

1. *Phaenosperma globosa* Munro ex Bentham, J. Linn. Soc., Bot. 19: 59. 1881.

显子草 xian zi cao

Euthryptochloa longiligula Cope.

Culms robust, solitary or tufted, stiff, erect or climbing, 1–1.5(–3) m, 4–5-noded, unbranched. Leaf sheaths smooth, usually shorter than internodes; leaf blades 10–50 × 1–3 cm, smooth or scabrous, abaxial (upper) surface dark green, adaxial (lower) surface whitish, apex acuminate; ligule 5–15(–25)

mm, scabrous. Panicle 15–40 cm, branches 5–10 cm, widely spreading at maturity. Spikelets narrowly elliptic-oblong at first, gaping at maturity, 4–4.5 mm, glossy; lower glume ca. 1/2 spikelet length, 1–3-veined; upper glume as long as spikelet, 3–5-veined; lemma narrowly ovate, apex obtuse. Anthers 1.5–2 mm. Caryopsis black-brown, 2.5–3 mm wide, rugose. Fl. and fr. May–Sep.

Mountain slopes, streams, valleys, roadsides in forests; 100–1800 m. Anhui, Gansu, Guangxi, Hubei, Jiangsu, Jiangxi, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [NE India, Japan, S Korea].

7. Tribe STIPEAE

针茅族 zhen mao zu

Wu Zhenlan (吴珍兰); Sylvia M. Phillips

Perennials, usually forming tussocks. Leaf blades linear to filiform, often convolute or folded; ligule membranous, margin often ciliolate. Inflorescence an open or contracted panicle, sometimes spikelike, spikelets all alike. Spikelets with 1 floret (to 3 in *Duthiea*), terete or laterally compressed, disarticulating above glumes; rachilla extension usually absent (present in *Stephanachne*, *Sinochasea*, and *Duthiea*); glumes equaling or longer than floret, persistent, hyaline to membranous, 1–7-veined; floret callus obtuse to pungent; lemma rounded on back, membranous to leathery, firmer than glumes, often indurated at maturity, 3–9-veined, often enclosing palea, apex entire or 2-toothed, awned from apex or between teeth; awn straight or geniculate, glabrous, pubescent or plumose; palea subequal to lemma, hyaline to membranous, usually 2-veined (5–7-veined in *Psammochloa*) but not keeled, apex usually acute. Lodicules 2 or 3. Stamens mostly 3 (1 in *Stephanachne monandra*), anthers sometimes bearded with apical tuft of short hairs. Stigmas 2 or 3. Caryopsis fusiform, tightly enclosed by lemma and palea; hilum linear; embryo short.

Between nine and 17 genera: temperate and warm-temperate regions; ten genera (one endemic) and 67 species (17 endemic) in China.

The number of genera that should be recognized in *Stipeae* is still controversial. Sometimes a broad view is taken of *Stipa*, but in Asia it has usually been broken into segregate taxa. This traditional treatment is followed here, with a few exceptions, to avoid the creation of many new combinations while the taxonomy is still unsettled.

Additionally, the first four small genera are of uncertain tribal placement. These are little known, undercollected grasses from the Himalayas and W China. They are sometimes placed in *Aveneae*, but on balance show more Stipoid characteristics, including multiveined glumes, an unkeeled palea, often 3 lodicules, and a linear hilum.

Lemma measurements refer to the lemma body and the callus together.

- 1a. Lemma apex deeply 2-lobed, lobes slenderly acuminate or bristle-like.
 - 2a. Lemma with a crown of hairs arising from base of apical lobes.
 - 3a. Rachilla extension present 44. *Stephanachne*
 - 3b. Rachilla extension absent 45. *Trikeria*
 - 2b. Lemma without an apical crown of hairs.
 - 4a. Ovary strigose; stigmas raised upon a long slender style 47. *Duthiea*
 - 4b. Ovary glabrous; stigmas sessile.
 - 5a. Stigmas 2 45. *Trikeria*
 - 5b. Stigmas 3 46. *Sinochasea*
- 1b. Lemma apex entire or shortly 2-toothed (if rarely 2-lobed, lobes not bristle-like).
 - 6a. Palea 5–7-veined, resembling lemma 48. *Psammochloa*
 - 6b. Palea 0–2-veined.
 - 7a. Floret dorsally compressed 49. *Piptatherum*
 - 7b. Floret terete or laterally compressed.
 - 8a. Callus usually long (more than 0.6 mm), pungent; lemma usually leathery, margins overlapping and enclosing palea, apex entire or minutely 2-toothed; awn usually deciduous, strongly geniculate with twisted column 50. *Stipa*
 - 8b. Callus usually short (less than 0.6 mm), obtuse to acute; lemma usually papery, margins typically not overlapping with palea midline exposed, infrequently overlapping, apex usually 2-toothed; awn persistent or deciduous, straight or weakly geniculate.
 - 9a. Awn plumose throughout 51. *Ptilagrostis*
 - 9b. Awn scabrid or column pubescent.
 - 10a. Lemma apex usually shortly 2-toothed, without retrorse spines 52. *Achnatherum*
 - 10b. Lemma apex with cylindrical beak armed with stout retrorse spines 53. *Orthoraphium*

44. STEPHANACHNE Keng, Contr. Biol. Lab. Chin. Assoc. Advancem. Sci., Sect. Bot. 9(2): 134. 1934.

冠毛草属 *guan mao cao shu*

Pappagrostis Roshevitz.

Perennials. Leaf blades linear. Inflorescence a contracted or spikelike panicle. Spikelets with 1 floret, bisexual; rachilla extension present, short; glumes lanceolate, subequal, longer than floret, membranous to herbaceous, 1–5-veined, apex acuminate; callus short, obtuse, shortly bearded; lemma narrowly ovate, herbaceous or thinly leathery, rounded on back, 5-veined, body pubescent or pilose, apex deeply 2-lobed, lobes acuminate or excurrent into a short awn, a circlet of long hairs across base of lobes, awned from sinus; awn geniculate with twisted column, scabrid throughout; palea narrowly lanceolate, equaling or slightly shorter than lemma, hairy between veins; lodicules 2 or 3, narrowly lanceolate. Stamens 1 or 3, anthers glabrous at apex. Stigmas 2.

Three species: W China, Mongolia, Tajikistan; three species (two endemic) in China.

- 1a. Spikelets dark gray or blackish, 12–15 mm; lemma lobes extended into 4–5 mm awnlets; central awn 10–15 mm 1. *S. nigrescens*
 1b. Spikelets yellowish green or tinged purple, 5–9 mm; lemma lobes extended into 0.5–3.5 mm mucros; central awn 6–9 mm.
 2a. Lemma 3–4 mm; stamens 3 2. *S. pappophorea*
 2b. Lemma 6–7 mm; stamen 1 3. *S. monandra*

1. *Stephanachne nigrescens* Keng, Contr. Biol. Lab. Chin. Assoc. Advancem. Sci., Sect. Bot. 9(2): 135, fig. 14. 1934.

黑穗茅 *hei sui mao*

Perennial, tufted. Culms erect, ca. 90 cm tall, 2–3 mm in diam., 3–4-noded. Leaf sheaths loose, not auriculate; leaf blades flat or involute, 15–20 cm, 5–6 mm wide, upper culm blades much shorter and narrower, abaxial surface scaberulous, adaxial surface glabrous or puberulent, apex finely acuminate; ligule 1–5 mm, lacerate. Panicle narrowly oblong in outline, densely contracted, usually interrupted at base, 4–10 cm; branches scabrid; pedicels 1–4 mm, puberulent. Spikelets 12–15 mm, blackish; glumes narrowly lanceolate, 3–5-veined, midvein scaberulous, apex acuminate-subulate, slightly outcurving; callus hairs ca. 1.5 mm; lemma 9–10 mm (including lobes), body appressed-pubescent, apical lobes extended into 4–5 mm awnlets, circlet of hairs 4–5 mm; awn 1–1.5 cm, geniculate at ca. 1/3 above base, column clearly twisted; palea 7–8 mm, appressed pubescent. Lodicules 3, ca. 3 mm. Stamens 3, anthers 1.2–2 mm. Fl. and fr. Jul–Sep.

• Under bushes, alpine grassy places, mountain slopes; 3800–4600 m. Gansu, Qinghai, Shaanxi, Sichuan.

2. *Stephanachne pappophorea* (Hackel) Keng, Contr. Biol. Lab. Chin. Assoc. Advancem. Sci., Sect. Bot. 9(2): 136. 1934.

冠毛草 *guan mao cao*

Calamagrostis pappophorea Hackel, Annuaire Conserv. Jard. Bot. Genève 7–8: 325. 1904; *Pappagrostis pappophorea* (Hackel) Roshevitz.

Perennial, forming dense tussocks from a short rhizome, base invested in old leaf sheaths. Culms erect, 10–40 cm tall, 1–1.3 mm in diam., smooth, 2–5-noded. Leaf sheaths tight, auriculate, auricles 2–5 mm; leaf blades flat or involute, 5–25 cm, 1–5 mm wide, both surfaces scabrid, apex finely acuminate; ligule 1.5–3 mm, lacerate. Panicle linear-oblong in outline, spikelike, not interrupted, 4–18 cm, slightly shining;

branches almost smooth; pedicels 0.5–2.5 mm, puberulent. Spikelets 5–7 mm, yellowish green; glumes narrowly lanceolate, 1–3-veined, midvein scabrid, apex slenderly acuminate; lemma 3–4 mm (including lobes), body appressed-pilose, apical lobes extended into ca. 0.5 mm mucros, circlet of hairs 3–4 mm; awn 6–8 mm, weakly geniculate near middle, column slightly twisted; palea slightly shorter than lemma. Lodicules 2 or 3, ca. 1 mm. Stamens 3, anthers 1–1.2 mm. Fl. and fr. Jul–Sep.

Dry stony mountain slopes, steppes, dried floodlands, roadsides; 1800–3200 m. Gansu, Nei Mongol, Qinghai, Xinjiang [Mongolia, Tajikistan].

3. *Stephanachne monandra* (P. C. Kuo & S. L. Lu) P. C. Kuo & S. L. Lu, Fl. Reipubl. Popularis Sin. 9(3): 305. 1987.

单蕊冠毛草 *dan rui guan mao cao*

Stephanachne pappophorea (Hackel) Keng var. *monandra* P. C. Kuo & S. L. Lu, Rep. Invest. Zool. Bot. Ngari Region Tibet [Xizang Ali Diqu Dong Zhi Wu Kao Cha Bao Gao], 106, 127. 1979.

Perennial, tufted. Culms erect, 30–50 cm tall, 1–2 mm in diam., scabrid, 2–3-noded. Leaf sheaths tight; leaf blades involute, 10–25 cm, 1–3 mm wide, both surfaces scabrid, apex acuminate; ligule 2–3 mm, toothed. Panicle linear-oblong in outline, spikelike, not interrupted, 4–6 cm, slightly shining; branches smooth; pedicels 1–5 mm, shortly hairy. Spikelets 7–9 mm, green tipped purple; rachilla extension unknown; glumes lanceolate, 3–5-veined, midvein scaberulous, apex acuminate; lemma 6–7 mm (including lobes), body pilose, apical lobes extended into 1.5–3 mm awnlets, circlet of hairs 2.5–3 mm; awn 7.5–9 mm, weakly geniculate below middle, column slightly twisted; palea 3–4 mm. Lodicules 2, 0.55–1.3 mm. Stamen 1, anther 0.7–1 mm. Fl. Aug.

• Under shrubs on mountain slopes; 4400–4700 m. SW Xizang (Burang, Gê'gyai).

45. TRIKERAIA Bor, Kew Bull. [9] 1954: 555. 1955.

三角草属 san jiao cao shu

Perennial. Leaf blades usually rolled; ligule short, erose, ciliolate. Inflorescence an open or contracted panicle; pedicels short. Spikelets with 1 floret, bisexual, slightly dorsally compressed; rachilla extension absent; glumes subequal or slightly unequal, lanceolate or lanceolate-oblong, herbaceous, scabrid or smooth, 3–5-veined, apex acuminate; callus short, obtuse, bearded; lemma slightly shorter than glumes, lanceolate, covering only flanks of palea, membranous, 3–5-veined, villous, apex 2-lobed, lobes acuminate to setiform, awned from between lobes; awn persistent, scabrid, weakly 1-geniculate, column loosely twisted, sometimes only slightly so; palea hyaline, back exposed, pubescent between veins. Lodicules 2 or 3, lanceolate. Stamens 3, anthers glabrous at apex. Stigmas 2.

Four species: N Pakistan to Bhutan and W China, at high altitudes; three species (one endemic) in China.

- 1a. Lemma with spreading pappuslike brush of hairs above middle, shortly pubescent below; awn 5–7 mm 1. *T. pappiformis*
 1b. Lemma uniformly hairy; awn 8–15 mm.
 2a. Glumes 5-veined; awn arising below middle of lemma, lobes acuminate; anthers 1–1.5 mm 2. *T. oreophila*
 2b. Glumes 3-veined; awn arising above middle of lemma, lobes setiform; anthers 4.5–5 mm 3. *T. hookeri*

1. *Trikeriaia pappiformis* (Keng) P. C. Kuo & S. L. Lu, Fl. Reipubl. Popularis Sin. 9(3): 317. 1987.

假冠毛草 jia guan mao cao

Stipa pappiformis Keng, Sunyatsenia 6: 71. 1941.

Perennial, rhizomatous. Culms 90–150 cm tall, 3–5-noded. Leaf sheaths glabrous, lower equaling and upper much shorter than internodes; leaf blades rolled or lower blades almost flat, 40–50 cm, 2–4 mm wide, scabrid, apex setiform; ligule ca. 1 mm. Panicle open, up to 30 cm; branches usually 2–3(–4) per node, filiform, up to 15 cm, glabrous, lower part bare, upper part densely spiculate. Spikelets yellowish green, rarely gray brown at apex; glumes subequal or upper slightly longer, narrowly lanceolate, 8–10 mm, 3-veined, apex attenuate; lemma 6–7 mm, 3-veined, spreading pappuslike ca. 5 mm hairs in upper part, sparsely pubescent below with 0.5–1 mm hairs, apical lobes 1–2 mm, slenderly acuminate; awn 0.5–0.7 cm, minutely hispidulous, slightly twisted below. Lodicules usually 3, 1–1.2 mm. Anthers 3–3.5 mm. Fl. and fr. Jul–Oct.

• Forest fringes, grassy mountain slopes, river banks; 3400–4300 m. Gansu, Qinghai, Sichuan, Xizang, Yunnan.

This species closely resembles species of *Stephanachne*, but lacks a rachilla extension.

The combination "*Achnatherum pappiforme* (Keng) Keng" (Claves Gen. Sp. Gram. Prim. Sin. 106, 213. 1957) was not validly published because a full and direct reference to the basionym was not provided.

2. *Trikeriaia oreophila* Cope, Kew Bull. 42: 350. 1987.

山地三角草 shan di san jiao cao

Trikeriaia tianshanica S. L. Lu & X. F. Lu.

Perennial, densely tufted. Culms 7–45 cm tall, 2–3-noded. Leaf sheaths glabrous, upper shorter than internodes; leaf blades stiff, involute, 3–12 cm, 1.5–5 mm wide, smooth or scaberulous; ligule 0.4–0.5 mm, obtuse. Panicle contracted, narrow, 1-sided, 2.5–8.5 × 1–1.5 cm; branches 1–2 per node, erect, up to 3.5 cm, scabrid. Spikelets green or yellowish tinged purple; glumes subequal, lanceolate, 9–14 mm, 5-veined, scabrid, narrowly acuminate; lemma ca. 10 mm, 5-veined, pilose,

hairs ca. 2 mm, split almost to lower 1/3, lobes 4.2–7 mm, slenderly acuminate, lateral veins continued into lobes, sometimes excurrent as short mucros; awn 0.8–1.2 cm, geniculate near middle, scabrid, twisted below bend. Lodicules 2 or 3, ca. 1 mm. Anthers 1–1.5 mm. Fl. and fr. Jun–Sep.

Grassy hillsides, windy plains; 2800–5200 m. Xinjiang, Xizang [Bhutan, India (Sikkim), Nepal].

3. *Trikeriaia hookeri* (Stapf) Bor, Kew Bull. [9] 1954: 555. 1955.

三角草 san jiao cao

Perennial, tufted with stout scaly rhizomes; old basal sheaths often pale purplish within. Culms 60–80 cm tall, 2–3-noded. Leaf sheaths slightly scabrid, lower longer and upper shorter than internodes; leaf blades 10–40 × 0.4–0.5 cm (when flattened), abaxial surface scaberulous-puberulous; ligule ca. 2 mm. Panicle contracted or open, 10–30 × 2–10 cm; branches 2–12 cm, scabrid, lower part bare, upper part densely spiculate. Spikelets purplish brown or green tinged purple; glumes oblong-lanceolate, subequal or upper slightly longer, 8–11 mm, 3-veined, scabrid, apex acuminate; lemma 5-veined, villous, hairs 2–4 mm, split to shortly above middle, lobes (1–)2–3.2 mm, acuminate into stiff 0.5–1 mm awnlets; awn stout, stiff, 1.2–1.5 cm, stiff, stout, scabrous, recurved to weakly 1-geniculate, loosely or sometimes only obscurely twisted below bend. Lodicules 1.5–2 mm. Anthers 4.5–5 mm. Fl. and fr. Jul–Sep.

Streams, valleys; 3600–4400 m. Qinghai, Xizang [Kashmir, N Pakistan].

- 1a. Panicle contracted, 10–20 × ca. 2 cm;
 branches 2–5 cm 3a. var. *hookeri*
 1b. Panicle open, up to 30 × 7–10 cm;
 branches up to 15 cm 3b. var. *ramosa*

3a. *Trikeriaia hookeri* var. *hookeri*

三角草(原变种) san jiao cao (yuan bian zhong)

Stipa hookeri Stapf, J. Linn. Soc., Bot. 30: 120. 1894;
Timouria aurita Hitchcock.

Panicle contracted, 10–20 × ca. 2 cm; branches erect or

obliquely ascending, 2–5 cm, lower 1/3 bare. Spikelets ca. 8 mm; lemma hairs ca. 2 mm. Fl. and fr. Jul–Sep.

Near streams in river valleys; 3600–4400 m. Qinghai (Yushu), Xizang [Kashmir, N Pakistan].

The combination "*Achnatherum hookeri* (Stapf) Keng" (Claves Gen. Sp. Gram. Prim. Sin. 106, 213. 1957) was not validly published because a full and direct reference to the basionym was not provided.

3b. *Trikeria hookeri* var. *ramosa* Bor, Kew Bull. [9] 1954: 557. 1955.

展穗三角草 zhan sui san jiao cao

Panicle open, up to 30 × 7–12 cm; branches up to 15 cm, lower half bare. Spikelets 8–11 mm; lemma hairs 1.5–4 mm.

• Streams, valleys; 3600–4400 m. Qinghai, Xizang.

46. *SINOCHASEA* Keng, J. Wash. Acad. Sci. 48: 115. 1958.

三蕊草属 san rui cao shu

Perennial, tufted. Leaf blades narrow, rolled. Inflorescence a contracted panicle. Spikelets with 1 floret, lightly laterally compressed; rachilla extension present, minute, glabrous or rarely with a few hairs; glumes subequal or lower glume slightly longer, as long as spikelet, herbaceous to scarious with hyaline margins, prominently 5–9-veined, apex acuminate; callus obtuse, shortly bearded; lemma narrowly oblong, shorter than glumes, papery, back rounded, 5–9-veined, hairy, apex deeply 2-lobed, awned from sinus; awn geniculate, column twisted; palea slightly shorter than lemma, 2-veined, not keeled. Lodicules 2(or 3), lanceolate. Stamens 3, anthers glabrous at apex. Ovary glabrous, stigmas 3, subsessile.

• One species: W China.

The presence of a rachilla extension is anomalous in *Stipeae*, which normally have strictly 1-flowered spikelets, and on this account the genus is sometimes placed in *Aveneae*. However, the multi-veined glumes, rounded palea lacking keels, and linear hilum are all Stipoid characters.

1. *Sinochasea trigyna* Keng, J. Wash. Acad. Sci. 48: 115. 1958.

