. japonica* Thunberg var. *euphlebia* (Merrill) N. P. Taylor; *S. japonica* var. *kwangsiensis* (C. C. Huang) N. P. Taylor; *S. kwangsiensis* C. C. Huang.

Trees to 8 m tall, d.b.h. to 20 cm. Branches with small but prominent pith. Petiole 1–2 cm; leaf blade elliptic, oblong, or obovate-elliptic, 5–18 × 2–6 cm, papery, glabrous, midvein adaxially prominent, secondary veins 7–10 on each side of midvein. Inflorescences 2–5 cm; rachis puberulent or glabrous; bracts broadly ovate, 1–1.5 mm. Sepals ovate, margin ciliate. Petals 5, yellowish, obovate to ovate-oblong, 4–5 mm. Male flowers: stamens longer than petals; filaments filiform; rudimentary gynoecium barlike, 3–4 mm, apex 3- or 4-lobed. Female flowers: rudimentary stamens shorter than petals; ovary globose; style ca. 1 mm; stigma capitate. Fruit bluish black, globose, 6–8 mm in diam., 1–3-seeded. Fl. Apr–Jun, fr. Jul–Sep.

Shady moist montane areas; 1000–2800 m. Guangdong, Guangxi, Guizhou, Sichuan, E Xizang, Yunnan [Bhutan, NE India, Laos, Myanmar, Nepal, N Thailand, N Vietnam].

Taylor (Kew Mag. 4: 183–185. 1987) treated *Skimmia arborescens* as *S. arborescens* subsp. *arborescens*, *S. euphlesia* as *S. japonica* var. *euphlesia*, and *S. kwangsiensis* as *S. japonica* var. *kwangsiensis*.

5. *Skimmia multinervia* C. C. Huang, Acta Phytotax. Sin. 7: 348. 1958.

多脉茵芋 duo mai yin yu

Skimmia laureola (Candolle) Siebold & Zuccarini ex Walpers subsp. *multinervia* (C. C. Huang) N. P. Taylor & Airy Shaw.

Trees to 13 m tall. Branches dark grayish, with scattered lenticels. Petiole 1–2 cm, stout; leaf blade oblanceolate to rarely narrowly oblong, 10–18 × 3–5 cm, leathery, midvein adaxially slightly prominent, secondary veins 12–20 on each side of mid-

vein, margin slightly revolute. Inflorescences 2–6 cm; rachis stout when young, puberulent, elongated in fruit; bracts ovate, 1–2 mm, margin ciliate. Pedicel stout. Sepals ovate, ca. 2 mm, margin ciliate. Petals 5, yellowish white, obovate-oblong to oblong, 4–5 mm, reflexed at anthesis. Stamens 5. Male flowers: stamens longer than petals; rudimentary gynoecium barlike, ca. 1.5 mm, apex entire or shallowly lobed. Female and bisexual flowers: rudimentary stamens as long as petals; ovary globose, 5-loculed; style ca. 1.5 mm; stigma capitate. Fruit bluish black, subglobose to slightly compressed, 6–8 mm in diam., 4- or 5-seeded. Fl. Apr–Jun, fr. Jul–Sep.

Montane forests; ca. 2000 m or above. SW Sichuan, NW Yunnan [Bhutan, NE India, Myanmar, Nepal, N Vietnam].

Taylor (Kew Mag. 4: 189. 1987) treated *Skimmia multinervia* as *S. laureola* subsp. *multinervia*.

14. MICROMELUM Blume, Bijdr. 137. 1825, nom. cons.

小芸木属 xiao yun mu shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Shrubs or trees, unarmed. Leaves alternate, odd-pinnate [or rarely digitately 3-foliolate and/or 1-foliolate]. Inflorescences terminal or terminal and axillary, panicle. Flowers bisexual, ellipsoid or broadly ellipsoid to obovoid to oblong in bud. Calyx cup-shaped, shallowly 5-lobed or -toothed. Petals 5, valvate in bud. Stamens 10, distinct, alternately unequal in length; filaments sublinear, ± straight. Disk annular or columnar. Gynoecium 3–5-loculed, syncarpous; radial walls of locules becoming curved after anthesis; ovules 2 per locule; style to 1.5 × as long as ovary, deciduous in fruit. Fruit a berry with neither pulp nor pulp vesicles; endocarp membranous. Seeds ellipsoid; seed coat membranous; endosperm lacking; embryo straight; cotyledons broadly elliptic, thin, convolute and/or folded; hypocotyl superior.

About ten species: S and SE Asia, Australia, SW Pacific islands; two species in China.

- 1a. Flower buds ellipsoid or broadly ellipsoid; petals 3–4 mm, outside glabrous or pubescent; margin of leaflet blades serrate or repand 1. *M. falcatum*
 1b. Flower buds oblong; petals 5–10 mm, outside densely pubescent; margin of leaflet blades crenate, repand, or entire 2. *M. integerrimum*

1. *Micromelum falcatum* (Loureiro) Tanaka, Bull. Mus. Nat. Hist. Nat., sér. 2, 2: 257. 1930.

大管 da guan

Aulacia falcata Loureiro, Fl. Cochinch. 1: 273. 1790.

Trees 1–3 m tall. Branchlets, petioles, and inflorescence rachises hirsute. Leaves 5–11-foliolate; petiolules 3–7 mm; leaflet blades alternate, ovate to lanceolate, inequilateral, 4–9 × 1.2–3.5(–4.5) cm, margin serrate or repand, apex acuminate to caudate. Inflorescences terminal. Flowers ellipsoid or broadly so in bud. Calyx lobes broadly triangular, less than 1 mm. Petals white, oblong, 3–4 mm, outside glabrous or pubescent. Longer stamens subequal to petal length, shorter ones subequal to gynoecium length. Style cylindrical, longer than ovary; stigma capitate. Fruit ellipsoid to obovoid, 8–10 × 7–9 mm, 1- or 2-seeded. Fl. Jan–Apr, fr. Jun–Aug.

Mountains; below 1200 m. SW Guangdong, Guangxi, Hainan, S Yunnan [Cambodia, Laos, Myanmar, Thailand, Vietnam].

2. *Micromelum integerrimum* (Buchanan-Hamilton ex Candolle) Wight & Arnott ex M. Roemer, Fam. Nat. Syn. Monogr. 1: 47. 1846.

小芸木 xiao yun mu

Trees 6–8 m tall. Bark gray, smooth. Leaves 7–15-foliolate or 5–11-foliolate; petiolules 2–5 mm; leaflet blades alternate to subopposite, elliptic, lanceolate, or ovate, inequilateral, both surfaces dark green, margin entire, apex acuminate. Flower buds pale green, oblong. Calyx lobes ca. 1 mm. Petals pale yellow, 5–10 mm, outside densely pubescent. Disk columnar. Stigma capitate. Fruit ellipsoid to obovoid, 1–1.5 × 0.6–1.2 cm, 1- or 2-seeded. Seed coat membranous. Fl. Feb–Apr, fr. Jul–Sep. 2n = 18.

Moist montane forests, valley forests, maritime thickets in sandy soil; near sea level to 2000 m. SW Guangdong, Guangxi, S and SW Guizhou, Hainan, SE Xizang, S Yunnan [Bhutan, Cambodia, India, Laos, Myanmar, Nepal, Philippines, Thailand, Vietnam].

- 1a. Young parts rust-colored pubescent; longest leaflet blades to 20 cm 2a. var. *integerrimum*
 1b. Young parts rust-colored hispid; longest leaflet blades to 24 cm 2b. var. *mollissimum*

2a. *Micromelum integerrimum* var. *integerrimum*

小芸木(原变种) xiao yun mu (yuan bian zhong)

Bergera integerrima Buchanan-Hamilton ex Candolle, Prodr. 1: 537. 1824.

Trees to 8 m tall. Young parts rust-colored pubescent. Leaves 7–15-foliolate; leaflet blades basally on rachis ca. 4 cm and apically to 20 × 8 cm. Fruit 1–1.5 × 0.7–1.2 cm.

Moist montane forests, maritime thickets in sandy soil; near sea level to 2000 m. SW Guangdong, Guangxi, S and SW Guizhou, Hainan, SE Xizang, S Yunnan [Bhutan, Cambodia, India, Laos, Myanmar, Nepal, Thailand, Vietnam].

2b. *Micromelum integerrimum* var. *mollissimum* Tanaka, Bull. Mus. Natl. Hist. Nat., sér. 2, 2: 157. 1930.

毛叶小芸木 *mao ye xiao yun mu*

Trees 6–8 m tall. Young parts rust-colored hispid. Leaves 5–11-foliolate; leaflet blades 10–24 × 4–8 cm. Young fruit ellipsoid, ca. 1 × 0.6–0.7 cm, pubescent, glabrescent when ripe, vermilion. Fl. Feb–Apr, fr. Jul–Sep.

Valley forests; 100–600 m. SE Guangxi, S Yunnan [Cambodia, Laos, Philippines, Vietnam].

15. *GLYCOSMIS* Corrêa, Ann. Mus. Natl. Hist. Nat. 6: 384. 1805, nom. cons.

山小橘属 *shan xiao ju shu*

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Shrubs or trees, unarmed, with rust-colored villosulous indumentum (sometimes becoming bleached) on terminal and axillary buds and usually on young inflorescences. Leaves alternate [rarely opposite], odd-pinnate, 1-foliolate, or simple. Inflorescences terminal and/or axillary, paniculate, compoundly racemose, or reduced to 1 or a few flowers. Flowers bisexual, globose to ellipsoid in bud. Sepals 4 or 5, basally connate. Petals 4 or 5, imbricate in bud. Stamens 8 or 10, distinct, alternately ± unequal in length; filaments ± straight. Disk annular, pulvinate, columnar, conic, or bell-shaped. Gynoecium 2–5-loculed, syncarpous; radial walls of locules straight; ovules 1(or 2) per locule; style to nearly as long as ovary, persistent in fruit. Fruit a berry, with mucilaginous pulp or dry, without pulp vesicles; endocarp membranous. Seeds with membranous seed coat; endosperm lacking; embryo straight; cotyledons elliptic, plano-convex, neither convolute nor folded; hypocotyl partly included between cotyledons.

About 50 species: E, S, and SE Asia, Australia; 11 species (two endemic) in China.

- 1a. Leaves, or most of them, simple or 1-foliolate.
- 2a. Leaves, or most of them, simple 1. *G. cochinchinensis*
- 2b. Leaves, or most of them, 1-foliolate.
- 3a. Leaflet blades lustrous when dry; petiole (0.6–)1.5–3 cm 2. *G. montana*
- 3b. Leaflet blades not lustrous when dry; petiole 0.2–0.5(–1.6) cm.
- 4a. Inflorescences less than 1 cm; anther connective with an apical oil gland and 2 or 3 abaxial oil glands 3. *G. pseudoracemosa*
- 4b. Inflorescences 2–5 cm; anther connective with only an apical oil gland 4. *G. longifolia*
- 1b. Leaves, or most of them, 2–7-foliolate.
- 5a. Margin of leaflet blades serrate or dentate; inflorescences often longer than 10 cm.
- 6a. Staminal filaments widest in ± their apical half; ovary glabrous 5. *G. pentaphylla*
- 6b. Staminal filaments widest in ± their basal half; ovary rust-colored villosulous 6. *G. esquirolii*
- 5b. Margin of leaflet blades entire or repand; inflorescences rarely longer than 10 cm.
- 7a. Ovary terete; petals ca. 5 mm, not caducous 7. *G. lucida*
- 7b. Ovary globose or ovoid; petals less than 5 mm, caducous.
- 8a. Leaves (3–)5–7-foliolate 8. *G. oligantha*
- 8b. Leaves (1 or)2–5-foliolate.
- 9a. Leaflet blades concolorous; petals ca. 4 mm 10. *G. parviflora*
- 9b. Leaflet blades discolorous; petals ca. 1.5 or ca. 3 mm.
- 10a. Petals ca. 1.5 mm; leaflet blades 5–9 cm wide 11. *G. xizangensis*
- 10b. Petals ca. 3 mm; leaflet blades 2–3 cm wide 9. *G. craibii*

1. *Glycosmis cochinchinensis* (Loureiro) Pierre in Engler & Prantl, Nat. Pflanzenfam. 3(4): 185. 1896.

山橘树 *shan ju shu*

Toluifera cochinchinensis Loureiro, Fl. Cochinch. 1: 262. 1790; *Glycosmis cochinchinensis* var. *contracta* Craib; *G. parkeri* Narayanaswamy; *G. touranensis* Guillaumin.

Shrubs or trees, 1–4 m tall. Leaves, or most of them, simple; petiole 3–10 mm; leaf blade suborbicular, broadly elliptic, ovate, oblong, or lanceolate, 4–26 × 2–8 cm, papery to

leathery, glabrous, base rounded, obtuse, cuneate, or attenuate, margin entire, apex rounded, obtuse, mucronate, or acuminate. Inflorescences axillary or terminal, with flowers conglomerate, rarely solitary, or in panicle ca. 5 cm. Sepals ovate, less than 1 mm. Petals white, ca. 3 mm. Stamens 10; filaments widest in ± their basal half. Disk obvious. Ovary globose; style short, narrow; stigma slightly expanded. Fruit reddish, 0.8–1.4 cm in diam. Fl. and fr. year-round.

Below 1000 m. Guangdong, S Guangxi, Hainan, S Yunnan [Cambodia, Laos, Myanmar, Thailand, Vietnam].

2. *Glycosmis montana* Pierre, Fl. Forest. Cochinch. 3: t. 285b. 1893.

海南山小橘 hai nan shan xiao ju

Glycosmis hainanensis C. C. Huang; *G. tonkinensis* Tanaka ex Guillaumin; *Tetracronia cymosa* Pierre.

Shrubs or trees, 1–3 m tall. Leaves, or most of them, 1-foliolate; petiole (0.6–)1.5–3 cm; petiolule 2–10 mm; leaflet blades obovate-oblong to oblanceolate, 5–15 × 1.5–6.5 cm, papery to leathery, glabrous, base often obtuse, margin entire, apex abruptly acuminate to elongately caudate. Inflorescences paniculate, 1–3 cm. Flowers small, globose in bud. Sepals broadly ovate, less than 1 mm. Petals white, ca. 3 mm, caducous. Stamens 10; filaments widest in ± their basal half. Disk obviously uplifted. Ovary broadly ovoid to subglobose; style stout; stigma slightly expanded. Fruit pink, globose, ca. 8 mm in diam. Fl. Oct–Mar, fr. Jul–Sep.

Woods on hillsides, near rivers; 200–500 m. Guangdong, Hainan, SE Yunnan (Funing) [Vietnam].

Stone (Proc. Acad. Nat. Sci. Philadelphia 137: 10. 1985) placed *Glycosmis montana* in synonymy of *G. lanceolata* (Blume) Sprengel ex Teijsmann & Binnendijk.

3. *Glycosmis pseudoracemosa* (Guillaumin) Swingle, Notul. Syst. (Paris) 2: 162. 1912.

华山小橘 hua shan xiao ju

Atalantia pseudoracemosa Guillaumin, Notul. Syst. (Paris) 1: 181. 1911; *Glycosmis sinensis* C. C. Huang.

