

75. HELICTOTRICHON Besser ex Schultes & J. H. Schultes, Mant. 3
(Addit. I ad Mant. Cl. III): 526 [“326”]. 1827.

异燕麦属 *yi yan mai shu*

Wu Zhenlan (吴珍兰); Sylvia M. Phillips

Avenastrum Opiz; *Avenula* (Dumortier) Dumortier; *Trisetum* sect. *Avenula* Dumortier.

Perennials, tussocky, often rhizomatous. Leaf blades linear to setaceous, flat, folded or rolled; ligule membranous. Inflorescence a panicle, open or often contracted, sometimes without secondary branching. Spikelets with 2 to several fertile florets and 1 or 2 reduced sterile florets above; rachilla pilose, disarticulating below each floret; glumes lanceolate, slightly unequal, usually shorter than spikelet and often shorter than lemmas, hyaline to membranous, lower glume 1–3-veined, upper glume 3–5-veined, keel scaberulous, apex acute; floret callus shortly bearded; lemmas lanceolate, firmly membranous to leathery, rounded or weakly keeled, 5–7(–9)-veined, glabrous, awned from middle of back or slightly above, apex minutely to deeply 2–4-toothed; awn geniculate with twisted column, sometimes weakly so or almost straight; palea slightly shorter than lemma and enclosed within lemma margins, keels scabrid-ciliate to ciliate. Ovary densely hairy toward apex. Caryopsis with linear hilum; endosperm sometimes liquid.

About 100 species: Europe eastward to Japan, North America, also on tropical mountains; 14 species (seven endemic) in China.

Most species provide good forage.

- 1a. Palea keels smooth, glabrous, back deeply sulcate; hairs at apex of each rachilla internode 4–6 mm 1. *H. pubescens*
- 1b. Palea keels scabrid to ciliate, back flat at maturity; hairs at apex of each rachilla internode 1–3 mm.
 - 2a. Leaf blades flat or folded, keeled, margins and abaxial midrib prominently white-thickened, adaxial surface not ribbed; leaf sheath margins connate for part of length; floret callus bearded on sides only.
 - 3a. Rhizomes present, plant forming loose turf; leaf sheaths closed for more than 1/2 of length; leaf blades 5–12 mm wide; spikelets 2–2.5 cm 2. *H. dahuricum*
 - 3b. Rhizomes absent, plant forming dense turf; leaf sheaths closed for less than 1/4 of length; leaf blades 2–5 mm wide; spikelets 1–1.8 cm 3. *H. hookeri*
 - 2b. Leaf blades flat or rolled, margins and midrib not thickened, adaxial surface closely ribbed with deep grooves between; leaf sheath margins free to base; floret callus evenly bearded.
 - 4a. Panicle open, sometimes nodding; branches ascending or spreading, up to 10 cm.
 - 5a. Lemma apex subentire or minutely denticulate.
 - 6a. Culms 20–45 cm; ligules to 0.5 mm; rachilla internodes hairy throughout length 4. *H. abietetorum*
 - 6b. Culms up to 80 cm tall; ligules ca. 1 mm; rachilla internodes hairy only in upper part 5. *H. leianthum*
 - 5b. Lemma apex 2-toothed.
 - 7a. Panicle branches in whorls of up to 8, with branchlets almost to base; lower culm internodes and sheaths villous 6. *H. yunnanense*
 - 7b. Panicle branches 2–4 per node (up to 6 in *H. altius*), bare in lower part; lower culm internodes glabrous (sheaths sometimes pilose).
 - 8a. Nodes of culm pubescent 7. *H. altius*
 - 8b. Nodes of culm glabrous.
 - 9a. Leaf blades 10–25 cm, 3–5 mm wide; spikelets 1–1.4 cm 8. *H. junghuhnii*
 - 9b. Leaf blades 6–11 cm, ca. 2 mm wide; spikelets 0.8–1 cm 9. *H. delavayi*
 - 4b. Panicle laxly to densely contracted; branches erect or narrowly ascending, usually less than 4 cm.
 - 10a. Panicle 10–17 cm; lemmas densely scabrid; awn arising from upper 1/3 of lemma, recurved, scarcely twisted 10. *H. schmidii*
 - 10b. Panicle 2–9(–14) cm; lemmas smooth, scaberulous or puberulous; awn arising near middle of lemma, geniculate with twisted column.
 - 11a. Spikelets reddish violet; anthers 1–1.6 mm 11. *H. potaninii*
 - 11b. Spikelets brown or tinged violet; anthers 3–4.2 mm.
 - 12a. Panicle densely contracted; axis and branches densely pubescent; culm pubescent below panicle; spikelets golden brown 12. *H. tibeticum*
 - 12b. Panicle laxly contracted; axis and branches scabrid or puberulent only in upper part; culm glabrous below panicle; spikelets pale yellowish brown tinged violet.
 - 13a. Plant densely tufted; sheaths of culm leaves usually pilose; leaf blades scabrid on adaxial surface; anthers ca. 3 mm 13. *H. tianschanicum*
 - 13b. Plant loosely tufted; sheaths of culm leaves usually glabrous; leaf blades densely puberulous on adaxial surface; anthers ca. 4 mm 14. *H. mongolicum*