三蕊草 san rui cao

Perennial forming small dense tussocks from a short rootstock; basal sheaths persistent. Culms stiffly erect, 7–45 cm tall, 1–2 mm in diam., scabrid under panicle, otherwise smooth, 2–3-noded. Leaf sheaths scaberulous; leaf blades stiff, setaceous, 3–16 cm, 1–2 mm wide, both surfaces and margins scabrid, apex acute; ligule membranous, 0.5–2 mm, truncate or obtuse, ciliolate. Panicle narrowly lanceolate in outline, 3–8.5 cm; branches erect, up to 3 cm; pedicels hispid. Spikelets 8–12 mm, greenish with purple apices; rachilla extension minute; glumes lanceolate, as long as spikelet, 5-veined, almost smooth or scaberulous; lemma (6–)8–9 mm, 5-veined, villous, lobes 3–6 mm; awn 0.9–1.1 cm; palea a little shorter than lemma,

pubescent between veins, apex 2-toothed. Lodicules 1.5–2 mm. Anthers ca. 1 mm. Ovary glabrous. Fl. and fr. Aug–Sep.

• Alpine meadows, mountain slopes; 3800–5100 m. Qinghai, Xizang.

A third small lodicule may be present in this species. *Sinochasea* is sometimes included within the otherwise unispecific genus *Pseudodanthonia* Bor & C. E. Hubbard, because *P. himalaica* (J. D. Hooker) Bor & C. E. Hubbard shares the unusual character of an ovary bearing 3 stigmas. *Sinochasea* is recognized here as distinct, because *Pseudodanthonia* differs by its 2-keeled, winged palea (not seen elsewhere in *Stipeae*) and hairy ovary.

Pseudodanthonia himalaica is known at present only from the NW Himalayas in India. It is a tussocky species about 50 cm tall with a long, acute ligule to 7 mm, larger spikelets with several florets, a geniculate awn to 2 cm, and shorter, obovate lodicules.

47. *DUTHIEA* Hackel, Verh. K.K. Zool.-Bot. Ges. Wien 45: 200. 1895 [“1896”].

毛蕊草属 mao rui cao shu

Thrixgyne Keng; *Triavenopsis* Candargy.

Perennials, tussocky. Leaf blades usually rolled. Inflorescence a simple panicle, compact or elongate, 1-sided, spikelets few. Spikelets with 1–3 florets, laterally compressed or cylindrical, disarticulating above glumes and between florets; rachilla extension present; glumes subequal, equaling or a little shorter than spikelet, herbaceous with hyaline margins, rounded on back, 5–9-veined, often with transverse veinlets; callus hairy; lemmas lanceolate to narrowly ovate, membranous or leathery, hispid or villous, apex 2-toothed to deeply 2-cleft, awned from between lobes; awn geniculate, column twisted; palea keeled, keels usually extended into sharp mucros. Lodicules absent (rarely 2, oblanceolate). Stamens 3, anthers glabrous or shortly hairy at apex. Ovary strigose, stigmas 2 or 3, borne on a long pubescent style. Caryopsis tipped by a subulate beak formed from persistent style.

Three species: Himalayas, from Afghanistan to W China; one species in China.

This genus is often placed in *Aveneae* on account of the several-flowered spikelets of some species; the keeled palea is also atypical in *Stipeae*. It belongs to a small group of genera, including *Pseudodanthonia*, *Sinochasea*, *Stephanachne*, and probably *Trikeria*, which occupy an intermediate and basal position between the two tribes. Multiveined glumes, 3 lodicules, and a linear hilum are all Stipoid characteristics. Three stigmas may also occur in this group. Molecular evidence is scanty but indicates Stipoid affinities.

1. *Duthiea brachypodium* (P. Candargy) Keng & P. C. Keng, *Acta Phytotax. Sin.* 10(2): 182. 1965.

毛蕊草 mao rui cao

Triavenopsis brachypodium P. Candargy, *Arch. Biol. Veg. Pure Appl.* 1: 65. 1901; *Duthiea dura* (Keng) Keng & P. C. Keng; *D. nepalensis* Bor; *Thrixgyne dura* Keng.

Perennial forming small dense tussocks, with or without long rhizomes; basal sheaths persistent, brown, papery. Culms stiffly erect, 25–100 cm tall, 1–3-noded. Leaf blades 2.5–13(–35) cm, 2–3.5 mm wide, glabrous, apex acute; ligule 2–3 mm, up to 8 mm on culm leaves. Raceme 7–10 × 0.5–0.7 cm; spikelets 8–18, overlapping. Spikelets narrowly cylindrical, 1.4–2.1 cm, floret 1, gray-green; rachilla extension ca. 2 mm, sometimes tipped with reduced floret; glumes oblong-lanceolate, 1.3–2.1 cm, subacute; callus densely pubescent; lemma

equal to spikelet, leathery, 10–11-veined, body hispid, especially around awn insertion, apex deeply 2-cleft, lobes 7–10 mm, scabrid, acuminate; awn densely scabrid-pubescent, column 0.8–1 cm, bristle 1–1.6 cm; palea keels thick, prominent. Lodicules absent or 2, oblanceolate. Anthers 1.4–1.6 mm, glabrous or with a few short hairs at apex. Style 6–7 mm; stigmas 2 or 3, 7–9 mm. Fl. and fr. Jun–Oct.

Open woodland, between bushes, sunny grassy slopes in high mountains; 3000–5300 m. Qinghai, Sichuan, Xizang, Yunnan [Bhutan, Nepal].

The specific epithet “*brachypodium*” is here a noun in apposition and should not be altered to “*brachypodia*.”

The other two species in the genus, *Duthiea bromoides* Hackel and *D. oligostachya* (Munro) Stapf from the W Himalayas, both have spikelets with more than one fertile floret and a branching inflorescence. A slender rachilla extension is often present in *D. brachypodium*.

48. PSAMMOCHLOA Hitchcock, *J. Wash. Acad. Sci.* 17: 140. 1927.

沙鞭属 sha bian shu

Perennial, rhizomatous. Leaf blades linear; ligule lanceolate. Inflorescence a long contracted panicle; pedicels short. Spikelets with 1 floret, bisexual; glumes lanceolate-oblong, upper glume slightly longer than lower, membranous, 3–5-veined with transverse veinlets; callus very short, obtuse, glabrous; lemma terete, equaling upper glume, papery with membranous upper margins and apex, 5–7-veined, villous, apex shortly toothed, awned from between teeth; awn caducous, fine, scabrid; palea subequal to and resembling lemma, 5–7-veined, without keels, villous, not enclosed by lemma at maturity. Lodicules 3. Stamens 3, anthers glabrous or tips penicillate.

One species: N China, Mongolia.

1. *Psammochloa villosa* (Trinius) Bor, *Kew Bull.* [6] 1951: 191. 1951.

沙鞭 sha bian

Arundo villosa Trinius, *Sp. Gram.* 3: t. 352. 1836; *Amophila villosa* (Trinius) Handel-Mazzetti; *Psammochloa mongolica* Hitchcock; *Timouria mongolica* (Hitchcock) Roshevitz; *T. villosa* (Trinius) Handel-Mazzetti.

Perennial; rhizomes widely spreading; old basal sheaths yellowish brown, finally fibrous. Culms robust, erect, 1–2 m tall, 0.8–1 cm in diam. Leaf sheaths smooth, glabrous, papery, longer than internodes, loosely overlapping and clothing much of culm; leaf blades flat, stiff, up to 50 cm, 5–10 mm wide,

abaxial surface smooth, glabrous, adaxial surface closely ribbed, apex usually convolute; ligule 5–8 mm. Panicle dense, spikelike, narrowly lanceolate in outline, up to 50 × 3–4.5 cm; branches erect, slender, scabrid. Spikelets 1–1.6 cm, pale yellowish; glumes puberulous, apex obtuse-erose; lemma 1–1.2 cm, densely villous with spreading ca. 4 mm hairs, apical teeth membranous, 0.4–0.6 mm, obtuse; awn 0.7–1 cm, bent just above base, slightly flexuous. Anthers ca. 7 mm. Fl. and fr. May–Sep.

Sand dunes; 900–2900 m. Gansu, Nei Mongol, Ningxia, Qinghai, N Shaanxi, Xinjiang [Mongolia].

This is a good sand-binding grass. The awns fall very early, so the spikelets usually appear to be awnless.

49. PIPTATHERUM P. Beauvois, *Ess. Agrostogr.* 17. 1812.

落芒草属 luo mang cao shu

Eriocoma Nuttall; *Fendleria* Steudel; *Urachne* Trinius.

Perennials, tufted. Leaf blades linear to setaceous, flat or rolled. Inflorescence an open or contracted panicle. Spikelets with 1 floret, bisexual, disarticulating above glumes; rachilla extension absent; glumes ovate to lanceolate, subequal, usually longer than floret, herbaceous to membranous, 3–7-veined, veins linked by veinlets or anastomosing near apex, apex obtuse to acuminate; callus very short, rounded, glabrous; lemma lanceolate to ovate or elliptic, dorsally compressed, leathery to bony, brown or black-brown at maturity, glossy, usually with appressed ascending white hairs, infrequently glabrous, covering sides of palea, apex entire or minutely 2-toothed, awned; awn caducous (rarely persistent), fine, straight, scabrid; palea back exposed between lemma margins. Lodicules 3. Stamens 3, anthers usually bearded at apex. Stigmas 2.

About 30 species: Europe through C Asia to the Himalayas and China, also in North America; nine species (two endemic) in China.

Quantitative characters are very variable and reliable qualitative characters are rather few. Plant size varies within wide limits for most species and spikelet size is also very variable. Lemma shape, a stable character, refers to the mature floret when full width has been attained. Other reliable characters for species separation, such as lemma pubescence and awn insertion, require careful observation and a good magnification.

- 1a. Lemma glabrous, slightly longer than glumes at maturity; glumes elliptic-ovate, apex broadly rounded; anthers glabrous at apex 1. *P. kuoi*
- 1b. Lemma usually pubescent, shorter than or equaling glumes; glumes lanceolate, apex obtuse or denticulate to acuminate; anthers usually hairy at apex (glabrous in *P. hilariae*).
- 2a. Awn 2–4(–7) mm; culms 20–60 cm tall, 2–3-noded; panicle often narrow.
- 3a. Lemma elliptic to ovate, apex shortly beaked, shortly 2-lobed, each lobe bearing hair tuft; anthers glabrous 2. *P. hilariae*
- 3b. Lemma narrowly lanceolate, apex entire or obscurely 2-lobed, not beaked, without hair tufts; anthers densely bearded.
- 4a. Lemma back pilose with 0.4–0.5 mm hairs, apex minutely 2-lobed; awn subterminal, bent at insertion 3. *P. gracile*
- 4b. Lemma back pubescent with 0.2–0.4 mm hairs, apex entire; awn terminal, straight at insertion 4. *P. laterale*
- 2b. Awn 5–9 mm; culms up to 100 cm tall, 3–5-noded; panicle lax, usually open.
- 5a. Glumes equaling or only slightly longer than lemma; branches of panicle 3–5 per node.
- 6a. Spikelets lanceolate, 5–9 mm; lemma 4–7.5 mm 5. *P. aequiglume*
- 6b. Spikelets ovate, 3.5–5 mm; lemma 2.5–4 mm 6. *P. tibeticum*
- 5b. Glumes distinctly longer than lemma; branches of panicle 2(–3) per node.
- 7a. Lemma lanceolate, hairy throughout; glumes herbaceous, apex usually purple.
- 8a. Panicle branches and pedicels scabrid; glumes 4.5–8 mm 7. *P. munroi*
- 8b. Panicle branches and pedicels smooth; glumes 8–9 mm 8. *P. grandispiculum*
- 7b. Lemma ovate, hairy in upper part, glabrous below; glumes membranous, green or gray brown 9. *P. songaricum*

1. *Piptatherum kuoi* S. M. Phillips & Z. L. Wu, Novon 15: 474. 2005.

钝颖落芒草 *dun ying luo mang cao*

Oryzopsis obtusa Stapf, Hooker's Icon. Pl. 24: t. 2393. 1895; *Piptatherum obtusum* (Stapf) Roshevitz (1951), not Nees & Meyen (1841).

Perennial, loosely tufted from knotty rootstock. Culms stiffly erect, up to 1 m tall, 2–2.5 mm in diam., scaberulous-puberulous, 2–3-noded. Leaf sheaths glabrous, shorter than internodes; leaf blades stiffly ascending, linear or broadly linear, flat or margins inrolled, 10–25 cm, 5–12 mm wide, abaxial surface smooth, adaxial surface asperulous-puberulous, apex slenderly acuminate; ligule 1–3 mm, obtuse or truncate. Panicle narrow, 15–25 cm; branches 2 per node, suberect, 1–5 cm, densely scabrid. Spikelets yellowish green; glumes elliptic-ovate, 4–5 × 3.5–4 mm, herbaceous, 5–7-veined with transverse veinlets, apex rounded; callus ca. 0.5 mm, knoblike, glabrous; lemma elliptic, 4–5 mm, shortly exerted from glumes, blackish brown at maturity, 5-veined, glabrous, margins overlapping (before caryopsis develops), apex entire; awn persistent, 10–17 mm. Anthers ca. 2.5 mm, glabrous at apex. Fl. and fr. Apr–Jul.

Under shrubs, moist shady places among rocks, roadsides; 600–1900 m. Guangdong, Guizhou, Henan, Hubei, Hunan, Shaanxi, E Sichuan, Taiwan, Yunnan, Zhejiang [Japan (Ryukyu Islands)].

This species is distinctive within the genus in China on account of its very broad glumes and plump, glabrous floret with the tip exerted from the glumes.

2. *Piptatherum hilariae* Pazij, Bot. Mater. Gerb. Inst. Bot. Zool. Akad. Nauk Uzbeksk. SSR 10: 20. 1948.

少穗落芒草 *shao sui luo mang cao*

Oryzopsis hilariae (Pazij) Uniyal; *O. humilis* Bor; *O. wendelboi* Bor; *Piptatherum humile* (Bor) S. Kumar & M. B. Raza.

Perennial, densely tufted. Culms 20–50 cm tall, 2–3-noded. Leaf sheaths glabrous, usually shorter than internodes; leaf blades gray-green or gray purple, usually rolled, rarely flat, up to 10(–30) cm, 2–4 mm wide, abaxial surface smooth or scaberulous, adaxial surface puberulous; ligule lanceolate, 3–6 mm. Panicle open or contracted, 5–12(–30) cm; branches 2 per node, spreading at anthesis, erect at maturity, longest less than 1/2 panicle length. Spikelets purplish red or gray-green; glumes lanceolate-ovate, 5–8 mm, apex sharply acuminate; callus glabrous; lemma elliptic to narrowly ovate, 3.5–4 mm, back pubescent with 0.2–0.3 mm hairs, midline glabrescent at maturity, apex usually shortly beaked, pale, glabrous, shortly 2-lobed above awn insertion, lobes rounded, each with tuft of hairs; awn caducous, 2–4 mm, often slightly bent at insertion. Anthers 1.5–2.5 mm, glabrous at apex or almost so. Fl. and fr. Jun–Sep.

River banks, plateaus; 3100–4500 m. Xizang (Lhohzag, Qusum) [E Afghanistan, NW India, Kashmir, Pakistan, Tajikistan (Pamirs)].

This species is close to *Piptatherum gracile*, but has an abruptly narrowed lemma apex, and the short apical hair tufts are distinctive. It is the only species of *Piptatherum* in China (except for the distinctive *P. kuoi*) with glabrous anthers (1 or 2 short hairs may be present, but never a dense tuft). In neighboring countries it occurs in the upper forest belt and in alpine thickets.

The name *Piptatherum humile* refers to small specimens with linear panicles.

3. *Piptatherum gracile* Mez, Repert. Spec. Nov. Regni Veg. 17: 211. 1921.

小落芒草 xiao luo mang cao

Oryzopsis gracilis (Mez) Pilger.

Perennial, densely tufted. Culms 10–50 cm tall, 2–3-noded. Leaf sheaths glabrous or scaberulous, shorter than internodes; leaf blades gray-green, filiform, usually rolled, 6–20 cm, 1–2 mm wide, abaxial surface smooth or scaberulous, adaxial surface pubescent; ligule lanceolate, 2–7 mm. Panicle laxly contracted to linear, 6–20 cm; branches 2(–4) per node, erect or ascending, longest ca. 1/3 panicle length. Spikelets yellowish green, apex purplish; glumes lanceolate, 5–8 mm, apex sharply acuminate; callus glabrous; lemma narrowly lanceolate, 3–5 mm, densely pilose with 0.4–0.5 mm hairs, apex minutely 2-lobed above awn insertion; awn caducous, delicate, 3–7 mm, slightly bent at insertion. Anthers 1.7–2.5 mm, densely bearded at apex. Fl. and fr. Jun–Aug.

Dry mountain slopes, alpine meadows; 3300–4900 m. Sichuan, Xizang, Yunnan [Afghanistan, NW India, Kashmir, Nepal, N Pakistan].

4. *Piptatherum laterale* (Regel) Munro ex Nevski, Trudy Bot. Inst. Akad. Nauk SSSR, Ser. 1, Fl. Sist. Vyssh. Rast. 4: 217. 1937.

细弱落芒草 xi ruo luo mang cao

Milium laterale Regel, Trudy Imp. S.-Peterburgsk. Bot. Sada 7: 645. 1881; *Oryzopsis lateralis* (Regel) Stapf ex J. D. Hooker.

Perennial, densely tufted. Culms 25–60 cm tall, 2–3-noded. Leaf sheaths glabrous, usually shorter than internodes; leaf blades rolled, setaceous or narrowly linear when flat, 5–15(–25) cm, 1–3 mm wide, abaxial surface scaberulous, adaxial surface pubescent; ligule lanceolate, 2–5 mm. Panicle loosely contracted to linear, 5–20 cm; branches 1–3 per node, erect or ascending, longest not usually more than 3 cm. Spikelets yellowish green, apex usually purplish; glumes lanceolate, 6–8 mm, herbaceous, apex acuminate; callus glabrous; lemma narrowly lanceolate to almost linear, (3.3–)4–6.5 mm, densely pubescent with 0.2–0.4 mm hairs, apex entire, awned from apex; awn sometimes tardily deciduous, delicate, 2–4(–6) mm, straight at insertion. Anthers 2–3.5 mm, bearded at apex. Fl. and fr. Jun–Aug.

Stony mountain slopes, grassy hollows, *Kobresia pygmaea* turf; 1800–4700 m. Sichuan, Xizang [Afghanistan, Kashmir, Kyrgyzstan, Nepal, N Pakistan, Tajikistan, Uzbekistan; SW Asia (Iran, Iraq, E Turkey)].

This is a variable species often confused in the literature with the closely related *Piptatherum gracile*.

5. *Piptatherum aequiglume* (Duthie ex J. D. Hooker) Roshevitz, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR 14: 113. 1951.

等颖落芒草 deng ying luo mang cao

Perennial, loosely tufted from a short rhizome. Culms 60–130 cm tall, 3–5-noded. Leaf sheaths glabrous, scabrid; leaf blades linear, flat, up to 30 cm, 5–10 mm wide, abaxial surface

scabrid, adaxial surface scaberulous; ligule rounded, 2–5(–13) mm. Panicle open at maturity, 10–25 cm; branches 3–5 per node, distant, ascending or widely spreading, longest up to 1/2 panicle length, scabrid, lower part bare. Spikelets gray-green; glumes narrowly lanceolate-oblong, (5–)5.5–9 mm, apex acute, occasionally mucronate; callus glabrous; lemma narrowly lanceolate, (4–)5.3–7.5 mm, equaling or slightly shorter than glumes, back pubescent with 0.15–0.3 mm hairs, glabrescent along midline at maturity, apex acute, smoothly extended into awn without constriction; awn tardily deciduous, 6–13 mm. Anthers 3–4 mm, bearded at apex. Fl. and fr. Jun–Sep.

Damp rocky places in montane forests; 1800–2900 m. Sichuan, Xizang, Yunnan [E Afghanistan, Bhutan, NW India, Kashmir, Pakistan].

This species is close to *Piptatherum munroi*, but is rather more lush and grows in more mesophytic habitats. The difference in awn insertion, although a small difference, is reliable for separating the two species.