Shrubs or trees, 1.5–3 m tall. Leaves, or most of them, 1-foliolate; petiole 2–5(–16) mm; petiolule 1–5 mm; leaflet blades oblong to lanceolate, 4–18 × 1.5–7 cm, papery, margin entire, apex acuminate. Inflorescences terminal or axillary, with flowers conglomerate or forming a short cyme, less than 1 cm. Sepals broadly ovate, less than 1 mm. Petals 5, white, ca. 4 mm. Stamens 10; filaments widest in ± their basal half. Ovary ovoid, becoming clavate; style extremely short. Fruit orange, broadly ellipsoid to subglobose, 1–1.2 × 0.8–1 cm. Fl. nearly year-round, fr. May–Dec.

Hilly areas in woods and thickets; 400–1200 m. SW and W Guangxi, SE Yunnan (Malipo) [N Vietnam].

4. *Glycosmis longifolia* (Oliver) Tanaka, Bull. Soc. Bot. France 75: 709. 1928.

长叶山小橘 chang ye shan xiao ju

Glycosmis pentaphylla (Retzius) Candolle subvar. *longifolia* Oliver, J. Linn. Soc., Bot. 5(Suppl. 2): 37. 1861; *G. cyanocarpa* (Blume) Sprengel var. *simplicifolia* Kurz; *G. cymosa* (Kurz) J. Narayanaswami ex Tanaka var. *simplicifolia* (Kurz) J. Narayanaswami.

Trees to 5 m tall. Bark brownish gray. Leaves, or most of them, 1-foliolate; petiole less than 5 mm; leaflet blade oblong, 10–18 × 4–5 cm, papery, base cuneate, margin entire, apex acuminate. Inflorescences axillary or terminal, paniculate, 2–5 cm. Sepals broadly ovate, less than 1 mm. Petals 3–4 mm,

caducous. Stamens 10; filaments widest in ± their basal half. Ovary globose; style short; stigma slightly expanded. Fruit oblong to obovoid, 10–15 × 8–10 mm, 1-seeded. Fl. Apr–Aug.

Valley woods; ca. 1300 m. SW and W Yunnan (Lushui, Zhenkang) [India, NE Myanmar, Sri Lanka].

Stone (Proc. Acad. Nat. Sci. Philadelphia 137: 5. 1985) placed *Glycosmis longifolia* in synonymy of *G. cyanocarpa* (Blume) Sprengel.

5. *Glycosmis pentaphylla* (Retzius) Candolle, Prodr. 1: 538. 1924.

山小橘 shan xiao ju

Limonia pentaphylla Retzius, Observ. Bot. 5: 24. 1789; *Glycosmis arborea* (Roxburgh) Candolle; *G. chylocarpa* Wight & Arnott; *G. quinquefolia* Griffith; *Limonia arborea* Roxburgh; *Myxospermum chylocarpum* (Wight & Arnott) M. Roemer.

Trees to 5 m tall. Leaves (3 or) 5-foliolate; petiolules 2–10 mm; leaflet blades oblong, 10–25 × 3–7 cm, papery, base cuneate, margin serrate, apex mucronate. Inflorescences axillary or terminal, paniculate. Flowers globose in bud. Sepals broadly ovate, less than 1 mm. Petals white or pale yellow, 3–4 mm, caducous. Stamens 10. Ovary globose to broadly ovoid; style extremely short; stigma slightly expanded. Fruit reddish, subglobose, 8–10 mm in diam. Fl. Jul–Oct, fr. Jan–Mar. $2n = 36, 54$.

Hillside and valley woods; 600–1200 m. S and SW Yunnan [Bhutan, Cambodia, NE India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, NW Vietnam].

6. *Glycosmis esquirolii* (H. Léveillé) Tanaka, Bull. Soc. Bot. France 75: 709. 1928.

锈毛山小橘 xiu mao shan xiao ju

Clausena esquirolii H. Léveillé, Repert. Spec. Nov. Regni Veg. 9: 324. 1911; *C. ferruginea* C. C. Huang; *Glycosmis ferruginea* (C. C. Huang) C. C. Huang; *G. winitii* Craib.

Trees 6–10 m tall. Leaves 4–7-foliolate; leaflet blades ovate to oblong, 10–16 × 4–7 cm, base cuneate, margin dentate, apex acuminate to obtuse. Inflorescences axillary or terminal, paniculate. Sepals broadly ovate, ca. 1 mm. Petals pale yellowish white, 3–4 mm. Stamens 10; filaments widest in ± their basal half; anthers elliptic, ca. 1 mm. Ovary subglobose, rust-colored villosulous; style extremely short. Fl. Oct–Mar, fr. Apr.

Mountain woods and thickets; 400–1300 m. W Guangxi, S Guizhou, S and SE Yunnan [Myanmar, Thailand].

7. *Glycosmis lucida* Wallich ex C. C. Huang, Guihaia 7: 119. 1987.

亮叶山小橘 liang ye shan xiao ju

Glycosmis cyanocarpa (Blume) Sprengel var. *cymosa* Kurz; *G. cymosa* (Kurz) J. Narayanaswami ex Tanaka (1941), not Zippelius ex Spanoghe (1841).

Trees 3–5 m tall. Leaves (1 or) 3- or 5(or 6)-foliolate; petiolules 2–8 mm; leaflet blades oblong to lanceolate, 7–18 × 3–6 cm, margin entire or repand, apex acuminate. Inflorescences

axillary or terminal, paniculate, 1–4 cm, many flowered. Sepals broadly ovate, ca. 1 mm, margin ciliate. Petals ca. 5 × 2–3 mm. Stamens 10; filaments linear. Ovary terete. Fruit orange, broadly ellipsoid to ovoid, 1–1.4 × 0.8–1.2 cm, 1-seeded. Fl. and fr. year-round but flowering peak Jan–Mar.

Mountain woods; 900–1400 m. Yunnan [Bhutan, India, NE Myanmar].

Stone (Proc. Acad. Nat. Sci. Philadelphia 137: 5. 1985) placed *Glycosmis lucida* in synonymy of *G. cyanocarpa* (Blume) Sprengel.

8. *Glycosmis oligantha* C. C. Huang, Guihaia 7: 122. 1987.

少花山小橘 shao hua shan xiao ju

Shrubs or trees, to 3 m tall. Leaves (3 or)5- or 7-foliolate; petiolules 3–5 mm; leaflet blades narrowly lanceolate, 5–9 × 1.5–2.5 cm, base attenuate, margin entire or repand, apex acuminate. Inflorescences axillary, 1–5-flowered. Sepals broadly ovate, ca. 1 mm wide. Petals ovate, ca. 3 mm, glabrous, apex obtuse. Stamens 10, longer ones ca. 2.5 mm, shorter ones ca. 1.5 mm. Ovary globose; style extremely short. Fruit not seen.

- Hillside woods; 200–500 m. SW Guangxi.

9. *Glycosmis craibii* Tanaka, Bull. Mus. Natl. Hist. Nat., sér. 2, 2: 159. 1930.

毛山小橘 mao shan xiao ju

Glycosmis puberula Lindley var. *craibii* (Tanaka) B. C. Stone.

Trees to 5 m tall. Leaves (1–)3- or 5-foliolate; leaflet blades oblong, lanceolate, or ovate, 5–10 × 2–3 cm, papery or rigidly so, base attenuate to cuneate, margin entire, apex acuminate to mucronate. Inflorescences axillary or terminal, less than 3 cm or rarely ca. 4 cm. Sepals broadly ovate to ovate, less than 1 mm or ca. 1 mm. Petals ca. 3 mm. Filaments linear or widest in ± their basal half. Ovary terete in bud, becoming broadly conic, gourd-shaped, or ovoid at anthesis, slightly pubescent or glabrous. Fruit reddish to orange, subglobose, 0.8–1.4 cm in diam., 1- or 2-seeded. Fl. and fr. year-round.

Hillside forests, woods, and thickets. Hainan, S Yunnan [N and NE Thailand, Vietnam].

Stone (Proc. Acad. Nat. Sci. Philadelphia 137: 18. 1985) reduced *Glycosmis craibii* to a variety of *G. puberula* Lindley.

- 1a. Filaments linear; ovary slightly pubescent 9a. var. *craibii*
 1b. Filaments widest in ± their basal half; ovary glabrous 9b. var. *glabra*

9a. *Glycosmis craibii* var. *craibii*

毛山小橘(原变种) mao shan xiao ju (yuan bian zhong)

Trees to 3 m tall. Leaflet blades oblong to lanceolate, 7–9 × 2.5–3 cm, papery, base attenuate, apex acuminate. Inflorescences axillary, less than 3 cm, few flowered. Sepals broadly ovate, ca. 1 mm wide. Petals subelliptic. Stamens slightly longer than petals; filaments linear. Ovary conic to gourd-shaped at anthesis, slightly pubescent. Fruit reddish to orange, 0.8–1 cm in diam., 1-seeded. Fl. Apr–May, fr. Aug–Oct.

Hillside forests. S Yunnan [NE Thailand].

9b. *Glycosmis craibii* var. *glabra* (Craib) Tanaka, Bull. Mus. Natl. Hist. Nat., sér. 2, 2: 159. 1930.

光叶山小橘 guang ye shan xiao ju

Glycosmis singuliflora Craib var. *glabra* Craib, Fl. Siam. 1: 226. 1926.

Trees to 5 m tall. Petiolules 2–6 mm; leaflet blades oblong, lanceolate, or ovate, 5–10 × 2–3 cm, rigidly papery, base attenuate to cuneate, apex acuminate to mucronate. Inflorescences axillary or terminal, rarely to 4 cm. Sepals ovate, less than 1 mm. Petals caducous. Stamens 10; filaments widest in ± their basal half. Ovary broadly ovoid at anthesis, glabrous. Fruit orange, 1–1.4 cm in diam., 1- or 2-seeded. Fl. and fr. year-round.

Hillside woods and thickets; 300–500 m. Hainan [N Thailand, Vietnam].

Stone (Proc. Acad. Nat. Sci. Philadelphia 137: 14. 1985) placed *Glycosmis craibii* var. *glabra* in synonymy of *G. ovoidea* Pierre.

10. *Glycosmis parviflora* (Sims) Little, Phytologia 2: 463. 1948.

小花山小橘 xiao hua shan xiao ju

Limonia parviflora Sims, Bot. Mag. 50: t. 2416. 1823; *Citrus erythrocarpa* Hayata; *Glycosmis citrifolia* Lindley; *G. erythrocarpa* (Hayata) Hayata; *L. citrifolia* Willdenow (1809), not Salisbury (1796).

Shrubs or trees, 1–3 m tall. Leaves (1 or)2–4(or 5)-foliolate; petiolules 1–5 mm; leaflet blades elliptic, oblong, or lanceolate, 5–19 × 2.5–8 cm, glabrous, base cuneate, margin entire, apex mucronate, acuminate, or obtuse. Inflorescences axillary or terminal, paniculate, 3–5 cm when axillary, to 14 cm when terminal. Sepals ovate, ca. 1 mm wide, apex obtuse. Petals white, ca. 4 mm, oblong. Stamens (8 or)10. Ovary broadly ovoid to globose; style extremely short; stigma slightly expanded. Fruit pale yellowish white but turning reddish to dark vermilion, globose to ellipsoid, 1–1.5 cm in diam., (1 or)2- or 3-seeded. Fl. Mar–May, fr. Jul–Sep. *2n* = 54.

Mountain woods; 200–1000 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Taiwan, S and W Yunnan [Japan (including Ryukyu Islands), Myanmar, NE Vietnam].

11. *Glycosmis xizangensis* (C. Y. Wu & H. Li) D. D. Tao, Acta Phytotax. Sin. 32: 369. 1994.

西藏山小橘 xi zang shan xiao ju

Walsura xizangensis C. Y. Wu & H. Li, Acta Phytotax. Sin. 18: 110. 1980; *Glycosmis medogensis* D. D. Tao ex C. C. Huang, nom. illeg. superfl.; *G. motuoensis* D. D. Tao, nom. illeg. superfl.

Shrubs or trees, to 3 m tall. Leaves 3- or 4-foliolate; petiolules 4–10 mm; leaflet blades alternate to subopposite, broadly ovate to obovate-elliptic, 12–20 × 5–9 cm, subleathery, abaxially pale green, adaxially dark green, base cuneate, margin entire or repand, apex mucronate. Inflorescences axillary, 2.5–4

cm. Sepals broadly ovate, less than 2 mm, margin ciliate. Petals oblong, ca. 1.5 mm, glabrous, apex obtuse. Stamens 10; filaments flattened; anthers elliptic. Ovary subglobose; style terete. Fruit not seen.

• Hillside woods; ca. 800 m. SE Xizang (Médog).

The later names *Glycosmis medogensis* and *G. motuoensis* are based on the same type (*Qinghai-Xizang Exped. 74-4540*) as *Walsura xizangensis*.

16. *CLAUSENA* N. L. Burman, Fl. Indica, 87, 243. 1768.

黄皮属 huang pi shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Shrubs or trees, unarmed, without rust-colored villosulous indumentum on terminal and axillary buds or young inflorescences. Leaves alternate, odd-pinnate. Inflorescences terminal or axillary, paniculate or in loose racemes. Flowers bisexual or very rarely female, globose to pyriform or rarely ovoid in bud. Sepals 4 or 5, connate at base or to their full length. Petals 4 or 5, imbricate in bud. Stamens 8 or 10, distinct, alternately unequal in length; filaments \pm abruptly dilated toward base, \pm straight or geniculate. Disk columnar, conic, bell-shaped, or \pm hourglass-shaped. Gynoecium (2-)-4- or 5-loculed, syncarpous; radial walls of locules straight; ovules 2 per locule; style 0.5-2.5 \times as long as ovary, deciduous in fruit. Fruit a berry, with neither pulp nor pulp vesicles; endocarp membranous. Seeds with membranous seed coat; endosperm lacking; embryo straight; cotyledons elliptic, plano-convex, neither convolute nor folded; hypocotyl partly included between cotyledons.

Between ca. 15 and 30 species: Africa, E, S, and SE Asia, NE Australia, SW Pacific islands; ten species (five endemic) in China.

This genus is especially diverse in Guangdong, Guangxi, and Yunnan.

- 1a. Calyx lobes 4; petals 4(or 5); stamens 8.
 2a. Leaves 15-37-foliolate; fruit vermilion or pale yellow.
 3a. Fruit vermilion; leaflet blades 2-9 \times 1-3 cm 1. *C. excavata*
 3b. Fruit pale yellow; leaflet blades not more than 2 \times 1 cm 2. *C. hainanensis*
 2b. Leaves not more than 15-foliolate; fruit bluish black.
 4a. Leaves 5-15-foliolate; leaflet blades asymmetric 3. *C. dunniana*
 4b. Leaves 5-7-foliolate; leaflet blades symmetric 4. *C. vestita*
 1b. Calyx lobes 5; petals (4 or)5; stamens 10.
 5a. Leaves 19-25-foliolate; stigma capitate or shield-shaped 5. *C. odorata*
 5b. Leaves not more than 15-foliolate; stigma punctiform to capitate.
 6a. Fruit bluish black 10. *C. lenis*
 6b. Fruit pale yellow to reddish.
 7a. Ovary and fruit pubescent; flower buds 5-ridged 6. *C. lansium*
 7b. Ovary pubescent or glabrous but fruit glabrous; flower buds not ridged.
 8a. Fruit longer than wide; leaflets more than 5 cm wide at middle of rachis 7. *C. yunnanensis*
 8b. Fruit \pm as wide as long; leaflets rarely to 5 cm wide at middle of rachis.
 9a. Leaflet blades 2-6 \times 1-3 cm, subsessile 8. *C. emarginata*
 9b. Leaflet blades 5-12 \times 2-4 cm, subtended by a 2-4 mm petiolule 9. *C. anisum-olens*

1. *Clausena excavata* N. L. Burman, Fl. Indica, 89. 1768.

