

45. POLYGONATUM Miller, Gard. Dict. Abr., ed. 4, [1109]. 1754.

黄精属 *huang jing shu*

Chen Xinqi (陈心启 *Chen Sing-chi*); Minoru N. Tamura

Herbs perennial, rhizomatous, sympodial, usually terrestrial, rarely epiphytic. Stem erect, arching, or sometimes ± scandent, simple. Leaves cauline, lateral and pseudoterminal, alternate, opposite, or whorled, sessile or shortly petiolate, sometimes cirrose at apex. Inflorescences axillary, umbel-, corymb-, or racemelike, or a solitary flower; bracts present or absent, when present herbaceous, membranous, or scarios, persistent or caducous. Flowers bisexual, usually pendulous, rarely erect; pedicel articulate at apex. Perianth segments 6, valvate, connate proximally and forming a tube usually for at least 1/2 their length. Corona absent. Stamens 6; filaments proximally adnate to perianth tube, free part filiform or flattened, short to long, smooth, papillose or hairy; anthers basifixed to dorsifixed and versatile, introrse, base 2-lobed. Ovary 3-loculed; ovules 2–8 per locule. Style slender; stigma 3-lobed, small. Fruit a berry, globose, several to more than 10-seeded. Seeds subglobose.

About 60 species: temperate regions of the N hemisphere, mainly from the Himalayas to Japan; 39 species (20 endemic) in China.

- 1a. Bracts ovate to lanceolate, 1–3.5 cm, herbaceous, usually 7- or more veined.
 - 2a. Perianth 3.5–5 mm; rhizome tuberous terete, 15–20 mm thick 4. *P. leiboense*
 - 2b. Perianth 11–25 mm; rhizome terete or ± moniliform, 3–6 mm thick, slender.
 - 3a. Plants laxly pubescent except basal part of stem and flowers; inflorescences 3- or 4-bracteate 3. *P. megaphyllum*
 - 3b. Plants glabrous; inflorescences (1 or)2-bracteate.
 - 4a. Bracts borne at base of pedicel, ovate to broadly ovate-elliptic, 2–3.5 × 1–3 cm; filaments papillose 1. *P. involucratum*
 - 4b. Bracts borne near apex of pedicel, lanceolate to oblong-lanceolate, to 2 × 0.3–0.6 cm; filaments smooth 2. *P. desoulavyi*
- 1b. Bracts subulate to linear-lanceolate, rarely to 1.2 cm, membranous, scarios, or subherbaceous with scarios margin, 1–5-veined, or veinless, or bracts absent.
 - 5a. Plants hirsutulous except flowers 27. *P. hirtellum*
 - 5b. Plants glabrous, or sometimes scabridulous, papillose, or hirsutulous on stem (glabrous on leaves).
 - 6a. Leaves mostly opposite or whorled.
 - 7a. Perianth (15–)18–25 mm.
 - 8a. Plants large, usually 1–3 m tall; leaves whorled, strongly cirrose at apex; perianth lobes 3–5 mm 17. *P. kingianum*
 - 8b. Plants small, less than 10 cm tall; leaves crowded, or alternate on proximal part of stem, straight at apex; perianth lobes 6–10 mm 18. *P. hookeri*
 - 7b. Perianth 5–12(–15) mm.
 - 9a. Filaments 5–7 mm 28. *P. wardii*
 - 9b. Filaments 0.5–3(–4) mm.
 - 10a. Ovary 4–7 mm; anthers 3–4 mm.
 - 11a. Leaves mostly whorled; pedicel of ripe berry ascending 26. *P. tessellatum*
 - 11b. Leaves mostly opposite; pedicel of ripe berry reflexed.
 - 12a. Leaves strongly cirrose at apex 25. *P. longistylum*
 - 12b. Leaves straight at apex.
 - 13a. Filaments dilated and saccate apically 23. *P. cathcartii*
 - 13b. Filaments not dilated apically.
 - 14a. Style 2–3 × as long as ovary; leaves sessile, linear-lanceolate, papery 24. *P. griffithii*
 - 14b. Style slightly longer than ovary; leaves petiolate, petiole ca. 5 mm, leaf blade ovate-oblong to ovate-lanceolate, subleathery 22. *P. oppositifolium*
 - 10b. Ovary 1.5–3 mm; anthers 1–3(–3.5) mm.
 - 15a. Leaves cirrose or curved at apex.
 - 16a. Style long, 1.5–2 × as long as ovary 36. *P. sibiricum*
 - 16b. Style short, subequaling ovary.
 - 17a. Inflorescences 2–6(–11)-flowered; bracts (1–)2–6 mm, scarios or subherbaceous with scarios margin, 1-veined 39. *P. zanlanscianense*
 - 17b. Inflorescences (1 or)2-flowered; bracts 1–2 mm, scarios, veinless, or bracts absent.
 - 18a. Leaves flaccid, apex usually cirrose at anthesis 37. *P. cirrhifolium*

- 18b. Leaves stiff, ± leathery, apex hooked at anthesis 38. *P. stewartianum*
- 15b. Leaves straight at apex.
- 19a. Leaves ± reflexed at anthesis 32. *P. curvistylum*
- 19b. Leaves horizontal or ascending.
- 20a. Leaves elliptic to oblong-lanceolate, 2–6 cm; flowers 6–8 mm; plants small, 8–30 cm tall.
- 21a. Leaves alternate or opposite, often in whorls of 3 in apical part of stem, apex subobtusate to acute; peduncle 2–6 mm; pedicels (2–)5–6 mm 31. *P. prattii*
- 21b. Leaves in whorls of 3–6, rarely also scattered between whorls, apex acuminate; peduncle 10–20 mm; pedicels 1–2 mm 33. *P. gracile*
- 20b. Leaves oblong-lanceolate to linear, 6–12 cm; flowers 8–12 mm; plants large, (20–)40–110 cm tall.
- 22a. Peduncle 2–4 mm 34. *P. stenophyllum*
- 22b. Peduncle 10–20 mm.
- 23a. Rhizome usually tuberous terete, very rarely moniliform, 7–15 mm thick 30. *P. verticillatum*
- 23b. Rhizome terete, 3–5 mm thick 35. *P. roseum*
- 6b. Leaves alternate or mostly so.
- 24a. Perianth 6–9(–11) mm.
- 25a. Perianth tube short, 1–3 mm, markedly shorter than lobes.
- 26a. Leaves 2.3–3.6 cm wide, apex straight; peduncle obsolete; plants small, 17–45 cm tall 21. *P. altelobatum*
- 26b. Leaves 0.8–1.7 cm wide, apex strongly cirrose; peduncle 1–1.5 cm; plants large, 80–170 cm tall 29. *P. alternicirrhosum*
- 25b. Perianth tube long, 4.5–6 mm, markedly longer than lobes.
- 27a. Stem hirsutulous; peduncle 2.5–5 cm 20. *P. longipedunculatum*
- 27b. Stem glabrous or papillose distally; peduncle 0.2–1.2 cm.
- 28a. Rhizome ± moniliform, 10–15 mm thick; leaves ± acuminate at apex; perianth ± urceolate; peduncle 5–12 mm; plants usually epiphytic 19. *P. punctatum*
- 28b. Rhizome terete, 3–5 mm thick; leaves subobtusate to acute at apex; perianth cylindrical; peduncle 2–6 mm; plants terrestrial 31. *P. prattii*
- 24b. Perianth (13–)14–30 mm.
- 29a. Rhizome gingerlike, moniliform or nearly so, with annual knots swollen; annual elongation (distance between knots) short.
- 30a. Filaments spurred apically; pedicel with a basal bract ca. 5 mm 12. *P. franchetii*
- 30b. Filaments usually not spurred apically; pedicel with a small, basal bract 1–2 mm or ebracteate.
- 31a. Leaves shortly pubescent abaxially; peduncle 3–8 cm, very slender 13. *P. filipes*
- 31b. Leaves glabrous abaxially; peduncle 1–4(–6) cm, relatively thick.
- 32a. Rhizome 5–7 mm thick; inflorescences 1- or 2-flowered; leaves 5–9 16. *P. nodosum*
- 32b. Rhizome 8–25 mm thick; inflorescences (1 or)2–7(–14)-flowered; leaves 10–23.
- 33a. Filaments thickened distally, slightly compressed or saccate-convex apically, 3–4 mm, papillose or pubescent 14. *P. cyrtoneura*
- 33b. Filaments thickened proximally, filiform apically, 5–10 mm, often wholly smooth, sometimes basally slightly verruculose 15. *P. arisanense*
- 29b. Rhizome terete; annual elongation long.
- 34a. Leaves long petiolate, petiole 5–15 mm; perianth tube often with short, cottony hairs inside.
- 35a. Bracts 8–12 mm, 3–5-veined; leaves 5–9, 7–9 cm wide, abaxially glaucous; rhizome 6–10 mm thick 5. *P. inflatum*
- 35b. Bracts absent to 8 mm, veinless or 1-veined; leaves 4 or 5, 1.8–3.5 cm wide, abaxially not glaucous; rhizome 3–4 mm thick 6. *P. acuminatifolium*
- 34b. Leaves sessile or shortly petiolate, petiole to 5 mm; perianth tube not pubescent inside.
- 36a. Leaves hispidulous abaxially 7. *P. humile*
- 36b. Leaves glabrous abaxially.
- 37a. Peduncle not adnate to stem proximally.
- 38a. Peduncle 3–5 cm; inflorescences (3–)5–12(–17)-flowered 11. *P. macropodium*
- 38b. Peduncle usually 1–1.5 cm; inflorescences 1–4(–8)-flowered 8. *P. odoratum*
- 37b. Peduncle adnate to stem proximally (2–15 mm).
- 39a. Perianth 14–16 mm; filaments glabrous 9. *P. adnatum*