1. *Helictotrichon pubescens* (Hudson) Pilger, Repert. Spec. Nov. Regni Veg. 45: 6. 1938.

毛轴异燕麦 mao zhou yi yan mai

Avena pubescens Hudson, Fl. Angl. 42. 1762; *Avenastrum pubescens* (Hudson) Opiz; *Avenula pubescens* (Hudson) Dumortier.

Perennial, shortly rhizomatous. Culms solitary or few, erect, 30–120 cm tall, 3–4-noded. Leaf sheaths of lower leaves pubescent, upper and infrequently also lower glabrous, closed to above middle; leaf blades linear-lanceolate, flat, 10–30 cm, 4–10 mm wide, usually pubescent on both surfaces, abaxial surface with thin midrib, margins only slightly thickened, apex subacute; ligule lanceolate, 3–6 mm. Panicle lax, oblong in outline, 8–15 cm or more; branches 4–6 per node, up to 5 cm, fine, scaberulous. Spikelets 1.2–1.7 cm, pale green or variegated purple, florets 2–4; rachilla hairs 4–6 mm; glumes hyaline, lower glume 10–11 mm, 1–3-veined, upper glume 13–17 mm, 3-veined; lemmas firmly herbaceous, hyaline above awn insertion, lowest 9–11 mm, scabrid, apex irregularly 2-denticulate; awn 1.5–2 cm, geniculate, column twisted, terete; palea subequal to lemma, keels close together, smooth, glabrous, hyaline between keels. Anthers 5–7 mm. Fl. and fr. Jun–Sep.

Grassy mountain slopes, forest margins, among shrubs; 1000–2600 m. Xinjiang [Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan; SW Asia (Caucasus, Turkey), Europe; introduced in North America].

This is a widespread, polymorphic species, varying especially in the degree of hairiness of the leaves and the width of the blades. The Chinese population probably corresponds to a broad-leaved, rather sparsely hairy form found in neighboring parts of Russia and C Asia, *Helictotrichon pubescens* var. *latifolium* (Printz) Tzvelev. No specimens from China have been seen. The typical variety has hairy leaves usually up to 5 mm wide.

Helictotrichon pubescens is distinguished from all other species in the genus by its palea with close, smooth keels. Molecular studies place it close to the group of species including *H. dahuricum* (see the comment under that species). However, it differs morphologically from those species in several characters besides the palea, including unthickened leaf blade margins, an evenly bearded (vs. laterally bearded) callus, and a hilum as long as the caryopsis (vs. half as long).

2. *Helictotrichon dahuricum* (Komarov) Kitagawa, Rep. Inst. Sci. Res. Manchoukuo 3: App. 1, 77. 1939.

大穗异燕麦 da sui yi yan mai

Avena planiculmis Schrader subsp. *dahurica* Komarov, Fl. Kamtschatka 1: 159. 1927; *Avenastrum dahuricum* (Komarov) Roshevitz; *Avenula dahurica* (Komarov) W. Sauer & H. Chmelistschek.

Perennial, rhizomatous, forming loose turf. Culms solitary or few, erect from decumbent base, 50–100 cm tall, 2–3-noded. Leaf sheaths of cauline leaves closed for 1/2 or more of length; leaf blades linear-lanceolate, flat, 8–25 cm, 5–12 mm wide, abaxial surface smooth with thick white midrib, adaxial surface scaberulous, margins thick, white, scaberulous, base rounded, apex abruptly acute; ligule lanceolate, 5–7(–10) mm. Panicle loosely contracted, 7–15 cm; branches usually paired, ascend-

ing, scabrid or almost smooth. Spikelets 1.7–2.5 cm, golden brown and purple, florets 5–6; rachilla hairs 1.5–2.5 mm; glumes membranous, 3-veined, lower glume 9.5–11 mm, upper glume 12–15 mm; lemmas leathery, hyaline above awn insertion, lowest 11–14 mm, asperulous, apex irregularly 2-denticulate; awn 1.5–1.7 cm, geniculate, column twisted, flat; palea keels ciliate. Anthers 6.5–7 mm. Fl. and fr. Jul–Sep.