假黄皮 jia huang pi

Amyris punctata Roxburgh; *Clausena excavata* var. *lunulata* (Hayata) Tanaka; *C. forbesii* Engler; *C. lunulata* Hayata; *C. moningeriae* Merrill; *C. punctata* (Roxburgh) Wight & Arnott; *C. tetramera* Hayata; *Lawsonia falcata* Loureiro.

Shrubs 1-2 m tall. Branchlets and leaf rachises pubescent, with oil glands. Leaves 21-27-foliolate but on young plants to 41-foliolate; petiolules 2-5 mm; leaflet blades ovate, lanceolate, or rhomboid, asymmetric, 2-9 \times 1-3 cm, both surfaces pubescent or only pubescent along veins, base oblique, margin repand. Inflorescences terminal; bracts opposite. Flowers globose in bud. Petals white or pale yellowish white, ovate to obovate, 2-3 \times 1-2 mm. Stamens 8; filaments basally dilated, geniculate at middle, apically linear. Style stout. Fruit ellipsoid, 1.2-1.8 \times 0.8-1.5 cm, 1- or 2-seeded. Fl. Apr-May and Jul-Aug(-Oct in Hainan), fr. Aug-Oct. $2n = 36$.

Below 1000 m. S Fujian, Guangdong, Guangxi, Hainan, Taiwan, S Yunnan [Bangladesh, Bhutan, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Philippines, Thailand, Vietnam].

2. *Clausena hainanensis* C. C. Huang & F. W. Xing, Guihaia 12: 215. 1992.

海南黄皮 hai nan huang pi

Shrubs or trees, to 5 m tall. Leaves 25-37-foliolate; petiolules ca. 1 mm; leaflet blades alternate or opposite, asymmetrically elliptic, ca. 2 \times 1 cm, midvein slightly depressed, base oblique and obtuse, margin repand, apex obtuse. Flowers not known. Infructescences terminal, narrowly paniculate, ca. 5 cm. Fruit pale yellow, ellipsoid, ca. 8 \times 5 mm, pubescent. Fr. Jul-Aug.

• Limestone mountains; 900-1000 m. Hainan (Changjiang).

3. *Clausena dunniana* H. Léveillé, Repert. Spec. Nov. Regni Veg. 11: 67. 1912.

齿叶黄皮 chi ye huang pi

Trees 2–5 m tall, deciduous. Leaves 5–15-foliolate; petiolules 4–8 mm; leaflet blades ovate to lanceolate, 4–10 × 2–5 cm, glabrous or villous, base asymmetric, margin serrate or rarely repand, apex acute to acuminate. Inflorescences terminal. Flowers 4(or 5)-merous, globose in bud. Stamens 8(or 10); filaments geniculate at middle, subulate at apex. Disk small. Ovary globose; style shorter than ovary. Fruit bluish black when ripe, globose, 1–1.5 cm in diam., 1- or 2-seeded. Fl. Jun–Jul, fr. Oct–Nov.

Montane forests, moist areas in mountains; 300–1500 m. Guangdong, Guangxi, Guizhou, W Hubei, Hunan, E and SE Sichuan, S Yunnan [NE Vietnam].

Molino (Bull. Mus. Natl. Hist. Nat., B, Adansonia 16: 130. 1994) placed *Clausena dunniana* in synonymy of *C. anisata* (Willdenow) J. D. Hooker ex Benth.

- 1a. Leaflet blades glabrous 3a. var. *dunniana*
1b. Leaflet blades villous 3b. var. *robusta*

3a. *Clausena dunniana* var. *dunniana*

齿叶黄皮(原变种) chi ye huang pi (yuan bian zhong)

Clausena dentata (Willdenow) M. Roemer var. *dunniana* (H. Léveillé) Swingle.

Leaflet blades glabrous.

Montane forests; 300–1500 m. Guangdong, Guangxi, Guizhou, Hunan, SE Sichuan, S Yunnan [NE Vietnam].

Molino (Bull. Mus. Natl. Hist. Nat., B, Adansonia 16: 130. 1994) placed *Clausena dentata* var. *dunniana* in synonymy of *C. anisata*.

3b. *Clausena dunniana* var. *robusta* (Tanaka) C. C. Huang, Acta Phytotax. Sin. 16(2): 85. 1978.

毛齿叶黄皮 mao chi ye huang pi

Clausena dentata var. *robusta* Tanaka, J. Bot. (Morot) 66: 228. 1930; *C. dentata* var. *henryi* Swingle; *C. henryi* (Swingle) C. C. Huang.

Leaflet blades villous. Leaflet blades and fruit slightly larger than those of autonym variety.

• Moist areas in mountains; 300–1300 m. W Hubei, Hunan, Guangxi, Guizhou, E Sichuan, S Yunnan.

Molino (Bull. Mus. Natl. Hist. Nat., B, Adansonia 16: 130. 1994) placed *Clausena dunniana* var. *robusta*, *C. dentata* var. *robusta*, *C. dentata* var. *henryi*, and *C. henryi* in synonymy of *C. anisata*.

4. *Clausena vestita* D. D. Tao, Acta Bot. Yunnan. 6: 73. 1984.

毛叶黄皮 mao ye huang pi

Trees to 4 m tall. Leaves 5–7-foliolate; petiolules 2–4 mm; leaflet blades alternate, broadly ovate, elliptic, or orbicular, 3–11 × 1.5–8 cm, apex rounded, obtuse, or acute. Calyx 4-parted, persistent in fruit. Fruit bluish black, globose to broadly ellipsoid, 1.2–1.6 cm in diam., glabrous, 1–3-seeded. Seeds ovoid to broadly ellipsoid, 8–12 × 6–9 mm. Fr. May.

• Thickets in dry hot river valleys; ca. 1900 m. NW Yunnan (Lijiang).

Molino (Bull. Mus. Natl. Hist. Nat., B, Adansonia 16: 130. 1994) placed *Clausena vestita* in synonymy of *C. anisata* (Willdenow) J. D. Hooker ex Benth.

5. *Clausena odorata* C. C. Huang, Acta Phytotax. Sin. 8: 92. 1959.

香花黄皮 xiang hua huang pi

Trees to 2 m tall. Shoots dark purplish red. Leaves 19–25-foliolate; petiolules 1–2 mm; leaflet blades oblong to lanceolate, asymmetric, 4–7 × 2–3.5 cm, base oblique, margin crenulate to subentire, apex acuminate and often retuse. Inflorescences terminal, paniculate. Flowers 5-merous, fragrant. Petals white, 3–4 mm. Stamens 10. Stigma capitate to shield-shaped. Fl. Apr.

• Thickets; ca. 1800 m. Yunnan (Mojiang).

Molino (Bull. Mus. Natl. Hist. Nat., B, Adansonia 16: 130. 1994) placed *Clausena odorata* in synonymy of *C. anisata* (Willdenow) J. D. Hooker ex Benth.

6. *Clausena lansium* (Loureiro) Skeels, Bull. Bur. Pl. Industr. U.S.D.A. 168: 31. 1909.

黄皮 huang pi

Quinaria lansium Loureiro, Fl. Cochinch. 1: 272. 1790; *Clausena wampi* (Blanco) Oliver; *Cookia wampi* Blanco.

Trees to 12 m tall. Leaves 5–11-foliolate; petiolules 4–8 mm; leaflet blades ovate to ovate-elliptic, 6–14 × 3–6 cm, midvein often pubescent, base rounded to broadly cuneate, margin repand to crenulate. Inflorescences terminal, paniculate. Flowers globose in bud. Calyx lobes broadly ovate, ca. 1 mm. Petals oblong, ca. 5 mm. Stamens 10; filaments linear, basal portion slightly expanded. Disk short. Ovary hirsute. Fruit pale yellow, globose, ellipsoid, or broadly ovoid, 1.5–3 × 1–2 cm, 1–4-seeded. Fl. Apr–May, fr. Jul–Aug (fl. and fr. ca. 1 month earlier in Hainan). $2n = 18$.

Fujian, Guangdong, Guangxi, S Guizhou, Hainan, Sichuan, SE Yunnan [Vietnam].

This species is cultivated for its fruit in China and elsewhere in warm areas of the world.

7. *Clausena yunnanensis* C. C. Huang, Acta Phytotax. Sin. 8: 91. 1959.

云南黄皮 yun nan huang pi

Trees 3–8 m tall. Bark gray. Branchlets stout; pith large. Leaves 5–11-foliolate; petiolules 4–6 mm; leaflet blades oblong to ovate-elliptic, 10–40 × 5–16 cm, papery, margin denticulate. Inflorescences terminal, paniculate, to 40 cm; bracts narrowly ovate, apex acute. Flowers globose in bud. Pedicel 1.5–3 mm. Sepals ovate, ca. 1 mm. Petals 2–3 mm. Stamens 10. Fruit orange, ellipsoid, ca. 3 × 2 cm, 1- or 2-seeded. Fl. Jun, fr. Sep–Oct.

• Mountain forests, forests on limestone; 500–1300 m. SW and W Guangxi, SE Yunnan.

Molino (Bull. Mus. Natl. Hist. Nat., B, Adansonia 16: 137. 1994) placed *Clausena yunnanensis* in synonymy of *C. engleri* Tanaka.

- 1a. Branchlets glabrate; leaflet blades abaxially shortly pubescent on venation 7a. var. *yunnanensis*

1b. Branchlets densely pubescent; leaflet blades abaxially with dense tufts of long weak trichomes, especially on midvein 7b. var. *longgangensis*

7a. *Clausena yunnanensis* var. *yunnanensis*

云南黄皮(原变种) yun nan huang pi (yuan bian zhong)

Branchlets glabrate. Leaf rachises minutely pubescent; petiolules glabrous or minutely pubescent; leaflet blades abaxially shortly pubescent on venation, adaxially glabrous or glabrate.

- Mountain forests. W Guangxi, SE Yunnan.

7b. *Clausena yunnanensis* var. *longgangensis* C. F. Liang & Y. X. Lu, *Guihaia* 10: 104. 1990.

弄岗黄皮 nong gang huang pi

Clausena yunnanensis var. *dolichocarpa* C. F. Liang & Y. X. Lu ex C. C. Huang.

Branchlets, leaf rachises, and petiolules densely pubescent. Leaflet blades abaxially with dense tufts of long weak trichomes, especially on midvein.

- Forests on limestone. SW Guangxi (Ningming).

Molino (Bull. Mus. Natl. Hist. Nat., B, Adansonia 16: 138. 1994) placed *Clausena yunnanensis* var. *longgangensis* in synonymy of *C. engleri*. *Clausena yunnanensis* var. *dolichocarpa* was not mentioned.

8. *Clausena emarginata* C. C. Huang, *Acta Phytotax. Sin.* 8: 93. 1959.

小黄皮 xiao huang pi

Trees 4–15 m tall. Branchlets grayish black. Leaves 5–11-foliolate; leaflet blades subsessile, obliquely lanceolate to ovate, 2–6 × 1–3 cm, dark brownish black when dry, base oblique, margin crenate, apex obtuse. Inflorescences terminal or axillary, 3–7 cm; bracts subulate. Calyx lobes broadly ovate. Petals ca. 4 mm at anthesis. Stamens 10; filaments slightly expanded in ± their basal half, geniculate, longer than anthers. Disk elongated. Ovary globose, glabrous. Fruit pale yellow,

globose, 8–10 mm in diam., 1- or 2-seeded. Fl. Mar–Apr, fr. Jun–Jul.

- Valley forests; 300–800 m. W Guangxi, SE Yunnan.

Molino (Bull. Mus. Natl. Hist. Nat., B, Adansonia 16: 134. 1994) placed *Clausena emarginata* in synonymy of *C. sanki* (Perrottet) J. F. Molino, which he later (Taxon 44: 427. 1995) decided should be called *C. anisum-olens*.

9. *Clausena anisum-olens* (Blanco) Merrill, *Publ. Bur. Sci. Gov. Lab.* 17: 21. 1904.

细叶黄皮 xi ye huang pi

Cookia anisum-olens Blanco, *Fl. Filip.* 359. 1837; *Clausena grandifolia* Merrill; *C. laxifolia* Quisumbing & Merrill; *C. loheri* Merrill; *C. todayensis* Elmer; *C. warburgii* Perkins.

Trees 3–6 m tall. Leaves 5–11-foliolate; petiolules 2–4 mm; leaflet blades falcately lanceolate to obliquely ovate, 5–12 × 2–4 cm, margin repand, apex acuminate to slightly obtuse. Inflorescences terminal. Flowers globose in bud, fragrant. Calyx lobes ovate, ca. 1 mm. Petals white, oblong, ca. 3 mm. Stamens 8 or 10; filaments slightly expanded in ± their basal half, geniculate. Style slightly shorter than ovary. Fruit pale yellow, globose, 1–2 cm in diam., 1- or 2-seeded. Fl. Apr–May, fr. Jul–Aug.

Taiwan (Lan Yu); cultivated in Guangdong, Guangxi, Yunnan [Philippines].

10. *Clausena lenis* Drake, *J. Bot. (Morot)* 6: 276. 1892.

光滑黄皮 guang hua huang pi

Clausena kerrii Craib.

Trees 2–3 m tall. Branchlet pith fairly large. Leaves 9–15-foliolate; leaflet blades ovate to lanceolate, asymmetric, 2–5 × 1.5–3.5 cm at base of rachis, ca. 18 × 11 cm at middle and apex of rachis, margin crenate. Inflorescences terminal. Flowers ovoid in bud. Calyx lobes 5. Petals (4 or)5, white but basally reddish to dark yellow. Stamens (8 or)10; filaments short; anthers oblong. Fruit globose, ca. 1 cm in diam., 1–3-seeded. Fl. Apr–Jun, fr. Sep–Oct.

Mountain forests; 500–1300 m. Guangdong, SW Guangxi, Hainan, S Yunnan [Laos, Thailand, NE Vietnam].

17. MURRAYA J. Koenig ex Linnaeus, Mant. Pl. 2: 554, 563. 1771 [“*Murraea*”], nom. cons.

九里香属 jiu li xiang shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Bergera J. Koenig ex Linnaeus; *Camunium* Adanson.

Shrubs or trees, unarmed, without rust-colored villosulous indumentum on terminal and axillary bud or young inflorescences. Leaves alternate, odd-pinnate (occasional leaves even-pinnate or 1-foliolate). Inflorescences terminal or terminal and axillary, paniculate or reduced to cymes or few to several-flowered racemes. Flowers bisexual, ellipsoid to obovoid, or narrowly so or subcylindric in bud. Sepals 4 or 5, connate at base or to ± half their length. Petals 4 or 5, imbricate in bud. Stamens (5–)8 or 10, distinct, alternately unequal in length; filaments linear or sublinear, ± straight. Disk annular, pulvinate, or columnar. Gynoecium 2–5-loculed, syncarpous; radial walls of locules straight; ovules 1 or 2 per locule; style 3–7 × as long as ovary, deciduous in fruit or sometimes basal portion persistent. Fruit a berry, with mucilaginous pulp and without pulp vesicles; endocarp fleshy. Seeds with membranous or fleshy seed coat; endosperm lacking; embryo straight; cotyledons elliptic, plano-convex, neither convolute nor folded; hypocotyl partly included between cotyledons.