39b. Perianth 20–25 mm; filaments densely white villous 10. *P. omeiense*

1. *Polygonatum involucratum* (Franchet & Savatier) Maximowicz, Mélanges Biol. Bull. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 11: 844. 1883.

二苞黄精 er bao huang jing

Periballanthus involucratum Franchet & Savatier, Enum. Pl. Jap. 2: 524. 1878; *Polygonatum platyphyllum* Franchet.

Rhizome terete, 3–5 mm thick, slender. Stem arching, 20–50 cm, glabrous. Leaves 4–7, alternate; petiole short or indistinct; leaf blade broadly elliptic to ovate, usually 5–10 × 3–6 cm, glabrous, base rounded or tapering, apex acute to shortly acuminate. Inflorescences 2-flowered; peduncle 1–2 cm, glabrous; bracts 2, borne at base of pedicel, ovate to broadly ovate-elliptic, 2–3.5 × 1–3 cm, leaflike, 7- or more veined, persistent. Flowers pendulous; pedicel 1–2 mm, glabrous. Perianth greenish white, cylindrical, 2.3–2.5 cm; lobes ca. 3 × 2 mm. Filaments ± compressed, 2–4 mm, papillose; anthers 3–5 mm. Ovary ca. 5 mm. Style 1.8–2 cm, slightly exerted. Berries ca. 1 cm in diam., 7- or 8-seeded. Fl. May–Jun, fr. Aug–Sep. $2n = 18^*$, (20, 22).

Forests, shaded and moist slopes; 700–1400 m. Hebei, Heilongjiang, Henan, Jilin, Liaoning, ?Nei Mongol, ?S Shaanxi (Qin Ling), Shanxi [Japan, Korea, Russia (Far East)].

Polygonatum cryptanthum H. Léveillé & Vaniot (Repert. Spec. Nov. Regni Veg. 5: 282. 1908), from small islands between Korea and Japan (Kyushu), is often considered to be conspecific with *P. involucratum* (e.g., by Jeffrey, Kew Bull. 34: 435–471. 1980). However, the former differs from the latter in its papillose peduncle, pedicels, and abaxial leaf and bract surfaces, shape and size of flowers, shape of filaments, and length of style in relation to perianth. In this treatment, *P. cryptanthum* is regarded as an independent species and is excluded from the synonymy of *P. involucratum*.

2. *Polygonatum desoulavyi* Komarov in Komarov & Alissova-Klobukova, Key Pl. Far East. USSR 1: 378. 1931.

长苞黄精 chang bao huang jing

Rhizome terete, ca. 3 mm thick, slender. Stem erect, 20–30 cm. Leaves alternate, elliptic to ovate, 6–8 cm, prominently 3–5-veined, apex acute to shortly acuminate. Inflorescences (1 or) 2-flowered; peduncle glabrous; bracts (1 or) 2, borne near apex of pedicel, lanceolate to oblong-lanceolate, to 2 × 0.3–0.6 cm, herbaceous, persistent. Flowers pendulous; pedicel glabrous. Perianth white, cylindrical, ca. 2.3 cm. Filaments ± compressed, smooth. $2n = 18$.

Forests; ca. 600 m. Heilongjiang [Korea, Russia (Far East)].

Further research is needed to determine whether or not *Polygonatum mediobracteatum* Ohwi (J. Jap. Bot. 13: 443. 1937) should be included within *P. desoulavyi*.

3. *Polygonatum megaphyllum* P. Y. Li, Acta Phytotax. Sin. 11: 252. 1966.

大苞黄精 da bao huang jing

Rhizome ± moniliform or terete, 3–6 mm thick. Stem arching, 15–30 cm, laxly pubescent except basally. Leaves 5 or 6, alternate; petiole very short; leaf blade narrowly ovate to

ovate-elliptic, 3.5–8 × 2.3–4.6 cm, both surfaces pubescent, base rounded, apex acuminate. Inflorescences usually 2-flowered; peduncle 4–6 mm, pubescent; bracts 3 or 4, borne at apex of peduncle, ovate or ovate-lanceolate, 1–2 × 0.5–1.2 cm, leaflike, 7- or more veined, pubescent, persistent. Flowers pendulous; pedicel 1–2 mm. Perianth pale green, cylindrical, 1.1–1.9 cm; lobes ca. 3 × 2 mm. Filaments slightly compressed to filiform, 4–5 mm, basally slightly verruculose, apically smooth; anthers 3–4 mm. Ovary 3–4 mm. Style 6–11 mm, usually slightly exerted. Fl. May–Jun. $2n = 22^*$.

• Forests, grassy slopes; 1700–2500 m. Gansu, Hebei, Shaanxi, Shanxi, Sichuan.

4. *Polygonatum leiboense* S. C. Chen & D. Q. Liu, Acta Phytotax. Sin. 22: 417. 1984.

雷波黄精 lei bo huang jing

Rhizome tuberous terete, 1.5–2 cm thick. Stem erect, to 1 m, glabrous. Leaves many, alternate or occasionally also opposite; petiole 5–10 mm; leaf blade oblong-lanceolate to lanceolate, (6–)9–11 × 1.5–2.2 cm, prominently 7-veined, glabrous, base tapering, apex long acuminate and obtuse tipped. Inflorescences umbel-like, 2- or 3-flowered; peduncle to 6 cm; bracts 2–4, oblong-lanceolate, 1–2 cm × 3–6 mm, leaflike, 7- or more veined, persistent. Pedicel 1–2 mm. Perianth greenish, cylindrical, 3.5–5 × ca. 2 mm; lobes oblong-ovate, ca. 2 × 1.5 mm, slightly shorter than or subequaling tube, apex penicillate-papillose adaxially. Filaments very short, ca. 0.3 mm, smooth; anthers suboblong, ca. 2 mm. Style slightly thickened, ca. 2 mm. Fl. May.

• About 2000 m. S Sichuan (Leibo Xian).

5. *Polygonatum inflatum* Komarov, Trudy Imp. S.-Peterburgsk. Bot. Sada 18: 442. 1901.

毛筒玉竹 mao tong yu zhu

Polygonatum inflatum var. *rotundifolium* Hatusima; *P. virens* Nakai.