Open forests, grassy places, among shrubs; 700–1000 m. Heilongjiang, Nei Mongol [Mongolia, E Russia].

Helictotrichon dahuricum and *H. hookeri* belong to a group of species that have been shown by molecular studies to be only distantly related to *Helictotrichon* s.s. This group is sometimes separated as the genus *Avenula*. Some of the most obvious morphological distinctions are given in key couplet 2. Unfortunately the type species of *Avenula* is *H. pubescens*, which shows major morphological differences from the other species placed in *Avenula*, as noted above. For this reason *Helictotrichon* is maintained here in the traditional sense. Further morphological and molecular studies are required to clarify relationships within the group.

3. *Helictotrichon hookeri* (Scribner) Henrard, Blumea 3: 429. 1940.

异燕麦 yi yan mai

Perennial, rhizomes very short or absent, forming mats. Culms tufted, erect, 20–70 cm tall, usually 2-noded. Leaf sheaths of cauline leaves closed for less than 1/4 of length; leaf blades flat or folded, 10–25 cm, 2–5 mm wide, smooth or scabrid, margins thick, white, base straight, apex subacute; ligule lanceolate, 3–6 mm. Panicle contracted, sometimes dense, 4–15 cm; branches usually paired, erect or ascending, scabrid, bearing 1–4 spikelets. Spikelets 1.1–1.7 cm, green or brown, florets 3–6; rachilla hairs 1–2 mm; glumes membranous, 3(–5)-veined, lower glume 9–12 mm, upper glume 10–13 mm; lemmas leathery, hyaline above awn insertion, lowest 10–13 mm, asperulous, apex 2-toothed; awn 1.2–1.5 cm, geniculate, column twisted, flat; palea keels minutely ciliate. Anthers ca. 4 mm. Fl. and fr. Jun–Sep.

Hill slopes in steppe, forest margins, moist meadows in high mountains; 100–3500 m. Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, Yunnan [Kazakhstan, Kyrgyzstan, Mongolia, Russia; North America].

This is a variable species with higher-altitude forms distinguishable at subspecific rank. These forms correspond to plants from uplands in W North America, from where the species was first described.

- 1a. Panicle 4–8 cm, dense; spikelets golden brown 3a. subsp. *hookeri*
- 1b. Panicle 5–15 cm, contracted; spikelets greenish 3b. subsp. *schellianum*

3a. *Helictotrichon hookeri* subsp. *hookeri*

异燕麦(原亚种) yi yan mai (yuan ya zhong)

Avena hookeri Scribner, True Grasses 123. 1890; *A. tentoensis* Honda; *Avenastrum asiaticum* Roshevitz; *A. tentoense* (Honda) Kitagawa; *Helictotrichon asiaticum* (Roshevitz) Grossheim.

Plant 20–50 cm tall. Panicle 4–8 cm, dense, branches usually bearing a single spikelet. Spikelets golden brown.

Mountain meadows and rocky mountain slopes; below 3500 m. Qinghai, Sichuan, Xinjiang, Yunnan [Mongolia, Russia; North America].

3b. *Helictotrichon hookeri* subsp. *schellianum* (Hackel) Tzvelev, *Novosti Sist. Vyssh. Rast.* 8: 68. 1971.

奢异燕麦 she yi yan mai

Avena schelliana Hackel, *Trudy Imp. S.-Peterburgsk. Bot. Sada* 12: 419. 1892; *Avenula hookeri* (Scribner) Holub subsp. *schelliana* (Hackel) M. N. Lomonosova; *A. schelliana* (Hackel) W. Sauer & H. Chmelistschek; *Helictotrichon schellianum* (Hackel) Kitagawa.

Plant 30–80 cm tall. Panicle 5–15 cm, contracted, branches bearing up to 4 spikelets. Spikelets silvery green, sometimes tinged brownish or violet.

Hill slopes in steppe, rocky slopes, forest margins. Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Xinjiang [Kazakhstan, Kyrgyzstan, Mongolia, Russia].

4. *Helictotrichon abietetorum* (Ohwi) Ohwi, *Acta Phytotax. Geobot.* 6: 151. 1937.

冷杉异燕麦 leng shan yi yan mai

Avena abietetorum Ohwi, *Acta Phytotax. Geobot.* 2: 162. 1933 [“*abietetorum*”], emend. Ohwi, *J. Jap. Bot.* 17: 441. 1941; *Helictotrichon hideoi* (Honda) Ohwi subsp. *abietetorum* (Ohwi) T. Koyama.