About 12 species: E, S, and SE Asia, Australia, SW Pacific islands; nine species (five endemic) in China.

In a cladistic analysis of selected species of subfamily Aurantioideae based on plastid DNA sequences and phytochemical features, R. Samuel et al. (Pl. Biol. 3: 77–87. 2001) proposed that *Murraya* is heterogeneous and that plants of *M.* sect. *Bergera* (J. Koenig ex Linnaeus) But & Y. C. Kong (including species 4–9 in the present enumeration) are generically distinct from those of *M.* sect. *Murraya*. However, as they pointed out, it is not clear yet whether *Bergera* is distinct from *Clausena*.

- 1a. Petals 1–2 cm; seeds villous.
- 2a. Leaf rachises winged 1. *M. alata*
- 2b. Leaf rachises not winged.
- 3a. Leaflet blades mostly suborbicular to ovate to elliptic, 1.5–6 cm wide 2. *M. paniculata*
- 3b. Leaflet blades elliptic-obovate or obovate, 0.5–3 cm wide 3. *M. exotica*
- 1b. Petals not more than 0.8 cm; seeds glabrous.
- 4a. Flowers 4(or 5)-merous; stamens 8(or 10).
- 5a. Leaflet blades lanceolate, 0.8–2 cm wide, tertiary veins inconspicuous 4. *M. tetramera*
- 5b. Leaflet blades ovate to elliptic or rarely lanceolate or obovate, 2–4 cm wide, tertiary veins adaxially slightly prominent 5. *M. euchrestifolia*
- 4b. Flowers 5-merous; stamens 10.
- 6a. Leaves 11–31-foliolate.
- 7a. Leaflet blades 3–6 mm wide, apex rounded to obtuse 6. *M. microphylla*
- 7b. Leaflet blades 5–20 mm wide, apex mucronate to acuminate 7. *M. koenigii*
- 6b. Leaves 3–11-foliolate.
- 8a. Leaflet blades pubescent abaxially 9. *M. kwangsiensis*
- 8b. Leaflet blades glabrous.
- 9a. Leaflet blades 5–6 × 2–3 cm 8. *M. cremulata*
- 9b. Leaflet blades 7–18 × 4–10 cm 9. *M. kwangsiensis*

1. *Murraya alata* Drake, J. Bot. (Morot) 6: 276. 1892.

翼叶九里香 *yi ye jiu li xiang*

Murraya alata var. *hainanensis* Swingle.

Shrubs 1–2 m tall. Branches yellowish gray to grayish white. Leaves 5–9-foliolate; petiolules ± short or leaflets sessile; leaflet blades obovate to obovate-elliptic, 1–3 × 0.6–1.5 cm, margin crenulate or entire, apex rounded or rarely obtuse. Inflorescences axillary, cymose. Flowers 5-merous. Sepals 1.5–2 mm. Petals white, 10–15 × 3–5 mm. Stamens 10. Ovary 2-loculed; ovules 1 per locule; style ca. 2 × as long as ovary; stigma capitate. Fruit vermilion, ovoid to globose, ca. 1 cm in diam., 2–4-seeded. Fl. May–Jul, fr. Oct–Dec.

Thickets in sandy areas; near sea level. SW Guangdong (Leizhou Banda), SW Guangxi (Beihai), S Hainan [NE Vietnam].

2. *Murraya paniculata* (Linnaeus) Jack, Malayan Misc. 1: 31. 1820.

千里香 *qian li xiang*

Chalcas paniculata Linnaeus, Mant. Pl. 1: 68. 1767; *C. exotica* (Linnaeus) Millspaugh; *Murraya omphalocarpa* Hayata; *M. paniculata* var. *exotica* (Linnaeus) C. C. Huang; *M. paniculata* var. *omphalocarpa* (Hayata) Tanaka.

Shrubs or trees, 1.8–12 m tall. Older branchlets grayish white to pale yellowish gray. Leaves 2–5-foliolate; petiolules less than 1 cm; leaflet blades mostly suborbicular to ovate to elliptic, 2–9 × 1.5–6 cm, margin entire or crenulate, apex rounded to acuminate. Inflorescences terminal or terminal and axillary. Flowers 5-merous, fragrant. Sepals ovate to lanceolate, to 2 mm, persistent in fruit. Petals white, narrowly elliptic to

oblanceolate, to 2 cm. Stamens 10. Fruit orange to vermilion, narrowly ellipsoid or rarely ovoid, 1–2 × 0.5–1.4 cm. Seeds villous. Fl. Apr–Oct, fr. Apr–Feb. $2n = 18$.

Thickets, montane forests; near sea level to 1300 m. Fujian, Guangdong, Guangxi, S Guizhou, Hainan, S Hunan, Taiwan, Yunnan [Bhutan, Cambodia, India, Indonesia, Japan (Ryukyu Islands), Laos, Malaysia, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam; Australia, SW Pacific islands].

Murraya paniculata var. *omphalocarpa* was accepted by Chang (Fl. Taiwan, ed. 2, 3: 527. 1993).

3. *Murraya exotica* Linnaeus, Mant. Pl. 2: 563. 1771.

九里香 *jiu li xiang*

Chalcas exotica (Linnaeus) Millspaugh; *Murraya paniculata* (Linnaeus) Jack var. *exotica* (Linnaeus) C. C. Huang.

Trees to 8 m tall. Older branchlets grayish white to pale yellowish gray. Leaves 3–7-foliolate; petiolules rather short; leaflet blades elliptic-obovate or obovate, 1–6 × 0.5–3 cm, margin entire, apex rounded or obtuse. Inflorescences terminal or terminal and axillary. Flowers 5-merous, fragrant. Sepals ovate, ca. 1.5 mm. Petals white, oblong, 1–1.5 cm. Stamens 10. Fruit orange to vermilion, broadly ovoid, 8–12 × 6–10 mm. Seeds villous. Fl. Apr–Aug, fr. Sep–Dec. $2n = 18^*$.

• Thickets; near sea level. S Fujian, Guangdong, Guangxi, S Guizhou, Hainan, Taiwan.

This species is widespread in cultivation in tropical and subtropical areas.

4. *Murraya tetramera* C. C. Huang, Acta Phytotax. Sin. 8: 102. 1959.

四数九里香 *si shu jiu li xiang*

Trees 3–7 m tall. Leaves 5–11-foliolate; petiolules 2–4 mm; leaflet blades lanceolate, 2–5 × 0.8–2 cm, dark brownish black when dry, apex acuminate. Inflorescences paniculate. Flowers 4-merous. Sepals ovate, less than 1 mm, connate at base. Petals white, oblong, 4–5 mm. Stamens 8. Ovary ellipsoid, ca. 1 mm. Fruit reddish, globose, 1–1.2 cm in diam., with many oil glands, 1–3-seeded. Seed coat membranous, smooth. Fl. Mar–Apr, fr. Jul–Aug.

• Often on limestone mountains. W Guangxi (Bose, Debao), SE Yunnan.

5. *Murraya euchrestifolia* Hayata, Icon. Pl. Formos. 6: 11. 1916.

豆叶九里香 dou ye jiu li xiang

Chalcas euchrestifolia Tanaka; *Clausena euchrestifolia* (Hayata) Kanehira.

Shrubs or trees, 1.5–7 m tall. Leaves 5–9-foliolate; leaflet blades ovate to elliptic or rarely lanceolate or obovate, 5–8 × 2–4 cm, margin entire, apex mucronate to acuminate. Inflorescences paniculate. Flowers 4(or 5)-merous. Sepals pale yellowish green, ovate, 0.6–1.5 mm. Petals obovate-elliptic, 3–5 mm. Stamens 8(or 10); anthers subglobose. Ovary pale yellowish green. Fruit red to dark red, globose, 1–1.5 cm in diam., 1- or 2-seeded. Seeds glabrous. Fl. Apr–Jul, fr. Sep–Dec.

• Well-drained forests and thickets; 500–1400 m. Guangdong (Fengkai, Nan'ao), Guangxi (Fangcheng), S and SW Guizhou (Wangmo, Xingyi), Hainan (Changjiang), Taiwan, Yunnan.

6. *Murraya microphylla* (Merrill & Chun) Swingle, J. Wash. Acad. Sci. 32: 26. 1942.

小叶九里香 xiao ye jiu li xiang

Clausena microphylla Merrill & Chun, Sunyatsenia 2: 251. 1935.

Shrubs or small trees. Leaves 11–21-foliolate; petiolules extremely short; leaflet blades suborbicular to ovate to elliptic, 3–20 × 3–6 mm, glabrous, base usually inequilateral, margin crenate, apex rounded to obtuse. Inflorescences terminal, 10–30-flowered. Flowers 5-merous. Sepals ovate-elliptic, ca. 1 mm, persistent in fruit. Petals in bud 4–5 mm. Fruit ellipsoid to ovoid-ellipsoid, to 1 cm. Fl. Apr–May and Jul–Oct, fr. Nov–Dec.

• Thickets in sandy areas. Guangdong, Hainan.

7. *Murraya koenigii* (Linnaeus) Sprengel, Syst. Veg. 2: 315. 1817.

调料九里香 tiao liao jiu li xiang

Bergera koenigii Linnaeus, Mant. Pl. 2: 555, 563. 1771; *Chalcas koenigii* (Linnaeus) Kurz.

Shrubs or trees, to 4 m tall. Leaves 17–31-foliolate; leaflet blades ovate, 2–5 × 0.5–2 cm, base obtuse to rounded and oblique, margin entire or crenulate. Inflorescences terminal, paniculate, many flowered. Flowers 5-merous, ellipsoid in bud. Sepals ovate, less than 1 mm. Petals white, oblanceolate to

oblong, 5–7 mm. Stamens 10. Stigma capitate. Fruit bluish black, ovoid to oblong, 1–1.5 cm, 1- or 2-seeded. Seed coat membranous. Fl. Mar–Apr, fr. Jul–Aug.

Moist forests; 500–1600 m. Guangdong, S Hainan, S Yunnan (Xishuangbanna) [Bhutan, India, Laos, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam].

8. *Murraya crenulata* (Turczaninow) Oliver, J. Linn. Soc., Bot. 5(Suppl. 2): 29. 1861.

兰屿九里香 lan yu jiu li xiang

Glycosmis crenulata Turczaninow, Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 30: 250. 1858; *Chalcas crenulata* (Turczaninow) Tanaka.

Small trees. Branchlets and leaves glabrous. Leaves 7–11-foliolate; petiolules ca. 3 mm; leaflet blades ovate-elliptic, 5–6 × 2–3 cm, base obtuse and oblique, apex acuminate. Inflorescences terminal, ca. 8 cm. Flowers 5-merous. Sepals suborbicular. Petals oblong, ca. 6 mm. Stamens 10. Ovary ca. 1.5 mm; style ca. 2.5 mm, stout, basal portion often persistent in fruit. Fruit broadly ovoid to subglobose, ca. 6 mm.

Taiwan (Lan Yu) [Indonesia, New Guinea, Philippines; SW Pacific islands].

9. *Murraya kwangsiensis* (C. C. Huang) C. C. Huang, Acta Phytotax. Sin. 16(2): 85. 1988.

广西九里香 guang xi jiu li xiang

Trees 1–2 m tall. Leaves 3–11-foliolate; petiolules 2–3 mm; leaflet blades alternate, ovate-oblong, 7–18 × 3–10 cm, leathery, both surfaces glabrous or abaxially pubescent, margin crenulate, apex obtuse to rounded. Flowers 5-merous, ellipsoid in bud. Sepals broadly ovate, ca. 1 mm. Petals ca. 4 mm. Stamens 10. Fruit globose, ca. 1 cm in diam. Fl. May, fr. Oct.

• Forests and thickets in valleys; 200–800 m. SW and W Guangxi, SE Yunnan.

1a. Leaflet blades abaxially pubescent

..... 9a. var. *kwangsiensis*

1b. Leaflet blades glabrous 9b. var. *macrophylla*

9a. *Murraya kwangsiensis* var. *kwangsiensis*

广西九里香(原变种) guang xi jiu li xiang (yuan bian zhong)

Clausena kwangsiensis C. C. Huang, Acta Phytotax. Sin. 8: 90. 1959.

Leaflet blades 3–10 × 2.5–6.5 cm, abaxially pubescent.

• Forests and thickets in valleys; 200–800 m. SW and W Guangxi, SE Yunnan.

9b. *Murraya kwangsiensis* var. *macrophylla* C. C. Huang, Acta Phytotax. Sin. 16(2): 85. 1978.

大叶九里香 da ye jiu li xiang

Leaflet blades 7–18 × 4–10 cm, glabrous. Fruit red.

• Valley forests. SW Guangxi.

18. LUVUNGA Buchanan-Hamilton ex Wight & Arnott, Prodr. Fl. Ind. Orient. 90. 1834.

三叶藤橘属 san ye teng ju shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Woody climbers, with straight or recurved axillary spines, without rust-colored villosulous indumentum on terminal and axillary buds or young inflorescences. Leaves alternate, digitately 3-foliolate; leaflets petiolulate (occasional leaves 1-foliolate, including sometimes all of those on new shoots). Inflorescences terminal, axillary, or basal to leaves, paniculate or racemose. Flowers bisexual. Calyx cup-shaped, 3–5-lobed (often irregularly) or truncate. Petals 3–5, imbricate in bud. Stamens 6–10, equal in length, distinct or monadelphous. Disk annular, pulvinate, or columnar. Gynoecium 2–4-loculed, syncarpous; ovules 1 or 2 per locule; style to 4 × as long as ovary, deciduous in fruit. Fruit a berry, with mucilaginous pulp and without pulp vesicles; endocarp membranous or fleshy. Seeds with membranous seed coat; endosperm lacking; embryo straight; cotyledons elliptic, plano-convex; hypocotyl partly included between cotyledons.

About ten species: S and SE Asia; one species in China.

1. *Luvunga scandens* (Roxburgh) Buchanan-Hamilton ex Wight & Arnott, Prodr. Fl. Ind. Orient. 90. 1834.

三叶藤 san ye teng

Limonia scandens Roxburgh, Fl. Ind., ed. 1832, 2: 380. 1832; *Luvunga nitida* Pierre.

Heavy woody climbers. Leaves digitately 3-foliolate; petiole 2–9 cm; petiolules 3–10 mm; leaflet blades elliptic to

obovate, 6–20 × 3–9 cm. Flowers ellipsoid in bud. Calyx 2.5–4 mm, shallowly 4-lobed. Petals 4.6–10 mm. Stamens 8 or fewer. Fruit yellow, globose or obpyriform, 3–5 cm in diam., surface smooth, 1–4-seeded; outer part of pericarp (exocarp and mesocarp) thick. Seeds broadly ovoid, 2–3 cm. Fl. Mar–Apr, fr. Oct–Dec.

Riverbanks, valleys of evergreen broad-leaved forests; below 600 m. Guangdong, Hainan, S Yunnan [Cambodia, India, Laos, Malaysia, Myanmar, Thailand, Vietnam].

