

84. ANTHOXANTHUM Linnaeus, Sp. Pl. 1: 28. 1753.

黄花茅属 huang hua mao shu

Wu Zhenlan (吴珍兰); Sylvia M. Phillips

Hierochloë R. Brown.

Perennial, fragrant herbs. Inflorescence an open or contracted panicle. Spikelets lanceolate to plumply elliptic or oblong, weakly laterally compressed, florets 3, brown, lower 2 florets staminate or sterile, terminal floret bisexual; rachilla disarticulating above glumes but not between florets. Glumes persistent, unequal to subequal, lanceolate to ovate, lower glume shorter, 1(–3)-veined, upper glume 3(–5)-veined, about as long as spikelet, apex acute. Lower 2 florets subequal, with a palea and 3 stamens, or sterile and epaleate, or a combination of both; lemmas equal to or shorter than upper glume, firmly membranous to leathery, often brown-pilose on back and ciliate along margins, apex emarginate to deeply 2-lobed, awnless, with a short straight awn from above middle, or geniculately awned from near base. Bisexual floret equaling or shorter than 2 lower florets; lemma cartilaginous, glossy, 3–5-veined, margins convolute and covering palea, apex awnless, rarely mucronate; palea 1–3-veined, without keels; lodicules absent or 2; stamens 2; stigmas plumose. $x = 5, 7$.

About 50 species: temperate and cold regions of both hemispheres, also on tropical mountains; ten species (three endemic) in China.

All species are scented with coumarin (C₉H₆O₂), and some are used medicinally for their coumarin content.

Hierochloë has traditionally been recognized on the basis of the two lower florets being staminate, paleate, and awnless or only shortly awned, in contrast to the sterile, epaleate, geniculately awned lower florets in typical *Anthoxanthum*. Lodicules are also absent in typical *Anthoxanthum*. However, it is now known that a considerable number of species is intermediate in these characters, including some in China, and also some (e.g., *A. hookeri*) where the sex of the lower florets is variable within the species. There is no justification for continuing to recognize two separate genera. The species are all clearly related by their unusual spikelet structure and by the presence of coumarin.

- 1a. Lemma of both lower florets awnless or mucronate.
 - 2a. Spikelets 3.5–6 mm; lower florets slightly shorter than glumes; plants up to 60 cm tall; panicle 4–10 cm 1. *A. nitens*
 - 2b. Spikelets 2.5–4 mm; lower florets equal to or longer than glumes; plants up to 30 cm tall; panicle 3–6 cm 2. *A. glabrum*
- 1b. Lemma of both lower florets awned, or at least lemma of second floret.
 - 3a. Lower florets both staminate, with a palea and stamens, or second floret sterile.
 - 4a. Culms 50–120 cm tall; leaf blades 6–15 mm wide; panicle 10–22 cm; 2 lower lemmas scabrid 3. *A. potaninii*
 - 4b. Culms 10–50 cm tall; leaf blades 2–8(–10) mm wide; panicle 1.5–10 cm; 2 lower lemmas pubescent.
 - 5a. Panicle 1.5–5 cm; awn of second lemma arising near middle, 3–7 mm, straight or weakly geniculate; bisexual floret hairy toward apex.
 - 6a. Lemma of second floret with straight ca. 3 mm awn 4. *A. tibeticum*
 - 6b. Lemma of second floret with weakly geniculate 4–7 mm awn 5. *A. monticola*
 - 5b. Panicle 6–10 cm; awn of second lemma arising near base, 6–11 mm, clearly geniculate; bisexual floret glabrous 6. *A. hookeri*
 - 3b. Lower florets both sterile, without a palea or stamens.
 - 7a. Spikelets ca. 3 mm, obovate 7. *A. pallidum*
 - 7b. Spikelets more than 3 mm, lanceolate to oblong.
 - 8a. Leaf blades up to 3 mm wide; spikelets 3–5 mm; glumes ovate 8. *A. sikkimense*
 - 8b. Leaf blades up to 7 mm wide; spikelets 4.3–9 mm; glumes lanceolate.
 - 9a. Spikelets 4.3–5.5 mm; lower glume 3/4 length of the upper glume; sterile lemmas ca. 4/5 length of spikelet 9. *A. horsfieldii*
 - 9b. Spikelets 6–9 mm; lower glume 1/2 length of upper glume; sterile lemmas 1/2–2/3 length of spikelet 10. *A. odoratum*

1. *Anthoxanthum nitens* (Weber) Y. Schouten & Veldkamp, Blumea 30: 348. 1985.