Rhizome terete, 6–10 mm thick. Stem arching, 50–80 cm, glabrous. Leaves 5–9, alternate; petiole 0.5–1.5 cm; leaf blade ovate to broadly elliptic, 8–16 × 7–9 cm, glabrous, abaxially glaucous, base rounded, apex obtuse to shortly acuminate. Inflorescences 2- or 3-flowered; peduncle 2–4 cm; bracts 2 or 3, borne at base of pedicel, linear-lanceolate, 8–12 × 1.5–3 mm, membranous, 3–5-veined, caducous. Flowers pendulous; pedicel 4–6 mm. Perianth pale green, campanulate-cylindrical, slightly constricted near mouth, 1.8–2.3 cm × 5–6 mm; lobes 2–3 × 3–4 mm. Filaments ± compressed, ca. 4 mm, free part cottony with uniseriate, short hairs; anthers ca. 4 mm. Ovary ca. 5 mm. Style ca. 1.5 cm, scarcely exerted. Berries blue-black, 1–1.2 cm in diam., 9–13-seeded. Fl. May–Jul, fr. Aug–Sep. $2n = 22^*$.

Forests, forest margins; near sea level to 1000 m. Heilongjiang, Jilin, Liaoning [Japan, Korea].

6. *Polygonatum acuminatifolium* Komarov, Izv. Imp. Bot. Sada Petra Velikago 16: 157. 1916.

五叶黄精 wu ye huang jing

Polygonatum quinquefolium Kitagawa.

Rhizome terete, 3–4 mm thick, slender. Stem erect, 20–30 cm, glabrous. Leaves 4 or 5, alternate; petiole 0.5–1.5 cm; leaf blade elliptic to oblong-elliptic, 5–9 × 1.8–3.5 cm, glabrous, abaxially not glaucous, base tapering, apex shortly acuminate and obtuse tipped. Inflorescences (1 or) 2-flowered; peduncle 1–2 cm; bracts (1 or) 2, subulate, to 8 mm, membranous, veinless or 1-veined, caducous, or bracts absent. Flowers pendulous; pedicel 1–6 mm. Perianth whitish green, cylindric, 2–2.7 cm; lobes 4–5 mm. Filaments compressed, 3.5–4.5 mm, free part papillose or shortly cottony, apex sometimes swollen-saccate; anthers 4–4.5 mm. Ovary ca. 6 mm. Style 1.5–2 cm. Fl. May–Jun. $2n = 20$.

Forests; 1100–1400 m. Hebei, Jilin, ?Liaoning [Russia (Far East)].

7. *Polygonatum humile* Fischer ex Maximowicz, Mém. Acad. Imp. Sci. St.-Petersbourg Divers Savans 9: 275. 1859.

小玉竹 xiao yu zhu

Polygonatum humillimum Nakai; *P. officinale* Allioni var. *humile* (Fischer ex Maximowicz) Baker.

Rhizome terete, (2–)3–5 mm thick, slender. Stem erect, (8–)25–50 cm, glabrous. Leaves 7–9(–11), alternate; petiole very short; leaf blade oblong to ovate-elliptic, (4–)5.5–8.5 × 1.5–4 cm, abaxially hispidulous, base obtuse, apex acuminate and obtuse tipped. Inflorescences usually 1-flowered; bracts absent. Flowers pendulous; pedicel 0.8–1.3 cm. Perianth white, tinged with green at apex, cylindric, 1.5–1.7 cm; lobes ca. 2 mm. Filaments slightly compressed, ca. 3 mm, densely verruculose; anthers ca. 3 mm. Ovary ca. 4 mm. Style 1.1–1.3 cm. Berries blue-black, ca. 1 cm in diam., 5- or 6-seeded. Fl. May–Jun, fr. Aug–Sep. $2n = 20^*$, (22, 30, 31).

Forests, grassy slopes; 800–2200 m. Hebei, Heilongjiang, Jilin, Liaoning, ?Nei Mongol, Shanxi [Japan, Korea, Mongolia, Russia (Far East, Siberia)].

8. *Polygonatum odoratum* (Miller) Druce, Ann. Scott. Nat. Hist. 60: 226. 1906.

玉竹 yu zhu

Convallaria odorata Miller, Gard. Dict., ed. 8, *Convallaria* no. 4. 1768; *C. polygonatum* Linnaeus; *Polygonatum hon-doense* Nakai ex Koidzumi; *P. japonicum* C. Morren & Decaisne; *P. langyaense* D. C. Zhang & J. Z. Shao; *P. maximowiczii* F. Schmidt; *P. odoratum* f. *ovalifolium* Y. C. Chu et al.; *P. officinale* Allioni; *P. officinale* var. *papillosum* Franchet; *P. planifolium* Kitagawa & Hir. Takahashi; *P. quelpaertense* Ohwi; *P. simizui* Kitagawa; *P. thunbergii* C. Morren & Decaisne; *P. vulgare* Desfontaines.

Rhizome terete, 5–14 mm thick. Stem arching, 20–50 (–100) cm, glabrous, angled. Leaves 7–12, alternate; petiole short; leaf blade abaxially glaucous, elliptic to ovate-oblong, 5–12(–20) × 3–6(–8) cm, often smooth, sometimes papillose-scabrous on veins, apex acuminate and obtuse tipped. Inflorescences 1–4(–8)-flowered; peduncle usually 1–1.5 cm;

bracts small or absent. Flowers pendulous; pedicel 5–10(–20) mm. Perianth yellowish green to white, cylindric to campanulate-cylindric, 1.3–2(–2.5) cm; lobes ca. 3 mm. Filaments filiform, smooth or verruculose; anthers ca. 4 mm. Ovary 3–4 mm. Style 1–1.4 cm, included. Berries blue-black, 7–10(–12) mm in diam., 7–9-seeded. Fl. May–Jun, fr. Jul–Sep. $2n = (18^*), 20^*, (21, 22^*, 23, 26, 28, 29, 30, 40^*)$.

Forests, shaded slopes; 500–3000 m. Anhui, Gansu, Guangxi, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Nei Mongol, Qinghai, ?Shaanxi, Shandong, Shanxi, Taiwan, ?Zhejiang [Japan, Korea, Mongolia, Russia; Europe].

9. *Polygonatum adnatum* S. Yun Liang, Acta Phytotax. Sin. 25: 65. 1987.

贴梗黄精 tie geng huang jing

Rhizome usually branched, terete, 4–7 mm thick. Stem erect, 12–35 cm, glabrous. Leaves 6, alternate; petiole 2–3 mm; leaf blade abaxially glaucous, ovate to elliptic, 5–9 × 3–3.8 cm, glabrous, base rounded to obtuse, apex obtuse to shortly acuminate. Inflorescences 1-flowered; bracts subulate, ca. 1 mm, caducous. Pedicel 2–3.5 cm, proximal 2–9 mm adnate to stem. Perianth subcylindric, 1.4–1.6 cm; lobes ca. 2 mm. Filaments ca. 7 mm, glabrous; anthers oblong, ca. 3 mm. Style ca. 1 cm. Fl. Jun–Jul.

• Shaded slopes; ca. 2300 m. S Sichuan (Leibo Xian).

10. *Polygonatum omeiense* Z. Y. Zhu, Bull. Bot. Res., Harbin 12: 267. 1992.

峨眉黄精 e mei huang jing

Rhizome branched, terete, 3–5 mm thick, densely noded. Stem erect, purple-brown spotted, 25–35 cm, glabrous. Leaves 7 or 8, alternate; petiole 2–5 mm; leaf blade oblong-lanceolate to ovate-elliptic, 4–10 × 2–3.5 cm, glabrous, base obtuse-cuneate, apex acute-obtuse to acuminate. Inflorescences 1- or 2-flowered; peduncle 1.5–5 cm; bracts small, caducous. Pedicel 5–10 mm. Perianth yellowish white, cylindric or campanulate-cylindric, 2–2.5 cm; lobes deltoid, 2–3 mm. Filaments compressed, 7–8 mm, densely white-villous; anthers oblong, ca. 4 mm. Ovary ca. 4 mm. Style 1.4–1.6 cm. Fl. May–Jun.