19. PARAMIGNYA Wight, Ill. Ind. Bot. 1: 108. 1838.

单叶藤橘属 dan ye teng ju shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Woody climbers or erect or scrambling shrubs. Branchlets with straight or recurved spines or rarely unarmed, without rust-colored villosulous indumentum on terminal and axillary buds or young inflorescences. Leaves alternate, 1-foliolate or simple; petiole 0.4–2.5 cm, usually bent and/or twisted and ± swollen apically. Flowers bisexual, axillary, solitary or in few-flowered fascicles. Sepals 4 or 5, connate at base or to ca. 2/3 their length. Petals 4 or 5, imbricate in bud. Stamens 8 or 10, equal in length, distinct. Disk cup-shaped, conic, or columnar. Gynoecium 3–5-loculed, syncarpous; ovules 1 or 2 per locule; style to 4 × as long as ovary, deciduous in fruit. Fruit a berry, with copious mucilaginous pulp and without pulp vesicles; endocarp fleshy. Seeds with membranous seed coat; endosperm lacking; embryo straight; cotyledons elliptic, plano-convex; hypocotyl partly included between cotyledons.

About 15 species: S and SE Asia, N Australia; one species in China.

1. *Paramignya confertifolia* Swingle, J. Arnold Arbor. 21: 17. 1940.

单叶藤橘 dan ye teng ju

Woody climbers or erect or scrambling shrubs, with recurved spines 2–8 mm or unarmed. Leaves 1-foliolate or simple; petiole 5–12 mm; leaf blade ovate to elliptic to obovate, 5–12 × 2–4.5 cm, glabrous or abaxially grading from sparsely pubescent to ± densely pubescent on midvein, base rounded to obtuse, margin crenate toward apex or entire, apex acuminate to shortly so. Pedicel 3–5 mm. Flowers 5-merous, ellipsoid to obovoid in bud. Sepals 0.5–1.5 mm, pubescent and/or margin ciliate, per-

sistent in fruit. Petals 6–10 mm, glabrous, deciduous in fruit. Stamens 10; filaments pubescent. Disk thickly columnar, ca. 1 mm, glabrous, ± accrescent and forming a stipe in fruit. Ovary hirsute; style ca. 5 × as long as ovary, pubescent basally or glabrous. Fruit reportedly green, ± globose, larger ones 1.5–2 cm in diam., subtended by a 1.3–2 mm stipe. Fl. Jul–Sep, fr. Oct–Dec.

Forests, streamsides, trailsides; 300–900 m. Guangdong, S Guangxi, Hainan, S Yunnan (Xishuangbanna) [N Vietnam].

Plants mistakenly treated as *Paramignya rectispinosa* Craib by C. C. Huang (Fl. Reipubl. Popularis Sin. 43(2): 155. 1997) belong here.

20. ATALANTIA Corrêa, Ann. Mus. Natl. Hist. Nat. 6: 383, 385, 386. 1805, nom. cons.

酒饼筋属 jiu bing le shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Severinia Tenore ex Endlicher.

Shrubs or trees, unarmed or with straight axillary spines, without rust-colored villosulous indumentum on terminal and axillary buds or young inflorescences. Leaves alternate, 1-foliolate or simple; petiole 2–13 mm, usually not bent, twisted, or swollen. Inflorescences terminal and/or axillary, fasciculate, racemose, or paniculate. Flowers bisexual. Sepals 3–5, connate at base to nearly their full length, or calyx splitting irregularly into 2 or 4 segments. Petals 3–5, imbricate in bud. Stamens 6–10, equal or alternately unequal in length, distinct, monadelphous, filaments coherent in phalanges, or filaments irregularly coherent. Disk annular, cup-shaped, or columnar. Gynoecium 2–5-loculed, syncarpous; ovules 1 or 2 per locule; style to 1.5 × as long as ovary, deciduous in fruit. Fruit a berry, usually with pulp vesicles and with or without mucilaginous pulp; endocarp membranous. Seeds with membranous seed coat; endosperm lacking; embryo straight; cotyledons elliptic, plano-convex; hypocotyl partly included between cotyledons.

About 17 species: S and SE Asia; seven species (two endemic) in China.

- 1a. Leaves simple; petiole not articulated with leaf blade.
 2a. Branchlets with spines ca. 4 cm or rarely unarmed; leaf blade 2–6(–10) × 1–5 cm, apex rounded or rarely narrowly obtuse, retuse to emarginate at tip; stamens 10; ripe fruit bluish black 1. *A. buxifolia*
 2b. Branchlets unarmed or rarely with sparse short spines; leaf blade 11–21 × 3–6(–10) cm, apex acuminate, sometimes retuse at tip; stamens 8; ripe fruit red 2. *A. kwangtungensis*
- 1b. Leaves 1-foliolate; petiole articulated with leaf blade.
 3a. Fruit ellipsoid to ovoid but pyriform when young, ca. 3 cm in diam. 7. *A. fongkaica*
 3b. Fruit globose or subglobose, 1.2–3 cm in diam.
 4a. Flowers 5–6 mm in diam.; petals 3–4 mm; fruit smooth 3. *A. henryi*
 4b. Flowers 8–15 mm in diam.; petals 6–10 mm; fruit scabrous.
 5a. Young branchlets and leaves glabrous 6. *A. acuminata*
 5b. Young branchlets and leaves with indumentum.
 6a. Leaflet blade apex acuminate; petiole 6–10 mm; fruit 1.5–2 cm or more in diam. 4. *A. dasycarpa*
 6b. Leaflet blade apex mucronate to obtuse; petiole 10–12 mm; fruit 2.5–3 cm in diam. 5. *A. guillauminii*

1. *Atalantia buxifolia* (Poiret) Oliver ex Bentham, Fl. Hongk. 51. 1861.

酒饼箭 jiu ping le

Citrus buxifolia Poiret, Encycl. 4: 580. 1797; *Dumula sinensis* Loureiro ex B. A. Gomes; *Limonia monophylla* Loureiro (1790), not Linnaeus (1767); *Severinia buxifolia* (Poiret) Tenore; *S. monophylla* Tanaka.

Shrubs ca. 2.5 m tall. Branches grayish brown; branchlets green, with spines or rarely unarmed; spines ca. 4 cm, apex red. Leaves simple; petiole 1–7 mm; leaf blade ovate, obovate, elliptic, or suborbicular, 2–6(–10) × 1–5 cm, leathery, with oil glands and an orange smell, midvein slightly ridged, secondary veins joined in an arched marginal vein, apex rounded to obtuse and retuse to emarginate at tip. Inflorescences axillary, fasciculate, (1- or) several flowered. Flowers 5-merous, subsessile. Calyx persistent. Petals white, 3–4 mm, with oil glands. Stamens 10; filaments white, distinct or sometimes a few basally connate. Style green, ± as long as ovary. Fruit bluish black when ripe, globose, slightly oblate, or subellipsoid, 0.8–1.2 cm in diam., smooth, 1- or 2-seeded. Seeds with 1(or 2) embryos; cotyledons green, with many oil glands. Fl. May–Dec, fr. Sep–Dec. $2n = 36$.

Forests or thickets near ocean; below 300 m. S Fujian, S Guangdong, S Guangxi, Hainan, S Taiwan, Yunnan [Malaysia, Philippines, Vietnam].

2. *Atalantia kwangtungensis* Merrill, Philipp. J. Sci. 21: 496. 1922.

广东酒饼箭 guang dong jiu ping le

Atalantia hainanensis Merrill & Chun ex Swingle; *A. roxburghiana* J. D. Hooker var. *kwangtungensis* (Merrill) Swingle.

Shrubs 1–2 m tall. Young branchlets green, slightly flat,

ridged. Leaf blade elliptic, lanceolate, or rarely obovate-elliptic, 11–21 × 3–6(–10) cm, pale green, abaxially grayish yellow when dry, oil glands pellucid and conspicuous, base cuneate, margin sinuate. Inflorescences axillary, 5 mm or less, with 3 to several flowers in a fasciclelike raceme. Flowers 4-merous. Petals white, 3–5 mm. Stamens 8, monadelphous or filaments coherent in phalanges. Style ± as long as ovary; stigma slightly clavate. Fruit red, ovoid, ellipsoid, or rarely globose, 1.3–1.8 × 0.7–1(–1.5) cm, smooth, with large oil glands, 1–3-seeded; exocarp ca. 0.5 mm thick. Seeds narrowly ovoid, 1–1.5 mm; embryo solitary. Fl. Jun–Jul, fr. Nov–Jan.

• Moist and shady places in evergreen broad-leaved forests; 100–400 m. W Guangdong, SE Guangxi, Hainan.

3. *Atalantia henryi* (Swingle) C. C. Huang, Guihaia 11: 5. 1991.

薄皮酒饼箭 bo pi jiu ping le

Atalantia racemosa Wight & Arnott var. *henryi* Swingle, J. Arnold Arbor. 21: 127. 1940.

Trees usually 3–7 m tall. Branchlets brown, slightly flat, glabrous or very sparsely pilose; spines few, 2 mm or less. Leaves 1-foliolate; petiole 4–8 mm; leaflet blade broadly ovate, ovate-elliptic, or sublanceolate, 5–11 × 2.5–5 cm, thickly papery to leathery, oil glands slightly sunken when dry, midvein slightly ridged, secondary veins very numerous and joined in an arched marginal vein, apex shortly acuminate to obtuse and emarginate at tip. Inflorescences axillary, racemose, 1–3 cm, ca. 30-flowered. Pedicel 1–5 mm, with 1 bracteole. Sepals 4(or 5), 1–1.5 mm, pubescent, basally connate, margin ciliate. Petals white, ca. 4 mm. Stamens 8; filaments 1–2 mm, distinct or sometimes in basally coherent phalanges. Gynoecium nearly as long as filaments; ovary subglobose, with 4 large oil glands, 2- or 3-loculed,

with 1 ovule per locule; stigma capitate. Fruit reddish orange, globose, 1.5–2 cm in diam., smooth, oil glands inconspicuous. Seeds broadly ovoid, 1–1.4 cm; seed coat thinly crustose, smooth; embryo solitary. Fl. Apr–May, fr. Nov–Dec.

Moist forests in limestone mountains; 300–1100 m. W Guangxi, Yunnan [NE Vietnam].

4. *Atalantia dasycarpa* C. C. Huang, Acta Phytotax. Sin. 16(2): 85. 1978.

厚皮酒饼筋 hou pi jiu bing le

Trees 2–5 m tall. Branchlets, leaves, and petioles with short crisped trichomes but glabrescent. Young branchlets slightly flat, with or without spines. Petiole 6–10 mm, adaxially narrowly canaliculate; leaflet blade narrowly elliptic to elliptic-lanceolate, 10–17 × 3–6 cm, dark green to yellowish green when dry, secondary veins numerous and conspicuous, base rounded, margin sinuate, apex acuminate and rarely emarginate at tip. Inflorescences axillary, racemose, 1–2 cm, 3–9-flowered; peduncle thinly pubescent. Flowers 4-merous. Pedicel thinly pubescent. Calyx lobes ovate-triangular, apex acute. Petals white, 6–8 mm. Stamens 8, slightly shorter than petals; filaments broad, distinct or sometimes cohering in phalanges, apex acute. Disk 1/4–1/3 as long as ovary. Ovary ellipsoid, with 4 large pale oil glands, 3- or 4-loculed, with 1 or 2 ovules per locule, apex narrow; style 4–5 mm. Fruit globose, 1.5–2 cm or more in diam., oil glands numerous, large, and conspicuously concave when dry; exocarp ca. 1.5 mm thick. Seeds broadly ellipsoid, 10–12 × 6–9 mm, narrowed at both ends; embryo solitary. Fl. Apr–May, fr. Oct–Dec.

Forests by rivers in valleys; 200–400 m. SW Guangxi [NE Vietnam].

5. *Atalantia guillauminii* Swingle, Notul. Syst. (Paris) 2: 159. 1911.

大果酒饼筋 da guo jiu bing le

Trees to 6 m tall. Young branchlets sparsely pubescent, unarmed or with few spines. Petiole 1–1.2 cm, stout, adaxially with short pubescence when young; leaflet blade narrowly elliptic, 14–18 × 5–6 cm, thickly papery, secondary veins numerous and conspicuous, base broadly cuneate, margin entire, apex narrowly obtuse to shortly acuminate. Ovary 3- or 4-loculed, with 1 or 2 ovules per locule. Inflorescences axillary, racemose, 1–1.5 cm, thinly pubescent. Fruit subglobose, 2.5–3 cm in diam., with oil glands conspicuously sunken when dry;

outer part of pericarp (exocarp and mesocarp) ca. 1 mm thick. Seeds broadly ellipsoid and slightly flat, 1.6–2.2 × ca. 1.5 cm; embryo solitary. Fr. Sep.

Moist forests in valleys; 200–300 m. SE Yunnan (Hekou) [N Vietnam].

6. *Atalantia acuminata* C. C. Huang, Guihaia 11: 6. 1991.

尖叶酒饼筋 jian ye jiu bing le

Trees 2–6 m tall, whole plant glabrous. Branchlets slender, with 2–5 mm spines. Petiole 3–6(–8) mm, adaxially shallowly canaliculate; leaflet blade lanceolate, 6–12 × 2–4 cm, secondary veins numerous and conspicuous, base narrowly cuneate, margin entire, apex acuminate. Inflorescences axillary, racemose, 3–9-flowered. Flowers 1–1.5 cm in diam. Calyx lobes 4, broadly ovate, ca. 2 mm. Petals white, 8–10 mm. Stamens 8, slightly shorter than petals; filaments broad, distinct or sometimes cohering in phalanges, apex acute. Ovary ellipsoid, without large oil glands, 3- or 4-loculed, with 1 or 2 ovules per locule, apex narrow; style 4–5 mm; stigma capitate. Fruit globose, 1.2–1.5 cm in diam., oil glands dense, large, and conspicuously concave when dry. Fl. May, fr. Oct.

Forests and thickets on limestone mountains; 700–900 m. W Guangxi, SE Yunnan [N Vietnam].

7. *Atalantia fongkaica* C. C. Huang, Guihaia 11: 5. 1991.

开封酒饼筋 kai feng jiu bing le

Shrubs to 1 m tall. Branchlets green, slightly flat, glabrous, with very short sometimes slightly flat spines. Leaves 1-foliolate; petiole 4–7 mm, articulated with blade; leaflet blade variable in shape and size, some obovate and 7–9 × 3–4 cm with shortly acuminate apex, others oblanceolate to narrowly elliptic and 10–16 × 4–6 cm with acuminate apex, thickly papery to leathery, glabrous, abaxially grayish yellow to yellowish gray when dry, midvein ridged, secondary veins numerous, tertiary veins conspicuous, base broadly cuneate to obtuse, margin sinuate or apically with minute obtuse teeth. Flowers axillary, solitary. Ovary 5-loculed, with 1 ovule per locule. Fruit pyriform when young but ellipsoid to ovoid when mature, ca. 3.8 × 3 cm, smooth, with slightly convex oil glands when dry; outer part of pericarp (exocarp and mesocarp) ca. 2 mm thick. Seeds 1.5–1.8 × 1–1.3 cm; seed coat smooth; embryo solitary; cotyledons green. Fr. Aug–Oct.

• Forests by rivers in valleys; below 200 m. Guangdong (Fengkai).

21. CITRUS Linnaeus, Sp. Pl. 2: 782. 1753.

柑橘属 gan ju shu

Zhang Dianxiang (张奠湘); David J. Mabberley

Aurantium Tournefort ex Miller; *Citream* Tournefort ex Miller; ×*Citrofortunella* J. Ingram & H. E. Moore; ×*Citroncirus* J. Ingram & H. E. Moore; +*Citroponcirus* H. Wu et al.; *Fortunella* Swingle; *Limon* Tournefort ex Miller; *Papeda* Hasskarl; *Poncirus* Rafinesque; *Pseudaegle* Miquel; *Sarcodactilis* C. F. Gaertner.