茅香 mao xiang

Poa nitens Weber, Prim. Fl. Holsat., Suppl. 2, no. 6. 1787; *Hierochloë bungeana* Trinius; *H. glabra* Trinius subsp. *bungeana* (Trinius) (Trinius) Peschkova; *H. odorata* (Linnaeus) P. Beauvois; *H. odorata* f. *pubescens* Krylov; *H. odorata* subsp. *pubescens* (Krylov) H. Hara ex T. Koyama; *Holcus odoratus* Linnaeus.

Plant with slender creeping rhizomes. Culms 20–60 cm

tall, 3–4-noded. Leaf sheaths glabrous or ± pubescent, longer than internodes; basal leaf blades up to 30 cm, 3–10 mm wide, culm leaves much shorter, glabrous or adaxial surface puberulous, margins scabrid, apex acuminate; ligule 2–5 mm, obtuse. Panicle pyramidal, loose, 4–10 cm; branches spreading, smooth, bare in lower half. Spikelets plumply elliptic, 3.5–6 mm, light brown, shining; glumes subequal, as long as spikelet, 1–3-veined; callus of staminate florets stiffly hairy (or glabrous in E Asia); lower florets staminate, lemmas slightly shorter than glumes, puberulous on back above middle, margins shortly cili-

ate, apex acute or minutely mucronate; bisexual floret ca. 3.5 mm, appressed-pubescent toward apex; palea 1-veined; anthers ca. 2.5 mm. Fl. and fr. Jun–Sep.

Mountain slopes, floodplains, wet grasslands; 500–3800 m. Gansu, Guizhou, Hebei, Heilongjiang, Henan, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan [Afghanistan, Japan, Korea, Kyrgyzstan, Mongolia, Russia; SW Asia (Caucasus), Europe, North America].

Over much of the range of this species, the callus of the staminate florets bears a circlet of short, stiff bristles. However, forms from E Asia with a glabrous callus like that of *Anthoxanthum glabrum* and the panicle and spikelet characters of *A. nitens* are difficult to place and have been assigned to both species at infraspecific rank. The names *Hierochloë bungeana* and *H. odoratum* subsp. *pubescens* belong here.

Unfortunately, the epithet “*odorata*,” by which this widespread species has long been known in *Hierochloë*, cannot be used in *Anthoxanthum* because the heterotypic name *A. odoratum* Linnaeus already exists.

Anthoxanthum nitens is used for medicine, weaving, and soil retention.

2. *Anthoxanthum glabrum* (Trinius) Veldkamp, *Blumea* 30: 347. 1985.

光稈香草 guang fu xiang cao

Hierochloë glabra Trinius in Sprengel, *Neue Entdeck. Pflanzentk.* 2: 66. 1821; *H. odorata* (Linnaeus) P. Beauvois subsp. *glabra* (Trinius) Tzvelev.

Plant with slender creeping rhizomes. Culms 10–30 cm tall, 2- or 3-noded. Leaf sheaths pubescent with reflexed hairs, longer than internodes; basal leaf blades 2–5 cm × ca. 3 mm, culm leaves much shorter, glabrous or adaxial surface puberulous, apex acuminate; ligule 2–5 mm, obtuse. Panicle ovate or oblong in outline, 3–6 cm; branches spreading or ascending, smooth. Spikelets plumply elliptic, 2.5–4(–4.5) mm, yellowish brown, shining; glumes subequal, slightly shorter than spikelet, 1–3-veined; callus of staminate florets glabrous; lower florets staminate, lemmas equal to or longer than glumes, subglabrous or minutely puberulous on back near apex, margins ciliate, apex obtuse or emarginate and mucronate, mucro up to 0.5 mm; bisexual floret 2–2.5 mm, pubescent toward apex; palea 1-veined; anthers 1.7–2 mm. Fl. and fr. Jun–Sep.