Perennial. Culms tufted, erect, 20–45 cm tall, 1–3-noded. Leaf sheaths often longer than internodes, glabrous; leaf blades linear, flat or rolled, 10–30 cm, 2–4 mm wide, abaxial surface smooth, glabrous, adaxial surface densely puberulous; ligule ca. 0.5 mm or absent, margin ciliolate. Panicle loose, narrowly lanceolate in outline, 10–15 cm; branches 2–4 per node, ascending, 4–5 cm, scabrid, bare in lower part, each bearing 1 or 2 spikelets. Spikelets ca. 1 cm, yellowish green or purplish, florets usually 3; rachilla hairs 2–2.5 mm; lower glume narrow ovate, 4.2–7 mm, 1(–2)-veined, upper glume 6.3–8.3 mm, 3-veined; lemmas herbaceous with membranous apex, 7-veined, first lemma 7.5–9 mm, smooth, apex usually subentire, occasionally splitting into 2 teeth; awn arising at upper 2/5 of lemma, 1.2–1.6 cm, geniculate, column loosely twisted, terete; palea keels ciliolate. Anthers 2.5–3 mm.

- High mountain peaks; ca. 3000 m. Taiwan.

5. *Helictotrichon leianthum* (Keng) Ohwi, *J. Jap. Bot.* 17: 440. 1941.

光花异燕麦 guang hua yi yan mai

Avena leiantha Keng, *Bull. Fan Mem. Inst. Biol., Bot.* 7: 35. 1936.

Perennial. Culms tufted, erect, up to 80 cm tall, 2–3-noded, glabrous or sparsely retrorsely pubescent below nodes. Leaf sheaths lax, glabrous; leaf blades flat or involute when dry, 10–30 cm, 3–6 mm wide, abaxial surface glabrous, adaxial surface pubescent, apex acuminate; ligule truncate, ca. 1 mm. Pan-

icle loose, 15–18 cm, nodding; branches in distant pairs, slender, often flexuous, scabrid, lower ca. 7 cm, bearing up to 4 spikelets in upper part. Spikelets 1–1.3 cm, pale green, florets 3–4; rachilla internodes glabrous toward base, hairs in upper part 1–2 mm; lower glume 4.6–5 mm, 1-veined, upper glume 5–7 mm, 3-veined; lemmas subleathery with hyaline apex, lowest 9–10 mm, 7-veined, smooth, apex subentire, minutely denticulate; awn 1.5–2 cm, weakly geniculate, column loosely twisted, terete; palea keels ciliate, hairs ca. 0.3 mm. Anthers 3–3.5 mm. Fl. and fr. May–Jul.

- Under forests in high mountains, mountain valleys, shady mountain slopes, damp places; 700–3700 m. Anhui, Gansu, Guizhou, Hubei, Shaanxi, Shanxi, Sichuan, Yunnan, Zhejiang (Lin’an).

This is an element of the *Helictotrichon junghuhnii* complex with rather short rachilla hairs confined to the upper part of the rachilla internode, a more or less undivided lemma apex, and conspicuously ciliate palea keels. It is very similar to *H. hideoi* (Honda) Ohwi from Japan, which also has a subentire lemma apex, but differs by its pubescent leaf sheaths and awn arising slightly higher on the lemma back.

6. *Helictotrichon yunnanense* B. S. Sun & S. Wang, *J. Yunnan Univ.* 15: 188. 1993.

滇异燕麦 dian yi yan mai

Perennial, shortly rhizomatous. Culms loosely tufted, 60–70 cm tall, 3–4-noded, lower internodes villous, especially below nodes. Leaf sheaths densely villous, usually longer than internodes; leaf blades broadly linear, flat, tough, 15–18 cm, 5–8 mm wide, abaxial surface asperulous, adaxial surface prominently ridged, hispid, apex subacute; ligule truncate, ca. 1 mm, back hairy, margin ciliate. Panicle loose, 20–30 cm, many spiculate; branches in whorls of up to 8, lower 8–10 cm, scabrid, with branchlets and spikelets throughout length. Spikelets 1.2–1.5 cm, green or tinged purplish, florets 3–5, spaced; rachilla filiform, hairs ca. 3.5 mm; glumes lightly keeled, keel scabrid, apex acuminate, lower glume ca. 5 mm, 1-veined, upper glume ca. 10 mm, 3-veined; lemmas papery with membranous apex, lowest ca. 10 mm, 5-veined, smooth, apex acuminate or splitting into 2 acuminate-mucronate teeth; awn ca. 1.5 cm, gently curved or almost straight, slightly twisted in lower half, terete; palea keels scabrid-ciliolate. Anthers 3.2–3.5 mm. Fl. and fr. summer to autumn.