• Forested slopes; ca. 1800 m. C Sichuan (Emei Shan).

11. *Polygonatum macropodum* Turczaninow, Bull. Soc. Imp. Naturalistes Moscou 5: 205. 1832.

热河黄精 re he huang jing

Polygonatum umbellatum Baker.

Rhizome terete, 1–2 cm thick. Stem erect, 30–100 cm, glabrous. Leaves alternate; petiole very short; leaf blade ovate or ovate-elliptic, rarely ovate-oblong, 4–8(–10) × 2–5 cm, glabrous, apex acute to acuminate. Inflorescences corymblike, (3–) 5–12(–17)-flowered; peduncle 3–5 cm; bracts borne on proximal part of pedicel, very small, or absent. Flowers pendulous; pedicel 0.5–1.5 cm. Perianth white or reddish, cylindric-campanulate, 1.5–2 cm; lobes 4–5 mm. Filaments ca. 5 mm, narrowly 3-winged, scurfy-scabrous; anthers ca. 4 mm. Ovary 3–4 mm. Style 1–1.3 cm. Berries deep blue, 7–11 mm in diam., 7-

or 8-seeded. Fl. May–Jun, fr. Sep. $2n = 22^*$.

• Forests, shaded slopes; 400–1500 m. Hebei, Liaoning, ?Nei Mongol, Shandong, Shanxi.

12. *Polygonatum franchetii* Hua, J. Bot. (Morot) 6: 392. 1892.

距药黄精 ju yao huang jing

Rhizome moniliform, 7–10 mm thick. Stem erect, 40–80 cm, glabrous. Leaves alternate; petiole very short; leaf blade oblong-lanceolate or occasionally narrowly oblong, 6–12 × 1.5–3.5 cm, glabrous, apex acuminate. Inflorescences 2(or 3)-flowered; peduncle 2–6 cm; bracts 2(or 3), borne at base of pedicel and enclosing flower bud, subequaling mature pedicel, membranous, deciduous. Flowers pendulous; pedicel ca. 5 mm. Perianth pale green, cylindric-campanulate, ca. 2 cm; lobes ca. 2 mm. Filaments slightly curved, compressed, ca. 3 mm, papillose, apex with a retrorse spur ca. 1.5 mm; anthers 2.5–3 mm. Ovary ca. 5 mm. Style ca. 1.5 cm. Berries purple, 7–8 mm in diam., 4–6-seeded. Fl. May–Jun, fr. Sep–Oct. $2n = 22^*$, 26^* .

• Forests; 1100–1900 m. Hubei, Hunan, Shaanxi, Sichuan.

13. *Polygonatum filipes* Merrill ex C. Jeffrey & McEwan, Kew Bull. 34: 445. 1980.

长梗黄精 chang geng huang jing

Rhizome moniliform, sometimes terete-moniliform, 1–1.5 cm thick. Stem erect, 30–70 cm, glabrous. Leaves alternate; petiole 2–4 mm; leaf blade oblong-lanceolate to elliptic, 6–12 × 3–7 cm, shortly pubescent on veins abaxially. Inflorescences 2–7-flowered; peduncle very slender, 3–8 cm; bracts caducous or absent. Flowers ± pendulous; pedicel 0.5–1.5 cm. Perianth yellowish green, cylindric, 1.5–2 cm; lobes ca. 4 mm. Filaments ca. 4 mm, shortly cottony; anthers 2.5–3 mm. Ovary ca. 4 mm. Style 1–1.4 cm. Berries ca. 8 mm in diam., 2–5-seeded. Fl. Apr–May, fr. Sep–Oct. $2n = 16^*$, 18^* .

• Forests, thickets, grassy slopes; 200–600 m. Anhui, Fujian, Guangdong, Guangxi, Hunan, Jiangsu, Jiangxi, Zhejiang.

14. *Polygonatum cyrtonema* Hua, J. Bot. (Morot) 6: 393. 1892.

多花黄精 duo hua huang jing

Polygonatum brachynema Handel-Mazzetti; *P. henryi* Diels; *P. martini* H. Léveillé; *P. multiflorum* Allioni var. *longifolium* Merrill.

Rhizome usually moniliform or tuberous moniliform, rarely subterete, 1–2 cm thick. Stem erect, 50–100 cm, glabrous. Leaves 10–15, alternate; petiole short; leaf blade elliptic to oblong-lanceolate, occasionally falcate, 10–18 × 2–7 cm, apex usually acuminate. Inflorescences umbel-like, (1 or) 2–7(–14)-flowered; peduncle 1–4(–6) cm; bracts borne on proximal part of pedicel, small, or absent. Flowers pendulous; pedicel 0.5–1.5(–3) cm. Perianth yellowish green, campanulate-cylindric, 1.8–2.5 cm; lobes ca. 3 mm. Filaments slightly compressed, 3–4 mm, papillose or shortly cottony, apically slightly dilated or saccate-convex; anthers 3.5–4 mm. Ovary 3–6 mm. Style 1.2–1.5 cm. Berries black, ca. 1 cm in diam., 3–9-seeded. Fl. May–Jun, fr. Aug–Oct. $2n = 18^*$, 20^* , 22^* .

• Forests, thickets, shaded slopes; 500–2100 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, ?S Shaanxi (Qin Ling), Sichuan, Zhejiang.

Polygonatum zhejiangense X. J. Xue & H. Yao (Bull. Bot. Res., Harbin 14: 242. 1994) seems to be related to, or conspecific with, *P. cyrtonema*, but its leaves are cirrose at the apex. No specimens have been seen by the present authors. *Polygonatum jinzhaiense* D. C. Zhang & J. Z. Shao (in D. C. Zhang et al., Guihaia 20: 34. 2000) was recently described from W Anhui (Jinzhai Xian). Although the present authors have not seen the type specimen, it is evident from the description that *P. jinzhaiense* is similar to *P. cyrtonema* and *P. arisanense* in general, but differs from these two species in rhizome shape and the position of the thickening part along the filaments—characters which are usually stable in *Polygonatum*. Further studies are needed to clarify whether or not *P. jinzhaiense* is distinct.

15. *Polygonatum arisanense* Hayata, Icon. Pl. Formos. 9: 140. 1920.

阿里黄精 a li huang jing

Polygonatum formosanum (Hayata) Masamune & Shimada; *P. officinale* Allioni var. *formosanum* Hayata.

Rhizome moniliform, 0.8–2.5 cm thick. Stem arching, 1–2 m, glabrous. Leaves 12–23, alternate; petiole 2–5 mm; leaf blade ± glaucous abaxially, lanceolate to narrowly oblong, 8–20 × 2–4.5 cm, glabrous, base obtuse, apex acute to acuminate. Inflorescences ± umbel-like, 2–4-flowered; peduncle 1–2 cm; bracts absent. Flowers pendulous; pedicel 0.5–1.5 cm. Perianth yellowish white, campanulate-cylindric, 2–2.8 cm; lobes 5–6 × 3.5–5 mm. Filaments 5–10 mm, basally thickened, occasionally compressed, smooth to slightly verruculose, apically filiform, smooth; anthers 2–5 mm. Ovary 4–5.5 mm. Style 1–1.5 cm. Berries ca. 8 mm in diam., several seeded. Fl. May. $2n = 22^*$, (44^*) .

• Forests; 600–2100 m. Taiwan.

16. *Polygonatum nodosum* Hua, J. Bot. (Morot) 6: 394. 1892.

节根黄精 jie gen huang jing

Polygonatum leveilleum Fedde; *P. mairei* H. Léveillé (1912, not 1909); *P. yunnanense* H. Léveillé.

Rhizome ± moniliform, 5–7 mm thick, rather slender. Stem erect, 15–40 cm, glabrous. Leaves 5–9, alternate; petiole short; leaf blade ovate-elliptic or elliptic, 5–7 × 2–4 cm, glabrous, apex shortly acuminate. Inflorescences 1- or 2-flowered; peduncle and pedicel 1–2 cm; bracts absent. Perianth yellowish green, cylindric, slightly constricted near mouth, 2–3 cm; lobes ca. 3 mm. Filaments slightly curved, compressed, 2–4 mm, free part papillose or shortly cottony; anthers ca. 5 mm. Ovary 4–5 mm. Style 1.7–2 cm. Berries ca. 7 mm in diam., 4–7-seeded. Fl. May–Jun, fr. Sep–Oct.