Mountain slopes in wet grassy places; 500–3300 m. Anhui, Hebei, Heilongjiang, Jiangsu, Jilin, Liaoning, Nei Mongol, Qinghai, Shandong, Xinjiang, Yunnan, Zhejiang (Lin’an) [Kazakhstan, Mongolia, Russia].

This species is very close to *Anthoxanthum nitens* and is not clearly separable from the Asian forms of that species that have a glabrous callus. There is a tendency in *A. glabrum* to smaller panicles and spikelets and relatively shorter glumes, thereby imparting a slightly different habit.

3. *Anthoxanthum potaninii* (Tzvelev) S. M. Phillips & Z. L. Wu, *Novon* 15: 476. 2005.

松序茅香草 song xu mao xiang cao

Hierochloë potaninii Tzvelev, *Rast. Tsentr. Azii* 4: 35. 1968.

Plant loosely tufted, shortly rhizomatous, brown scales at

base. Culms 50–120 cm tall, 4-noded, nodes black-brown. Leaf sheaths glabrous, smooth or scaberulous, shorter than internodes below and longer above; leaf blades broadly linear, 15–25 cm, 6–15 mm wide, both surfaces scabrid; ligule up to 1 cm, lanceolate. Panicle fairly loose, 10–22 × 2–6 cm; branches smooth. Spikelets 3.5–6 mm; glumes unequal, lower glume about half spikelet length, 1-veined, upper glume a little shorter than spikelet, 3-veined; lower florets staminate, lemmas ca. 5 mm, scabrid on back, margins ciliate, apex emarginate; first lemma awnless or mucronate; second lemma with subapical awn up to 4 mm; bisexual floret similar to staminate but smooth on back, scabrid near apex; palea 1(–2)-veined; anthers 2–3.5 mm. Fl. Jun.

• Grassy places in mountain valleys, forest margins and among shrubs; 2500–3000 m. S Gansu, W Sichuan.

Anthoxanthum laxum (R. Brown ex J. D. Hooker) Veldkamp (*Hierochloë laxa* R. Brown ex J. D. Hooker) has been confused with this species. *Anthoxanthum laxum* occurs on high-mountain ledges and in alpine pastures above 3000 m in E Afghanistan, Kashmir, Nepal, and N Pakistan. It can be distinguished by its smooth leaf blades, subequal glumes, and pilose or hirsute apex of the bisexual floret.

4. *Anthoxanthum tibeticum* (Bor) Veldkamp, *Blumea* 30: 350. 1985.

藏茅香 zang mao xiang

Hierochloë tibetica Bor, *Kew Bull.* [8] 1953: 271. 1953.

Plants with slender creeping rhizomes. Culms 20–35 cm tall, 2-noded. Leaf sheaths smooth, glabrous; leaf blades flat or involute, basal 2–5 cm, 2–3 mm wide, culm blades shorter and broader, both surfaces smooth and glabrous, margins scabrid; ligule 2–2.5 mm. Panicle loose or contracted, 2.5–5 × 1–3 cm, with ca. 10 spikelets; branches capillary, smooth, flexuous, pubescent. Spikelets obovate, 5–6 mm, purplish; glumes subequal, as long as spikelet, broadly ovate-oblong, 3-veined, apex hyaline, otherwise purple, back glabrous or a few scattered hairs; lower florets staminate, lemmas densely pubescent; first lemma bilobed, awnless; second lemma 2-cleft to about middle, short-awned from sinus, awn straight, 2–3 mm; bisexual floret ca. 2.5 mm, pubescent above middle; palea 2-veined; anthers 1.2–1.5 mm.

• Exposed mountain ridges and slopes; ca. 5000 m. Xizang.

5. *Anthoxanthum monticola* (Bigelow) Veldkamp, *Blumea* 30: 347. 1985.

高山茅香 gao shan mao xiang

Holcus monticola Bigelow, *New England J. Med. Surg.* 5: 334. 1816; *Hierochloë alpina* (Swartz ex Willdenow) Roemer & Schultes; *H. monticola* (Bigelow) Á. Löve & D. Löve; *Holcus alpinus* Swartz ex Willdenow.