- 1a. Ligules 2–5 mm; spikelets (5.5–)6.5–9 mm; awn tardily deciduous 5a. var. *aequiglume*
 1b. Ligules 8–13 mm; spikelets ca. 5 mm; awn readily deciduous 5b. var. *ligulatum*

5a. *Piptatherum aequiglume* var. *aequiglume*

等颖落芒草(原变种) deng ying luo mang cao (yuan bian zhong)

Oryzopsis aequiglumis Duthie ex J. D. Hooker, Fl. Brit. India 7: 234. 1896 [“1897”]; *O. multiradiata* (Hackel) Handel-Mazzetti; *O. munroi* Stapf f. *multiradiata* Hackel; *Piptatherum sinense* Mez.

Ligule ovate, rounded, 2–5 mm. Spikelets (5.5–)6.5–9 mm; lemma 5.5–7.5 mm, pubescent with 0.15–0.3 mm hairs, passing smoothly into awn; awn tardily deciduous, 6–13 mm. Fl. and fr. Aug–Sep.

Rocky fissures near streams; 1800–2900 m. Sichuan, Xizang, Yunnan [E Afghanistan, Bhutan, NW India, Kashmir, Pakistan].

5b. *Piptatherum aequiglume* var. *ligulatum* (P. C. Kuo & Z. L. Wu) S. M. Phillips & Z. L. Wu, Novon 15: 475. 2005.

长舌落芒草 chang she luo mang cao

Oryzopsis aequiglumis var. *ligulata* P. C. Kuo & Z. L. Wu, Acta Phytotax. Sin. 19: 435. 1981.

Ligule long-lanceolate, 8–13 mm. Spikelets 4.9–5.2 mm; lemma ca. 4 mm, pilose with ca. 0.4 mm hairs, constricted at awn junction; awn readily deciduous, 7–8 mm. Fr. Sep.

• Near rocks of rivers, moist ground; 1800–2800 m. Yunnan (Lijiang).

This taxon appears to be a local element from the *Piptatherum aequiglume-munroi* species group. The glumes clearly exceed the lemma, and the delicate, caducous awn with constricted disarticulation point are indicative of *P. munroi*, but glume shape is nearer *P. aequiglume*. The ligule is remarkably long, and lemma pubescence is longer than in either species. It may prove to merit separate specific status when better known.

6. *Piptatherum tibeticum* Roshevitz, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR 11: 23. 1949.

藏落芒草 zang luo mang cao

Perennial, tufted from a short rhizome. Culms 30–100 cm, 2–5-noded. Leaf sheaths loose, shorter than internodes; leaf blades linear, flat or slightly rolled, 5–25 cm, 2–4 mm, scabrid; ligule ovate to long-lanceolate, 3–10 mm. Panicle open, ovate in outline, 10–20 cm; branches 3–5 per node, spreading, ca. 3 cm, scabrid, upper half with spikelets. Spikelets yellowish green, apex purplish red; glumes ovate, 3.5–5 mm, glabrous or puberulous, apex acuminate; callus glabrous; lemma ovate, 2.5–4 mm, equaling or slightly shorter than glumes, back pubescent, glabrescent along midline at maturity, infrequently always glabrous; awn caducous, 5–7 mm. Anthers ca. 1 mm, bearded at apex. Fl. and fr. Jun–Aug.

• Field margins, grassy mountain slopes, forest fringes; 1300–3900 m. Gansu, Qinghai, Shaanxi, Sichuan, Xizang, Yunnan.

This is a variant from the *Piptatherum aequiglume-munroi* species group with small, broad spikelets.

- 1a. Lemma 2.5–3.5 mm, pubescent when young, glabrescent along midline at maturity 6a. var. *tibeticum*
 1b. Lemma 3–4 mm, always smooth and glabrous 6b. var. *psilolepis*

6a. *Piptatherum tibeticum* var. *tibeticum*

藏落芒草(原变种) zang luo mang cao (yuan bian zhong)

Oryzopsis tibetica (Roshevitz) P. C. Kuo.

Lemma 2.5–3.5 mm, back pubescent when young, glabrescent along midline at maturity. Fl. and fr. Jun–Aug.

• Field margins, grassy mountain slopes, forest fringes; 1300–3900 m. Gansu, Qinghai, Shaanxi, Sichuan, Xizang, Yunnan.

6b. *Piptatherum tibeticum* var. *psilolepis* (P. C. Kuo & Z. L. Wu) S. M. Phillips & Z. L. Wu, Novon 15: 475. 2005.

光稃落芒草 guang fu luo mang cao

Oryzopsis tibetica var. *psilolepis* P. C. Kuo & Z. L. Wu, Acta Phytotax. Sin. 19: 435. 1981; *O. psilolepis* (P. C. Kuo & Z. L. Wu) L. Liu.

Lemma 3–4 mm, always smooth and glabrous. Fl. Jun.

• Mountain slopes; 2400–3300 m. Sichuan, Xizang.

7. *Piptatherum munroi* (Stapf) Mez, Repert. Spec. Nov. Regni Veg. 17: 212. 1921.

落芒草 luo mang cao

Perennial, loosely tufted from a short rhizome. Culms 30–100 cm tall, 3–5-noded. Leaf sheaths smooth or scabrid; leaf blades linear, flat, 6–30 cm, 2–5 mm wide, abaxial surface glabrous, adaxial surface puberulous; ligule lanceolate, 2–5 mm. Panicle open, often ovate in outline, 10–25 cm; branches (1–)2(–3) per node, distant, ascending or widely spreading, longest up to 1/2 panicle length, scabrid, lower 2/3 bare. Spikelets gray-green or apex and margins purple; glumes lanceolate, 4.5–8 mm, papery, apex narrowly acuminate into sharp beak;

callus glabrous; lemma lanceolate, 2.5–4.5(–5) mm, back pubescent, glabrescent along midline at maturity, apex acute, constricted at awn insertion; awn fine, caducous, 6–9 mm, straight or slightly flexuous. Anthers 1–2.5 mm, apex bearded. Fl. and fr. Jun–Aug.

Alpine scrub, mountain meadows, roadsides, farmlands, alluvial fans; 2200–5000 m. Gansu, Guizhou, Qinghai, Sichuan, Xinjiang, Xizang, Yunnan [E Afghanistan, Bhutan, N India, Kashmir, Nepal, N Pakistan].

This is a common species from high parts of W China and the W Himalayas. It is readily recognizable by its relatively robust habit, large, open panicle with sharply purple-beaked spikelets, lanceolate, hairy lemmas, and long, delicate awns constricted at the base and readily falling.

- 1a. Glumes 5–7 mm; lemma 4–5 mm; anthers 2–2.5 mm 7a. var. *munroi*
 1b. Glumes 4.5–5 mm; lemma 2.5–3 mm; anthers 1–1.8 mm 7b. var. *parviflorum*

7a. *Piptatherum munroi* var. *munroi*

落芒草(原变种) luo mang cao (yuan bian zhong)

Oryzopsis munroi Stapf in J. D. Hooker, Fl. Brit. India 7: 234. 1896 [“1897”]; *O. geminiramula* Ohwi.

Glumes 5–7 mm; lemma 4–5 mm; awn 3–7 mm; anthers 2–2.5 mm. Fl. and fr. Jun–Aug.

Alpine scrub, mountain meadows, roadsides, farmlands; 2200–5000 m. Gansu, Guizhou, Qinghai, Sichuan, Xinjiang, Xizang, Yunnan [E Afghanistan, Bhutan, N India, Kashmir, Nepal, N Pakistan].

7b. *Piptatherum munroi* var. *parviflorum* (Z. L. Wu) S. M. Phillips & Z. L. Wu, Novon 15: 475. 2005.

小花落芒草 xiao hua luo mang cao

Oryzopsis munroi var. *parviflora* Z. L. Wu, Acta Phytotax. Sin. 30(2): 174. 1992; *O. stewartiana* Bor.

Glumes 4.5–5 mm; lemma 2.5–3 mm; awn 7–9 mm; anthers 1–1.8 mm. Fl. and fr. Jul–Sep.

Alluvial fans; ca. 2700 m. Gansu, Qinghai [NW India].

This taxon differs very little from *Piptatherum tibeticum*, which is reported to have a broader floret and more branches at the panicle nodes.

8. *Piptatherum grandispiculum* (P. C. Kuo & Z. L. Wu) S. M. Phillips & Z. L. Wu, Novon 15: 475. 2005.

大穗落芒草 da sui luo mang cao

Oryzopsis grandispicula P. C. Kuo & Z. L. Wu, Acta Phytotax. Sin. 19: 435. 1981; *O. macrospicula* P. C. Kuo & Z. L. Wu, nom. illeg. superfl.

Perennial, tufted from a short rhizome. Culms ca. 100 cm tall, 3–4-noded. Leaf sheaths shorter than internodes; leaf blades gray-green, flat or rolled, 4–15 cm, 2–3 mm wide, smooth; ligule lanceolate, 4–5 mm. Panicle open, broadly ovate, up to 25 cm; branches 2–6 per node, up to 10 cm, smooth, lower 1/2–2/3 bare. Spikelets gray-green, apex purplish gray; glumes lan-

ceolate, 8–9 mm, glabrous, apex long acuminate into beak; callus glabrous; lemma narrowly lanceolate, 5–6 mm, back pubescent, glabrescent at maturity; awn caducous, 4–7 mm. Anthers ca. 3.5 mm, bearded at apex. Fl. and fr. Aug–Sep.

- Rocky slopes; ca. 3700 m. Xizang (Xigazê).

This is a variant from the *Piptatherum aequiglume-munroi* species group, distinguished by its smooth leaves and panicle branches.

9. *Piptatherum songaricum* (Trinius & Ruprecht) Roshevitz, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR 14: 106. 1951.

新疆落芒草 xin jiang luo mang cao

Urachne songarica Trinius & Ruprecht, Sp. Gram. Stipac. 15. 1842; *Oryzopsis songarica* (Trinius & Ruprecht) B. Fedtschenko; *O. tianschanica* Drobow & Vvedensky; *Piptatherum songaricum* subsp. *tianschanicum* (Drobow & Vvedensky) velev.

Perennial, densely tufted from a short rhizome. Culms (25–)30–60(–100) cm tall, 2–4-noded. Leaf sheaths glabrous, shorter than internodes; leaf blades flat or loosely rolled, 5–20 cm, 2–4 mm wide, abaxial surface scaberulous toward apex, adaxial surface glabrous or puberulous; ligule lanceolate, 5–8 mm. Panicle lax, 10–20(–30) cm; branches (1–)2 per node, slender, ascending, sinuous or sometimes nodding, longest 1/2–2/3 panicle length, scabrid at least in upper part, spikelets clustered toward apices. Spikelets green or gray-brown; glumes broadly lanceolate, 6–10 mm, membranous except at base, scabrid, apex acuminate; callus glabrous; lemma ovate, 3–5.2 mm, pubescent above middle, glabrous below except for small tufts at basal margins, glabrescent along midline at maturity, apex acute; awn caducous, 5–8 mm. Anthers 1.5–2 mm, bearded at apex. Fl. and fr. Jun–Aug.

Rocky moist places on mountain slopes; 1000–1900 m. Xinjiang [Kazakhstan, W Mongolia, Russia].

50. STIPA Linnaeus, Sp. Pl. 1: 78. 1753.

针茅属 zhen mao shu

Perennials, forming dense tussocks, old basal sheaths persistent. Leaf blades filiform to setaceous, convolute, abaxial surface smooth or scabrid, adaxial surface prominently ribbed. Inflorescence usually a contracted panicle, enclosed in uppermost leaf sheath or shortly exerted, spikelets few. Spikelets with one floret, bisexual; glumes subequal, hyaline or membranous, much longer than floret, 3–5-veined, long acuminate; callus pungent, shortly bearded; lemma narrowly lanceolate, terete, usually leathery, (3–)5-veined, hairy, margins overlapping, apex entire; awn articulated at lemma apex and deciduous at maturity, scabrid to plumose, 1–2-geniculate, column tightly twisted, bristle straight, flexuous or curling; palea subequaling lemma, hyaline, enclosed within lemma. Lodicules 2 or 3, lanceolate. Stamens 3, anthers glabrous or shortly hairy at apex. Stigmas 2.

About 100 species: temperate and warm-temperate regions of Asia and Europe, in dry, open habitats; 23 species (three endemic) in China.

- 1a. Awn scabrid or minutely hispidulous (hairs to 0.3 mm) throughout.
 - 2a. Cleistogamous spikelets present in basal leaf sheaths; lemma 0.5–0.6 cm 1. *S. bungeana*
 - 2b. Cleistogamous spikelets not present in basal leaf sheaths; lemma 0.8–1.7 cm.
 - 3a. Panicle branches not enclosed by uppermost leaf sheath, usually clearly exerted; awn minutely hispidulous, bristle straight or slightly flexuous.
 - 4a. Glumes 1.2–1.5 cm, apex finely acuminate; awns separate, bristle stiff 2. *S. przewalskyi*
 - 4b. Glumes 1.5–3 cm, apex filamentous; awns twisted together at top of panicle, bristle flexuous 3. *S. capillacea*
 - 3b. Panicle branches enclosed by expanded uppermost leaf sheath; awn scabrid, bristle curling.
 - 5a. Glumes 1.8–2.5 cm; awn column 1.5–2.5 cm to first bend 4. *S. sareptana*
 - 5b. Glumes 2.5–4.5 cm; awn column 3–10 cm to first bend.
 - 6a. Ligule of culm leaves 1.5–2 mm 5. *S. baicalensis*
 - 6b. Ligule of culm leaves 3–10 mm.
 - 7a. Lemma 1–1.2 cm; awn 13–18 cm 6. *S. capillata*
 - 7b. Lemma 1.5–1.7 cm; awn 20–28 cm 7. *S. grandis*
 - 1b. Awn plumose or at least shortly hairy along part or all of its length.
 - 8a. Awn plumose, or at least shortly hairy, throughout its length.
 - 9a. Awn 1-geniculate (sometimes weakly 2-geniculate in *S. consanguinea*).
 - 10a. Awn shortly pubescent, hairs on bristle 0.4–0.7 mm 9. *S. consanguinea*
 - 10b. Awn plumose, hairs on bristle 2–5 mm.
 - 11a. Panicle shortly exerted; lemma evenly hairy 10. *S. mongolorum*
 - 11b. Panicle branches enclosed by uppermost leaf sheath; lemma hairs in lines 11. *S. caucasica*
 - 9b. Awn 2-geniculate.
 - 12a. Lemma hairs in lines; glumes gray-green or pale brownish, narrowly lanceolate, long attenuate-filiform.
 - 13a. Glumes 1.8–3 cm; lemma smooth or scaberulous below apex; awn hairs 1–4 mm.
 - 14a. Culms 15–35 cm; awn 4–6 cm, hairs on bristle 3–4 mm 12. *S. orientalis*
 - 14b. Culms 40–80 cm; awn 9–20 cm, hairs on bristle 1–2.5 mm 13. *S. arabica*

- 13b. Glumes 1.2–2 cm; lemma spinulose below apex; awn hairs 0.8–1.5 mm 14. *S. breviflora*
- 12b. Lemma evenly hairy; glumes green or dark purple, lanceolate, acuminate into awn-point.
- 15a. Panicle branches 3–6 cm, flexuous; glumes dark purple; awn 6.5–9 cm, hairs shorter below, 2–3 mm on bristle 15. *S. purpurea*
- 15b. Panicle branches 2–4 cm, straight; glumes green or purplish; awn 3–6 cm, hairs longer below, 0.3–0.7 mm on bristle 16. *S. roborowskyi*
- 8b. Awn plumose only on column or only on bristle.
- 16a. Awn 1.5–3 cm; column plumose, bristle glabrous or minutely hairy (hairs 0.1–0.2 mm).
- 17a. Panicle 1–2 cm wide; branches 1–3 cm, suberect.
- 18a. Awn obscurely 2-geniculate, hairs on column up to 1 mm; spikelets 1.1–1.4 cm 17. *S. regeliana*
- 18b. Awn distinctly 2-geniculate, hairs on column 2–3 mm; spikelets 0.6–1.1 cm 18. *S. subsessiliflora*
- 17b. Panicle (2–)3–7 cm wide; branches 3–6 cm, spreading or obliquely ascending.
- 19a. Leaf blades scabrid or hairy; panicle branches spreading, with cushion in axils; ligule 3–7 mm; column hairs 3–4 mm 19. *S. penicillata*
- 19b. Leaf blades smooth, glabrous; panicle branches ascending, without cushion in axils; ligule 1–1.5 mm; column hairs 1–2 mm 20. *S. aliena*
- 16b. Awn 6–28 cm; column glabrous, bristle plumose, hairs 2–6 mm.
- 20a. Awn 1-geniculate, 6–13 cm 8. *S. tianschanica*
- 20b. Awn 2-geniculate, 15–28 cm.
- 21a. Glumes 2–3 cm; lemma evenly hairy; awn hairs 2–3 mm 21. *S. lessingiana*
- 21b. Glumes 3–5.5 cm; lemma hairs in lines; awn hairs 3–6 mm.
- 22a. Column of awn 5–6 cm to first bend; ligule up to 4 mm 22. *S. kirghisorum*
- 22b. Column of awn 3.5–4.5 cm to first bend; ligule 4–12 mm 23. *S. macroglossa*

1. *Stipa bungeana* Trinius, Enum. Pl. China Bor. 70. 1833.

长芒草 chang mang cao

Perennial, densely tufted. Culms 20–60 cm tall, 2–5-noded. Basal leaf sheaths pubescent, slightly swollen, enclosing cleistogamous spikelets, culm sheaths glabrous or margin ciliate; leaf blades acicular, convolute, basal blades up to 17 cm, culm blades 3–15 cm; ligule of basal leaves rounded, 0.2–0.5 mm, ciliate, of culm leaves lanceolate, 3–5 mm, apex denticulate. Panicle 12–20 cm, base enclosed by uppermost leaf sheath, gradually exerted after maturity. Spikelets gray-green or purple; glumes narrowly lanceolate, 0.9–1.5 cm, apex extended into a slender awn-tipped cusp; callus pungent, 1–1.3 mm; lemma 5–6 mm, pilose in longitudinal lines, awn articulation with a ring of short hairs; awn deciduous, 4–7 cm, scabrid, 2-geniculate, column 1–1.5 cm to first bend, 0.5–1 cm to second bend, bristle 3–5 cm. Cleistogamous spikelets laterally compressed, awnless or shortly awned. Caryopses regularly produced in cleistogamous spikelets. Fl. and fr. May–Oct.

Rocky slopes, loess hills, river banks, roadsides; 500–4000 m. Anhui, Gansu, Hebei, Henan, Jiangsu, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Sichuan, Xinjiang, Xizang [Kazakhstan (Tien Shan), Kyrgyzstan (Tien Shan), Mongolia].

This is a good forage grass for summer pasture, becoming green early in the season.

2. *Stipa przewalskyi* Roshevitz, Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR 1(6): 3. 1920.

甘青针茅 gan qing zhen mao

Perennial, loosely tufted. Culms 30–100 cm tall, 2–3-noded. Leaf sheaths glabrous, lower slightly longer than internodes; leaf blades filiform, convolute, basal blades up to 30 cm, culm blades 10–15 cm, outer surface scabrid; ligule of basal leaves rounded, 0.5–1 mm, of culm leaves lanceolate, 2–3 mm,

decurent and adnate to margins of leaf sheath. Panicle slightly spreading, 15–30 cm, exerted from uppermost leaf sheath at maturity. Spikelets gray-green becoming purple; glumes narrowly lanceolate, 1.2–1.5 cm, apex slenderly acuminate; callus pungent, ca. 2 mm; lemma 8–10 mm, densely hairy in a ventral longitudinal line, longitudinally pilose on back, hispidulous below apex, a ring of short hairs at awn articulation; awn deciduous, 4–6 cm, 2-geniculate, column 1.5–2.5 cm to first bend, setulose with ca. 0.3 mm spinules, ca. 1 cm to second bend, bristle scabrid, stiff, straight, 1.5–2.5 cm. Fl. and fr. May–Aug.

• Grassy rocky hillsides, roadsides; 800–3600 m. Gansu, Hebei, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xizang.