- Mountain slopes; ca. 3500 m. NW Yunnan (Zhongdian).

This distinctive species is easily recognizable by its densely villous leaf sheaths and lower culm internodes, many-spiculate panicle with whorled branches, slender, elongate rachilla internodes, and only slightly curved awn.

7. *Helictotrichon altius* (Hitchcock) Ohwi, *J. Jap. Bot.* 17: 440. 1941.

高异燕麦 gao yi yan mai

Avena altior Hitchcock, *Proc. Biol. Soc. Washington* 43: 96. 1930; *Avenastrum trisetoides* Kitagawa.

Perennial, shortly rhizomatous. Culms erect from shortly decumbent base, solitary or few, 1–1.2 m tall, 3–4-noded, nodes pubescent. Leaf sheaths usually shorter than internodes, densely puberulous or basal sheaths glabrous; leaf blades broadly linear, flat, ca. 15 cm, 3–8 mm wide, abaxial surface pubescent, sca-

brid, adaxial surface pilose, or sometimes glabrous; ligule truncate or erose, 1–2 mm, margin ciliolate. Panicle loose, lanceolate to oblong in outline, 10–20 cm; branches 4–6 per node, ascending, slender, often flexuous, up to 7 cm, scabrid, lower part bare, upper part bearing 1–3 spikelets. Spikelets 0.8–1.4 cm, yellowish green or purplish green, florets 3–4(–5); rachilla hairs 2–3 mm; glumes thinly membranous, lower glume 4–7 mm, 1-veined, upper glume 8–11 mm, 3-veined; lemmas leathery, lowest ca. 9 mm, 5–7-veined, smooth; awn 1–1.5 cm, geniculate, column twisted, terete; palea keels ciliolate. Anthers 4–5 mm. Fl. and fr. Jul–Aug.

• Moist grassy slopes, under shrubs, *Picea* forests; 2000–4000 m. Gansu, Heilongjiang, Ningxia, Qinghai, Sichuan.

This is an element of the *Helictotrichon junghuhnii* complex, mainly distinguished by the hairy culm nodes.

8. *Helictotrichon junghuhnii* (Buse) Henrard, *Blumea* 3: 425. 1940.

变绿异燕麦 *bian lü yi yan mai*

Avena junghuhnii Buse in Miquel, Pl. Jungh., Gramineae, preprint, 15. 1854; *A. aspera* Munro ex Thwaites var. *roylei* J. D. Hooker; *Helictotrichon virescens* (Nees ex Steudel) Henrard; *Trisetum virescens* Nees ex Steudel.

Perennial. Culms loosely tufted, erect, 60–120 cm tall, 3–5-noded. Leaf sheaths usually longer than internodes, basal sheaths densely pubescent, upper sheaths glabrous; leaf blades flat or margins involute, 10–25 cm, 3–5 mm wide, scabrid or adaxial surface thinly pubescent, apex acuminate; ligule truncate, 1–2 mm. Panicle loose, up to 20 cm, erect or nodding; branches 2–4 per node, ascending or spreading, lower 5–12 cm, slender, scabrid, bare in lower part, with up to 9 spikelets. Spikelets 1–1.4 cm, greenish or purplish, florets 2–5; rachilla hairs 1–2 mm; glumes hyaline at margins and apex, lower glume 4–9 mm, 1–3-veined, upper glume 7–10 mm, 3–5-veined; lemmas subleathery with hyaline apex, lowest 9–11 mm, 5–7-veined, scabrid at least toward apex, apex 2-lobed, lobes acuminate or shortly awn-pointed; awn 1–2 cm, weakly geniculate, column loosely twisted, terete; palea keels minutely ciliolate to ciliate with 0.1–0.2 mm hairs. Anthers 2–3.5 mm. Fl. and fr. Jun–Aug.

Grassy mountain slopes, forests, damp places; 2000–3900 m. Guizhou, Henan, Qinghai, Shaanxi, Sichuan, E Xizang, Yunnan [Bhutan, India, Indonesia, Myanmar, Nepal, Pakistan].

The publication of the name *Avena junghuhnii* in Buse's preprint in February 1854 shortly predates the publication of *Trisetum virescens* by Steudel in April 1854.