• Forests, shaded moist places along ravines, shaded rocks; 1600–2000 m. Gansu, Guangxi, Hubei, ?S Shaanxi (Qin Ling), Sichuan, Yunnan.

17. *Polygonatum kingianum* Collett & Hemsley, J. Linn. Soc., Bot. 28: 138. 1890.

滇黄精 dian huang jing

Polygonatum agglutinatum Hua; *P. cavaleriei* H. Léveillé; *P. darrisi* H. Léveillé; *P. ericoideum* H. Léveillé; *P. esquirolii* H. Léveillé; *P. huanum* H. Léveillé; *P. kingianum* var. *cavaleriei* (H. Léveillé) C. Jeffrey & McEwan; *P. kingianum* var. *ericoideum* (H. Léveillé) C. Jeffrey & McEwan; *P. kingianum* var. *grandifolium* D. M. Liu & W. Z. Zeng; *P. kingianum* var. *uncinatum* (Diels) C. Jeffrey & McEwan; *P. uncinatum* Diels.

Rhizome subterete or submoniliform, 1–3 cm thick. Stem erect, 1–3 m, glabrous, apex subscaudent. Leaves in whorls of 3–10, sessile, linear to lanceolate, 6–20(–25) × 0.3–3 cm, herbaceous or leathery, apex cirrose. Inflorescences (1 or) 2–4(–6)-flowered; peduncle 1–2 cm, pendulous; bracts borne usually on proximal part of pedicel, small, membranous. Pedicel 0.5–1.5 cm. Perianth pink or white, cylindric-campanulate, 1.8–2.5 cm; lobes 3–5 mm. Filaments filiform or compressed, 1.7–5 mm, glabrous or slightly papillose; anthers 4–6 mm. Ovary 4–6 mm. Style (0.8–)1–1.4 cm. Berries red, 1–1.5 cm in diam., 7–12-seeded. Fl. Mar–May, fr. Sep–Oct. $2n = 26^*, 30^*, 32^*, 64$.

Forests, thickets, shaded moist grassy slopes and rocks; 700–3600 m. Guangxi, Guizhou, Sichuan, Yunnan [Myanmar, Thailand, Vietnam].

This species is highly variable. For example, the type of *Polygonatum cavaleriei* (*Cavalerie* 2166, E) is apparently quite different from that of *P. kingianum* in leaves and flowers. Further studies are needed to confirm whether or not the synonyms listed above for *P. kingianum* really belong to this species.

18. *Polygonatum hookeri* Baker, J. Linn. Soc., Bot. 14: 558. 1875.

独花黄精 du hua huang jing

Polygonatum pumilum Hua.

Rhizome terete, 3–7 mm thick, usually with slightly swollen annual knots; annual elongation (distance between knots) 2–3.5 cm. Stem erect, less than 10 cm, glabrous. Leaves several to more than 10, usually crowded, proximal ones alternate, distal ones opposite or in whorls of 3, sessile, linear to oblong, 2–4.5 cm × 3–8 mm, glabrous. Inflorescence solitary in axil of basal leaf, 1(or 2)-flowered; bracts small, membranous, caducous. Flower erect; pedicel 4–7 mm. Perianth purple or pink, cylindric-funnelform, 1.5–2(–2.5) cm; tube 3–4 mm wide; lobes 6–10 mm. Filaments very short, ca. 0.5 mm; anthers ca. 2 mm. Ovary 2–3 mm. Style 1.5–2 mm. Berry red, 7–8 mm in diam., 5–7-seeded. Fl. May–Jun, fr. Sep–Oct. $2n = 30$.

Forests, grassy slopes, alluvial soil; 3200–4300 m. Gansu, Qinghai, ?S Shaanxi (Qin Ling) Sichuan, Xizang, Yunnan [N India, Sikkim].

19. *Polygonatum punctatum* Royle ex Kunth, Enum. Pl. 5: 142. 1850.

点花黄精 dian hua huang jing

Disporopsis mairei H. Léveillé; *Polygonatum anomalum* Hua; *P. marmoratum* H. Léveillé; *P. mengtzensense* F. T. Wang & Tang; *P. parcefolium* F. T. Wang & Tang; *P. sinomairei* F. T. Wang & Tang.

Rhizome ± moniliform, 1–1.5 cm thick, with dense, fleshy

roots. Stem arching, usually spotted with lilac, (10–)30–70 cm, sometimes papillose distally. Leaves alternate or occasionally also subopposite; petiole short; leaf blade ± shiny, ovate to lanceolate, rarely slightly falcate, 6–14 × 1.5–5 cm, usually with distinct cross veins, apex ± acuminate and obtuse tipped. Inflorescences racemose, 2–6(–8)-flowered; peduncle 5–12 mm; bracts caducous or absent. Flowers pendulous or erect; pedicel 2–10 mm. Perianth white, sometimes greenish spotted with lilac, ± urceolate, 7–9(–11) mm; lobes 1.5–2 mm. Filaments filiform, 0.5–1 mm, smooth to scabrous; anthers 1.5–2 mm. Ovary 2–2.5(–4) mm. Style 1.5–2.5 mm; stigma slightly dilated. Berries red, ca. 7 mm in diam., 8–10-seeded. Fl. Apr–Jun, fr. Sep–Nov. $2n = (26), 30$.

On rocks or trees in forests; 1100–2700 m. Guangxi, Guizhou, Hainan, ?S Shaanxi (Qin Ling), Sichuan, Xizang, Yunnan [Bhutan, NE India, Myanmar, Nepal, Sikkim, Thailand, Vietnam].

20. *Polygonatum longipedunculatum* S. Yun Liang, Acta Phytotax. Sin. 25: 64. 1987.

长柄黄精 chang bing huang jing

Rhizome branched, tuberous terete, 5–6 mm thick. Stem erect, ca. 35 cm, hirsutulous. Leaves ca. 11, alternate; petiole short, ca. 2 mm; leaf blade ovate-elliptic, 6–12 × 2.5–7 cm, glabrous, base subrounded, apex shortly acuminate. Inflorescences 5- or 6-flowered; peduncle 2.5–5 cm, laxly pubescent; bracts caducous or absent. Pedicel 0.8–1.5 cm. Perianth ca. 7 mm; lobes lanceolate-ovate, 1.5–2 mm. Filaments very short, ca. 0.7 mm, glabrous; anthers ovate-lanceolate, 1.8–2 mm. Fl. Jul.

• Forested slopes; 1800–1900 m. S Sichuan (Leibo Xian), SE Yunnan (Mengzi Xian).

21. *Polygonatum altelobatum* Hayata, Icon. Pl. Formos. 5: 229. 1915.

短筒黄精 duan tong huang jing

Rhizome tuberous terete, 1–2 cm thick. Stem erect, 17–45 cm, glabrous. Leaves alternate; petiole ca. 5 mm; leaf blade oblong-lanceolate, sometimes slightly falcate, 6–13 × 2.3–3.6 cm, many veined, glabrous, base acute, apex acuminate, obtuse tipped. Inflorescences 1- or 2-flowered; peduncle obsolete; bracts caducous or absent. Flowers ± pendulous; pedicel 0.7–2 cm. Perianth white, campanulate-cylindric, 6–8 mm; tube 1–2 mm; lobes oblong or oblong-lanceolate, 5–6 mm. Filaments very short, 0.3–1 mm; anthers ovate-oblong, 1–2 mm. Ovary 2–3 mm. Style 1–1.5 mm. Berries blackish brown, 7–10 mm in diam., ca. 16-seeded. Fl. May–Jun, fr. Oct.

• Forests; 600–1900 m. Taiwan.

No specimens of this species have been seen by the present authors.

22. *Polygonatum oppositifolium* (Wallich) Royle, Ill. Bot. Himal. Mts. 1: 380. 1839.