This is a forage grass of summer pasture in steppe and forest steppe regions.

3. *Stipa capillacea* Keng, Sunyatsenia 6(2): 100. 1941.

丝颖针茅 si ying zhen mao

Perennial, tufted. Culms 15–50 cm tall, 2–3-noded. Basal leaves 1/3–1/2 length of culms; leaf sheaths glabrous, longer than internodes; leaf blades acicular, convolute, up to 20 cm, outer surface smooth or scaberulous; ligule of basal and culm leaves ca. 0.6 mm, truncate, ciliolate. Panicle narrowly contracted, 14–18 cm, often exerted from uppermost leaf sheath at maturity; branches erect-ascending, awns of spikelets twisted together at panicle top to form a tail. Spikelets greenish or purplish; glumes narrowly lanceolate, body ca. 1.5 cm, apex long attenuate into capillary 1–1.5 cm filament, often breaking into fine threads; callus pungent, 2–2.5 mm; lemma 7–10 mm, pubescent in a ventral longitudinal line, shortly longitudinally pilose on back, hispidulous below apex, a ring of stiff hairs at awn articulation; awn deciduous, 7–10 cm, 2-geniculate, column glabrous or puberulous, sometimes with longer hairs to 0.8

mm, 1–2 cm to first bend, 0.6–1 cm to second bend, bristle setulose, flexuous, 5–7 cm, apex filamentous. Fl. and fr. Jul–Sep.

Alpine scrub, wet meadows, hills, montane plains, river banks; 2900–5000 m. Gansu, Qinghai, Sichuan, Xizang, Yunnan [Bhutan, N India, Kashmir, Nepal].

This is an easily recognizable species because of its spirally coiling awns and filamentous glume tips.

- 1a. Glumes 2.5–3 cm; lemma ca. 10 mm ... 3a. var. *capillacea*
 1b. Glumes 1.5–2(–2.2) cm; lemma
 (7–)8–9 mm 3b. var. *parviflora*

3a. *Stipa capillacea* var. *capillacea*

丝颖针茅(原变种) si ying zhen mao (yuan bian zhong)

Stipa koelzii R. R. Stewart.

Glumes 2.5–3 cm. Lemma ca. 10 mm. Anthers ca. 4 mm. Fl. and fr. Jul–Sep.

Alpine scrub, meadows, hills, montane plains, river banks; 2900–5000 m. Gansu, Qinghai, Sichuan, Xizang, Yunnan [Bhutan, N India, Kashmir, Nepal].

3b. *Stipa capillacea* var. *parviflora* N. X. Zhao & M. F. Li, Acta Bot. Yunnan. 16: 229. 1994.

小花丝颖针茅 xiao hua si ying zhen mao

Glumes 1.5–2(–2.2) cm. Lemma (7–)8–9 mm. Anthers ca. 2 mm. Fl. Aug.

• Meadows on lake margins, moist places, field margins; 4200–4400 m. Xizang (Langkazê, Tingri).

This variety is used for forage and fiber.

4. *Stipa sareptana* A. K. Becker, Bull. Soc. Imp. Naturalistes Moscou 57: 52. 1882.

新疆针茅 xin jiang zhen mao

Perennial, compactly tufted. Culms 30–80 cm tall, smooth or spinulose, 2–3-noded, nodes dark, exposed. Basal leaves 1/2 length of culms, leaf sheaths smooth or spinulose, shorter than internodes; leaf blades setaceous, convolute, outer surface smooth or scabrid to shortly spinulose; ligule 2–10 mm, of basal leaves rounded, of culm leaves lanceolate. Panicle narrow, 10–20 cm, base enclosed by expanded uppermost leaf sheath. Spikelets yellowish green; glumes narrowly lanceolate, 1.5–2.5 cm, apex filiform; callus pungent, 2.2–3 mm; lemma 9–11 mm, shortly hairy in longitudinal lines, an obscure ring of hairs at awn articulation; awn deciduous, 10–15(–20) cm, scabrid, 2-geniculate, column 1.5–2.5 cm to first bend, 1–1.5 cm to second bend, bristle 9–15 cm, curling. Fl. and fr. Jun–Aug.

Steppes, mountain slopes, floodlands, river banks; 400–4500 m. Gansu, Hebei, Nei Mongol, Ningxia, Qinghai, Shanxi, Xinjiang, Xizang [Kazakhstan, Mongolia, Russia, Tajikistan].

This species differs from others in the *Stipa capillata* group by its basal leaves, which are much shorter than the culms, exposed culm nodes, and rather small spikelets.

- 1a. Culms and outer surface of leaf blades
 scabrid or shortly spinulose 4a. var. *sareptana*
 1b. Culms and outer surface of leaf blades
 smooth and glabrous 4b. var. *krylovii*

4a. *Stipa sareptana* var. *sareptana*

新疆针茅(原变种) xin jiang zhen mao (yuan bian zhong)

Stipa capillata Linnaeus var. *sareptana* (A. K. Becker) Schmalhausen.

Culms spinulose. Leaf sheaths smooth or spinulose; leaf blades spinulose on outer surface; ligule of culm leaves 5–7(–10) mm. Awn with column ca. 2.5 cm to first bend, 1–1.5 cm to second bend, bristle 10–15 cm. Fl. and fr. Jun–Aug.

Drought steppe, desert steppe, Gobi desert; 400–2700 m. Xinjiang [Kazakhstan, Mongolia, Russia, Tajikistan].

4b. *Stipa sareptana* var. *krylovii* (Roshevitz) P. C. Kuo & Y. H. Sun, Fl. Reipubl. Popularis Sin. 9(3): 275. 1987.

西北针茅 xi bei zhen mao

Stipa krylovii Roshevitz, Izv. Glavn. Bot. Sada SSSR 28: 379. 1929; *S. capillata* var. *coronata* Roshevitz; *S. sareptana* subsp. *krylovii* (Roshevitz) D. F. Cui.

Culms smooth. Leaf sheaths smooth; leaf blades smooth on outer surface; ligule of culm leaves 2–3 mm. Awn with column 1.5–2 cm to first bend, ca. 1 cm to second bend, bristle 7–10 cm. Fl. and fr. Jun–Sep.

Mountain slopes, floodlands, river banks; 400–4500 m. Gansu, Hebei, Nei Mongol, Ningxia, Qinghai, Shanxi, Xinjiang, Xizang [Kazakhstan, Mongolia, Russia].

This variety is used as a forage grass in steppe regions.

5. *Stipa baicalensis* Roshevitz, Izv. Glavn. Bot. Sada SSSR 28: 380. 1929.

狼针草 lang zhen cao

Perennial, tufted. Culms 50–80 cm tall, 3–4-noded, lower nodes concealed. Leaf sheaths smooth or scabrid, lower usually longer than internodes; leaf blades convolute, basal blades up to 40 cm, outer surface smooth; ligule truncate or 2-toothed, ciliate, of basal leaves 0.5–1 mm, of culm leaves 1.5–2 mm. Panicle narrow, 20–50 cm, base often enclosed by expanded uppermost leaf sheath. Spikelets gray-green or purplish brown; glumes narrowly lanceolate, 2.5–3.5 mm, apex filiform; callus pungent, ca. 4 mm; lemma 12–15 mm, shortly hairy in longitudinal lines, a ring of short hairs at awn articulation; awn deciduous, 14–17 cm, scabrid, 2-geniculate, column 3–5 cm to first bend, 1.5–2 cm to second bend, bristle curling, ca. 10 cm. Fl. and fr. Jun–Oct.

Mountain slopes, dry grassy places; 700–4000 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Qinghai, Shaanxi, Shanxi, Xizang [Kazakhstan, Mongolia, Russia].

This species is scarcely distinguishable from the widespread *Stipa capillata*. It has a short ligule and a definite ring of short hairs at the awn articulation. It provides forage in dry steppe and meadow steppe regions.

6. *Stipa capillata* Linnaeus, Sp. Pl., ed. 2, 1: 116. 1762.

针茅 zhen mao

Perennial, densely tufted. Culms 40–80 cm tall, often 4-noded, lower nodes concealed. Leaf sheaths smooth or slightly scabrid, lower longer than internodes; leaf blades convolute, basal blades up to 40 cm, outer surface smooth or scabrid; ligule lanceolate, of basal leaves 1–1.5 mm, of culm leaves 3–10 mm. Panicle narrow, 10–25 cm or more, base enclosed by expanded uppermost leaf sheath. Spikelets yellowish green or gray-white; glumes narrowly lanceolate, 2.5–3.5 cm, apex filiform; callus pungent, 2–3 mm; lemma 9–12 mm, shortly hairy in longitudinal lines, smooth and glabrous toward apex; awn deciduous, 11–19 cm, scabrid, 2-geniculate, column 3.5–5 cm to first bend, ca. 1.5 cm to second bend, bristle curling, ca. 10 cm. Fl. and fr. Jun–Aug.

Mountain valleys, plains, rocky slopes; 500–2300 m. N Gansu, Hebei, Shanxi, N Xinjiang [Kashmir, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan; SW Asia, Europe].

This is a widespread species yielding good forage in the steppe zone when young. After the fruiting heads appear the sharp calluses can cause damage to cattle.

7. *Stipa grandis* P. A. Smirnov, Repert. Spec. Nov. Regni Veg. 26: 267. 1929.

大针茅 da zhen mao

Perennial, densely tufted. Culms 50–100 cm tall, 3–4-noded, lower nodes concealed. Basal leaves often reaching to panicle, leaf sheaths smooth or scabrid, lower longer than internodes; leaf blades filiform, convolute, up to 50 cm, outer surface smooth; ligule of basal leaves rounded, 0.5–1 mm, ciliate, of culm leaves lanceolate, 2.5–10 mm. Panicle narrow, 20–50 cm, base enclosed by expanded uppermost leaf sheath. Spikelets greenish purple; glumes narrowly lanceolate, 3–4.5 cm, apex filiform; callus pungent, 4–4.5 mm; lemma 15–17 mm, shortly hairy in longitudinal lines, a ring of short hairs at awn articulation; awn deciduous, 20–28 cm, scabrid, 2-geniculate, column 7–10 cm to first bend, 2–2.5 cm to second bend, bristle curling, 11–18 cm. Fl. and fr. May–Aug.

Flat open steppes; 100–3400 m. Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi [Mongolia, Russia].

This species is very close to *Stipa capillata*, but with larger spikelets and longer awns. It provides good forage for grazing and cutting in the steppe zone.

8. *Stipa tianschanica* Roshevitz in B. Fedtschenko, Fl. Aziatsk. Ross. 1(12): 149. 1916.

天山针茅 tian shan zhen mao

Culms 10–25 cm tall, 2–3-noded, glabrous or pubescent below nodes. Basal leaves equaling or overtopping culms; leaf sheaths glabrous, shorter than internodes; leaf blades convolute, acicular, outer surface smooth or scabrid; ligule ca. 1 mm, obtuse, densely pilose. Panicle contracted, 4–10 cm, branches usually enclosed by inflated uppermost leaf sheath. Spikelets pale

greenish; glumes narrowly lanceolate, equal or lower glume slightly longer, 2–3.5 cm, apex hyaline, long attenuate-filiform; callus pungent, 1.5–2 mm; lemma 7–10 mm, pilose in longitudinal lines, apex with a ring of short hairs or glabrous; awn deciduous, 6–13 cm, 1-geniculate, column 1–2.5 cm, glabrous, bristle 4–14 cm, plumose, hairs 3–6 mm. Fl. and fr. Jun–Jul.

Dry mountain slopes, dry steppes, deserts; 300–4500 m. Gansu, Hebei, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Xinjiang, Xizang [Kazakhstan, Kyrgyzstan, Mongolia, Russia, Uzbekistan].

This is the only species in China with a clearly 1-geniculate awn with glabrous column and feathery bristle. The twisted column is almost smooth, and the hairs of the feather begin just below the bend, splaying out around it. It is a good forage grass.

- 1a. Lemma apex scabrid, with a ring of short hairs 8a. var. *tianschanica*
- 1b. Lemma apex smooth, glabrous.
 - 2a. Glumes 2–2.5 cm; awn bristle 4–7 cm 8b. var. *gobica*
 - 2b. Glumes 3–3.5 cm; awn bristle 10–15 cm 8c. var. *klemenzii*

8a. *Stipa tianschanica* var. *tianschanica*

天山针茅(原变种) tian shan zhen mao (yuan bian zhong)

Stipa potaninii Roshevitz.

Culms 17–23 cm tall. Panicle ca. 5 cm. Glumes 2.7–3.3 cm; lemma 7–8 mm, apex scabrid, with a ring of short hairs; awn 7–9.5 cm, column 1.2–1.5 cm, bristle 6–7 cm, hairs to 6 mm. Fl. and fr. Jun–Jul.

Dry mountain slopes; 2100–2600 m. Gansu, Qinghai, Xinjiang, Xizang [Kazakhstan (Tien Shan), Kyrgyzstan, Uzbekistan].

This variety has the most westerly distribution within the species, being more or less confined to the Tien Shan range.

8b. *Stipa tianschanica* var. *gobica* (Roshevitz) P. C. Kuo & Y. H. Sun, Fl. Reipubl. Popularis Sin. 9(3): 277. 1987.

戈壁针茅 ge bi zhen mao

Stipa gobica Roshevitz, Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR 5: 13. 1924; *S. gobica* var. *wulateica* Y. Z. Zhao; *S. sinomongholica* Ohwi; *S. tianschanica* subsp. *gobica* (Roshevitz) D. F. Cui; *S. wulateica* (Y. Z. Zhao) Y. Z. Zhao.

Culms 10–12 cm tall. Panicle 4–7 cm. Glumes 2–2.5 cm; lemma 7.5–8.5 mm, apex smooth, without a ring of short hairs; awn 6–8 cm, column 1–1.5 cm, bristle 4–6 cm, hairs 3–5 mm. Fl. and fr. Jun–Jul.

Gravelly slopes, stony plains, dry steppes, deserts; 300–4500 m. Gansu, Hebei, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Xinjiang [Mongolia].

8c. *Stipa tianschanica* var. *klemenzii* (Roshevitz) Norlindh, Fl. Mongol. Steppe 1: 66. 1949.

石生针茅 shi sheng zhen mao

Stipa klemenzii Roshevitz, Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR 5: 12. 1924.

Culms 20–40 cm tall. Panicle 6–10 cm. Glumes 3–3.5 cm; lemma 9–11 mm, apex smooth, without a ring of short hairs; awn 9.5–13 cm, column 1.5–2.5 cm, bristle 10–15 cm, hairs up to 6.5 mm. Fl. and fr. Jun–Jul.

Gravelly slopes; ca. 1400 m. Nei Mongol [Mongolia, Russia (near Mongolian border)].

9. *Stipa consanguinea* Trinius & Ruprecht, Sp. Gram. Stipac. 78. 1842.

宜红针茅 yi hong zhen mao

Perennial, tufted. Culms erect or geniculate at base, 15–50 cm tall, 2-noded. Leaf sheaths shorter than internodes; leaf blades grayish green, setaceous, abaxial surface smooth, glabrous; ligule of basal leaves 0.1–0.4 mm, of culm leaves 1–1.5 mm. Panicle contracted, 6–8 cm, base enclosed in uppermost leaf sheath. Spikelets tinged purplish; glumes subequal, 2.2–2.6 cm, hyaline, apex long acuminate; callus short; lemma 8–10 mm, hairy in longitudinal lines, hairs denser in lower part, a ring of short hairs at awn articulation; awn deciduous, 8–11 cm, pubescent, 1(or 2)-geniculate, hairs on column 0.2–0.4 mm, bristle slightly flexuous, hairs 0.4–0.7 cm. Fl. and fr. May–Jul.

Open stony slopes; 1500–2500 m. Xinjiang [Mongolia (Altai), Russia (Altai)].

This species has sometimes been considered conspecific with *Stipa koelzii* (a synonym of *S. capillacea* in this treatment), but it has much larger glumes lacking filamentous tips and more clearly pubescent, non-spiralling awns. It also grows in drier habitats.

10. *Stipa mongolorum* Tzvelev, Rast. Tsentr. Azii 4: 57. 1968.

蒙古针茅 meng gu zhen mao

Perennial, densely tufted. Culms 15–40 cm tall, 1–2-noded, pubescent below nodes. Basal leaves 1/2 length of culms; leaf sheaths glabrous or hairy on margin, shorter than internodes; leaf blades acicular, convolute, outer surface smooth or almost so; ligule 0.3–0.5 mm, densely hairy. Panicle open, lax, 8–20 cm, shortly exserted from uppermost leaf sheath. Spikelets pale greenish; glumes subequal or lower slightly longer, narrowly lanceolate, 1.4–1.9 cm, membranous, apex acuminate-filiform; callus pungent, 1.5–2 mm; lemma 6–7.5 mm, uniformly densely pilose; awn deciduous, 4.5–6.4 cm, plumose throughout, 1-geniculate, column 0.4–0.7 cm, hairs ca. 2 mm, bristle 4–6 cm, hairs 2–3.5 mm. Fl. and fr. Jun–Aug.

Rocky or stony slopes, dry steppes; ca. 1500 m. Nei Mongol, Ningxia (Helan Shan) [Mongolia].

The awn has a shorter column in proportion to the bristle than in *Stipa caucasica*.

11. *Stipa caucasica* Schmalhaus. Ber. Deutsch. Bot. Ges. 10: 293. 1892.

镰芒针茅 lian mang zhen mao

Densely tufted perennial, roots thick, tomentose, clothed in sand grains; old basal sheaths forming large clumps. Culms 15–30 cm tall, 2–3-noded, lower internodes pubescent. Basal leaves 2/3 length of culms; leaf sheaths shorter than internodes; leaf blades acicular, convolute, outer surface smooth or scabrid,

ligule of basal leaves truncate, ca. 0.5 mm, of culm leaves rounded, 1–1.5 mm, ciliate. Panicle narrow, 5–10 cm, branches enclosed in inflated uppermost leaf sheath. Spikelets pale green-brown sometimes faintly purple-tinged; glumes equal or lower glume slightly longer, narrowly lanceolate, 1.5–4 cm, apex long attenuate-filiform; callus pungent, 1–2 mm; lemma 7–10 mm, pilose in longitudinal lines, a ring of soft hairs at apex; awn deciduous, 5–12 cm, hairy throughout, 1-geniculate, column 1.5–2.3 cm, hairs 1–2 mm, bristle 5–8 cm, falcately curved, plumose, hairs 3–5 mm. Fl. and fr. Apr–Jun.

Stony mountain slopes, sand dunes, gravel plains; 1400–5100 m. Gansu, Hebei, Henan, Nei Mongol, Ningxia, Qinghai, Shaanxi, Xinjiang, Xizang [Afghanistan, Kashmir, Kazakhstan, Kyrgyzstan, Mongolia, Russia (Siberia), Tajikistan, Turkmenistan; SW Asia (Caucasus, N Iran)].

This is a widespread and highly polymorphic species. Variation in China is best accommodated within the following two subspecies. *Stipa caucasica* subsp. *glareosa* has a rather more easterly distribution, but smaller, scabrid-leaved forms occur sporadically throughout the range of the species in part related to increased altitude. The species is close to *S. orientalis*, the most obvious difference being the 1-geniculate awn. Hybrids between *S. caucasica* and *S. orientalis* have been reported.

- 1a. Leaf blades usually smooth on outer surface; glumes 3.5–4 cm; awn 7–12 cm 11a. subsp. *caucasica*
- 1b. Leaf blades usually scabrid on outer surface; glumes 1.5–3.5 cm; awn 4.5–7 cm ... 11b. subsp. *glareosa*

11a. *Stipa caucasica* subsp. *caucasica*

镰芒针茅(原亚种) lian mang zhen mao (yuan ya zhong)

Stipa orientalis Trinius var. *grandiflora* Ruprecht.

Plant coarse, at least 20 cm tall; leaf blades 0.5–1 mm in diam., outer surface usually smooth; glumes 3.5–4 cm; awn 7–14 cm.

Stony slopes, landslips; 1400–4500 m. Xinjiang, Xizang [Afghanistan, Kashmir, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan; SW Asia (Caucasus, N Iran)].

This subspecies provides fodder in early spring in desert steppe.

11b. *Stipa caucasica* subsp. *glareosa* (P. A. Smirnov) Tzvelev, Novosti Sist. Vyssh. Rast. 11: 20. 1974.