Plant forming loose mats, shortly rhizomatous, base clothed in papery old sheaths. Culms solitary or few, erect, 10–40 cm tall, 2–3-noded. Leaf sheaths smooth, glabrous, longer than internodes, upper slightly inflated; leaf blades glossy, basal inrolled, 20–30 cm, 2–3 mm wide, culm blades shorter, flat; ligule 1–2 mm. Panicle contracted, oblong or ovate in outline, 1.5–4 × 1–2 cm; branches short, paired. Spikelets

broadly oblong, 5–6 mm; glumes subequal, as long as spikelet, lower 1–3-veined, upper 3–5-veined; lower florets staminate, lemmas scabrid-pubescent on back, hispid toward apex, margins ciliate; first lemma emarginate with 1–3 mm, straight sub-apical awn; second lemma 2-cleft to middle or below, awned from sinus, awn weakly geniculate, 4–7 mm; bisexual floret ca. 4 mm, pilose toward apex; palea 1-veined, ciliolate along upper part of vein; anthers ca. 2.5 mm. Fl. and fr. Jul–Aug. $2n = 56$ (also 58, 63, 64, 66, 68, 71, 72, 74–78).

Alpine steppe; ca. 2300 m. NE China [Japan, Korea, Mongolia, Russia; N Europe, North America].

This is an arctic-alpine species of both the Old and New Worlds.

The specific epithet of *Holcus alpinus* cannot be used when this name is transferred to *Anthoxanthum* because the heterotypic name *A. alpinum* Å. Löve & D. Löve already exists.

6. *Anthoxanthum hookeri* (Grisebach) Rendle, J. Linn. Soc., Bot. 36: 380. 1904.

藏黄花茅 zang huang hua mao

Ataxia hookeri Grisebach, Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ. 3: 77. 1868; *Anthoxanthum elongatum* (Handel-Mazzetti) Veldkamp; *A. latifolium* B. S. Sun & S. Wang; *A. latifolium* var. *purpurascens* B. S. Sun & S. Wang; *Hierochloë elongata* Handel-Mazzetti; *H. hookeri* (Grisebach) Maximowicz.

Plant loosely tufted, shortly rhizomatous. Culms 20–50 cm tall, 3–4-noded. Leaf sheaths glabrous or puberulous; leaf blades linear or broadly linear, 5–25 cm, 3–8 mm wide, pubescent or abaxial surface glabrous, apex acuminate; ligule 1.5–5 mm, truncate-lacerate. Panicle rather loose or contracted, lanceolate or lanceolate-oblong in outline, 6–10 cm. Spikelets lanceolate-oblong, 5.5–8 mm, green when young, maturing purplish brown; glumes unequal, lanceolate, lower glume 3–5(–6) mm, 1(–3)-veined, upper glume equal to spikelet, 3(–5)-veined; lower florets pubescent on back, apex 2-lobed, lobes acute; first floret usually staminate with palea (rarely stamens abortive), lemma 5–6 mm, lobed in upper 1/3, awned from sinus, awn fine, straight, 1–4 mm; second floret often sterile and epaleate (but sometimes staminate with palea), lemma awned from lower 1/4, apical lobes short or back splitting to awn insertion, awn geniculate, 6–11 mm; bisexual floret 2.5–3.2 mm, smooth, shiny, (3–)5-veined; palea veinless; anthers 2.5–3.5 mm. Fl. and fr. May–Dec.

Open grassy mountainsides, dry rocky ridges, forests; 2100–4000 m. Guizhou, Sichuan, Xizang, Yunnan [Bhutan, NE India, N Myanmar, Nepal].

The sexuality of the 2 lower florets is very variable in this species. *Anthoxanthum latifolium* is based on a particularly broad-leaved form from Yunnan.

7. *Anthoxanthum pallidum* (Handel-Mazzetti) Tzvelev, Rast. Tsentr. Azii 4: 35. 1968.

淡色黄花茅 dan se huang hua mao

Hierochloë pallida Handel-Mazzetti, Akad. Wiss. Wien,

Math.-Naturiss. Kl., Anz. 57: 273. 1920.