This taxon lies at the center of a polymorphic complex extending from Pakistan and India to China and mountains in SE Asia. Variation within the complex is poorly understood and requires further investigation. Variable characters include lemma scabridity and apex, length and quantity of rachilla hairs, length of the cilia on the palea keels, and anther length. The midline of the lemma above the awn insertion is very fragile, frequently splitting into acuminate lobes, but sometimes remaining almost entire, even within the same panicle.

The name *Helictotrichon polyneurum* (J. D. Hooker) Henrard has

been misapplied in China to specimens of *H. junghuhnii*. This member of the *H. junghuhnii* complex is known only from the Nilgiri Hills of S India. It is distinguished by its open, ovate panicle with smooth, widely spreading panicle branches and large, brownish spikelets with many prominent veins.

9. *Helictotrichon delavayi* (Hackel) Henrard, *Blumea* 3: 427. 1940.

云南异燕麦 *yun nan yi yan mai*

Avena delavayi Hackel, *Oesterr. Bot. Z.* 52: 189. 1902.

Perennial. Culms erect, slender, 35–50 cm tall, 2–3-noded. Leaf sheaths tight, shorter than internodes, puberulous near margins, otherwise glabrous; leaf blades narrowly linear, flat or margins involute, stiff, 6–11 cm, 1.5–2 mm wide, abaxial surface of lower blades pubescent, both surfaces scabrid, apex acute; ligule truncate, 1.5–2 mm. Panicle ovate-oblong in outline, 5–10 cm, slightly nodding; branches usually paired, lower ca. 6 cm, scabrid, bearing 2–4 spikelets in distal part. Spikelets 0.8–1 cm, green variegated yellow and purple, florets 3–4; rachilla shortly bearded; lower glume 5.5–7 mm, 1-veined, upper glume 7–8 mm, 3-veined; lemmas firm with scarious apex, lowest 7.5–9 mm, 5-veined, scaberulous, apex 2-toothed, teeth acuminate-mucronate; awn 1.3–1.5 cm, geniculate with twisted column, terete; palea slightly shorter than lemma, keels ciliolate. Anthers 2–2.5 mm. Fl. and fr. Jun–Aug.

• Montane meadows, forests; 2100–3700 m. Shaanxi, Sichuan, Yunnan.

This is a small, narrow-leaved variant from the *Helictotrichon junghuhnii* complex.

10. *Helictotrichon schmidii* (J. D. Hooker) Henrard, *Blumea* 3: 427. 1940.

粗糙异燕麦 *cu cao yi yan mai*

Perennial. Culms tufted, 50–70 cm tall, 3-noded. Leaf sheaths densely pubescent; leaf blades flat, folded or rolled, mainly basal, 7–12 cm, 2–4 mm wide, scabrid or pubescent; ligule truncate, ca. 2 mm, usually lacerate. Panicle narrowly contracted, linear-oblong, 10–17 cm; branches 2 or 3 per node, lowest up to 3.5 cm, erect, scaberulous or pubescent, bearing branchlets and short-pedicelled spikelets to base. Spikelets 0.7–1 cm, greenish or purplish, florets usually 3; rachilla hairs ca. 1 mm; glumes membranous, lower glume (1.5–)4–6 mm, 1-veined, upper glume (3–)5.5–7 mm, 3-veined, apex acuminate-mucronate; lemmas herbaceous with membranous apex, lowest 6–7 mm, 5–7-veined, densely scabrid, sometimes with a few scattered hairs, awned from upper 1/5–1/3, apex 2-toothed, teeth acuminate-aristulate; awn 0.5–1 cm, reflexed from near base, scarcely twisted, terete; palea keels scabrid-ciliolate, hairs ca. 0.1 mm. Anthers 1.4–2 mm. Fl. and fr. Apr–Aug.

Grassy clearings in forests, riversides, ditches; 2000–3300 m. Guizhou, Sichuan, Yunnan [S India].

This species is otherwise known only from the hills of S India. The awn arises higher on the lemma back than usual and is outwardly curved rather than geniculate. The Indian population has longer lemmas (7–9 mm).

Trisetum lautum Chrtk (Folia Geobot. Phytotax. 25: 333. 1990), described from Yunnan, may be the same as this species. The type has not been seen.

- 1a. Panicle densely spiculate; spikelets 0.8–1 cm; lower glume 4–6 mm, upper glume 5.5–7 mm 10a. var. *schmidii*
1b. Panicle loose and delicate, branches spaced; spikelets ca. 0.7 cm; lower glume 1.5–3.5 mm, upper glume 3–5.5 mm 10b. var. *parviglumum*

10a. Helictotrichon schmidii var. *schmidii*

粗糙异燕麦(原变种) cu cao yi yan mai (yuan bian zhong)

Avena aspera Munro ex Thwaites var. *schmidii* J. D. Hooker, Fl. Brit. India 7: 277. 1896 [“1897”].