沙生针茅 sha sheng zhen mao

Stipa glareosa P. A. Smirnov, Bull. Soc. Imp. Naturalistes Moscou 38: 12. 1929; *S. caucasica* f. *desertorum* Roshevitz; *S. caucasica* subsp. *desertorum* (Roshevitz) Tzvelev; *S. caucasica* var. *desertorum* (Roshevitz) Tzvelev; *S. glareosa* var. *langshanica* Y. Z. Zhao; *S. langshanica* (Y. Z. Zhao) Y. Z. Zhao.

Plant delicate, up to 20 cm tall; leaf blades 0.25–0.5 mm in diam., outer surface usually scabrid; glumes 2–3.5 cm; awn 4.5–7 cm.

Stony mountain slopes, sand dunes, gravel plains; 600–5100 m. Gansu, Hebei, Henan, Nei Mongol, Ningxia, Qinghai, Shaanxi, Xinjiang, Xizang [Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia (Siberia), Tajikistan].

Stipa langshanica appears to represent a small, local variant from a mountain range in Nei Mongol. The type has not been seen.

12. *Stipa orientalis* Trinius in Ledebour, Fl. Altaic. 1: 83. 1829.

东方针茅 dong fang zhen mao

Perennial, densely tufted; old basal sheaths forming large clumps, yellowish, slightly glossy, margins ciliate. Culms 15–35 cm tall, 2–3-noded, nodes purple, internodes puberulous. Basal leaves 1/2–2/3 length of culms; leaf sheaths shorter than internodes; leaf blades filiform, convolute, 4–15 cm, abaxial surface scaberulous-puberulous; ligule lanceolate, 2–4 mm, ciliate. Panicle contracted, 4–8 cm, branches frequently enclosed by inflated uppermost leaf sheath. Spikelets green, or occasionally faintly purple-tinged, with silvery tips; glumes narrowly lanceolate, lower usually slightly longer, 1.8–2.2 cm, apex scarious, finely long-acuminate; callus pungent, ca. 2 mm; lemma 7–8 mm, pilose in ventral line and along midvein, intermediate veins pilose at least below middle, a ring of short soft hairs at awn articulation; awn deciduous, 4–6 cm, hairy throughout, 2-geniculate, column 0.7–1.2 cm to first bend, 0.5–0.8 cm to second bend, shortly hairy, hairs 0.5–1 mm, bristle 3–4 cm, plumose, hairs 3–4 mm at base reducing toward apex. Fl. and fr. May–Jul.

Rocky slopes, mountain valleys, desert steppes; 400–5100 m. Qinghai, Xinjiang, Xizang [Kashmir, Kyrgyzstan, W Mongolia, Russia, Tajikistan, Turkmenistan, Uzbekistan; Europe (Ural)].

This is a good forage grass in desert steppe regions.

13. *Stipa arabica* Trinius & Ruprecht, Sp. Gram. Stipac. 77. 1842.

图尔盖针茅 tu er gai zhen mao

Stipa arabica subsp. *caspia* (K. Koch) Tzvelev; *S. arabica* var. *szovitsiana* Trinius; *S. arabica* var. *turgaica* (Roshevitz) Tzvelev; *S. caspia* K. Koch; *S. szovitsiana* (Trinius) Grisebach; *S. turgaica* Roshevitz.

Perennial, tufted. Culms 40–80 cm tall, gray pubescent, 2–3-noded, nodes often dark-brown. Basal leaves 1/2 length of culms; leaf sheaths shorter than internodes, pubescent or lower part subglabrous; leaf blades filiform, convolute, outer surface glabrous to densely pilose; ligule lanceolate, 5–10 mm. Panicle contracted, 15–35 cm, base enclosed by slightly inflated uppermost leaf sheath. Spikelets pale green or greenish yellow; glumes narrowly lanceolate, 2–3 cm, membranous, apex long-acuminate; callus pungent, ca. 1 mm; lemma 9–12 mm, shortly hairy in longitudinal lines not reaching apex, a ring of hairs at awn articulation; awn 9–20 cm, deciduous, hairy throughout, 2-geniculate, column 1.5–1.8 cm to first bend, hairs ca. 1 mm, ca. 1.5 cm to second bend, bristle 6–7 cm, plumose on second column and bristle, hairs 1–2.5 mm. Fl. and fr. May–Jul.

Rocky slopes, Gobi desert; 500–3100 m. Xinjiang, Xizang [Afghanistan, Kazakhstan, Kyrgyzstan, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan; SW Asia].

This is a widespread and variable species, reaching the eastern limit of its range in W China. It is sometimes subdivided into more narrowly defined species or infraspecific taxa based on variations in leaf indumentum and spikelet size. Chinese material is referable to subsp. *caspia*, or *Stipa caspia* at specific rank. *Stipa arabica* subsp. *arabica* from SW Asia has lemmas 7–9 mm and awns not exceeding 9 cm. *Stipa*

turgaica is based on a form with densely pilose leaf blades. *Stipa arabica* is a good forage grass in desert steppe regions.

14. *Stipa breviflora* Grisebach, Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ. 3: 82. 1868.

短花针茅 duan hua zhen mao

Perennial, forming spreading tuft; old basal sheaths pubescent. Culms sometimes geniculate, 20–60 cm tall, 1–3-noded. Basal leaves 1/4–1/3 length of culms; leaf sheaths shorter than internodes; leaf blades acicular, convolute, 7–15 cm, outer surface glabrous; ligule of basal leaves 0.5–1.5 mm, rounded, ciliate, of culm leaves up to 2 mm. Panicle loosely contracted, 10–25 cm, base enclosed by uppermost leaf sheath. Spikelets pale gray-green or light brown with silvery tips; glumes narrowly lanceolate, lower often slightly longer, 1.2–2 cm, apex scarious, acuminate into fragile filiform extension; callus pungent, 1.2–1.5 mm; lemma 0.6–0.8 cm, pilose along veins in lower half, minutely asperulous above, scabrid-spinulose below apex, a ring of short stiff hairs at awn articulation; awn 5.5–8 cm, deciduous, hairy throughout, 2-geniculate, column 1–1.6 cm to first bend, 0.7–1 cm to second bend, hairs 0.8–1 mm, bristle 3–6 cm, hairs 1–1.5 mm. Fl. May–Jul.

Gravel and rocky slopes; 700–4700 m. Gansu, Hebei, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, Xizang [Kashmir, Kazakhstan (Tien Shan), Kyrgyzstan, Mongolia, Nepal, Tajikistan, Uzbekistan].

This species is easily recognized by its shortly plumose awn, spinulose lemma apex, and hairy basal sheaths. The long filiform glume tips are readily broken off, so that the spikelets appear to be much shorter. This is a spring forage grass in desert steppe regions.

15. *Stipa purpurea* Grisebach, Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ. 3: 82. 1868.

紫花针茅 zi hua zhen mao

Lasiagrostis tremula Ruprecht; *Ptilagrostis purpurea* (Grisebach) Roshevitz; *Stipa purpurea* subsp. *arenosa* (Tzvelev) D. F. Cui; *S. purpurea* var. *arenosa* Tzvelev; *S. pilgeriana* K. S. Hao.

Perennial, densely tufted. Culms 20–45 cm tall, 1–2-noded. Basal leaves 1/2 length of culms; leaf sheaths smooth, longer than internodes; leaf blades acicular, convolute, outer surface smooth or scabrid; ligule of basal leaves ca. 1 mm, obtuse, ciliate, of culm leaves lanceolate, 3–6 mm, decurrent and adnate to margins of leaf sheath. Panicle open, up to 15 cm, base enclosed in elongate purple uppermost leaf sheath, spikelets few; branches 3–6 cm, capillary, flexuous. Spikelets purple; glumes lanceolate, 1.3–2.5 cm, apex acuminate into 2–3 mm awn point; callus pungent, 1.5–2.2 mm; lemma 8–12 mm, back softly pubescent, apex without ring of hairs; awn deciduous, 6–9 cm, plumose throughout, hairs 2–3 mm, 2-geniculate, column 1.5–1.8 cm to first bend, 0.7–1 cm to second bend, bristle 4.5–7 cm. Fl. and fr. Jun–Oct.

Stony slopes, valley silt, sand or gravel flats; 1900–5200 m. Gansu, Qinghai, Sichuan, Xinjiang, Xizang [Kashmir, Kyrgyzstan (Pamirs), Tajikistan (Tien Shan)].

This species provides forage in mountain areas. At high altitudes it often occurs in *Kobresia pygmaea* turf.

16. *Stipa roborowskyi* Roshevitz, Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR 1(6): 1. 1920.

昆仑针茅 kun lun zhen mao

Perennial, forming dense tussocks. Culms 30–75 cm tall, 2–3-noded. Basal leaves 1/2–2/3 length of culms; leaf sheaths longer than internodes; leaf blades acicular, convolute, 8–10 cm, outer surface sparsely pubescent; ligule of basal leaves lanceolate, 2–5 mm, of culm leaves 3–7(–12) mm. Panicle 15–30 cm, base included in uppermost leaf sheath; branches obliquely ascending, straight, 2–4 cm. Spikelets green or tinged pale purple; glumes narrowly lanceolate, 1.4–1.6 cm, apex finely acuminate; callus pungent, 1–3 mm; lemma 7–8 mm, back pubescent, a ring of hairs at awn articulation; awn deciduous, 4–6 cm, hairy throughout, 2-geniculate, column plumose with ca. 2 mm hairs, 0.6–0.7 cm to first bend, ca. 1 cm to second bend, bristle 3–4 cm, hairs 0.3–0.7 mm. Fl. and fr. Jul–Sep.

Grassy mountainsides, silt fans and gravelly places by lakes; 3500–5100 m. Qinghai, Xinjiang (Kunlun Shan, Pamirs), Xizang [India (Sikkim), Kashmir].

This is a good forage grass in steppe and meadow steppe regions.

17. *Stipa regeliana* Hackel, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1: 130. 1884.

狭穗针茅 xia sui zhen mao

Stipa purpurascens Hitchcock.

Perennial, densely tufted. Culms 20–50 cm tall. Basal leaves 1/3–1/2 length of culms; leaf sheaths glabrous; leaf blades setaceous, convolute, outer surface smooth or slightly scaberulous, apex often with a tuft of ca. 0.2 mm spinules; ligule lanceolate, 4–6 mm, puberulent. Panicle narrow, 3–10 cm, exerted from uppermost leaf sheath; branches suberect, spikelets few. Spikelets purple with pale tips; glumes subequal or lower glume slightly longer, narrowly oblong, 1.1–1.4 cm, membranous, apex acute to finely acuminate; callus pungent, 1–1.5 mm; lemma 7–8 mm, pubescent, hairs slightly longer below awn; awn stout, stiff, 1.5–2 cm, 1–2-geniculate, column weakly twisted, shortly plumose, 0.3–0.5 cm to first bend, ca. 0.5 cm to second bend, this sometimes obscure, hairs 0.7–1 mm decreasing toward bristle, bristle ca. 1 cm, setulose, hairs appressed, 0.1–0.2 mm. Fl. and fr. Jul–Sep.

Montane grasslands, alluvial flats in mountain valleys, floodplains; 1600–4600 m. Gansu, Ningxia, Qinghai, Sichuan, Xinjiang, Xizang, Yunnan [Kashmir, E Kazakhstan, Kyrgyzstan (Tien Shan), Tajikistan (E Pamirs)].

The combination "*Achnatherum purpurascens* (Hitchcock) Keng" (Claves Gen. Sp. Gram. Prim. Sin. 106, 213. 1957) was not validly published because Keng did not cite the place and date of valid publication of the basionym.

This is a forage grass in montane regions.

18. *Stipa subsessiliflora* (Ruprecht) Roshevitz in B. Fedtschenko, Izv. Imp. Bot. Sada Petra Velikago 14 (Suppl. 2): 50. 1915.

座花针茅 zuo hua zhen mao

Lasiagrostis subsessiliflora Ruprecht in Osten-Sacken &

Ruprecht, Sert. Tianschan. 35. 1869; *Ptilagrostis subsessiliflora* (Ruprecht) Roshevitz; *Stipa basioplumosa* Munro ex J. D. Hooker; *S. subsessiliflora* subsp. *basioplumosa* (Munro ex J. D. Hooker) D. F. Cui; *S. subsessiliflora* var. *basioplumosa* (Munro ex J. D. Hooker) P. C. Kuo & Y. H. Sun.

Perennial, densely tufted. Culms 10–45 cm tall, 2–3-noded. Basal leaves 1/3 length of culms; leaf sheaths glabrous, lower shorter than internodes, upper longer than internodes; leaf blades setaceous, convolute, basal blades up to 15 cm, outer surface scabrid; ligule lanceolate, 2–4 mm or slightly shorter at base. Panicle narrow, 7–14 × 1–2 cm, base enclosed by uppermost leaf sheath when young; branches suberect, 1–3 cm. Spikelets purple; glumes equal or lower longer, lanceolate-oblong, 0.6–1.1 cm, papery, apex scarious, acute to attenuate-mucronate; callus pungent, ca. 1 mm; lemma 4–6 mm, pubescent; awn deciduous, 1.5–2.7 cm, 2-geniculate, column plumose, hairs to first bend 2–3 mm, hairs to second bend 1–1.5 mm, bristle scabrid. Fl. and fr. Jul–Sep.

Stony slopes, alluvial plains, sandy river banks; 1900–5200 m. Gansu, Qinghai, Sichuan, Xinjiang, Xizang, Yunnan [Kashmir, E Kazakhstan, Kyrgyzstan, Russia (Altai), Tajikistan, Uzbekistan].

This is a high mountain species, yielding good forage.

19. *Stipa penicillata* Handel-Mazzetti, Oesterr. Bot. Z. 85: 226. 1936.

疏花针茅 shu hua zhen mao

Perennial, tufted. Culms 25–70 cm tall, 1–2-noded. Basal leaves reaching to panicle; leaf sheaths scabrid to white-hirsute; leaf blades setaceous, convolute, basal blades up to 30 cm, outer surface densely scabrid with some longer spinules or hirsute; ligule lanceolate, 3–7 mm, acute. Panicle open, 15–25 cm, exerted from uppermost leaf sheath; branches with axillary cushions, capillary, flexuous, with 2–4 spikelets. Spikelets green or flushed purplish; glumes subequal or lower slightly longer, lanceolate-oblong, 0.8–1 cm, apex acuminate into a fine point; callus pungent, ca. 1 mm; lemma 5–8 mm, pilose; awn ca. 2 cm, deciduous, 1–2-geniculate, column plumose, hairs 3–4 mm, 0.3–0.7 cm to first bend, 0.4–0.5 cm to second bend, this sometimes obscure, bristle 0.7–1.8 cm, scabrid. Fl. and fr. Jun–Sep.

• Mountain slopes, sand and gravel of river and lake valleys; 1400–5200 m. Gansu, Qinghai, Shaanxi, Sichuan, Xinjiang, Xizang.

- 1a. Leaf sheaths and blades scabrid; ligule glabrous on back 19a. var. *penicillata*
 1b. Leaf sheaths and blades densely hirsute; ligule hairy on back, ciliolate along margin 19b. var. *hirsuta*

19a. *Stipa penicillata* var. *penicillata*

疏花针茅(原变种) shu hua zhen mao (yuan bian zhong)

Stipa laxiflora Keng.

Leaf sheaths and blades scabrid; ligule glabrous on back. Fl. and fr. Jun–Sep.

• Mountain slopes, sand and gravel of river and lake valleys; 1400–5200 m. Gansu, Qinghai, Shaanxi, Sichuan, Xinjiang, Xizang.

This is a good forage grass when young.

19b. *Stipa penicillata* var. *hirsuta* P. C. Kuo & Y. H. Sun, Bull. Bot. Res., Harbin 4(4): 89. 1984.

毛疏花针茅 mao shu hua zhen mao

Leaf sheaths and blades densely hirsute with gray-white hairs; ligule hairy on back, ciliate along margin. Awn distinctly 2-geniculate. Fl. and fr. Jul–Sep.

• Dry mountain slopes, ravine sides; 3400–4500 m. Qinghai.

20. *Stipa aliena* Keng, Sunyatsenia 6(1): 74. 1941.

异针茅 yi zhen mao

Perennial, tufted. Culms 20–40 cm tall, 1–2-noded. Basal leaves 1/2–2/3 length of culms; leaf sheaths smooth, glabrous, longer than internodes; leaf blades setaceous, convolute, basal blades up to 24 cm, outer surface smooth; ligule rounded, 1–1.5 mm, shorter in basal leaves, hairy on back. Panicle open, 10–15 cm; branches without axillary cushions, loosely ascending. Spikelets gray-purple; glumes subequal, lanceolate, 1–1.3 cm, apex slenderly acuminate; callus pungent, ca. 1 mm; lemma 6.5–8 mm, pilose; awn persistent, 1.8–2.5 cm, 2-geniculate, column 0.4–0.5 cm to first bend, plumose, hairs 1–2 mm at base reducing toward first bend, 0.4–0.5 cm to second bend, puberulous, bristle 1–1.5 cm, appressed-puberulous. Fl. and fr. Jul–Sep.

• Damp grassy mountain slopes, silt fans, river banks; 2900–4600 m. Gansu, Qinghai, Sichuan, Xizang.

This is a good forage grass in steppe regions.

21. *Stipa lessingiana* Trinius & Ruprecht, Sp. Gram. Stipac. 79. 1842.

细叶针茅 xi ye zhen mao

Perennial, tufted. Culms 30–60 cm tall, 2–3-noded. Basal leaves 1/2–2/3 length of culms; leaf sheaths smooth or margins ciliate, longer than internodes; leaf blades setaceous, up to 35 cm, 0.3–0.5 mm in diam., outer surface scabrid at least in apical part; ligule of basal leaves 0.2–0.5 mm, rounded, ciliate, of culm leaves 1–2 mm. Panicle narrow, 10–20 cm, base enclosed by uppermost leaf sheath. Spikelets yellowish green; glumes subequal, linear-lanceolate, 2–3 cm, apex attenuate into hyaline filament; callus pungent, 1.5–2 mm; lemma 8–10 mm, pubescent, densely in lower part and sparsely in upper part, a ring of short hairs at apex; awn deciduous, 15–20 cm, 2-geniculate, column 2–3 cm to first bend, smooth, glossy, 1–1.5 cm to second bend, bristle 8–15 cm, plumose, hairs 2–3 mm. Fl. and fr. May–Jul. $2n = 44$.

Rocky hill slopes, piedmont regions; 800–1300 m. Xinjiang [Kazakhstan, Kyrgyzstan, Mongolia, S Russia, Tajikistan, Turkmenistan; SW Asia (Caucasus, Iran), E Europe].

Stipa hohenackeriana Trinius & Ruprecht has been reported from Xinjiang. It differs from *S. lessingiana* by the smooth outer surface of the leaf blades, longer ligules (1.5–5 mm), and scabrid awn column.

Stipa lessingiana is a good forage grass in steppe regions.

22. *Stipa kirghisorum* P. A. Smirnov, Repert. Spec. Nov. Regni Veg. 21: 232. 1925.

大羽针茅 da yu zhen mao

Stipa pennata Linnaeus subsp. *kirghisorum* (P. A. Smirnov) Freitag.

Perennial, tufted. Culms 35–60 cm tall, 4-noded. Basal leaves 2/3 to equaling length of culms; leaf sheaths longer than internodes, scabrid, lowermost with ciliate margins; leaf blades setaceous, convolute, 0.5–0.7 mm in diam., outer surface scabrid; ligule of basal leaves 1–1.5 mm, rounded, margin ciliate, of culm leaves up to 4 mm, acuminate. Panicle narrow, 10–15 cm, branches often enclosed by uppermost leaf sheath. Spikelets yellowish green; glumes subequal, lanceolate, 3.5–5 cm, apex acuminate into long fragile filiform tip; callus pungent, 2.5–4 mm; lemma 14–18 mm, hairs in longitudinal lines, marginal line terminating 1–2 mm below apex, dorsal lines separate to base, apex glabrous; awn deciduous, 16–26 cm, 2-geniculate, column smooth, glossy, 5–6 cm to first bend, 1–2 cm to second bend, bristle 12–18 cm, plumose, hairs 4–5 mm. Fl. and fr. May–Sep.