Culms geniculate at base, shortly stoloniferous, 7–16 cm tall. Leaf sheaths glabrous; leaf blades flat, lanceolate, 5–12 cm, 2–4 mm wide; ligule 1–2.5 mm. Panicle contracted, 2.5–4 × 0.4–0.5 cm; branches single or in pairs; pedicels very short, setulose-pilose. Spikelets obovate, ca. 3 mm; glumes subequal, ovate, pale with green keel, 3-veined, sparsely setose, apex acute; lower florets as long as glumes, sterile, composed only of lemmas, densely appressed-pilose on back, apex 2-lobed; first lemma with awn arising from middle, awn straight, equaling lemma body; second lemma deeply bifid, awned from sinus, awn straight; bisexual floret less than 1/2 length of glumes, smooth, shiny; anthers ca. 3 mm. Fl. and fr. spring to summer.

• Mountain slopes, damp meadows, ca. 2700 m. Sichuan, NE Yunnan.

8. *Anthoxanthum sikkimense* (Maximowicz) Ohwi, Bull. Tokyo Sci. Mus. 18: 8. 1947.

锡金黄花茅 xi jin huang hua mao

Hierochloë sikkimensis Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 32: 626. 1888; *Anthoxanthum gracillimum* (J. D. Hooker) Mez; *Hierochloë gracillima* J. D. Hooker.

Plant probably shortly rhizomatous. Culms solitary or few, very slender, 30–45 cm, 2–3-noded. Leaf blades narrowly linear, often involute when dry, 5–17 cm, ca. 0.3 mm wide; ligule 2–4 mm, truncate-erose. Panicle contracted, linear-oblong in outline, 3.8–5 cm; branches very short, with few spikelets. Spikelets oblong-ovate, 3–5 mm, yellow or purplish; glumes unequal, lower glume ovate, ca. 3 mm, upper glume oblong-ovate, as long as spikelet; lower florets sterile, composed only of lemmas, pilose on back, apex 2-lobed, lobes truncate-ciliolate; first lemma 3–3.8 mm, lobed in upper 1/3, awned from sinus, awn straight, 1.7–1.8 mm; second lemma 3.9–4 mm, awned from lower 1/4, awn geniculate, 6–6.7 mm; fertile floret ca. 2.3 mm, smooth, shiny; palea 1-veined.

Grassy mountainsides, among bushes; 2000–2500 m. Yunnan (Kunming, Chengjiang) [India (Sikkim), Nepal].

9. *Anthoxanthum horsfieldii* (Kunth ex Bennett) Mez ex Reeder, J. Arnold Arbor. 24: 327. 1950.

台湾黄花茅 tai wan huang hua mao

Ataxia horsfieldii Kunth ex Bennett, Pl. Jav. Rar. 8. 1838; *Anthoxanthum formosanum* Honda; *A. horsfieldii* var. *formosanum* (Honda) Veldkamp; *A. horsfieldii* var. *viridescens* (Honda) Veldkamp; *A. japonicum* (Maximowicz) Hackel ex Matsumura subsp. *luzoniense* (Merrill) T. Koyama; *A. luzoniense* Merrill; *A. viridescens* Honda; *Hierochloë horsfieldii* (Kunth ex Bennett) Maximowicz.

Plant loosely tufted, shortly rhizomatous. Culms 10–60 cm tall, 3–5-noded. Leaf sheaths glabrous or sparsely pilose; leaf blades loosely involute, 6–13 cm, 2–5 mm wide, glabrous or adaxial surface pubescent; ligule 2–4 mm, truncate. Panicle narrow, contracted, 2.5–7 cm; branches up to 5 cm; pedicels pubescent. Spikelets lanceolate-oblong, 4.3–5.5 mm; glumes un-

equal, glabrous, lower glume 2/3 to 3/4 length of upper glume, 1-veined, upper glume as long as spikelet, 3-veined; lower florets sterile, composed only of lemmas, ca. 4 mm, pilose on back, apex 2-lobed, lobes obtuse; first lemma awned from above middle, awn straight, 0.8–1.5 mm; second lemma awned from lower 1/4–1/3, awn geniculate, 4.5–6 mm; bisexual floret 2.5–3 mm, smooth, shiny; anthers 1.5–2 mm. Fl. Oct.