Culms relatively stout, erect. Panicle densely contracted, many spiculate; branches 2–3 per node. Spikelets 0.8–1 cm; lower glume 4–6 mm, upper glume 5.5–7 mm. Fl. and fr. Apr–Aug.

Grassy clearings in forests, ditches; 2000–3300 m. Guizhou, Sichuan, Yunnan [S India].

10b. Helictotrichon schmidii var. *parviglumum* Keng ex Z. L. Wu, Acta Biol. Plateau Sin. 2: 15. 1984.

小颖异燕麦 xiao ying yi yan mai

Culms slender, delicate. Panicle sparse; branches short, spaced, bearing 1–3 spikelets. Spikelets ca. 0.7 cm; lower glume 1.5–3.5 mm, upper glume 3–5.5 mm. Fl. and fr. Apr–Sep.

• Riversides, moist places, forests; 2800–3300 m. Sichuan, Yunnan.

The identity and status of this taxon require confirmation.

11. Helictotrichon potaninii Tzvelev, Rast. Tsentr. Azii 4: 101. 1968.

短药异燕麦 duan yao yi yan mai

Perennial, loosely tufted. Culms erect from ascending base, 25–50 cm tall, 2–3-noded. Leaf sheaths smooth, glabrous; leaf blades narrowly linear, flat, 5–20 cm, 2–4 mm wide, adaxial surface slightly scabrid or sparsely pilose, abaxial surface almost smooth; ligule 1.5–3.5 mm, margin lacerate. Panicle dense, spikelike, narrowly oblong in outline, 5–9 cm, often interrupted, slightly nodding; branches very short, scabrid. Spikelets 0.7–0.9 cm, reddish violet, florets 3–4; rachilla hairs 2–4 mm; glumes unequal, lower glume ca. 5 mm, 1-veined, upper glume ca. 7 mm, 3-veined; lemmas firm with membranous apex, 6–9.5 mm, scaberulous, apex finely 2-toothed; awn 1–1.4 cm, geniculate, column twisted, terete; palea keels ciliate. Anthers 1–1.6 mm. Fl. Jun–Jul.

• High mountain forests; 3900–4200 m. Sichuan.

12. Helictotrichon tibeticum (Roshevitz) J. Holub, Preslia 31: 50. 1959.

藏异燕麦 zang yi yan mai

Perennial, densely tufted. Culms erect, 15–100 cm tall, 2–

3-noded, pubescent below panicle. Leaf sheaths densely pubescent or sometimes glabrous; leaf blades filiform, often rolled, 15–30 cm, 1–2 mm wide, densely pubescent on both surfaces, or sometimes scabrid; ligule 0.3–0.5 mm, margin ciliate. Panicle contracted, often dense and spikelike, ovate to oblong in outline, 2–6(–14) cm, rachis, branches, and pedicels all densely pubescent; branches suberect, 0.5–5 cm, lower with 4–7 spikelets. Spikelets 0.7–1.2 cm, golden brown or dark brown, florets 2–4; rachilla hairs 1.5–2 mm; glumes membranous, lower glume 7–9 mm, 1-veined, upper glume 8–11 mm, 3-veined; lemmas firmly papery, lowest 6–8.5 mm, 5–7-veined, scaberulous or puberulous, apex minutely 2-toothed or entire; awn 1–1.5 cm, weakly geniculate, column loosely twisted, terete; palea keels ciliate. Anthers 3–4.2 mm. Fl. and fr. Jun–Sep.

• Rocky mountain slopes, alpine steppe, among shrubs; 2600–4600 m. Gansu, Nei Mongol, Qinghai, Sichuan, Xinjiang (Tian Shan), Xizang, Yunnan.

This is a handsome species with contracted, golden brown panicles.

- 1a. Panicle densely contracted, 2–6 cm; spikelets with 2(–3) florets 12a. var. *tibeticum*
1b. Panicle laxly contracted, 6–14 cm; spikelets with 3–4 florets 12b. var. *laxiflorum*

12a. Helictotrichon tibeticum var. *tibeticum*

藏异燕麦(原变种) zang yi yan mai (yuan bian zhong)

Avena tibetica Roshevitz, Izv. Glavn. Bot. Sada RSFSR 27: 98. 1928; *A. suffusca* Hitchcock; *Helictotrichon suffusum* (Hitchcock) Ohwi; *H. tibeticum* var. *suffusum* (Hitchcock) Tzvelev.