Rocky mountain slopes, alluvial fans, dry steppes; 300–2400 m. Xinjiang [Afghanistan (Hindu Kush), Kashmir, Kazakhstan, Kyrgyzstan, W Mongolia, N Pakistan, Tajikistan, Uzbekistan].

This is part of the widespread *Stipa pennata* complex, extending from W Europe to Siberia and the Himalayas, and including a number of subsidiary taxa. *Stipa kirghisorum* is one of the more distinctive segregates, differing from *S. pennata* s.s. by the longer marginal lines of hairs on the lemma and dorsal lines separate to the base. It is a common forage grass in steppe regions.

23. *Stipa macroglossa* P. A. Smirnov, Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR 5: 47. 1924.

长舌针茅 chang she zhen mao

Perennial. Culms 30–50 cm tall, 2–3-noded, pubescent below nodes. Basal leaves nearly equal to culms; leaf sheaths shorter than internodes, scabrid; leaf blades setaceous, convolute, ca. 0.5 mm in diam., outer surface strongly scabrid; ligule linear-lanceolate, 4–7(–12) mm, laterally decurrent and adnate to margins of leaf sheath. Panicle contracted, 10–15 cm, base enclosed by expanded uppermost leaf sheath. Spikelets yellowish green; glumes 4–5.5 cm, apex long acuminate-filiform; callus pungent, ca. 3 mm; lemma 12–16 mm, hairs in longitudinal lines, marginal line terminating 2.5–3.5 mm below apex, other lines shorter, apex glabrous; awn deciduous, 15–28 cm, 2-geniculate, column smooth, glossy, 3–4.5 cm to first bend, ca. 2 cm to second bend, bristle 15–20 cm, plumose, hairs 3–6 mm. Fl. and fr. Jun–Sep.

Dry steppes, rocky slopes; 800–1800 m. Xinjiang [Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan].

This is a member of the *Stipa pennata* complex, distinguished by an exceptionally long ligule. It provides good forage when young in steppe regions.

51. PTILAGROSTIS Grisebach in Ledebour, Fl. Ross. 4: 447. 1852.

细柄茅属 xi bing mao shu

Stipa sect. *Ptilagrostis* (Grisebach) Hackel.

Perennials, densely tufted. Culms slender, erect. Leaf blades setaceous. Inflorescence an open or loosely contracted panicle. Spikelets with 1 floret, bisexual, disarticulating above glumes; rachilla extension absent; glumes lanceolate to elliptic-oblong, subequal, a little longer than floret, herbaceous to scariosus, 1–3-veined, apex obtuse to acuminate; callus short, obtuse, shortly bearded; lemma lanceolate, terete, papery, 3–5-veined, pubescent or pilose, margins not overlapping, apex minutely or distinctly 2-toothed, awned from between teeth; awn persistent, plumose throughout, 1(or 2)-geniculate, column twisted; palea midline exposed between lemma margins. Lodicules 3. Stamens 3, anthers glabrous or apex with hair tufts. Stigmas 2.

Eleven species: E Tajikistan (Pamirs) to Russia (NE Siberia), also W United States, on mountains; seven species (two endemic) in China.

Ptilagrostis pelliottii is a distinct and readily separable species, but most of the remainder of the genus comprises a complex of intergrading forms and local variants. The genus is weakly separated from *Stipa*, *S. subsessiliflora* being intermediate.

- 1a. Ligule truncate, ciliate; leaf blades fairly stiff; glumes lanceolate, sharply acuminate; gravelly and rocky places on desert plains 1. *P. pelliottii*
- 1b. Ligule oblong or lanceolate, rounded, glabrous; leaf blades softer; glumes elliptic or oblong-lanceolate, obtuse to acute; alpine meadows and high hilly steppe.
- 2a. Panicle open, 3–5 cm wide; branches up to 6 cm, spreading.
- 3a. Glumes 2.6–3.5 mm; awn 0.6–1 cm 2. *P. luquensis*
- 3b. Glumes 4.5–7 mm; awn 1–3 cm.
- 4a. Anthers 1–2 mm, with hair-tufts at apex; glumes gray-brown or purplish, whitish at apex; awn 1–2 cm 3. *P. dichotoma*
- 4b. Anthers 1.8–3 mm, glabrous; glumes dark-purple at base, otherwise whitish; awn 1.5–3 cm 4. *P. mongholica*
- 2b. Panicle contracted, 0.7–2 cm wide; branches 0.3–2.8 cm, suberect or narrowly ascending.
- 5a. Spikelets 8–12 mm; glumes unequal 5. *P. yadongensis*
- 5b. Spikelets 4–7 mm; glumes subequal.
- 6a. Panicle with sheathing membranous bract at base of lowest branches; spikelets purple; lemma 3.5–5 mm; awn 1–1.5 cm 6. *P. concinna*
- 6b. Panicle without membranous bract at base of lowest branches; spikelets brownish mauve; lemma 4.5–6 mm; awn 1.5–2 cm 7. *P. junatovii*

1. *Ptilagrostis pelliottii* (Danguy) Grubov, Consp. Fl. Mongol. 62. 1955.

中亚细柄茅 zhong ya xi bing mao

Stipa pelliottii Danguy in Lecomte, Notul. Syst. (Paris) 2: 167. 1912.

Perennial, densely tufted from a short rhizome, old basal sheaths persistent. Culms 20–50 cm tall, 1–2 mm in diam., 2–3-noded. Leaf blades gray-green, fairly rigid, setaceous, (3–)6–10 cm, abaxial surface scabrid; ligule truncate, ca. 1 mm, margin ciliate. Panicle lax, up to 10 × 3–4 cm; branches usually paired, capillary, 2.5–4 cm, lower part bare. Spikelets yellowish; glumes lanceolate, 5–6 mm, 3-veined with lateral veins short, membranous, smooth, apex sharply acuminate; lemma 3–4 mm, 3-veined, veins convergent at apex, evenly pubescent throughout, apex minutely 2-toothed; awn 2–3 cm, strongly curved near base, column short, twisted, plumose; palea subequal to lemma, 1-veined. Anthers ca. 2.5 mm, apex glabrous. Fl. and fr. Aug–Oct.

Desert plains, rocky slopes, on rocks and gravel; 1100–3500 m. Gansu, Nei Mongol, Ningxia, Qinghai, Xinjiang [Mongolia (Gobi Desert)].

2. *Ptilagrostis luquensis* P. M. Peterson et al., Sida 21: 1356. 2005.

短花细柄茅 duan hua xi bing mao

Perennial, densely tufted. Culms 5–23 cm tall, 0.5–0.8 mm in diam., 1-noded. Leaf blades filiform, 2–6 cm, abaxial surface smooth or scaberulous; ligule oblong, 0.4–1.2 mm. Panicle open, ovate in outline, 2–5.2 × 1–3 cm; branches single or paired, loosely ascending or spreading, prominent axillary cushions present, capillary, bare in lower part; pedicels 3–12 mm. Spikelets whitish with purplish base; glumes oblanceolate to elliptic-oblong, 2.6–3.5 mm, lower glume 1–3-veined, upper glume 3–5-veined, apex scaberulous, obtuse; lemma 2.2–2.7 mm, pilose below middle, densely scaberulous above; awn 0.6–1 cm, column twisted, plumose, hairs 1.2–2 mm; palea subequal to lemma, 2-veined. Anthers 1–1.4 mm, bearded at apex. Fl. and fr. Jul–Sep.

• Grassy plains; 3300–4800 m. Gansu, Qinghai, Sichuan, Xizang.

3. *Ptilagrostis dichotoma* Keng ex Tzvelev, Rast. Tsentr. Azii 4: 43. 1968.

双叉细柄茅 shuang cha xi bing mao

Perennial, densely tufted. Culms 15–50 cm tall, 0.7–1 mm in diam., 1–2-noded. Leaf blades setaceous, up to 20 cm, abaxial surface smooth or scabrid; ligule triangular or lanceolate, 1–3 mm. Panicle open, ovate in outline, 6–10(–14) × 2–6 cm; branches usually single, rarely paired, dichotomously branched, sometimes with prominent axillary cushions, filiform, bare in lower part; pedicels slender, 5–15 mm. Spikelets purplish or gray-brown, whitish at apex; glumes elliptic, 4.5–

6.5 mm, 3-veined, apex usually smooth, obtuse to acute; lemma 3.6–5.2 mm, pilose below middle, scabrid or minutely pubescent above; awn 1–2 cm, column twisted, plumose, hairs 1.2–3 mm below bend, shorter above; palea equal to lemma, 2-veined. Anthers 1–2 mm, bearded at apex. Fl. and fr. Jul–Sep.

Alpine meadows, grassy mountain slopes, forests, under shrubs; 3000–4800 m. Gansu, Nei Mongol, Qinghai, Shaanxi, Sichuan, Xizang, Yunnan [Bhutan, N India, Nepal].

Specimens from the southern slope of the Himalayas usually have smooth leaf blades, but those from further north generally have scabrid blades. An exceptionally tall specimen with small spikelets (3.2–4 mm) and very scabrid panicle branches, collected at 2800 m in Qinghai (Nanshan), has been separated as *Ptilagrostis dichotoma* var. *roshevitsiana* Tzvelev (Rast. Tsentr. Azii 4: 43. 1968). It seems likely that this will prove to be a different species when more material is available.

Ptilagrostis dichotoma is very indistinctly separable from *P. mongholica*, and specimens from the Himalayas have been identified as the latter. However, the presence of shorter, bearded anthers does seem to be correlated with a slightly different smaller habit and shorter awns. *Ptilagrostis dichotoma* is also very close to *P. concinna*, but it lacks the sheathing, membranous bract at the base of the panicle characteristic of that species.

4. *Ptilagrostis mongholica* (Turczaninow ex Trinius) Grisebach in Ledebour, Fl. Ross. 4: 447. 1852 [“1853”].

细柄茅 xi bing mao

Stipa mongholica Turczaninow ex Trinius, Mém. Acad. Imp. Sci. Saint-Petersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat. 4, 2(1): 42. 1836; *Ptilagrostis tibetica* (Mez) Tzvelev; *Stipa tibetica* Mez.

Perennial, densely tufted. Culms 30–60 cm tall, 1–1.5 mm in diam., usually 2-noded. Leaf blades setaceous, up to 20 cm, abaxial surface scabrid; ligule obtuse, 1–3 mm. Panicle open, ovate in outline, 12–17 × 6–9 cm; branches single or paired, with prominent axillary cushions, widely spreading, capillary, lower part bare, pedicels long, capillary. Spikelets dark-purple or grayish at base, whitish scarious above; glumes elliptic-oblong, 4.5–6(–7) mm, 3–5-veined, apex scabrid, obtuse to acute; lemma 4–6 mm, pilose below middle, scabrid above; awn 1.5–3 cm, weakly geniculate, column slightly flexuous, plumose, hairs 1.2–1.5 mm; palea equal to lemma, 2-veined. Anthers 1.8–3 mm, glabrous at apex. Fl. and fr. Jul–Aug.

Alpine steppes; 2000–4600 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, Yunnan [Bhutan, Kashmir, Mongolia, Nepal, Russia].

5. *Ptilagrostis yadongensis* P. C. Keng & J. S. Tang, J. S. W. Agric. Coll. 1985(4): 44. 1985.

大穗细柄茅 da sui xi bing mao

Ptilagrostis macrospicula L. B. Cai.

Perennial, forming small dense tussocks. Culms 8–18 cm tall, ca. 0.8 mm in diam., 1–2-noded. Leaf blades setaceous, 2–10 cm, abaxial surface glabrous; ligule lanceolate, 2.5–6 mm, denticulate. Panicle contracted, 4–8 × 0.7–1 cm, lowermost branches subtended by 2 ca. 5 mm membranous bracts; lower

branches paired, 0.3–2.8 cm, suberect, spikelets few. Spikelets brownish or purplish; glumes lanceolate, unequal, lower glume 8.5–12.5 mm, 3-veined, upper glume 8–9.5 mm, 1-veined, apex acute; lemma 5.5–8 mm, glabrous in middle part, gradually pubescent toward base and apex, apex 2-toothed; awn 14–16 mm, 1-geniculate, plumose below bend with ca. 1.5 mm hairs, pubescent above with ca. 0.4 mm hairs; palea shorter than lemma by 0.5–1.5 mm, 2-veined. Anthers 1.9–2.5 mm, glabrous at apex. Fr. Sep.

• Meadows on mountainsides; ca. 4000 m. Xizang.

6. *Ptilagrostis concinna* (J. D. Hooker) Roshevitz in Komarov, Fl. URSS 2: 75. 1934.

太白细柄茅 tai bai xi bing mao

Stipa concinna J. D. Hooker, Fl. Brit. India 7: 230. 1896 [“1897”].

Perennial, densely tufted, old basal sheaths forming tight clusters. Culms 10–30 cm tall, 0.6–1 mm in diam., 2-noded. Leaf blades setaceous, 5–15 cm, abaxial surface smooth; ligule obtuse, 0.5–2 mm. Panicle contracted, 2–5 × 1–2 cm, lowest branches enclosed by a sheathing lanceolate membranous bract, smaller bracts present at base of some upper branches; branches usually paired, 1–2 cm, suberect, spikelets few. Spikelets dark purple or purplish red with white scarious apices; glumes elliptic, 4–6.3 mm, lower glume 1-veined, upper glume 3-veined, apex smooth, acute; lemma 3.5–5 mm, pilose below middle, scabrid above, apex 2-toothed, teeth 0.3–0.5 mm; awn 1–1.5 cm, plumose, hairs 1–1.5 mm, shorter toward apex, column loosely twisted; palea subequal to lemma, 2-veined. Anthers 1.5–2.2 mm, bearded at apex. Fl. and fr. Jul–Sep.

Alpine meadows, moist grassy places, under shrubs, swampy places, *Kobresia* moors; 3700–5400 m. Gansu, Qinghai, Shaanxi, Sichuan, Xinjiang, Xizang, Yunnan [India (Sikkim), Kashmir, Kyrgyzstan (Tien Shan), Tajikistan (Pamirs)].

7. *Ptilagrostis junatovii* Grubov, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR 17: 3. 1955.

窄穗细柄茅 zhai sui xi bing mao

Perennial, tufted. Culms erect, 15–30 cm tall, ca. 1 mm in diam., 2-noded. Leaf blades setaceous, involute, 5–15 cm, abaxial surface smooth, prominently veined; ligule obtuse, 0.5–2 mm. Panicle contracted, 4–8(–10) × 1–1.5 cm, lowest branches without sheathing membranous bract; branches usually paired. Spikelets brownish mauve, usually purplish at base; glumes elliptic, (5–)6–7 mm, 3-veined, apex scabrid; lemma 4.5–6 mm, pilose below middle, shortly pubescent above, apex 2-toothed; awn (1–)1.5–1.7 cm, geniculate in a right angle, hairs longer on column, fewer toward apex; palea slightly shorter than lemma, 2-veined. Anthers ca. 1.2 mm, bearded at apex. Fl. and fr. Jul–Sep.

Alpine meadows, grassy mountain slopes, floodlands, forests, under shrubs; 3200–4500 m. Xinjiang, Xizang [Kazakhstan, Mongolia, Russia].

This species is very close to *Ptilagrostis concinna*, but lacks a sheathing bract at the base of the panicle.

52. ACHNATHERUM P. Beauvois, Ess. Agrostogr. 19, 146. 1812.芨芨草属 *ji ji cao shu**Lasiagrostis* Link; *Stipa* sect. *Lasiagrostis* (Link) Hackel; *Timouria* Roshevitz.

Perennials, usually tussocky. Leaf blades linear to setaceous, flat or rolled. Inflorescence an open or contracted panicle, sometimes almost spikelike. Spikelets with 1 floret, bisexual, disarticulating above glumes; rachilla extension absent; glumes lanceolate to elliptic-oblong, subequal or slightly unequal, a little longer than floret, membranous, 1–3(–5)-veined, apex obtuse to acuminate; callus short, obtuse or acute, not pungent, shortly bearded; lemma lanceolate, terete, usually papery, sometimes becoming somewhat indurate at maturity, 3–5-veined, pilose, margins typically approximate, sometimes overlapping, apex shortly 2-toothed, awned from between teeth; awn persistent or deciduous, straight or 1(or 2)-geniculate with twisted column, scabrid throughout or column minutely hairy; palea midline often exposed between lemma margins. Lodicules 3, lanceolate. Stamens 3, anthers often with hair tufts at apex. Stigmas 2.

About 50 species: N Africa, Europe eastward to Japan, North America; 18 species (six endemic) in China.

Achnatherum is sometimes included within a more broadly defined *Stipa*, mainly because of the difficulty in placing the group of species around *A. sibiricum*, which are intermediate in their characteristics. Some species, including *A. inebrians*, are poisonous to livestock.

- 1a. Awn straight or slightly curved, without obvious column, very indistinctly twisted below, usually falling early.
 - 2a. Leaf blades 1–2 cm wide; glumes 7–9-veined 1. *A. coreanum*
 - 2b. Leaf blades 0.1–1 cm wide; glumes 1–3-veined.
 - 3a. Culms usually more than 1 m; ligule of culm leaves 5–17 mm.
 - 4a. Lemma pilose throughout; awn 0.5–1.2 cm 2. *A. splendens*
 - 4b. Lemma pilose along lateral veins; awn 0.2–0.4 cm 3. *A. breviaristatum*
 - 3b. Culms less than 1 m; ligule of culm leaves 0.2–1 mm.
 - 5a. Panicle spikelike, 4–7 cm; glumes keeled; awn ca. 0.4 cm 4. *A. saposhnikovii*
 - 5b. Panicle open or contracted, 7–30 cm; glumes rounded on back; awn 0.4–2 cm.
 - 6a. Lemma pubescent below, a conspicuous tuft of longer hairs below apex; awn 1.5–2 cm 5. *A. inaequiglume*
 - 6b. Lemma evenly pubescent; awn 0.4–1.2 cm.
 - 7a. Ligule 0.5–1 mm 6. *A. caragana*
 - 7b. Ligule 0.1–0.2 mm or absent.
 - 8a. Densely tufted, without rhizome; leaf blades 1–2 mm wide; branches of panicle 2 per node; awn 0.4–0.8 cm 7. *A. chinense*
 - 8b. Loosely tufted, shortly rhizomatous; leaf blades 3–10 mm wide; branches of panicle 3–4 per node; awn 0.8–2 cm 8. *A. henryi*
 - 1b. Awn clearly geniculate with twisted column, persistent (caducous in *A. psilatherum*).
 - 9a. Culms slender, less than 1 m tall, 1–1.5 mm in diam.; leaf blades usually rolled, 0.5–2(–4) mm wide.
 - 10a. Spikelets 7.5–14 mm; lemma pilose below middle; awn with pubescent column.
 - 11a. Anthers 2–2.5 mm, often glabrous 9. *A. chingii*
 - 11b. Anthers 2.8–4.5 mm, bearded 10. *A. duthiei*
 - 10b. Spikelets 5–7 mm; lemma pilose throughout; awn scabrid throughout.
 - 12a. Panicle contracted, branches suberect, spiculate to base.
 - 13a. Awn 2–3 cm, persistent; anthers 2.8–3.5 mm 11. *A. jacquemontii*
 - 13b. Awn 1.5–1.8 cm, caducous; anthers 2–2.5 mm 12. *A. psilatherum*
 - 12b. Panicle lax, branches spreading, bare in lower part; awn 1–1.5 cm 13. *A. nakaii*
 - 9b. Culms fairly robust, up to 1.5 m tall, 1.5–4 mm in diam.; leaf blades often flat, 2–10 mm wide.
 - 14a. Lemma 4–4.2 mm; panicle densely contracted, spikelike 14. *A. inebrians*
 - 14b. Lemma 4.5 mm or more; panicle open or contracted.
 - 15a. Leaf sheaths scabrid; culms scabrid below panicle; leaf blades pubescent; glumes puberulous 15. *A. pubicalyx*
 - 15b. Leaf sheaths smooth; culms smooth; leaf blades smooth or scabrid; glumes glabrous, smooth or asperulous.
 - 16a. Panicle densely contracted, branches with spikelets to base; leaf blades often convolute, 0.3–0.7 mm wide; callus acute, 0.5–1 mm 16. *A. sibiricum*
 - 16b. Panicle open or loosely contracted, branches often bare below middle; leaf blades flat, up to 1 cm wide; callus obtuse, 0.3–0.5 mm.
 - 17a. Awn 20–25 mm 17. *A. pekinense*
 - 17b. Awn 10–18 mm 18. *A. brandisii*

1. *Achnatherum coreanum* (Honda) Ohwi, J. Jap. Bot. 17: 404. 1941.