Shrubs or small trees, evergreen, rarely deciduous. Young branches often flat and angled, usually with solitary (rarely paired) spines at axils. Leaves 1-foliolate, rarely 3-foliolate or simple; petiole usually articulated with base of leaf blade, usually conspicuously winged; leaf blade subleathery to leathery, with dense pellucid fragrant oil dots, margin crenulate or rarely entire. Flowers axillary,

hermaphrodite or male, solitary or in small fascicles, fragrant. Calyx cup-shaped; lobes 3–5, subglabrous. Petals (3 or)4 or 5(–8), white or outside pinkish red, imbricate, thick. Stamens usually 4(–10) × as many as petals, free or basally coherent. Disk annular or short, with nectary glands. Ovary (3–)5–14(–18)-loculed, each locule with 2–8 or more ovules; stigma large. Fruit a berry (hesperidium) with sarcocarp segments of pulp vesicles and adaxially attached seeds. Seed coat smooth or ridged; embryo(s) 1 to many, like cotyledons milky white, green, or rarely yellowish, germination hypogeous.

Between 20 and 25 species: E, S, and SE Asia, Australia, SW Pacific islands, with many cultivated taxa widely naturalized in warm countries; 11 species and hybrid species (three endemic) native, naturalized, or extensively cultivated in China, plus five hybrid species cultivated to a limited extent.

In China, many early hybridizations appear to have taken place, and many cultivated taxa have become naturalized (these are listed at the end of the generic account). For a discussion of the status of several taxa formerly considered species see Nicolosi et al. (Theor. Appl. Genetics 100: 1155–1166. 2000) and Mabberley (Blumea 49: 481–498. 2004). Hybrids readily form between species, and as apomixis is common, such hybrids can be fixed as cultivars, with occasional outcrossings leading to yet more. Because these hybrids can thereby span, through backcrossing, the spectrum of variation between the original, probably geographically isolated, species, it is impossible to provide a key to cover all plants that may be found. The key here therefore covers the apparently wild species and some of the most common cultivar groups now referred to as hybrid taxa. Doubtful taxa are not included in the key, but descriptions of two are included at the end of the treatment.

Because of the enormous worldwide economic importance of the genus, *Citrus* is treated more fully, particularly with regard to synonymy, than is the norm in this flora. The following treatment is the first floristic one to take account of current advances in the understanding of the genus.

- 1a. Plants deciduous; leaves of mature plants 3(–5)-foliolate 1. *C. trifoliata*
 1b. Plants evergreen; leaves 1-foliolate or rarely simple.
 2a. Ovary with 3 or 4(–6) locules, each with 3 or 4 ovules 4. *C. japonica*
 2b. Ovary with (6 or)7–15 locules, each with many ovules.
 3a. Leaves with a winged petiole much more than half as long as leaf blade.
 4a. Leaf blade margin entire to finely crenulate, apex acuminate 2. *C. cavaleriei*
 4b. Leaf blade margin conspicuously crenulate, apex obtuse to subrounded and sometimes mucronate 3. *C. hystrix*
 3b. Leaves with a winged petiole less than half as long as leaf blade or absent.
 5a. Petiole not winged; fruit pericarp thicker than sarcocarp 5. *C. medica*
 5b. Petiole winged although sometimes only narrowly; fruit pericarp thinner than sarcocarp.
 6a. Cotyledons green.
 7a. Fruit oblong or at least with a marked apical mammilla; petals outside pinkish or reddish 9. *C. ×limon*
 7b. Fruit globose, obovate, pyriform, or broadly obconic and without a marked apical mammilla;
 petals outside white or purplish.
 8a. Young branches, calyx lobes, and ovaries with trichomes; fruit 10 cm or more in diam. 6. *C. maxima*
 8b. Young branches, calyx lobes, and ovaries glabrous; fruit to 10 cm in diam. but often
 much smaller 10. *C. ×aurantium*
 6b. Cotyledons milky white.
 9a. Flowers solitary or in small fascicles; pericarp easily removed.
 10a. Fruit pale yellow, orange, red, or carmine; sarcocarp usually sweet 7. *C. reticulata*
 10b. Fruit pale yellow; sarcocarp acid and bitter 11. *C. ×junos*
 9b. Flowers usually in fascicles; pericarp not easily removed.
 11a. Fruit greenish yellow, with an apical papilla; sarcocarp very acid 8. *C. ×aurantifolia*
 11b. Fruit orange, reddish, or sometimes yellow, without an apical papilla; sarcocarp
 sour or sweet 10. *C. ×aurantium*

1. *Citrus trifoliata* Linnaeus, Sp. Pl., ed. 2, 2: 1101. 1763.

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Aegle sepiaria Candolle; *Citrus trifolia* Thunberg; *C. trifoliata* subf. *monstrosa* (T. Itô) Hiroe; *C. trifoliata* var. *monstrosa* T. Itô; *C. triptera* Desfontaines; *Poncirus trifoliata* (Linnaeus) Rafinesque; *P. trifoliata* var. *monstrosa* (T. Itô) Swingle; *Pseudaegle sepiaria* (Candolle) Miquel.

Trees or treelets, 1–5 m tall. Branches green, flat, ridged when young; spines ca. 4 cm, base flat, apex rufous. Foliage spurs unarmed, developed from dormant buds on twigs of previous year, with very short internodes bearing 1–5 leaves. Leaves palmately 3(–5)-foliolate, in juveniles usually simple or 1-foliolate; petiole narrowly winged; leaflet blades 2–5 × 1–3 cm, central one as long or longer than laterals, midvein with short trichomes when young, margin finely crenulate or entire.

Flowers solitary or paired, 3.5–8 cm in diam. Calyx lobes 5–7, basally connate. Petals (4 or)5(or 6), white, obovate, 1.5–3 cm, imbricate. Stamens usually 20; filaments of different lengths. Ovary 6–8-loculed, hairy; ovules 4–8, in 2 rows per locule; style short, thick; stigma clavate. Fruit dark yellow, subglobose to pyriform, usually 3–4.5 × 3.5–6 cm, with coarse ring-shaped furrows or sometimes smooth. Seeds 20–50, broadly ovoid, 0.9–1.2 cm; embryo(s) solitary or several; seed coat smooth or with inconspicuous fine ridges. Fl. May–Jun, fr. Oct–Nov.

• Anhui, Chongqing, S Gansu, N Guangdong, N Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, NW Jiangxi, S Shaanxi, Shandong, S Shanxi, Zhejiang.

2. *Citrus cavaleriei* H. Léveillé ex Cavalerie, Bull. Géogr. Bot. 21: 211. 1911.

宜昌橙 yi chang cheng

Citrus ×aurantium Linnaeus subsp. *ichangensis* (Swingle) Guillaumin; *C. hongheensis* Y. M. Ye et al.; *C. ichangensis* Swingle; *C. macrosperma* T. C. Guo & Y. M. Ye.

Trees or shrubs, 2–10 m tall. Branchlets subglabrous; spines straight, stout, smaller on flowering branches. Leafy petiole 1–3 × as long as blade, narrowly elliptic, 6–16 × 2.5–4 cm, base cuneate, margin finely crenulate, apex rounded; leaf blades ovate-lanceolate, ca. 2(–8) × 0.7–1.5(–4.5) cm, margin entire to finely crenate, apex acuminate. Flowers solitary or to 9 in fascicles, 3–3.5 cm in diam.; buds pale purplish red, broadly ellipsoid. Calyx lobes 5. Petals 4 or 5, white or pink, 1–1.8 × 0.5–0.8 cm. Stamens 16–30; filaments distinct or cohering in bundles, ciliate. Ovary pale green, subellipsoid; style ca. 6.5 mm; stigma pale yellow, with fine shallow grooves. Fruit pale yellow, oblate, globose, or pyriform, usually 3–5 × 4–6 cm but when pyriform to 9–10 × 7–8(–12) cm, with narrow longitudinal grooves, oil dots large and conspicuously prominent, base rounded, apex rounded, dimpled, and with or without a papilla; pericarp to 2 cm thick but usually much less; sarcocarp in 7–13 segments, yellowish white, very sour. Seeds 30 or more, subglobose to irregularly pyramidal, ca. 1.5 × 1.5 × 1.2 cm; seed coat yellowish white, chalaza dark brown, large, and covering almost half of coat; embryo(s) solitary to numerous; cotyledons milky white. Fl. Mar–Jun, fr. Oct–Dec.

• Mountains, hills, valleys; below 2500 m. S Gansu, N Guangxi, Guizhou, W Hubei, NW and W Hunan, S Shaanxi, Sichuan, Yunnan.

This species is a parent with *Citrus ×aurantium* of *C. ×webberi* Wester, and possibly a parent with *C. reticulata* of *C. ×junos*.

3. *Citrus hystrix* Candolle, Cat. Pl. Horti Monsp. 19, 97. 1813.

箭叶橙 jian ye cheng

Citrus auraria Michel; *C. echinata* Saint-Lager; *C. hyalopulpa* Tanaka; *C. kerrii* (Swingle) Tanaka; *C. macroptera* Montrouzier var. *kerrii* Swingle; *C. papeda* Miquel; *Fortunella sagittifolia* F. M. Feng & P. I Mao; *Papeda rumphii* Hasskarl.

Trees 3–6 m tall. Branchlets with spines. Leaves dark red when young; petiole winged, apex rounded to truncate; leaf blade ovate, 5–8 × 2.5–4.5 cm, 1–2.5 cm longer (rarely same length) and 0.5–1 cm wider than winged petiole, tertiary veins conspicuous, margin apically conspicuously and sparsely crenate, apex narrowly obtuse. Inflorescences with (1 or) 3–5 flowers; peduncle 1–5 mm. Flower buds globose. Calyx lobes 4 or 5, broadly triangular, ca. 4 × 6 mm. Petals white but pinkish red outside, 7–10 mm. Stamens ca. 30; filaments distinct. Style short, thick. Fruit lemon yellow, ellipsoid to subglobose, 5–7 × 3–5 cm, slightly coarse or smooth, oil dots numerous and prominent, apex rounded; pericarp thick; sarcocarp in 11–13 segments, very acidic and slightly bitter. Seeds numerous 1.5–1.8 × 1–1.2 cm, ridged; embryo solitary; cotyledons milky white. Fl. Mar–May, fr. Nov–Dec.

N Guangxi, Yunnan [Indonesia, Myanmar, New Guinea, Philippines, Thailand].

Although apparently native to S China into SE Asia and Malesia, the natural distribution of this species is obscured by cultivation. Selected forms are cultivated throughout the warm parts of the world for their

culinary (leaves) and medicinal (fruit) uses. All named taxa (save perhaps some from central Malesia) seem to have been based on cultivated plants as discussed by Mabberley (Gard. Bull. Singapore 54: 173–184. 2002). Commonly seen in China are cultivated plants (the “lime leaves” of commerce) with the following characteristics: leaf blade broadly elliptic, apex obtuse to rounded; fruit subglobose, ca. 4 × 3.5 cm, smooth, apex with a papilla; pericarp ca. 2 mm thick; sarcocarp in 6 or 7 segments, 6–8-seeded but 1 or 2 seeds undeveloped; seeds pyramidal, 1.5–1.8 × 1–1.4 cm, 0.8–1.2 mm thick, with alveolate ridges.

4. *Citrus japonica* Thunberg, Nova Acta Regiae Soc. Sci. Upsal. 3: 208. 1780.

金柑 jin gan

Atalantia hindsii (Champion ex Benth) Oliver ex Benth; *Citrus ×aurantium* Linnaeus var. *globifera* Engler; *C. ×aurantium* subsp. *japonica* (Thunberg) Engler; *C. ×aurantium* var. *japonica* (Thunberg) Hooker; *C. ×aurantium* subvar. *madurensis* (Loureiro) Engler; *C. ×aurantium* subvar. *margarita* (Loureiro) Engler; *C. ×aurantium* var. *oliviformis* Risso ex Loiseleur; *C. ×aurantium* subvar. *spinosa* Siebold & Zuccarini ex Engler; *C. hindsii* (Champion ex Benth) Govaerts; *C. inermis* Roxburgh; *C. japonica* subf. *crassifolia* (Swingle) Hiroe; *C. japonica* subf. *hindsii* (Champion ex Benth) Hiroe; *C. japonica* var. *madurensis* (Loureiro) Guillaumin; *C. japonica* subf. *margarita* (Loureiro) Hiroe; *C. japonica* var. *margarita* (Loureiro) Guillaumin; *C. kinokuni* Tanaka; *C. madurensis* Loureiro; *C. margarita* Loureiro; *C. ×nobilis* Loureiro var. *inermis* (Roxburgh) Sagot; *Fortunella chintou* (Swingle) C. C. Huang; *F. crassifolia* Swingle; *F. hindsii* (Champion ex Benth) Swingle; *F. hindsii* var. *chintou* Swingle; *F. japonica* (Thunberg) Swingle; *F. margarita* (Loureiro) Swingle; *F. obovata* Tanaka; *F. venosa* (Champion ex Benth) C. C. Huang; *Sclerostylis hindsii* Champion ex Benth; *S. venosa* Champion ex Benth.

Trees to 5 m tall, d.b.h. to 20 cm. Branchlets numerous; spines variable, to 5 cm on young growth but some only a few mm on flowering shoots. Leaves 1-foliolate or sometimes mixed with simple leaves; petiole 6–9 mm, narrowly winged; leaf blade elliptic to obovate-elliptic, 4–6 × 1.5–3 cm, base rounded to broadly cuneate, margin dentate near apex or rarely entire, apex rounded and rarely mucronate. Flowers solitary or fascicled, subsessile. Calyx 4- or 5-lobed. Petals 5, ca. 5 mm or less. Stamens ca. 20; filaments cohering into 4 or 5 bundles. Ovary as long as style, 3- or 4-loculed, with 3 or 4 ovules per locule. Fruit bright orange to red, globose to slightly obovate, 9–10 mm in diam., smooth, 3- or 4-seeded; pericarp sweet and edible; sarcocarp acidic. Seeds broadly ovoid, apex mucronate; seed coat smooth; embryos at least sometimes numerous; cotyledons green. Fl. Apr–May, fr. Oct–Dec. $2n = 18^*$, 20^* , 36^* .

• Evergreen broad-leaved forests; 600–1000 m. S Anhui, Fujian, Guangdong, SE Guangxi, Hainan, Hunan, Jiangxi, Zhejiang.

This appears to be the truly wild kumquat from which cultivars with greatly increased fruit-sizes of different shapes have been selected. However, recent field studies in China show a considerable amount of variation within some wild populations of what is treated here as *Citrus japonica*. Future comprehensive field and cytological studies throughout

the complex may show that geographical subspecies or cytological races of the wild form could be formally recognized.

None of the cultivars, formerly recognized as species, has been found in truly "natural" habitats. They are cultivated on a large scale in S China and have sometimes become naturalized. *Citrus japonica* and *C. reticulata* are parents of *C. ×microcarpa*. Many of the above synonyms can perhaps best be referred to cultivar groups, corresponding to the subformae of Hiroe. Commonly seen cultivar groups in China have the following characteristics, but some cultivars are intermediate.