对叶黄精 dui ye huang jing

Convallaria oppositifolia Wallich, Asiat. Res. 13: 380. 1820.

Rhizome ± branched, tuberous terete, 1–1.5 cm thick.

Stem arching, 40–60 cm, glabrous. Leaves many, opposite; petiole short, ca. 5 mm; leaf blade usually shiny, ovate-oblong to ovate-lanceolate, 6–11 × 1.5–3.5 cm, subleathery, with distinct cross veins, apex acuminate. Inflorescences 3–5-flowered; peduncle pendulous, 5–8 mm; bracts small, membranous, caducous. Pedicel 5–12 mm. Perianth white or pale yellowish green, sometimes spotted with lilac, cylindrical, slightly constricted near mouth, 1.1–1.3 cm; lobes ca. 2.5 mm. Filaments filiform, 3.5–4 × ca. 0.25 mm, papillose, sometimes smooth proximally; anthers ca. 4 mm. Ovary ca. 5 mm. Style ca. 6 mm. Fl. May. $2n = (24), 30^*, (36)$.

Rocks in forests; 1800–2200 m. S Xizang [Bhutan, NE India, Nepal, Sikkim].

23. *Polygonatum cathcartii* Baker, J. Linn. Soc., Bot. 14: 559. 1875.

棒丝黄精 *bang si huang jing*

Rhizome irregularly moniliform, ca. 1.5 cm thick. Stem erect, 0.6–2 m, glabrous. Leaves opposite, occasionally also alternate or in whorls of 3; petiole short or indistinct; leaf blade abaxially grayish glaucous, lanceolate to oblong-lanceolate, 7–15 × 1.5–4 cm, apex acuminate. Inflorescences (1 or) 2- or 3-flowered; peduncle pendulous, 1.5–3 cm; bracts small, membranous, caducous. Pedicel 5–10 mm. Perianth pale yellow or white, cylindrical or ± campanulate, 1.1–1.5 cm; lobes 2–3 mm. Filaments 2–3 mm, apically dilated and saccate; anthers 3–4 mm. Ovary 5–7 mm. Style ca. 4 mm. Berries orange-red, ca. 7 mm in diam., 2–4-seeded; pedicel reflexed at maturity. Fl. Jun–Jul, fr. Sep–Oct.

Forests; 2400–2900 m. Sichuan, Xizang, Yunnan [Bhutan, Nepal, Sikkim].

24. *Polygonatum griffithii* Baker, J. Linn. Soc., Bot. 14: 558. 1875.

三脉黄精 *san mai huang jing*

Stem terete, ca. 90 cm, slender, glabrous. Leaves all opposite, distant, sessile, green adaxially, subglaucous abaxially, linear-lanceolate, 7.5–13 cm, papery, 3-veined, apex acute to acuminate. Peduncle and pedicels 1.2–2 cm. Flowers paired. Perianth tube white, constricted above ovary; lobes green, deltoid, very short. Stamens inserted at mouth of perianth tube; filaments very short, naked; anthers small. Style filiform, 2–3 × as long as the ovary. $2n = ?36^*$.

About 1700 m. Xizang [Nepal].

One of us (Tamura) has not seen specimens of this species which, according to Chen (Fl. Xizang, 5: 572. 1987), is related to *P. cathcartii*. The chromosome number $2n = 36$ was reported for *P. griffithii* from SE Xizang (Mêdog Xian) by Gu and Sun (Acta Bot. Yunnan. 20: 207–210. 1998), but judging from the photograph of the chromosomes in the paper, the karyotype corresponds well with that of *Maianthemum*.

25. *Polygonatum longistylum* Y. Wan & C. Z. Gao, Guihaia 10: 177. 1990.

百色黄精 *bai se huang jing*

Rhizome tuberous terete, 1.7–2.6 cm thick. Stem suberect,

to 1.3 m, glabrous. Leaves opposite or subopposite, sometimes also alternate or in whorls of 3 or 4; petiole 3–6 mm; leaf blade elliptic-lanceolate, 13–19 × 3.5–5 cm, glabrous, base obtuse-rounded, apex strongly cirrose. Inflorescences 1- or 2-flowered; peduncle 2–2.7 cm; bracts 2, white, lanceolate, 2–2.5 mm, membranous. Pedicel 7–9 mm. Perianth cylindrical, ca. 1.5 cm; lobes oblong-ovate, 4–5 mm. Filaments ca. 2 mm, glabrous; anthers 3–4 mm. Ovary ca. 4 mm. Style 7–8 mm. Fl. Jun.

• W Guangxi (Bose Xian); also cultivated in Guangxi (Nanning Shi).

26. *Polygonatum tessellatum* F. T. Wang & Tang, Bull. Fan Mem. Inst. Biol. 7: 85. 1936.

格脉黄精 *ge mai huang jing*

Rhizome moniliform, ca. 1.5 cm thick. Stem erect to arching, 50–80 cm, glabrous. Leaves in whorls of 3–5, occasionally also opposite, sessile, oblong-lanceolate to lanceolate, 7–12 × 1.5–2.5 cm, leathery, with 3 distinct, longitudinal veins and cross veins, apex acuminate. Inflorescences 1–3-flowered; peduncle very short; bracts caducous or absent. Pedicel 1.5–3.5 cm. Perianth pale yellow, 1–1.2 cm; lobes ca. 2.5 mm. Filaments slightly compressed, ca. 3 mm, papillose-scabrous; anthers 3–3.5 mm. Ovary ca. 4 mm. Style subequalling ovary. Berries red, ca. 8 mm in diam., 9–12-seeded; pedicel ascending at maturity. Fl. May, fr. Sep–Nov. $2n = 60$.

Rocks, trees in forests; 1600–2200 m. Guangxi, W Yunnan [Myanmar, Thailand].

27. *Polygonatum hirtellum* Handel-Mazzetti, Symb. Sin. 7: 1209. 1936.

粗毛黄精 *cu mao huang jing*

Polygonatum alternicirrhosum Handel-Mazzetti var. *piliferum* P. Y. Li.

Rhizome moniliform, 1–2 cm thick, with ovoid-globose annual knots. Stem erect, 30–100 cm, hirsutulous. Leaves alternate or in whorls of 3, sometimes also opposite, sessile, oblong-lanceolate to lanceolate, 3–10 × 0.7–1.5 cm, hirsutulous particularly on abaxial veins, margin slightly crisped, apex slightly curved to strongly cirrose. Inflorescences (1 or) 2- or 3-flowered; peduncle (1–) 4–10 mm, hirsutulous; bracts lanceolate, very small, membranous, caducous, or absent. Flowers pendulous; pedicel 2–4 mm, hirsutulous. Perianth white, cylindrical-campanulate, 7–8 mm; lobes 1.5–2 mm. Filaments very short, ca. 0.5 mm; anthers ca. 1.5 mm. Ovary ca. 2 mm. Style ca. 1 mm. Fl. Jun.

• Forests, open slopes; 1000–2900 m. S Gansu, ?S Shaanxi (Qin Ling), Sichuan.

28. *Polygonatum wardii* F. T. Wang & Tang, Bull. Fan Mem. Inst. Biol. 7: 284. 1937.

西藏黄精 *xi zang huang jing*

Rhizome unknown. Stem erect, dull crimson striate, to 40 cm. Leaves opposite or whorled except basal ones alternate; petiole very short or indistinct; leaf blade abaxially glaucous, ovate- or oblong-elliptic, 3.8–6 × 1.4–3.2 cm, glabrous, apex

acuminate. Inflorescences 2-flowered; peduncle curved, 1.1–2.7 cm; bracts lanceolate, small, caducous. Flowers pendulous; pedicel 0.5–1.6 cm. Perianth pale yellow to dull orange, 1–1.4 cm; lobes ca. 2 mm. Filaments 3–5 mm; anthers ca. 2 mm. Fruit unknown.

Bamboo thickets; 3000–3600 m. Xizang [NE India].

No specimens of this species were seen by the present authors.