大叶直芒草 da ye zhi mang cao

Stipa coreana Honda, Koryo Shikerin No Ippan: 80. 1932; *Orthoraphium coreanum* (Honda) Ohwi; *Orthoraphium grandifolium* (Keng) Keng ex P. C. Kuo; *Patis coreana* (Honda) Ohwi; *Stipa grandifolia* Keng.

Perennial from a short knotty rhizome. Culms solitary or few, stiffly erect, up to 1 m tall, 2–3 mm in diam., 7–8-noded. Leaves all cauline; leaf sheaths usually longer than internodes, scabrid or puberulous, pilose at collar; leaf blades linear-lanceolate, flat, 10–35 × 1–2 cm, scaberulous or puberulous especially on abaxial surface, base attenuate, apex finely acuminate; ligule 0.5–2 mm, truncate, erose. Panicle linear, 20–35 cm; branches single or paired, simple, puberulous. Spikelets gray-green or dark-green; glumes lanceolate, subequal, 13–15 mm, herbaceous, 7–9-veined with transverse veinlets, apex acuminate; callus obtuse, ca. 1 mm; lemma 1–1.2 cm, indurate at maturity, evenly pubescent, margins overlapping, apex shortly 2-toothed, teeth minutely hairy; awn persistent, 2.5–3.5 cm, scabrid, slightly twisted with lateral grooves below, upper part flexuous. Lodicules 2, lanceolate, ca. 1.8 mm. Anthers 5–7 mm. Ovary villous below styles. Fl. and fr. Aug–Oct.

Hillsides, forests in mountain valleys, grassy places in gullies, near roads; 400–1500 m. Anhui, Hebei, Hubei, Jiangsu, Jiangxi, Shaanxi, Zhejiang [Japan, Korea].

This species has firmer glumes with more veins than usual, only 2 lodicules, and a distinctive hairy ovary. It has been placed in the genus *Orthoraphium*, but appears to have very little affinity with the single Himalayan member of that genus. It is also rather anomalous in *Achnatherum*, but is placed here until generic limits in *Stipeae* are better understood.

2. *Achnatherum splendens* (Trinius) Nevski, Trudy Bot. Inst. Akad. Nauk SSSR, Ser. 1, Fl. Sist. Vyssh. Rast. 4: 224. 1937.

芨芨草 ji ji cao

Stipa splendens Trinius, Neue Entdeck. Pflanzenk. 2: 54. 1821; *S. altaica* Trinius; *S. schlagintweitii* Mez; *Lasiagrostis splendens* (Trinius) Kunth; *Stipa kokonorica* K. S. Hao.

Perennial, forming large dense tussocks; roots thick, tough, coated with sand; old basal sheaths fibrous. Culms stiff, erect, 0.5–2.5 m tall, 3–5 mm in diam., 2–3-noded. Leaf sheaths glabrous; leaf blades convolute, tough, 30–60 cm, 5–6 mm wide, abaxial surface smooth; ligule triangular, 5–10(–17) mm, acute. Panicle pyramidal, (15–)30–60 cm; branches 2–6 per node, ascending or spreading, 8–17 cm, lower part bare. Spikelets 4.5–7 mm, gray-green with purple-brown base; glumes unequal, elliptic, lower glume 4–5 mm, 1-veined, upper glume 6–7 mm, 3-veined, scabrid, apex acute or denticulate; callus obtuse, 0.3–0.6 mm; lemma 4.8–5.7 mm, scaberulous-puberulous, also evenly pilose with longer hairs, apex 2-toothed; awn 0.5–1.2 cm, caducous, straight or slightly curving and indistinctly twisted below, scabrid. Anthers 2.5–3.5 mm, bearded at apex. Fl. and fr. Jun–Sep.

Dry mountain slopes, grassy places on slightly alkaline, sandy

soil; 900–4500 m. Gansu, Heilongjiang, Henan, Nei Mongol, Ningxia, Qinghai, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan [Afghanistan, N India, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan].

This species tolerates high levels of salinity and is used for improving saline and alkaline land. It is also a good forage grass and a source of fiber.

3. *Achnatherum breviaristatum* Keng & P. C. Kuo, Fl. Tsinling. 1(1): 442. 1976.

短芒芨芨草 duan mang ji ji cao

Perennial, shortly rhizomatous; rhizomes clothed in smooth yellowish green scales. Culms erect, ca. 1.5 m tall, 2–3-noded. Leaf sheaths smooth or scaberulous, longer than internodes; leaf blades convolute, up to 50 cm, abaxial surface smooth, margins setosely scabrid; ligule oblong-lanceolate, up to 14 mm. Panicle contracted, ca. 30 cm; branches several per node, suberect, short, with spikelets to base; pedicels 2–10 mm, setulose. Spikelets 6–6.5 mm, yellowish green becoming purplish at base; glumes subequal, lanceolate-elliptic, lower glume ca. 6 mm, 5–7-veined at base, upper glume ca. 6.5 mm, often 5-veined at base, glabrous, apex acute; callus obtuse; lemma ca. 5 mm, pilose along lateral veins with long white hairs, apex shortly 2-toothed; awn 0.2–0.4 cm, straight. Anthers 3.5–4 mm, bearded at apex. Fl. Jun.

• Grassy places on mountain slopes, dry river valleys; ca. 2100 m. Gansu (Minxian).

4. *Achnatherum saposhnikovii* (Roshevitz) Nevski, Trudy Bot. Inst. Akad. Nauk SSSR, Ser. 1, Fl. Sist. Vyssh. Rast. 4: 224. 1937.

钝基草 dun ji cao

Timouria saposhnikovii Roshevitz in B. Fedtschenko, Fl. Aziatsk. Ross. 12: 174. 1916; *Stipa saposhnikovii* (Roshevitz) Kitagawa.

Perennial, forming small tufts. Culms erect, 25–50 cm tall, 1–1.5 mm in diam., 2–3-noded. Leaf sheaths shorter than internodes, tightly overlapping, smooth; leaf blades convolute, setaceous, 5–15 cm, 1–2.5 mm wide, abaxial surface smooth; ligule 0.2–0.7 mm. Panicle linear, spikelet-like, dense, 3–7 × 0.6–0.8 cm; branches appressed to axis, 0.5–2 cm, scabrid, with spikelets to base. Spikelets 5–6 mm, yellowish green; glumes keeled, lanceolate, slightly unequal, lower glume 5–6 mm, upper glume 4.5–5 mm, prominently 3-veined, keel scabrid, apex finely acuminate; callus obtuse, ca. 0.3 mm, lemma elliptic, 2.5–3.5 mm, back pilose, apex 2-toothed, teeth ca. 0.2 mm; awn ca. 0.4 cm, caducous, straight or slightly twisted at base, scabrid. Anthers 1.6–2 mm, glabrous at apex. Fl. and fr. Jul–Sep.

Dry stony slopes, steppe regions; 1500–3500 m. Gansu, Nei Mongol, Ningxia, Qinghai, Xinjiang [Kazakhstan, Kyrgyzstan, Mongolia, Uzbekistan].

This grass is distinctive in the genus on account of its keeled, prominently 3-veined glumes. It is sometimes placed in the separate genus *Timouria*, but resembles *Achnatherum* in its elliptic floret and 2-toothed lemma.

5. *Achnatherum inaequiglume* Keng, Fl. Tsinling. 1(1): 443. 1976.

异颖茭草 yi ying ji cao

Perennial, densely tufted. Culms erect or geniculately ascending, 30–65 cm tall, 0.8–1 mm in diam., 2–3-noded. Leaf sheaths shorter than internodes, glabrous or upper part often puberulous; leaf blades filiform, up to 20 cm, abaxial surface smooth; ligule 0.5–1 mm, truncate or toothed. Panicle contracted, oblong in outline, moderately dense, 7–13 cm; branches ascending, 0.5–3 cm, with spikelets to base; pedicels scaberulous-puberulous. Spikelets greenish or grayish; glumes lanceolate, unequal, lower glume 7–8 mm, upper glume 5–6 mm, membranous, 3-veined, scabrid especially along midvein, lower margins sometimes sparsely pilose, apex acuminate; callus obtuse, ca. 0.3 mm; lemma 3–4 mm, densely pubescent, a conspicuous brush of longer 3–4 mm hairs below apex, apex shortly 2-toothed; awn 1.5–2 cm, lower 1/4–1/3 curved and obscurely twisted, scabrid. Anthers 2–2.5 mm, glabrous at apex. Fl. and fr. Jul–Sep.

- Dry mountain slopes; 900–2200 m. Gansu, Sichuan.

6. *Achnatherum caragana* (Trinius) Nevski, Trudy Bot. Inst. Akad. Nauk SSSR, Ser. 1, Fl. Sist. Vyssh. Rast. 4: 337. 1937.

小茭草 xiao ji cao

Stipa caragana Trinius, Mém. Acad. Imp. Sci. St.-Petersbourg, Sér. 6, Sci. Math. 1: 74. 1831; *Lasiagrostis caragana* (Trinius) Trinius & Ruprecht; *Oryzopsis asiatica* Mez.

Perennial, densely tufted; roots sometimes coated in sand. Culms erect, 50–90 cm tall, 1.5–3 mm in diam., 3–5-noded. Leaf sheaths shorter than internodes, smooth or scabrid; leaf blades gray-green, flat or convolute and setaceous, 15–30 cm, 1–2.5 mm wide, abaxial surface smooth except toward apex; ligule truncate, 0.5–1 mm. Panicle open, lax, 15–30 cm; branches 2–5 per node, ascending to divaricate, 5–13 cm, bare in lower part, spikelets crowded above. Spikelets 4.2–5.5 mm, pale green; glumes subequal, elliptic, membranous becoming hyaline upward, lower 1–3-veined, upper 3-veined, apex acute; callus obtuse, 0.2–0.3 mm; lemma narrowly elliptic, 3–4 mm, densely appressed-pilose, apex minutely 2-toothed; awn caducous, 0.7–1.2 cm, flexuous or almost straight, indistinctly twisted below, scabrid. Anthers 1.5–2 mm, apex bearded or glabrous. Fl. and fr. Jun–Aug.

Dry rocky or stony slopes; 900–1200 m. Xinjiang [Afghanistan, Kazakhstan, Pakistan, Russia, Tajikistan; SW Asia (Caucasus, Iran, E Turkey)].

7. *Achnatherum chinense* (Hitchcock) Tzvelev, Rast. Tsentr. Azii 4: 40. 1968.

中华茭草 zhong hua ji cao

Oryzopsis chinensis Hitchcock, Proc. Biol. Soc. Washington 43: 92. 1930; *Piptatherum parviflorum* Roshevitz.

Perennial, usually densely tufted. Culms erect, 30–80 cm tall, ca. 1 mm in diam., 2–4-noded. Leaf sheaths glabrous or ciliolate along mouth and margins, shorter than internodes; leaf

blades mainly basal, usually rolled, filiform, 10–30 cm, 1–2 mm, abaxial surface smooth or scabrid along veins, adaxial surface and margins scabrid; ligule 0.1–0.2 mm. Panicle open, ovate in outline, sometimes nodding, 12–15 cm; branches usually 2 per node, distant, slender, 5–7 cm, spikelets clustered toward apices. Spikelets 3.3–4.5 mm, green; glumes subequal, lanceolate, hyaline, 3–5-veined, lateral veins not extending to apex, apex acute or denticulate; callus obtuse, ca. 0.15 mm; lemma elliptic, 2–3 mm, leathery, dark brown at maturity, densely pubescent, margins overlapping at least toward apex, apex shortly 2-toothed; awn caducous, 0.4–0.8 cm, very weakly geniculate column slightly twisted. Anthers ca. 1.8 mm, minutely bearded at apex.

- Dry mountain slopes, grassy roadsides, forest fringes; 500–2400 m. Gansu, Hebei, Henan, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi.

8. *Achnatherum henryi* (Rendle) S. M. Phillips & Z. L. Wu, Novon 15: 475. 2005.

湖北茭草 hu bei ji cao

Perennial, loosely tufted from a short knotty rhizome. Culms erect or slightly geniculate, 40–95 cm tall, 3–4-noded. Leaf sheaths ciliolate at abaxial junction with blade, shorter or lower longer than internodes; leaf blades linear, usually flat, 6–30 cm, 3–10 mm wide, abaxial surface smooth, adaxial surface and margins scaberulous, base narrowed, apex slenderly acuminate; ligule ca. 0.2 mm or absent. Panicle open to loosely contracted, 15–20 cm; branches 3–4 per node, capillary, 5–8 cm. Spikelets yellowish with green veins; glumes ovate-oblong, 3–4.5(–6) mm, hyaline, scabrid, 3-veined, veins prominent, distinct to apex, indistinct transverse veinlets present, apex apiculate or denticulate; callus thinly pilose; lemma elliptic-oblong, 2.5–3.5(–4) mm, subleathery, pallid, 3–5-veined, appressed pubescent, apex entire or emarginate; awn persistent, stout, flexuous, 0.8–1.2(–2) cm, very slightly twisted toward base. Anthers 1.5–2 mm, minutely bearded or glabrous at apex. Fl. Apr–Jun.

- Mountain slopes, forests, shady roadsides, moist places; 100–2500 m. Gansu, Guizhou, Henan, Hubei, Shaanxi, Sichuan, Yunnan.

The 3 prominent, green veins of the glumes are an obvious feature of the spikelet. They are linked above the middle by inconspicuous, transverse veinlets. The species has 3 lodicules (not 2, as given in the protologue), which sometimes have hairy tips.

- 1a. Glumes apiculate or denticulate, 3–4.5 mm; awn 0.8–1.2 cm 8a. var. *henryi*
- 1b. Glumes acuminate, 5–6 mm; awn 1.5–2 cm 8b. var. *acutum*

8a. *Achnatherum henryi* var. *henryi*

湖北茭草(原变种) hu bei ji cao (yuan bian zhong)

Stipa henryi Rendle, J. Linn. Soc., Bot. 36: 382. 1904; *Oryzopsis henryi* (Rendle) Keng ex P. C. Kuo.

Glumes 3–4.5 mm, apex apiculate or denticulate; lemma 2.5–3.5 mm, apex emarginate or entire; awn 0.8–1.2 cm. Anther apex bearded or glabrous. Fl. Apr–Jun.

• Forests on mountain slopes, shady roadsides, among rocks; 100–2300 m. Gansu, Hubei, Shaanxi, Sichuan.

8b. *Achnatherum henryi* var. *acutum* (L. Liu ex Z. L. Wu) S. M. Phillips & Z. L. Wu, *Novon* 15: 475. 2005.

尖颖芨芨草 *jian ying ji ji cao*

Oryzopsis henryi var. *acuta* L. Liu ex Z. L. Wu, *Acta Phytotax. Sin.* 19(4): 435. 1981; *Oryzopsis acuta* (L. Liu ex Z. L. Wu) L. Liu.

Glumes 5–6 mm, apex acuminate; lemma ca. 4 mm, apex entire; awn 1.5–2 cm. Anther apex slightly bearded. Fl. May.

• Moist places; ca. 2500 m. Yunnan.

9. *Achnatherum chingii* (Hitchcock) Keng, *Fl. Tsinling*. 1(1): 152. 1976.

细叶芨芨草 *xi ye ji ji cao*

Stipa chingii Hitchcock, *Proc. Biol. Soc. Washington* 43: 94. 1930.

Perennial, densely tufted. Culms erect, 40–70 cm tall, ca. 1.5 mm in diam., 2–3-noded. Leaf sheaths shorter than internodes, smooth; leaf blades filiform, convolute, soft, up to 25 cm, 0.5–1 mm wide, scabrid; ligule lanceolate, 2–4 mm, often 2-lobed or obtuse. Panicle open or loosely contracted, 10–20 cm; branches often paired, laxly ascending or lower spreading, lower part bare, upper part with few spikelets. Spikelets 7–12 mm, yellowish green or purple at base; glumes subequal, lanceolate-oblong, membranous, lower 7–8 mm, 1–3-veined, upper 8–10 mm, 3-veined, apex obtuse; callus obtuse or acute, 0.5–1 mm; lemma 6–8 mm, lower back pubescent, apex 2-toothed; awn persistent, 1–1.8 cm, 1(–2)-geniculate, column twisted, pubescent, bristle glabrous; palea slightly shorter than lemma. Anthers ca. 2 mm, glabrous or with a few hairs at apex. Fl. and fr. Jul–Sep.

• 2200–4000 m. Gansu, Qinghai, Shaanxi, Shanxi, Sichuan, Xizang, Yunnan.

This taxon appears to differ from *Achnatherum duthiei* only in its shorter anthers. An examination of a sufficient quantity of specimens may show them to be the same species.

10. *Achnatherum duthiei* (J. D. Hooker) P. C. Kuo & S. L. Lu, *Fl. Reipubl. Popularis Sin.* 9(3): 322. 1987.

藏芨芨草 *zang ji ji cao*

Stipa duthiei J. D. Hooker, *Fl. Brit. India* 7: 232. 1896 [“1897”]; *Achnatherum chingii* var. *laxum* S. L. Lu.

Perennial, densely tufted. Culms erect, 50–80 cm tall, 1–2 mm in diam., 3–4-noded. Leaf sheaths smooth or scaberulous; leaf blades narrowly linear to setaceous, thin, flat or convolute when dry, 10–30 × 0.1–0.25 cm, abaxial surface smooth; ligule of culm leaves oblong, 2–2.5 mm. Panicle open or loosely contracted, 10–25 cm; branches paired, 3–10 cm, pairs distant, laxly ascending or lower spreading, few spiculate, bare in lower part. Spikelets 9–14 mm, pale yellowish, base brownish purple; glumes subequal, lanceolate, membranous, lower 3–5-veined, upper 5-veined, apex hyaline, acuminate; callus acute, 0.5–0.8 mm; lemma 7(–9) mm, back loosely pilose below middle, gla-

brous or sparsely pubescent above, apex 2-toothed, teeth 0.5–1 mm; awn 1.4–1.8 cm, persistent, delicate, weakly 1-geniculate, column loosely twisted, pubescent, bristle scabrid; palea as long as lemma. Anthers 3–4.5 mm, bearded at apex. Fl. and fr. Jul–Sep.

Mountain shrubland and in coniferous forest; 2500–4500 m. Qinghai, Shaanxi, Sichuan, Xizang, Yunnan [N India, Kashmir, Nepal].

11. *Achnatherum jacquemontii* (Jaubert & Spach) P. C. Kuo & S. L. Lu, *Fl. Reipubl. Popularis Sin.* 9(3): 323. 1987.

干生芨芨草 *gan sheng ji ji cao*

Stipa jacquemontii Jaubert & Spach, *Ill. Pl. Orient.* 4: 60. 1851; *Lasiagrostis jacquemontii* (Jaubert & Spach) Munro ex Boissier; *Stipa sibirica* Linnaeus var. *pallida* J. D. Hooker.

Perennial, densely tufted from tough rootstock. Culms wiry, 30–70 cm tall, 1–1.5 mm in diam., 2–4-noded. Leaf sheaths glabrous, lower longer than internodes; leaf blades setaceous, convolute, 10–25 cm, ca. 0.8 mm wide, abaxial surface smooth, adaxial surface pubescent; ligule truncate, ca. 0.3 mm. Panicle contracted, narrow, 10–20 cm; branches 2 to several per node, laxly suberect, delicate, 2–7 cm, with spikelets to base. Spikelets 5–7 mm, greenish or purplish; glumes subequal, elliptic-lanceolate, 3-veined, membranous, smooth, apex acute; callus obtuse, 0.3–0.4 mm; lemma 4–5 mm, membranous, pilose throughout, apex 2-toothed, teeth 0.3–0.4 mm; awn persistent, 2–3 cm, very fine, weakly 2-geniculate, column twisted, scabrid throughout; palea 2/3 length of lemma. Anthers 2.8–3.5 mm, bearded at apex. Fl. and fr. Jul–Sep.