Round Kumquat Group

Trees 2–5 m tall. Petiole 6–10 mm or rarely longer, wings narrow; leaf blade ovate-elliptic to elliptic-lanceolate, 4–8 × 1.5–3.5 cm, base broadly cuneate, apex obtuse and sometimes mucronate. Flowers 1–3 per fascicle; peduncle 6 mm or less. Petals 6–8 mm. Stamens 15–25. Ovary globose, ± as long as style, 4–6-loculed. Fruit orangish yellow to orangish red, globose, 1.5–2.5 cm in diam., 2–5-seeded; pericarp 1.5–2 mm thick, sweet. Seeds ovoid, base rounded; embryo solitary. Fl. Apr–May, fr. Nov–Feb.

Oval Kumquat Group

Trees to 3 m tall. Petiole ca. 1.2 cm, wings very narrow; leaf blade ovate-lanceolate to long elliptic, 5–11 × 2–4 cm, base broadly cuneate to nearly rounded, apex obtuse to slightly acute. Flowers 1–3 per fascicle; peduncle 3–5 mm. Petals 6–8 mm. Stamens 20–25. Ovary elliptic; style usually ca. 1.5 × as long as ovary, slender; stigma slightly clavate. Fruit orangish yellow to orangish red, ellipsoid to ovoid-ellipsoid, 2–3.5 cm in diam., oil dots usually slightly expanded, 2–5-seeded; pericarp ca. 2 mm thick, sweet; sarcocarp in 4 or 5 segments, acidic. Seeds ovoid, apex acute; embryo solitary or rarely numerous. Fl. Mar–May, fr. Oct–Dec.

5. *Citrus medica* Linnaeus, Sp. Pl. 2: 782. 1753.

香橼 xiang yuan

Aurantium medicum (Linnaeus) M. Gómez; *Citreum vulgare* Tournefort ex Miller; *Citrus alata* (Yu. Tanaka) Tanaka; *C. ×aurantium* Linnaeus subvar. *amilbed* Engler; *C. ×aurantium* subvar. *chakotra* Engler; *C. cedra* Link; *C. cedrata* Rafinesque; *C. fragrans* Salisbury; ?*C. kwangsiensis* Hu; *C. ×limon* (Linnaeus) Osbeck var. *digitata* Risso; *C. medica* var. *alata* Yu. Tanaka; *C. medica* var. *digitata* Risso; *C. medica* var. *ethrog* Engler; *C. medica* f. *monstrosa* Guillaumin; *C. medica* var. *proper* J. D. Hooker; *C. medica* var. *sarcodactylis* (Hoola van Nooten) Swingle; *C. odorata* Rousset; *C. sarcodactylis* Hoola van Nooten; *C. tuberosa* Miller; *Sarcodactylis helicteroides* C. F. Gaertner.

Shrubs or small trees. Branches, leaf buds, and flower buds purplish when young. Branches with ca. 4 cm spines. Leaves simple or rarely 1-foliolate; petiole short, not winged; leaf blade elliptic to ovate-elliptic, 6–12 × 3–6 cm or larger, margin serrate, apex rounded, obtuse, or rarely mucronate. Inflorescences axillary, ca. 12-flowered or sometimes flowers solitary. Flowers bisexual or sometimes male by ± complete abortion of pistil. Petals 5, 1.5–2 cm. Stamens 30–50. Ovary cylindrical; style long and thick; stigma clavate. Fruit pale yellow, elliptic to sub-

globose, to 2 kg, surface coarse; pericarp white to pale yellow and soft within, thicker than sarcocarp, removed with difficulty; sarcocarp with 10–15 segments, colorless, nearly pellucid to pale milky yellow, acidic to slightly sweet, fragrant. Seeds small; seed coat smooth; embryo(s) solitary to several; cotyledons milky white. Fl. Apr–May, fr. Oct–Nov. $2n = 18, 20$.

Cultivated and sometimes naturalized. Guangxi, SW Guizhou, Hainan, Sichuan, E Xizang, Yunnan [native to NE India and possibly Myanmar].

This species is a parent with *Citrus ×aurantium* of *C. ×limon* and with ?*C. hystrix* of *C. ×aurantiifolia*.

The Buddha-hand Citron (佛手 fo shou), with separated segments ± surrounded by pericarp, is best treated as a cultivar, correctly *Citrus medica* 'Fingered.'

6. *Citrus maxima* (Burman) Merrill, Interpr. Herb. Amboin. 296. 1917.

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Aurantium maximum Burman in Rumphius & Burman, Herb. Amboin. Auctuar. 7: Index [16]. 1755; *A. decumanum* (Linnaeus) Miller; *Citrus ×aurantium* Linnaeus subsp. *decumana* (Linnaeus) Tanaka; *C. ×aurantium* var. *decumana* Linnaeus; *C. ×aurantium* f. *grandis* (Linnaeus) Hiroe; *C. ×aurantium* var. *grandis* Linnaeus; *C. costata* Rafinesque; *C. decumana* (Linnaeus) Linnaeus; *C. grandis* (Linnaeus) Osbeck; *C. grandis* var. *pyriformis* (Hasskarl) Karaya; *C. grandis* var. *sabon* (Siebold ex Hayata) Hayata; ?*C. kwangsiensis* Hu; *C. medica* Linnaeus subf. *pyriformis* (Hasskarl) Hiroe; *C. obovoidea* Yu. Tanaka; *C. pampelmos* Risso; *C. pampelmos* Risso; *C. pyriformis* Hasskarl; *C. sabon* Siebold ex Hayata.

Trees. Young branches, abaxial surface of leaves, peduncles, and ovaries pilose. Branches usually purplish, flat with ridges when young. Petiole 2–4 × 0.5–3 cm or less, winged; leaf blade broadly ovate or elliptic, 9–16 × 4–8 cm or larger, thick, dark green, base rounded, apex rounded to obtuse and sometimes mucronate. Flowers solitary or in racemes; flower buds purplish or rarely milky white. Calyx 3–5-lobed. Petals 1.5–2 cm. Stamens 25–35, some undeveloped. Style long and thick. Fruit pale yellow and yellowish green, globose, oblate, pyriform, or broadly obconic, usually more than 10 cm in diam., with large prominent oil dots, to 200-seeded or seedless; pericarp spongy; sarcocarp with 10–15(–19) segments, white, pink, reddish, or rarely milky yellow. Seeds irregularly shaped, with conspicuous ridges, undeveloped seeds numerous; embryo solitary; cotyledons milky white. Fl. Apr–May, fr. Sep–Dec. $2n = 18, 36$.

Cultivated and naturalized in S China [probably native to SE Asia].

Pomelo or shaddock includes cultivars with round to obovoid fruit much favored for festival decoration as well as eating. No truly wild plants (presumably with much smaller fruit) have been seen. *Citrus maxima* is a parent with *C. reticulata* of *C. ×aurantium*.

7. *Citrus reticulata* Blanco, Fl. Filip. 610. 1837.

柑橘 gan ju

Citrus ×aurantium Linnaeus f. *deliciosa* (Tenore) Hiroe; *C. ×aurantium* var. *tachibana* Makino; *C. daoxianensis* S. W. He

& G. F. Liu; *C. deliciosa* Tenore; *C. depressa* Hayata; *C. erythroa* Yu. Tanaka; *C. madurensis* Loureiro var. *deliciosa* (Tenore) Sagot; *C. mangshanensis* S. W. He & G. F. Liu; *C. ×nobilis* Loureiro subf. *deliciosa* (Tenore) Hiroe; *C. ×nobilis* var. *deliciosa* (Tenore) Guillaumin; *C. ×nobilis* subf. *erythroa* (Yu. Tanaka) Hiroe; *C. ×nobilis* var. *major* Ker Gawler; *C. ×nobilis* var. *ponki* Hayata; *C. ×nobilis* subf. *reticulata* (Blanco) Hiroe; *C. ×nobilis* var. *spontanea* Ito; *C. ×nobilis* subf. *succosa* (Tanaka) Hiroe; *C. ×nobilis* var. *sunki* Hayata; *C. ×nobilis* subf. *tachibana* (Makino) Hiroe; *C. ×nobilis* var. *tachibana* (Makino) Ito; *C. ×nobilis* subf. *unshiu* (Marcowicz) Hiroe; *C. ×nobilis* var. *unshiu* (Marcowicz) Tanaka ex Swingle; *C. ×nobilis* var. *vangasy* (Bojer) Guillaumin; *C. ponki* Yu. Tanaka; *C. poonensis* Yu. Tanaka; *C. reticulata* var. *austera* Swingle; *C. reticulata* subsp. *deliciosa* (Tenore) Rivera et al.; *C. reticulata* subsp. *tachibana* (Tanaka) Rivera et al.; *C. reticulata* subsp. *unshiu* (Marcowicz) Rivera et al.; *C. succosa* Tanaka; *C. suhuiensis* Hayata; *C. sunki* Tanaka; *C. tachibana* (Makino) Yu. Tanaka; *C. tachibana* subf. *depressa* (Hayata) Hiroe; *C. tachibana* subf. *ponki* (Hayata) Hiroe; *C. tachibana* subf. *suhuiensis* (Hayata) Hiroe; *C. tachibana* subf. *sunki* (Hayata) Hiroe; *C. tangerina* Yu. Tanaka; *C. tankan* Hayata; *C. unshiu* Marcowicz; *C. vangasy* Bojer.

Small trees. Branchlets numerous, with few spines. Leaves 1-foliolate; leaf blade lanceolate, elliptic, or broadly ovate, basal articulated part to leaf blade usually narrow or only a remnant, midvein furcate near apex, margin apically obtusely crenulate or rarely entire, apex emarginate. Flowers solitary to 3 in a fascicle. Calyx irregularly 3–5-lobed. Petals usually 1.5 cm or less. Sta-

mens 20–25. Style long, slender; stigma clavate. Fruit pale yellow, orange, red, or carmine, oblate to subglobose, smooth or coarse; pericarp very thin to thick, easily removed; sarcocarp with 7–14 segments or rarely more, sweet to acidic and sometimes bitter, with few to many seeds or rarely seedless; pulp vesicles plump, short, rarely slender and long. Seeds usually ovoid, base rounded, apex narrow and acute; embryos numerous, rarely solitary; cotyledons dark green, pale green, or milky white; chalaza purple. Fl. Apr–May, fr. Oct–Dec. $2n = 18, 27, 36$.

Extensively cultivated in China S of the Qin Ling [possibly native to SE China and/or S Japan (see below)].

Tangerine or mandarin orange is the parent with *Citrus maxima* of *C. ×aurantium*, with *C. japonica* of *C. ×microcarpa*, and possibly with *C. cavaleriei* of *C. ×junos*. The recently recognized subspecies are perhaps better considered as cultivar groups to which most of the synonyms would be referred. However, some names in the synonymy may be referable to those cultivars of *C. ×aurantium* that are repeated backcrosses with *C. reticulata*. Trees referred to *C. tachibana* may represent true wild forms and have the following characteristics:

Trees to 3 m tall. Branchlets numerous, with short spines. Petiole 8–10 mm, very narrowly winged; leaf blade elliptic, 6–7 × 3.5–4 cm, secondary veins inconspicuous, base broadly cuneate, margin crenulate, apex narrow, obtuse, and conspicuously emarginate. Flowers solitary, 1.2–1.4 cm in diam.; flower buds subglobose. Pedicel ca. 2 mm. Petals white. Stamens ca. 20. Fruit yellow, oblate, 2–2.5 × 2.5–3.4 cm, smooth; pericarp 1.5–2 mm thick; sarcocarp with 7–9 segments, yellow, very acidic and bitter, 5- or 6-seeded. Seeds broadly ovoid, ca. 1 cm; seed coat smooth; embryos numerous; cotyledons greenish.

Hillside forests; low elevations. Taiwan [Japan (Ryukyu Islands)].

Hybrid taxa sometimes naturalized in China

8. *Citrus ×aurantiifolia* (Christmann) Swingle, J. Wash. Acad. Sci. 3: 465. 1913 [*“aurantiifolia”*], pro sp.

来檬 lai meng

Limonia ×aurantiifolia Christmann, Vollst. Pflanzensyst. 1: 618. 1777 [*“aurantiifolia”*], pro sp.; *Citrus ×acida* Persoon; *C. ×aurantiifolia* subsp. *murgetana* Garcia Lidón et al.; *C. ×aurantium* Linnaeus subsp. *aurantiifolia* (Christmann) Guillaumin; *C. ×aurantium* var. *proper* Guillaumin; *C. hystrix* Candolle subsp. *acida* Engler; *C. ×javanica* Blume; *C. ×lima* Macfadyen; *C. medica* Linnaeus subf. *aurantiifolia* (Christmann) Hiroe.

Small trees. Branchlets numerous and irregular, with short stout spines. Leaves slightly stiff with a short, conspicuous petiole; leaf blade broadly ovate to elliptic, 5–8 × 2–4 cm, base rounded, margin crenulate, apex obtuse and sometimes mucronate. Inflorescences with ca. 7 flowers or rarely flowers solitary. Calyx cup-shaped; lobes 4 or 5. Petals (4 or)5, white, 1–1.2 cm, rather thick. Stamens 20–25. Ovary globose; style short, ± as long as stigma; stigma large. Fruit greenish yellow, globose, ellipsoid, or obovoid, usually 4–5 cm in diam., smooth, with prominent oil glands, apex with a papilla; pericarp thin; sarcocarp with 9–12 segments, very acidic. Seeds few, ovoid; seed coat smooth; cotyledons milky white. Fl. Apr–May, fr. Sep–Dec. $2n = 18, 27$.

Trailsides; low elevations. Occasionally naturalized in Yunnan.

As a common name, lime covers a number of different *Citrus* species and hybrid species. Those referred to as *C. ×aurantiifolia* are hybrids involving *C. medica* and possibly *C. hystrix*.

9. *Citrus ×limon* (Linnaeus) Osbeck, Reis Ostindien China, 250. 1765 [*“limonia”*], pro sp.

柠檬 ning meng

Citrus medica Linnaeus var. *limon* Linnaeus, Sp. Pl. 2: 782. 1753; *C. ×aurantium* Linnaeus subsp. *bergamia* (Risso) Engler; *C. ×aurantium* var. *bergamia* (Risso) Brandis; *C. ×aurantium* var. *mellarosa* (Risso) Engler; *C. ×bergamia* Risso; *C. ×bergamia* subsp. *mellarosa* (Risso) Rivera et al.; *C. ×bergamota* Rafinesque; *C. ×limodulcis* Rivera et al.; *C. ×limonum* Risso; *C. medica* Linnaeus f. *limon* (Linnaeus) Hiroe; *C. medica* subsp. *limonum* (Risso) J. D. Hooker; *C. medica* var. *limonum* (Risso) Brandis; *C. ×mellarosa* Risso; *C. ×meyer* Yu. Tanaka; *Limonia ×vulgaris* Ferrarius ex Miller (1754), not *C. ×vulgaris* Risso (1813).

Small trees. Branches ± spiny. Young leaves and flower buds reddish purple. Leaf blade ovate to elliptic, 8–14 × 4–6 cm, margin conspicuously crenulate, apex usually mucronate. Flowers solitary or several in fascicles. Flowers bisexual or male by ± complete abortion of pistil. Calyx cup-shaped; lobes 4 or 5. Petals 1.5–2 cm, outside purplish, inside white. Stamens 20–25 or more. Ovary subcylindric or barrel-shaped; stigma clavate.