29. *Polygonatum alternicirrhosum* Handel-Mazzetti, Symb. Sin. 7: 1209. 1936.

互卷黄精 hu juan huang jing

Polygonatum racemosum F. T. Wang & Tang.

Rhizome moniliform, thick. Stem erect, usually flexuous distally, 0.8–1.7 m, glabrous. Leaves alternate; petiole 3–5 mm; leaf blade oblong-lanceolate to lanceolate, 5–10 × 0.8–1.7 cm, glabrous, margin slightly crisped, apex strongly cirrose. Inflorescences racemelike, 1–5-flowered; peduncle 1–1.5 cm, slender, ascending and apically recurved; bracts small, scarious. Pedicel 3–8 mm. Perianth white, cylindric, 7–8 mm; tube 2–3 mm; lobes 4–5 mm. Filaments short, less than 1 mm, glabrous; anthers ca. 1.2 mm. Ovary ca. 2.5 mm. Style ca. 1.5 mm. Fl. May–Jul.

• Rocks in limestone areas; 1700–1800 m. SW Sichuan.

30. *Polygonatum verticillatum* (Linnaeus) Allioni, Fl. Pedem. 1: 131. 1785.

轮叶黄精 lun ye huang jing

Convallaria verticillata Linnaeus, Sp. Pl. 1: 315. 1753; *Polygonatum erythrocarpum* Hua; *P. kansuense* Maximowicz ex Batalin; *P. minutiflorum* H. Léveillé.

Rhizome usually shortly branched, usually tuberous terete, very rarely moniliform, 0.7–1.5 cm thick. Stem erect, (20–)40–80 cm, glabrous. Leaves in whorls of 3, occasionally alternate near base of stem, sometimes opposite near apex of stem, sessile, oblong-lanceolate to linear, 6–10 × 0.5–3 cm, apex acute to acuminate, not cirrose. Inflorescences 1- or 2(–4)-flowered; peduncle 1–2 cm; bracts small or absent. Flowers pendulous; pedicel 3–10 mm. Perianth pale purple (or white or pale yellow, but probably only when dry), cylindric, 0.8–1.2 cm; lobes 2–3 mm. Filaments 0.5–1(–2) mm, papillose; anthers ca. 2.5 mm. Ovary ca. 3 mm. Style 2.5–3 mm. Berries red, 6–9 mm in diam., 6–12-seeded. Fl. May–Jun, fr. Aug–Oct. $2n = (24), 28, 30, (56^*), 60, (64, 66, 84), ca. 90$.

Forests, grassy slopes; 2100–4000 m. Gansu, Nei Mongol, Qinghai, Shaanxi, Shanxi, Sichuan, Xizang, Yunnan [Afghanistan, Bhutan, Nepal, Pakistan, Russia, Sikkim; SW Asia, Europe].

Rudolf Kamelin (pers. comm.) believes that *Polygonatum verticillatum* is absent from China, and that the plants there are instead *P. kansuense* (*P. erythrocarpum*). In SW Asia and Europe, *P. verticillatum* has leaves in whorls of 5–7, inflorescences mostly 3- or 4-flowered, perianth white, and berries dark blue-green (although one of us (Tamura) has collected *P. verticillatum* with orange berries in S Denmark: Tamura & Kubitzki 3425 (KYO)). Tamura considers that *P. verticillatum* of the present sense may be a species in which different lineages are lumped. However, Chen and Tamura together decided to

maintain the present circumscription until sufficient morphological variation data have accumulated. Kamelin also notes that *Polygonatum minutiflorum*, regarded here as a synonym of *P. verticillatum*, may instead be synonymous with *P. gracile*, in which case the former name, published in 1915, would have priority.

31. *Polygonatum prattii* Baker, Hooker's Icon. Pl. 23: t. 2217. 1892.

康定玉竹 kang ding yu zhu

Polygonatum delavayi Hua; *P. gentilianum* H. Léveillé.

Rhizome terete, 3–5 mm thick, slender. Stem erect, 8–30 cm, slender, glabrous. Leaves 4–15, alternate, sometimes also opposite in proximal part of stem, mostly opposite in distal part of stem, often in whorls of 3 in apical part of stem; petiole very short; leaf blade elliptic to oblong, 2–6 × 1–2 cm, apex sub-obtuse or acute. Inflorescences 2(or 3)-flowered; peduncle 2–6 mm; bracts very small, caducous. Flowers pendulous; pedicel (2–)5–6 mm. Perianth white or pale purple, cylindric, 6–8 mm; tube smooth or papillose-scarious inside; lobes 1.5–2.5 mm. Filaments very short, papillose; anthers ca. 1.5 mm. Ovary ca. 1.5 mm. Style ca. 1.5 mm. Berries purple-red to brown, 5–7 mm in diam., 1- or 2-seeded. Fl. May–Jun, fr. Aug–Oct. $2n = 28^*, 56^*$.

• Forests, thickets, grassy slopes; 2500–3300 m. W Sichuan, NW Yunnan.

32. *Polygonatum curvistylum* Hua, J. Bot. (Morot) 6: 424. 1892.

垂叶黄精 chui ye huang jing

Rhizome usually shortly branched, subterete, sometimes submoniliform due to many short branches, 5–10 mm thick. Stem erect, 15–35 cm, glabrous. Leaves many, in whorls of 3–6, occasionally also alternate or opposite, sessile, linear-lanceolate to linear, 3–7 cm × 1–5 mm, apex acuminate, ascending before anthesis, ± pendulous after anthesis. Inflorescences 1- or 2-flowered; peduncle 7–9 mm; bracts caducous or absent. Flowers pendulous; pedicel 2–4 mm. Perianth pale purple, cylindric, 6–8 mm; lobes 1.5–2 mm. Filaments very short, ca. 0.7 mm, slightly scabrous; anthers ca. 1.5 mm. Ovary ca. 2 mm. Style subequalling ovary. Berries red, 6–8 mm in diam., 3–7-seeded. Fl. May–Jul, fr. Sep–Oct. $2n = 28^*$.

• Forests, grasslands; 2700–3900 m. W Sichuan, NW Yunnan.

33. *Polygonatum gracile* P. Y. Li, Acta Phytotax. Sin. 11: 252. 1966.

细根茎黄精 xi gen jing huang jing

Rhizome terete, 2–3 mm thick, slender. Stem 10–30 cm, slender, glabrous. Leaves in (1 or)2(or 3) whorls of 3–6, rarely also a few scattered between whorls; petiole very short; leaf blade oblong to oblong-lanceolate, 3–6 × 0.8–2 cm, glabrous, apex acuminate. Inflorescences usually 2-flowered; peduncle slender, 1–2 cm; bracts membranous, 2–3 mm. Pedicel 1–2 mm. Perianth pale yellow, cylindric, 6–8 mm; lobes ca. 1.5 mm. Filaments very short, ca. 0.5 mm; anthers ca. 1.5 mm. Ovary ca. 1.5 mm. Style slightly shorter than ovary. Berries 5–7 mm in diam., 2–4-seeded. Fl. Jun, fr. Aug.

• Forests, grassy slopes; 2100–2400 m. Gansu, Shaanxi, Shanxi.

34. *Polygonatum stenophyllum* Maximowicz, Mém. Acad. Imp. Sci. St.-Petersbourg Divers Savans 9: 274. 1859.

狭叶黄精 xia ye huang jing

Polygonatum verticillatum (Linnaeus) Allioni var. *stenophyllum* (Maximowicz) Baker.

Rhizome terete, 4–6 mm thick, with slightly swollen annual knots. Stem erect, 60–110 cm, glabrous. Leaves many, in whorls of 4–6, sessile, abaxially slightly glaucous, linear-lanceolate, 6–10 cm × 3–8 mm, glabrous, apex acuminate. Inflorescences 2-flowered; peduncle reflexed, 2–4 mm; bracts white, 2–3 mm, membranous. Pedicel 2–3 mm. Perianth white, cylindrical, slightly constricted near mouth, 0.8–1.2 cm; lobes 2–3 mm. Filaments filiform, ca. 1 mm; anthers ca. 2 mm. Ovary ca. 2.5 mm. Style ca. 3.5 mm. Fl. Jun. $2n = 24, 30$.