Dry mountain slopes, especially in rock crevices; ca. 3300 m. Xizang [E Afghanistan, NW India, Kashmir, N Pakistan].

This is a well-defined species from rocky places in the W Himalayas. *Achnatherum duthiei* has a similar but wider distribution. Besides the key characters, *A. jacquemontii* can also be distinguished from *A. duthiei* by its short ligule, whorls of panicle branches bearing more spikelets, and shorter palea.

12. *Achnatherum psilanthrum* Keng ex Tzvelev, *Rast. Tsent. Azii* 4: 41. 1968.

光药芨芨草 *guang yao ji ji cao*

Perennial, densely tufted. Culms erect, 40–100 cm tall, 1–1.5 mm in diam., 2–3-noded. Leaf sheaths smooth, shorter than internodes; leaf blades filiform, to 12 cm, to 0.5 mm wide, surfaces smooth or scaberulous; ligule truncate, 0.1–0.5 mm, often toothed. Panicle loosely contracted, narrowly oblong in outline, 5–15 cm; branches 2 to several per node, suberect or slightly spreading, delicate, up to 2.5 cm. Spikelets 6–7 mm, purple with pale hyaline apices; glumes subequal or lower glume slightly shorter, lanceolate, 3-veined, apex acuminate to a fine point; callus subacute, ca. 0.3 mm; lemma 3.8–4.5 mm, densely pubescent, apex subentire; awn caducous, 1.5–1.8 cm, 1-geniculate, scabrid, column weakly twisted; palea as long as lemma. Anthers 2–2.5 mm, glabrous at apex. Fl. and fr. Jun–Sep.

• Grassy and rocky mountainsides, river banks, floodlands; 2000–4100 m. Gansu, Qinghai, Sichuan.

13. *Achnatherum nakaii* (Honda) Tateoka ex Imzab in Ma et al., Fl. Intramangol. 7: 196. 1983.

朝阳芨芨草 chao yang ji ji cao

Stipa nakaii Honda, Rep. First Sci. Exped. Manchoukuo, Sect. IV, 4: 104. 1936; *S. roerichii* Keng.

Perennial, densely tufted; roots sometimes coated with sand. Culms erect, 40–60 cm tall, 1–1.2 mm in diam., 2–3-noded. Leaf sheaths smooth or sparsely pubescent, lower longer than internodes; leaf blades setaceous, 10–30 cm, 1–4 mm wide, smooth or scabrid along margins; ligule truncate, 0.5–1 mm, lacerate. Panicle fairly loose, 12–25 cm; branches 2–3 per node, ascending or widely spreading at maturity, scabrid, lower part bare. Spikelets 5–6.5 mm, yellowish green or brownish purple; glumes oblong-lanceolate, subequal or lower glume slightly shorter, 3-veined, puberulous, acute; callus obtuse, ca. 0.5 mm; lemma firm, 4.5–5 mm, densely pubescent; awn persistent, 1–1.5 cm, weakly 1(or 2)-geniculate, scabrid throughout. Anthers 3–4 mm, glabrous or with a few hairs at apex. Fl. and fr. Jul–Sep.

Grassy places on mountain slopes, floodlands; 1200–1700 m. Hebei, Liaoning, Nei Mongol, Shanxi [Mongolia].

This species appears to be a small-spiculate member of the *Achnatherum sibiricum-pekinese* complex. The type has not been seen.

The combination *Achnatherum nakaii* has usually been attributed to Tateoka (J. Jap. Bot. 30: 208. 1955), but it was not validly published there because Tateoka made no reference to Honda's basionym.

14. *Achnatherum inebrians* (Hance) Keng ex Tzvelev, Rast. Tsentr. Azii 4: 40. 1968.

醉马草 zui ma cao

Stipa inebrians Hance, J. Bot. 14: 212. 1876.

Perennial, tussocky. Culms erect, (40–)60–100 cm tall, 2.5–4 mm in diam., 3–4-noded, nodes dark, puberulous below. Leaf sheaths smooth; leaf blades linear, flat or convolute at margins, 8–15(–30) cm, 2–5(–10) mm wide, abaxial surface granular-scaberulous, apex finely acuminate; ligule truncate, 0.5–1.2 mm. Panicle densely contracted, almost spike-like, narrowly oblong in outline, interrupted below, 10–25 cm; branches up to 5 per node, erect, densely clothed with spikelets. Spikelets 5–6 mm, gray-green or purplish, tinged bronze at maturity; glumes subequal, lanceolate, 3-veined, asperulous, midrib scabrid, apex acute or obtuse and denticulate; callus acute, ca. 0.5 mm; lemma 4–4.2 mm, firm, dark brown at maturity, pilose, hairs slightly longer upward, increasing to 1.1–1.3 mm around awn base, apex shortly 2-toothed; awn tardily deciduous, stiff, 1–1.3 cm, 1-geniculate, column minutely pubescent, bristle scabrid. Anthers ca. 2 mm, bearded at apex. Fl. and fr. Jul–Sep.

Upland steppes, grassy mountainsides, roadside bordering fields, floodlands; 1700–4200 m. Gansu, Nei Mongol, Ningxia, Qinghai, Sichuan, Xinjiang, Xizang [Mongolia].

This grass is reported to cause intoxication in cattle.

15. *Achnatherum pubicalyx* (Ohwi) Keng, Fl. Tsinling. 1(1): 153. 1976.

毛颖芨芨草 mao ying ji ji cao

Stipa pubicalyx Ohwi, J. Jap. Bot. 17: 401. 1941; *Achnatherum pekinese* subsp. *pubicalyx* (Ohwi) T. Koyama.

Perennial, loosely tufted, scaly buds at base. Culms erect, 60–100 cm tall, scabrid under panicle, 3–4-noded. Leaf sheaths scabrid, lower longer than internodes; leaf blades flat, often involute at margins, up to 40 cm, 3–5 mm wide, adaxial surface densely pubescent, abaxial surface scabrid, apex finely acuminate; ligule truncate, ca. 1 mm. Panicle slightly contracted, 15–25 cm; branches 2–4 per node, ascending, with spikelets to base. Spikelets 8–9 mm, purple or brownish; glumes subequal or upper glume slightly longer, elliptic-oblong, 3-veined, appressed-puberulous, apex acute or obtuse; callus subacute, ca. 0.8 mm; lemma narrowly lanceolate, 6–7 mm, leathery, pilose, margins overlapping and enclosing palea, apex very slightly lobed; awn persistent, 2–2.5 cm, 1-geniculate, column twisted, minutely hispidulous, bristle scabrid. Anthers 4–5 mm, bearded at apex. Fl. and fr. Jul–Sep.

Grassy mountain slopes, forests; 600–2700 m. Gansu, Hebei, Heilongjiang, Jilin, Nei Mongol, Qinghai, Shaanxi, Shanxi, Xinjiang [Korea].

This taxon is a pubescent variant of the *Achnatherum sibiricum-pekinese* complex and is sometimes included within *A. pekinese*.

16. *Achnatherum sibiricum* (Linnaeus) Keng ex Tzvelev, Probl. Ekol. Geobot. Bot. Geogr. Florist. 140. 1977.

羽茅 yu mao

Avena sibirica Linnaeus, Sp. Pl. 1: 79. 1753; *Achnatherum avenoides* (Honda) Y. L. Chang; *A. confusum* (Litvinov) Tzvelev; *A. sibiricum* var. *qinghaiense* Y. J. Wang; *Stipa avenoides* Honda; *S. confusa* Litvinov; *S. sibirica* (Linnaeus) Lamarck.

Perennial, loosely tufted, scaly buds at base. Culms erect, 60–150 cm tall, 1.7–3 mm in diam., smooth, 3–4-noded. Leaf sheaths smooth, lower longer than internodes; leaf blades usually convolute, occasionally flat, 20–60 cm, 3–7 mm wide, abaxial surface smooth, adaxial surface scaberulous, sometimes also pilose, apex finely acuminate; ligule truncate, 0.5–2 mm. Panicle contracted, often dense, 10–30(–60); branches 3 to several per node, suberect or narrowly ascending, with spikelets to base. Spikelets 7–10 mm, yellowish green or purple; glumes subequal, elliptic-oblong, 3-veined, smooth or scaberulous, often scabrid-spinulose on midvein, apex acute or denticulate; callus acute, 0.5–1 mm; lemma narrowly lanceolate, leathery, 5–8 mm, densely pilose, hairs slightly longer upward, 1–2 mm at awn base, margins overlapping and enclosing palea, apex entire; awn persistent, 1.5–2.5 cm, 1(or 2)-geniculate, column twisted, minutely hispidulous, bristle scabrid. Anthers ca. 4 mm, bearded at apex. Fl. and fr. Jul–Sep.

Grassy mountain slopes, forest fringes, roadsides; 600–3400 m. Heilongjiang, Henan, Nei Mongol, Ningxia, Qinghai, Sichuan, Xinjiang, Xizang, Yunnan [Kazakhstan, Kyrgyzstan, Mongolia, Russia, Uzbekistan; SW Asia (Caucasus)].

Achnatherum sibiricum, *A. brandisii*, *A. pekinese*, *A. pubicalyx*, and probably *A. nakaii* form a complex of rather ill-defined, intergrading species. The complex lies on the boundary between *Stipa* and

Achnatherum. The leathery, convolute lemma enclosing the palea and almost entire lemma apex are typical of *Stipa*, whereas the short glumes scarcely exceeding the floret, non-pungent callus, and persistent awn are characters of *Achnatherum*. The poisonous properties reported for some members of this complex are due to the presence of cyanogenic glycosides.

Besides the key characters, typical *Achnatherum sibiricum* is distinguished from *A. pekinense* by the entire lemma apex and the slightly longer lemma hairs around the base of the awn. *Achnatherum sibiricum* var. *qinghaiense* is said to be distinguished by obtuse glumes and an obtuse callus. The type has not been seen.

17. *Achnatherum pekinense* (Hance) Ohwi, Bull. Natl. Sci. Mus. 33: 66. 1953.

京芒草 jing mang cao

Stipa pekinensis Hance, J. Bot. 15: 268. 1877; *Achnatherum effusum* (Maximowicz) Y. L. Chang; *A. extremiorientale* (H. Hara) Keng; *A. pekinense* subsp. *effusum* (Maximowicz) T. Koyama; *S. extremiorientalis* H. Hara; *S. japonica* (Hackel) Hackel; *S. sibirica* (Linnaeus) Lamarck var. *effusa* Maximowicz; *S. sibirica* var. *japonica* Hackel.

Perennial, loosely tufted, scaly buds at base. Culms erect, 60–150 cm tall, 1.8–3 mm in diam., 3–4-noded. Leaf sheaths smooth, lower longer than internodes; leaf blades linear or broadly linear, flat or margins inrolled, 20–50 cm, 4–10 mm wide, abaxial surface smooth, adaxial surface and margins scabrid, apex finely acuminate; ligule truncate, 1–1.5 mm. Panicle open, sometimes effuse, 12–40 cm; branches 2–4 per node, bare below middle. Spikelets 8–13 mm, yellowish green or purplish; glumes subequal or lower glume slightly longer, elliptic-oblong, 3-veined, smooth, glabrous, apex of lower glume acuminate, of upper glume acute or denticulate; callus obtuse, 0.3–0.5 mm; lemma narrowly lanceolate, 5–7 mm, leathery, pilose, hairs slightly longer upward, 0.6–1.2 mm at awn base, margins overlapping and enclosing palea, apex very shortly toothed; awn persistent, stiff, 2–3 cm, 1-geniculate,

column twisted, minutely hispidulous, bristle scabrid. Anthers 4–6 mm, bearded at apex. Fl. and fr. Jul–Oct.

Open forest, among shrubs, roadsides; 300–3600 m. Anhui, Gansu, Hebei, Heilongjiang Henan, Jilin, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Yunnan [Japan, Korea, E Russia].

This species is often confused with *Achnatherum sibiricum*, and intermediates appear to be common.

18. *Achnatherum brandisii* (Mez) Z. L. Wu, Acta Phytotax. Sin. 34: 154. 1996.

展序芨芨草 zhan xu ji ji cao

Stipa brandisii Mez, Repert. Spec. Nov. Regni Veg. 17: 207. 1921; *Stipa subeffusa* Ohwi.

Perennial, loosely tufted. Culms erect, 70–150 cm tall, 3–4-noded. Leaf sheaths smooth, lower longer than internodes; leaf blades usually flat, up to 40 cm, 4–10 mm wide, abaxial surface smooth, adaxial surface smooth or scabrid, apex finely acuminate; ligule truncate, up to 1 mm. Panicle open, 10–30 cm; branches usually 2 per node, laxly ascending to widely spreading at maturity, lower part bare or with spikelets to base. Spikelets 7–10 mm, pallid or green; glumes subequal, elliptic-oblong, 3-veined, midvein scabrid, apex acute or denticulate; callus obtuse, 0.3–0.5 mm; lemma narrowly lanceolate, 5.5–7.5 mm, leathery, pilose, hairs slightly longer below awn, margins overlapping and enclosing palea, apex rounded, not lobed; awn persistent, 1–1.8 cm, 1(or 2)-geniculate, column twisted, scabrid throughout. Anthers 4–5 mm, bearded at apex. Fl. and fr. Jul–Sep.

Forest fringes, grassy mountain slopes, riverine floodplains; 1500–3800 m. W Gansu, Qinghai, Sichuan, Xizang, Yunnan [Afghanistan, Bhutan, NW India, Nepal, Pakistan].

This species differs from *Achnatherum pekinense* in little more than its shorter awn and more westerly distribution. Further work may show that subspecific rank under *A. pekinense* is more appropriate. It is reputed to be poisonous to livestock.

53. ORTHORAPHIUM Nees, Proc. Linn. Soc. London 1: 94. 1841.

直芒草属 zhi mang cao shu

Stipa sect. *Orthoraphium* (Nees) Hackel.

Perennial. Leaf blades narrowly linear. Inflorescence a narrow panicle; branches erect. Spikelets with 1 floret, bisexual, disarticulating above glumes; rachilla extension absent; glumes lanceolate-oblong, unequal with upper longer, thinly papery, 3–5-veined, apex acute or obtuse; callus obtuse, shortly bearded; lemma narrowly lanceolate, slightly dorsally flattened, firmly papery, pilose, margins overlapping only toward apex, apex narrowed to cylindrical beak slightly exceeding upper glume and bearing 2 to several stout retrorse spines; awn persistent, almost straight, hispid at base, otherwise scabrid; palea exposed between lemma margins. Lodicules 3. Stamens 3, anthers glabrous. Stigmas 2.

One species: outer ranges of the Himalayas, including China.

1. *Orthoraphium roylei* Nees, Proc. Linn. Soc. London 1: 94. 1841.

直芒草 zhi mang cao

Stipa roylei (Nees) Duthie.

Loosely tufted, shortly rhizomatous. Culms 40–60 cm tall,

3–5-noded. Leaf sheaths glabrous, mostly longer than internodes; leaf blades flat (inrolled when dry), 15–30 cm, 2–3 mm wide, abaxial surface smooth, scabrid toward apex, adaxial surface pubescent; ligule oblong-lanceolate, up to 5 mm. Panicle linear, 10–20 cm; branches single or lower paired, up to 7 cm, smooth. Spikelets green or tinged purplish; lower glume 5–8 mm, upper glume 7–11 mm, smooth; callus 0.5–0.7 mm; lem-

ma 9–10 mm, loosely pubescent in lower 1/4–1/2; awn 1.3–1.7 cm, stiffly hispid at base, hairs 0.5–0.8 mm, scabrid above. Anthers 2–3 mm. Fl. and fr. Aug–Oct.

Open grassy mountainsides, forest clearings; 2700 m and above.

Sichuan, Xizang, Yunnan [Bhutan, N India, Kashmir, N Myanmar, Nepal].

The long, retrorse spines at the lemma apex are an unmistakable distinguishing feature of this species.

8. Tribe BRYLKINIEAE

扁穗草族 *bian sui cao zu*

Wu Zhenlan (吴珍兰); Sylvia M. Phillips

Perennial. Leaf sheaths with connate margins; leaf blades linear, transverse veinlets present; ligule very short, membranous. Inflorescence a lax raceme. Spikelets with 1 fertile floret, 2 sterile empty lemmas below and a rachilla extension above, strongly laterally compressed, falling entire together with the pedicel; glumes unequal, narrowly lanceolate, shorter than lemmas, herbaceous, 3–5-veined, apex acuminate to caudate; lemmas lanceolate, thinly leathery, strongly keeled, 5–7-veined, sterile lemmas acuminate to short-awned, fertile lemma with a straight awn from apex; palea keels closely adjacent. Lodicules 2, free, fairly large, rectangular, hyaline. Stamens 3. Caryopsis narrowly ellipsoid, apex with glossy rounded caplike appendage with central knob from style base, embryo small, hilum linear, slightly shorter than caryopsis. Leaf anatomy: non-Kranz; microhairs absent. $x = 10$.

One species: China, Japan, E Russia.

This is a unispecific tribe of uncertain affinity, found in cool, temperate forests.

54. BRYLKINIA F. Schmidt, Mém. Acad. Imp. Sci. Saint Pétersbourg, Sér. 7, 12: 199. 1868.

扁穗草属 *bian sui cao shu*

Description and distribution as for tribe.

1. *Brylkinia caudata* (Munro) F. Schmidt, Mém. Acad. Imp. Sci. Saint Pétersbourg, Sér. 7, 12: 199. 1868.

扁穗草 *bian sui cao*

Ehrharta caudata Munro in A. Gray, Mem. Amer. Acad. Arts, n.s., 6: 420. 1859.

Perennial with slender rhizomes, basal sheaths becoming fibrous. Culms loosely tufted, erect, 50–70 cm tall, 3–5-noded. Leaf sheaths pubescent with retrorse hairs, upper sheaths shorter than internodes; leaf blades flat or margins involute, thin, 20–30 × 0.3–1 cm, abaxial surface glabrous, adaxial surface pubes-

cent or glabrous, slightly narrowed to base, tapering to acuminate apex; ligule 0.2–0.6 mm, thick. Raceme 6–22 cm; spikelets 13–20, distant, divaricate becoming pendulous; axis 4-angled; pedicels 2–7 mm, bent at base, spinulose. Spikelets 1–1.4 cm, greenish; lower glume 5–6 mm, 3-veined, upper glume 6–7.5 mm, 5-veined; sterile lemmas 1–1.4 cm; fertile lemma 1–1.2 cm, narrowly winged along upper keel; awn 0.9–1.5 cm; palea shorter than lemma, membranous, ciliolate along keels. Anthers ca. 4 mm. Fl. and fr. summer. $2n = 40$.

Forest glades; below 3000 m. Jilin (Changbai Shan), Sichuan [Japan, Russia (Far East)].

9. Tribe MELICEAE

臭草族 *chou cao zu*

Wu Zhenlan (吴珍兰); Sylvia M. Phillips

Perennial. Culms usually unbranched. Leaf sheaths tubular, margins fused for most or all of their length; leaf blades linear, transverse veinlets sometimes present; ligule membranous, sometimes tubular and lobed on side opposite blade. Inflorescence an open or contracted panicle, sometimes scanty or racemelike. Spikelets all alike, laterally compressed, of 1 to many fertile florets, upper florets sterile and often gathered into a clump of rudimentary lemmas, usually disarticulating below each floret; glumes persistent, usually shorter than spikelet, often shorter than adjacent lemma, often papery with hyaline margins, 1–5-veined; lemmas herbaceous or becoming leathery, rounded on back, prominently 5–9(–13)-veined, awnless or with straight or curved awn from apex or back; lodicules 2, fused, short, fleshy, truncate. Stamens (2 or)3. Caryopsis ellipsoid; hilum linear. Leaf anatomy: non-Kranz; microhairs absent. $x = 9, 10$.

Eight genera and ca. 130 species: temperate regions throughout the world; three genera and 34 species (nine endemic) in China.

This small tribe is allied to *Poeae*, but differs in the closed, tubular leaf sheaths, small, fleshy lodicules, and chromosome number.

- 1a. Floret callus hairy; lemma awned 57. *Schizachne*
 1b. Floret callus glabrous; lemma awnless.