Culms 15–70 cm tall. Panicle densely contracted, spike-like, ovate to oblong in outline, 2–6 cm; branches 0.5–1.3 cm. Spikelets with 2(–3) florets. Fl. and fr. Jun–Sep.

• Rocky mountain slopes, alpine steppe, among shrubs; 2600–4600 m. Gansu, Nei Mongol, Qinghai, Sichuan, Xinjiang (Tian Shan), Xizang, Yunnan.

12b. Helictotrichon tibeticum var. *laxiflorum* Keng ex Z. L. Wu, Acta Biol. Plateau Sin. 2: 16. 1984.

疏花藏异燕麦 shu hua zang yi yan mai

Culms 50–100 cm tall. Panicle laxly contracted, narrowly elliptical in outline, 6–14 cm; branches up to 5 cm. Spikelets with 3–4 florets. Fl. Jun–Jul.

• Mountain slopes, meadow steppe; 3200–3400 m. Qinghai, Sichuan.

13. Helictotrichon tianschanicum (Roshevitz) Henrard, Blumea 3: 429. 1940.

天山异燕麦 tian shan yi yan mai

Avenastrum tianschanicum Roshevitz, Izv. Bot. Sada Akad. Nauk SSSR 30: 773. 1932.

Perennial, densely tufted. Culms erect, 14–50 cm tall, glabrous below panicle. Leaf sheaths usually densely pubescent; leaf blades filiform, 1/8–1/2 length of culms, 1.5–3 mm wide,

scabrid on adaxial surface; ligule of basal leaves 2–3 mm, of culm leaves less than 1 mm. Panicle contracted, oblong in outline, 4–8 cm; branches suberect, short, puberulous, with few spikelets. Spikelets 0.9–1.1 cm, yellowish brown variegated violet, florets 2–3; rachilla bearded; lower glume 8–10 mm, 1–3-veined, upper glume 9–11 mm, 3–5-veined; lowest lemma 7–8 mm, 5–7-veined, apex denticulate; awn ca. 1.5 cm, genicu-

late, column twisted, terete; palea keels ciliolate. Anthers ca. 3 mm. Fl. and fr. Jul–Sep.

Shady places on mountain slopes, forests; 1400–2700 m. Xinjiang (Tian Shan) [Kazakhstan (Tien Shan), Tajikistan (Pamirs)].

Several species of *Helictotrichon*, including *H. tianschanicum* and *H. mongolicum*, have been described by Russian authors from the mountain ranges bordering Xinjiang and Mongolia. The described differences between them are very slight and may perhaps refer to geographic races rather than species. It has not been possible to study variation nor to verify their identity.

Helictotrichon altaicum Tzvelev (*H. desertorum* subsp. *altaicum* (Tzvelev) Holub), described from Mongolia, has been reported in Xinjiang. It differs mainly in the presence of a continuous ring of subepidermal sclerenchyma in the leaf blades, which is lacking in *H. tianschanicum* and *H. mongolicum*.

14. *Helictotrichon mongolicum* (Roshevitz) Henrard, *Blumea* 3: 431. 1940.

蒙古异燕麦 meng gu yi yan mai

Avena mongolica Roshevitz, *Izv. Glavn. Bot. Sada SSSR* 27: 96. 1928.

Perennial, densely tufted. Culms erect, 12–16 cm tall, glabrous or scabrid, 1–2-noded. Leaf sheaths glabrous or minutely puberulous; leaf blades filiform, 15–30 cm, 1.5–2 mm wide, puberulous on adaxial surface; ligule of basal leaves 2–3 mm, of culm leaves ca. 0.5 mm, margin puberulous. Panicle contracted or rather lax, 3–9 cm, often somewhat 1-sided; branches paired, 1–2 cm, puberulous. Spikelets 1–1.2 cm, yellowish brown or variegated violet, florets 3; rachilla bearded; glumes 9–11 mm, lower glume 1-veined, upper glume 3-veined; lowest lemma 8–10 mm, 5–7-veined, apex 2-toothed; awn 1.3–1.5 cm, geniculate, column twisted, terete; palea keels scabrid. Anthers ca. 4 mm. Fl. and fr. Jun–Sep.

Montane forests, subalpine meadows, riversides; 1200–2700 m. Xinjiang [Kazakhstan (Tarbagatai Mountains), Mongolia, Russia (Siberia)].

Flora of China 22: 317–322. 2006.