Forests, thickets. ?Hebei, Heilongjiang, Jilin, Liaoning, ?Nei Mongol [Korea, Russia (Far East)].

35. *Polygonatum roseum* (Ledebour) Kunth, Enum. Pl. 5: 144. 1850.

新疆黄精 xin jiang huang jing

Convallaria rosea Ledebour, Icon. Pl. 3: t. 1. 1829.

Rhizome terete, 3–5 mm thick, slender. Stem erect, 40–80 cm, glabrous. Leaves in whorls of 3 or 4, sometimes also alternate or opposite in proximal part of stem, sessile, lanceolate to linear-lanceolate, 7–12 × 1–1.6 cm, apex acute. Inflorescences 1- or 2-flowered; peduncle 1–1.5 cm; bracts very small. Pedicel 1–4 mm. Perianth pale purple, cylindrical, 1–1.2 cm; lobes 1.5–2 mm. Filaments very short, less than 1 mm, glabrous; anthers 1.5–1.8 mm. Ovary ca. 2 mm. Style ca. 2 mm. Berries 7–11 mm in diam., 2–7-seeded. Fl. May, fr. Oct. $2n = 28$.

Shaded slopes; 1400–1900 m. Xinjiang [Kazakhstan, Kyrgyzstan, Tajikistan, Russia].

36. *Polygonatum sibiricum* Redouté, Liliac. 6: t. 315. 1811.

黄精 huang jing

Polygonatum chinense Kunth.

Rhizome usually shortly branched, subterete or tuberous terete, 1–2 cm thick. Stem erect or sometimes subscandent, 50–90(–140) cm, glabrous. Leaves in whorls of 4–6, sessile, abaxially glaucous, linear-lanceolate, 8–15 cm × 4–16 mm, glabrous, apex strongly cirrose or curved. Inflorescences umbel-like, usually 2–4-flowered; peduncle 1–2 cm; bracts borne at base of pedicel, subulate to linear-lanceolate, 3–5 mm, membranous, 1-veined, persistent. Flowers pendulous; pedicel (2.5–) 4–10 mm. Perianth milky white to pale yellow, cylindrical, slightly constricted in middle, 0.9–1.2 cm; lobes ca. 4 mm. Filaments 0.5–1 mm; anthers 2–3 mm. Ovary ca. 3 mm. Style 5–7 mm. Berries black, 7–10 mm in diam., 4–7-seeded. Fl. May–Jun, fr. Aug–Sep. $2n = 20, 21, 22^*, 24^*, 26, 28, 36$.

Forests, thickets, shaded slopes; 800–2800 m. Anhui, Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Zhejiang [Korea, Mongolia, Russia (Siberia)].

37. *Polygonatum cirrhifolium* (Wallich) Royle, Ill. Bot. Himal. Mts. 1: 380. 1839.

卷叶黄精 juan ye huang jing

Convallaria cirrhifolia Wallich, Asiat. Res. 13: 382. 1820; *Polygonatum bulbosum* H. Léveillé; *P. cirrhifolioides* D. M. Liu & W. Z. Zeng; *P. fargesii* Hua; *P. fuscum* Hua; *P. lebrunii* H. Léveillé; *P. mairei* H. Léveillé (1909, not 1912); *P. souliei* Hua; *P. strumulosum* D. M. Liu & W. Z. Zeng; *P. trinerve* Hua.

Rhizome moniliform or tuberous terete, 1–2 cm thick. Stem erect or scandent, 30–90 cm, glabrous. Leaves in whorls of 3–6, rarely also a few alternate in proximal part of stem, sessile, narrowly linear to linear-lanceolate, very rarely oblong-lanceolate, 4–9(–12) cm × 2–8(–15) mm, apex usually cirrose at anthesis. Inflorescences usually 2-flowered; peduncle 3–10 mm; bracts 1–2 mm, scarious, veinless, or bract absent. Flowers pendulous; pedicel 3–8 mm. Perianth white, greenish, or pale purple, subcylindric, slightly constricted in middle, 8–11 mm; lobes ca. 2 mm. Filaments 0.6–0.8 × ca. 0.15 mm, papillose; anthers 2–2.5 mm. Ovary ca. 2.5 mm. Style ca. 2 mm. Berries red or purple-red, 8–9 mm in diam., 4–9-seeded. Fl. May–Jul, fr. Sep–Oct. $2n = (20^*, 24^*), 30^* (38)$.

Forests, grassy slopes; 2000–4000 m. Gansu, Guangxi, Ningxia, Qinghai, Shaanxi, Sichuan, Xizang, Yunnan [Bhutan, India, Nepal, Sikkim].

Rudolf Kamelin (pers. comm.) believes that both *Polygonatum fargesii* and *P. fuscum* differ from *P. cirrhifolium*: *P. fargesii* has leaves not cirrose apically, perianth white, and is distributed in Bhutan, China, and Sikkim; *P. fuscum* has stems 30–35 cm tall, never scandent, leaves not cirrose apically, perianth green (or dark green or brown-green), and is endemic to China. One of us (Tamura) considers that *P. cirrhifolium* of the present sense may be a species in which different lineages are lumped. However, Chen and Tamura together decided to maintain the present circumscription until sufficient morphological variation data have accumulated.

38. *Polygonatum stewartianum* Diels, Notes Roy. Bot. Gard. Edinburgh 5: 298. 1912.

西南黄精 xi nan huang jing

Polygonatum kalapanum Handel-Mazzetti.

Rhizome ± thick. Stem erect or semiscandent, sometimes minutely spotted with lilac, 30–80 cm, glabrous. Leaves (except basal ones) in whorls of 3 or 4, occasionally opposite, sessile, abaxially glaucous, linear to lanceolate, 5–11 cm × 5–16 mm, ± leathery, abaxially scaberrulose on veins, apex hooked at anthesis. Inflorescences (1 or) 2-flowered; peduncle 0.5–1.5 cm; bracts very small. Flowers pendulous; pedicel 3–10 mm. Perianth purplish pink, pale greenish purple, or greenish crimson, cylindrical, 5–12 mm; lobes 1–3 mm. Filaments 0.6–1.5 mm, papillose; anthers 1–3.5 mm. Ovary ca. 3 mm. Style 2–2.5 mm. Berries 5–7 mm in diam., 2- or 3-seeded. Fl. May. $2n = 28^*$.

• Forests, thickets, dry shaded slopes; 2700–3300 m. Sichuan, Yunnan.

39. *Polygonatum zanlanscianense* Pampanini, Nuovo Giorn. Bot. Ital., n.s., 22: 267. 1915.

湖北黄精 hu bei huang jing

Polygonatum anhuiense D. C. Zhang & J. Z. Shao; *P. kungii* F. T. Wang & Tang.

Rhizome moniliform or gingerlike, 1–2.5 cm thick. Stem erect or slightly scandent distally, to over 1 m, glabrous. Leaves in whorls of 3–6; petiole very short or indistinct; leaf blade variable, elliptic to oblong-lanceolate, rarely to linear, (5–)8–15 × (0.4–)1.3–2.8(–3.5) cm, glabrous, apex strongly cirrose to curved. Inflorescences umbel-like, 2–6(–11)-flowered; peduncle 0.5–2(–4) cm; bracts borne at base of pedicel, (1–)2–6 mm, scarious or subherbaceous with scarious margin, 1-veined, persistent. Pedicel (2–)4–7(–10) mm. Perianth white, yellowish green, or pale purple, slightly constricted at middle, 6–9 mm; lobes ca. 1.5 mm. Filaments 0.7–1 mm; anthers 2–2.5 mm. Ovary ca. 2.5 mm. Style 1.5–2 mm. Berries purple-red or black, 6–7 mm in diam., 2–4-seeded. Fl. Jun–Jul, fr. Aug–Oct. $2n = 22^*$, 28^* , 30^* , 32^* .

• Forests, shady and moist slopes; 800–2700 m. Gansu, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Sichuan, ?Zhejiang.