Fruit yellow, ellipsoid to ovoid, narrowed at both ends, surface usually coarse and lemon scented, apex usually with a mamilla; pericarp thick, difficult to remove; sarcocarp in 8–11 segments, pale yellow, acidic. Seeds ovoid, small, apex acute; seed coat smooth; embryo usually solitary but sometimes numerous; cotyledons milky white. Fl. Apr–May, fr. Sep–Nov. $2n = 18, 36$.

Cultivated and sometimes naturalized in S China.

The parents of the lemon are *Citrus ×aurantium* and *C. medica*. Backcrosses with either parent give a range of sour to sweet lemons which go under various names and perhaps would best be considered as forming cultivar groups, e.g., Bergamot Group. The rough lemon, *C. ×taitensis* Risso (*C. ×aurantium* subsp. *jambhiri* Engler; *C. ×jambhiri* Lushington; *C. ×sinensis* subsp. *jambhiri* (Lushington) Engler), sometimes included here, is perhaps *C. medica* × *C. reticulata*.

The name "*Citrus limonia*" has been misapplied to other *Citrus* taxa.

10. *Citrus ×aurantium* Linnaeus, Sp. Pl. 2: 782. 1753, pro sp.

酸橙 suan cheng

Aurantium ×acre Miller; *A. ×corniculatum* Miller; *A. ×distortum* Miller; *A. ×humile* Miller; *A. ×myrtifolium* Descourtiz; *A. ×sinense* Miller; *A. ×vulgare* (Risso) M. Gómez; *Citrus ×amara* Link; *C. ×aurantium* subsp. *amara* Engler; *C. ×aurantium* var. *bigaradia* (Loiseleur) Brandis; *C. ×aurantium* var. *crassa* Risso; *C. ×aurantium* var. *daidai* Makino; *C. ×aurantium* var. *dulcis* Hayne; *C. ×aurantium* var. *fetifera* Risso; *C. ×aurantium* var. *lusitanica* Risso; *C. ×aurantium* var. *myrtifolia* Ker Gawler; *C. ×aurantium* subf. *nobilis* (Loureiro) Hiroe; *C. ×aurantium* var. *sanguinea* Engler; *C. ×aurantium* subf. *sinensis* (Linnaeus) Hiroe; *C. ×aurantium* subsp. *sinensis* (Linnaeus) Engler; *C. ×aurantium* var. *sinensis* Linnaeus; *C. ×aurantium* subsp. *suntara* Engler; *C. ×aurantium* var. *vulgaris* (Risso) Risso & Poiteau; *C. ×aurata* Risso; *C. ×bigaradia* Loiseleur; *C. ×changshan-huyou* Y. B. Chang; *C. ×communis* Poiteau & Turpin; *C. decumana* (Linnaeus) Linnaeus var. *paradisi* (Macfadyen) H. H. A. Nicholls; *C. ×dulcis* Persoon; *C. ×florida* Salisbury; *C. ×humilis* (Miller) Poiré; *C. maxima* (Burman) Merrill var. *uvacarpa* Merrill; *C. ×myrtifolia* (Ker Gawler) Rafinesque; *C. ×paradisi* Macfadyen; *C. ×sinensis* (Linnaeus) Osbeck; *C. ×sinensis* var. *brassiliensis* Tanaka; *C. ×sinensis* subsp. *crassa* (Risso) Rivera et al.; *C. ×sinensis* subsp. *fetifera* (Risso) Rivera et al.; *C. ×sinensis* subsp. *lusitanica* (Risso) Rivera et al.; *C. ×sinensis* var. *sanguinea* (Engler) Engler; *C. ×sinensis* var. *sekkon* Hayata; *C. ×sinensis* subsp. *suntara* (Engler) Engler; *C. ×taiwanica* Tanaka & Shimada; *C. ×tangelo* Ingram & H. E. Moore; *C. ×vulgaris* Risso.

Small trees. Branches with spines up to ca. 8 cm. Petiole obovate, 1–3 × 0.6–1.5 cm, base narrow; leaf blades dark green, thick. Inflorescences racemes, with few flowers or flowers solitary. Flowers perfect or male by ± complete abortion of pistil; buds ellipsoid to subglobose. Calyx lobes 4 or 5. Petals 2–3.5 mm in diam. Stamens 20–25, usually basally connate into bundles. Fruit orange to reddish, globose to obovate, surface coarse; pericarp thick, sometimes difficult to remove; sarcocarp with 10–13 segments, acidic and sweet or sometimes bitter. Seeds numerous, large, with ridges; embryo(s) solitary to numerous; cotyledons milky white. Fl. Apr–May, fr. Sep–Dec. $2n = 18$.

Cultivated and sometimes naturalized in most of China S of the Qin Ling.

Oranges and grapefruit are *Citrus maxima* × *C. reticulata* and the backcrosses with the parental species. Many of these hybrids arose in China, although others were synthesized, especially in the U.S.A., and introduced in China. The cultivars can be arranged in groups: Sour Orange Group (the sour or bitter orange most like the original cross), Sweet Orange Group (the commercially most important being backcrosses with *C. reticulata*), and Grapefruit Group (representing backcrosses with *C. maxima* and first being made in the Caribbean).

Sweet Orange Group

Petiole long and narrow; leaf blade ovate, ovate-elliptic, or rarely lanceolate, 6–10 × 3–5 cm or larger. Calyx lobes 3–5. Petals white or rarely purplish, 1.2–1.5 cm. Style stout; stigma large. Fruit orangish yellow to orangish red, globose, depressed globose, or ellipsoid; sarcocarp with 9–12 segments, yellow, orange, or purplish, sweet or slightly acidic. Seeds few or absent; seed coat slightly ridged; embryos numerous; cotyledons milky white. Fl. Mar–Jun, fr. Oct–Dec but some cultivars Feb–Apr. $2n = 18, 27, 36, 45$.

Below 1500 m. Cultivated S of the Qin Ling, as far NW as SE Gansu and as far SW as SE Xizang.

Grapefruit Group

Branches glabrous. Leaves similar to those of *Citrus maxima* but leaf blade smaller and narrower, midvein ciliate. Flowers smaller than those of *C. maxima*. Calyx lobes glabrous. Fruit yellow, depressed globose to globose, smaller than those of *C. maxima*; pericarp thin; sarcocarp with 12–15 segments, yellowish white or pink, tender, juicy, slightly fragrant and acidic. Seeds few or absent; embryos numerous. Fr. Oct–Nov. $2n = 18, 20, 27, 36$.

11. *Citrus ×junos* Siebold ex Tanaka, Sieb. Sens. Tor. Hy-akun. Kin. Ronbunshu, 65. 1924.

香橙 xiang cheng

Citrus ×aurantium Linnaeus subsp. *junos* (Siebold ex Tanaka) Makino; *C. ×hsiangyuan* Tanaka; *C. medica* subf. *junos* (Siebold ex Tanaka) Hiroe; ?*C. sechen* Kokaya; *C. sechen* subsp. *sjanshen* Kokaya; ?*C. ×wilsonii* Tanaka.

Small trees. Branches often with long stout spines; branchlets, leaves, and petioles sparsely pubescent when young. Petiole obovate-elliptic, 1–2.5 × 0.4–1.5 cm, base cuneate, apex rounded to obtuse; leaf blade ovate to lanceolate, 2.5–8 × 1–4 cm, thickly papery, base rounded to obtuse, margin apically finely dentate or rarely entire, apex acuminate, mucronate, or often obtuse and emarginate. Flowers solitary, shortly pedicellate. Calyx cup-shaped; lobes 4 or 5, broadly ovate, apex acute. Petals white, sometimes outside purplish, 1–1.3 cm. Stamens 20–25. Style ca. 2 × as long as ovary. Fruit pale yellow, obovate to nearly pyriform, 4–8 cm in diam., surface coarse and with large oil dots, apex grooved; pericarp 2–4 mm thick, easily removed; sarcocarp with 9–11 segments, pale yellowish white, very acidic and bitter. Seeds ca. 40, broadly ovoid, smooth; cotyledons milky white; embryo(s) solitary to numerous. Fl. Apr–May, fr. Oct–Nov.

Cultivated and sometimes naturalized. S Anhui, S Gansu, Guizhou, Hubei, Hunan, S Jiangsu, S Shaanxi, Sichuan, Yunnan, Zhejiang.

The parents of this hybrid species are possibly *Citrus cavaleriei* and *C. reticulata*.

Additional Hybrid Taxa Cultivated to a Limited Extent in China

Citrus ×microcarpa Bunge, Enum. Pl. China Bor. 10. 1833.

×*Citrofortunella microcarpa* (Bunge) Wijnands; ×*C. mitis* (Blanco) J. Ingram & H. E. Moore; *Citrus* ×*mitis* Blanco.

Calamondin or calamansi is hybrid between *Citrus reticulata* and *C. japonica*.

Citrus ×latifolia (Tanaka ex Yu. Tanaka) Tanaka, Kwaju Bunruigaku [Systematic Pomology], 140. 1951.

Citrus ×*aurantiifolia* (Christmann) Swingle var. *latifolia* Tanaka ex Yu. Tanaka, Iconogr. Jap. Citrus Fruits 1: 57. 1946; *C. ×aurantiifolia* subsp. *latifolia* (Tanaka ex Yu. Tanaka) S. Ríos et al.

Seedless lime is a hybrid between *Citrus ×aurantiifolia* and possibly *C. ×limon*.

Citrus ×floridana (J. Ingram & H. E. Moore) Mabberley, Telopea 7: 337. 1998.

×*Citrofortunella floridana* J. W. Ingram & H. E. Moore, Baileya 19: 170. 1975.

Limequat is a hybrid between *Citrus japonica* and *C. ×aurantiifolia*.

Citrus ×georgiana Mabberley, Blumea 49: 490. 2004.

Citranglequat is a hybrid between *Citrus ×insitorum* and *C. japonica*.

Citrus ×insitorum Mabberley, Gard. Bull. Singapore 54: 193. 2002.

×*Citroncirus webberi* J. Ingram & H. E. Moore, Baileya 19: 171. 1975, not *Citrus ×webberi* Wester (1915).

Citrangle, a hybrid between *Citrus ×aurantium* and *C. trifoliata*, is widely grown in China as a rootstock.

Doubtful Taxa

Citrus ×polytrifolia Govaerts, World Checkl. Seed Pl. 3(1): 15. 1999.

富民枳 fu min zhi

Poncirus ×polyandra S. Q. Ding et al., Acta Bot. Yunnan. 6: 292. 1984, not *Citrus polyandra* Tanaka (1928).

Trees to 2.5 m tall, evergreen. Young branches green, triangular but becoming cylindrical with age. Leaves palmately 3-foliolate; petiole 1–2 cm, narrowly winged; lateral leaflet blades 2.7–3.8 × 0.7–1.7 cm; central leaflet blade 3.5–5 × 0.9–1.4 cm, dark green, base cuneate, margin sinuate crenulate, apex mucronate. Flower solitary, 6.4–7 cm in diam. Pedicel 3–7 cm, ca. 2 mm in diam. Calyx lobes 5, broadly ovate, ca. 7 × 5 mm. Petals white, 5–9, 3.2–3.4 × 1.6–1.9 cm, broadly elliptic, lanuginous with more trichomes especially at margins. Stamens 35–43; filaments ca. 4 mm, distinct; anthers yellow with milky white subpellucid dots. Ovary oblate, ca. 6 mm in diam., lanuginous, 10-loculed; style ca. 2 mm; stigma green, clavate, ca. 2 mm, apex emarginate. Fruit green, oblate, lanuginous when young. Fl. Mar–Apr, fr. Aug–Sep.

- Forests on mountain slopes; ca. 2400 m. SE Yunnan (Funing).

This appears to be a *Citrus trifoliata* hybrid with another *Citrus*

species. Such hybrids are commonly found where the parents are grown together.

Fortunella bawangica C. C. Huang, Guihaia 11: 8. 1991.

霸王金橘 ba wang jin ju

Trees to 4 m tall. Young branches flat; spines ca. 4 cm. Petiole 3–5(–17) mm; leaf blade elliptic to ovate, (2–)4–7(–10) × (1–)2–3 cm, base rounded to obtuse, margin conspicuously crenulate on basal half, apex rounded. Flowers solitary. Pedicel ca. 5 mm but ca. 1 cm in fruit. Calyx lobes ca. 1 mm. Petals elliptic to lanceolate, ca. 7 mm. Stamens 20–25; filaments cohering into bundles; anthers mostly fertile. Ovary ovoid, 5–7-loculed, with 1 or 2 ovules per locule; style short; stigma clavate. Fruit pyriform, 2.2–2.5 × 1.8–2.2 cm, 1- or 2-seeded; carpodium ca. 2 mm thick. Seeds ovoid, base rounded, apex acute; seed coat smooth; embryo solitary; cotyledons green.

- Scrub; ca. 1200 m. Hainan.

Recent field studies show that populations morphologically in accordance with *Fortunella bawangica* are widely distributed in Hainan Island. The only character that can be used to distinguish this entity from typical wild populations of *Citrus japonica* is its pear-shaped fruit. Further study is needed to ascertain whether *F. bawangica* is a separate species or only a geographical race of *C. japonica*.

22. AEGLE Corrêa, Trans. Linn. Soc. London 5: 222. 1800, nom. cons.

木橘属 mu ju shu

Zhang Dianxiang (张奠湘); Thomas G. Hartley

Trees, deciduous, with straight axillary spines. Leaves alternate, odd-pinnately (1 or)3(or 5)-foliolate. Inflorescences terminal and axillary, loosely fasciculate or racemose and few flowered or flowers solitary. Flowers bisexual, fragrant. Calyx cup-shaped, 4- or 5-lobed. Petals 4 or 5, imbricate in bud. Stamens 30–50 or more; filaments short, subulate, distinct or irregularly coherent at base; anthers linear-lanceolate. Disk columnar or bell-shaped. Gynoecium 8–20-loculed, syncarpous; ovules many per locule, in 2 rows;

style short and thick; stigma capitate, cylindric, or bluntly conic, longitudinally grooved. Fruit a berry, globose to ellipsoid to pyriform; exocarp thin, parenchymatous; mesocarp woody; endocarp fleshy, soft and pulpy, becoming hard and reddish orange when dry, composed largely of elongate sessile pulp vesicles which are lacking within seed locules. Seeds depressed ovoid, woolly when ripe, embedded in a clear glutinous substance that becomes hard when dry; seed coat fleshy; endosperm lacking; embryo solitary, straight; cotyledons ovate, plano-convex; hypocotyl partly included between cotyledons.

One species: native to India, cultivated in China.

1. *Aegle marmelos* (Linnaeus) Corrêa, Trans. Linn. Soc. London 5: 223. 1800.

木橘 mu ju

Crateva marmelos Linnaeus, Sp. Pl. 1: 444. 1753.

Trees to 10 m tall; spines to 3 cm. Leaflet blades ovate to elliptic, 4–12 × 2–6 cm, base rounded to narrowly cuneate, margin crenulate, apex acuminate or sometimes acute. Calyx

lobes ca. 1 mm. Petals white, ca. 1 cm. Stamens nearly as long as petals. Gynoecium ca. 6 mm. Fruit greenish yellow, 10–12 × 6–8 cm; mesocarp ca. 3 mm thick. Seeds ca. 8 mm. Fr. Oct. $2n = 18, 36$.

Cultivated in forests on slightly dry hillsides; 600–1000 m. S and SW Yunnan [native to India].

This species is used medicinally.