Mountains, grassy places, in sun or shade; 2500–3300 m. Guizhou, Taiwan [India, Japan, Malaysia, New Guinea, Philippines, Thailand].

Anthoxanthum horsfieldii is a variable species of mountains in SE Asia, extending into India. There are small differences between the populations from different islands or mountain areas, and these populations are sometimes recognized at varietal rank. However, this approach has led to a proliferation of varieties based on overlapping, only partially segregating characters and is not followed here.

Both lower florets appear to be sterile and epaleate in Taiwan, but in SE Asia the first floret may sometimes be staminate with a palea. *Anthoxanthum horsfieldii* is in fact very close to *A. hookeri* from the Himalayas, which differs in little more than its rather looser panicle and acute lemma lobes.

10. *Anthoxanthum odoratum* Linnaeus, Sp. Pl. 1: 28. 1753.

黄花茅 huang hua mao

Plant loosely tufted, sometimes rhizomatous. Culms 15–60(–100) cm tall, 1–3-noded. Leaf sheaths glabrous or loosely pilose, mouth glabrous or bearded; leaf blades flat, up to 12 cm, 2–7 mm wide, glabrous or loosely pilose, smooth or scabrid, apex acuminate; ligule 1–3 mm, obtuse. Panicle dense, spike-like, lanceolate to narrowly oblong in outline, 2–7(–10) × 0.4–1 cm; branches short; pedicels pubescent or glabrous. Spikelets lanceolate, 6–9 mm; glumes unequal, pubescent or punctiform-scabrid, margins sometimes ciliate, lower glume ca. 1/2 length of upper glume, 1-veined, upper glume subequal to spikelet, 3-veined; lower florets sterile, composed only of lemmas, 2.5–3.5 mm, pilose on back, apex 2-lobed, lobes short, obtuse; first lemma awned from near middle, awn straight, 2–4 mm; second lemma awned near base, awn geniculate, 7–9 mm; bisexual floret 2–3 mm, smooth, shiny; palea 1-veined; anthers 3–4.5 mm. Fl. and fr. May–Aug.

Meadows, alpine steppe; 1400–2900 m. Jiangxi, Taiwan (introduced), Xinjiang, NE China [Japan, Korea, Mongolia, Russia; Europe].

- 1a. Pedicels and glumes pubescent 10a. subsp. *odoratum*
1b. Pedicels and glumes glabrous 10b. subsp. *alpinum*

10a. *Anthoxanthum odoratum* subsp. *odoratum*

黄花茅(原亚种) huang hua mao (yuan ya zhong)

Leaf blades hairy or glabrous. Panicle up to 7(–10) cm; pedicels pubescent. Spikelets with pubescent glumes. $2n = 20$.

Meadows, introduced. Jiangxi (Lu Shan), Taiwan [Russia; Europe].

This is a polymorphic grass, introduced in grass seed or adventive in many temperate countries.

10b. *Anthoxanthum odoratum* subsp. *alpinum* (Á. Löve & D. Löve) Tzvelev, Zlaki SSSR, 354. 1976.

日本黄花茅 ri ben huang hua mao

Anthoxanthum alpinum Á. Löve & D. Löve, Rep. Univ. Inst. Appl. Sci., Reykjavik, Dept. Agric., Ser. B 3: 105. 1948; *A. nipponicum* Honda; *A. nipponicum* var. *furumii* Honda; *A. odoratum* var. *alpinum* (Á. Löve & D. Löve) Uechtritz; *A. odoratum* subsp. *furumii* (Honda) Koyama; *A. odoratum* subsp. *nipponicum* (Honda) Tzvelev; *A. odoratum* var. *nipponicum* (Honda) Tzvelev.

Leaf blades always glabrous. Panicle 2–3 cm; pedicels glabrous. Spikelets with glabrous glumes. Fl. and fr. Jun–Aug. $2n = 10$.

Alpine bush and steppe; 1400–2900 m. Xinjiang, NE China [Japan, Korea, Russia; Europe].

Diploid variants of *Anthoxanthum odoratum* occur mainly in the arctic and on mountains. They tend to be glabrous, but cannot be reliably separated from the widespread, tetraploid form on the basis of morphological characters.

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