smooth or scaberulous. Spikelets 3.5–4.5 mm, greenish or purplish; glumes glabrous; lower glume 2.3–2.5 mm, 3–5-veined, scabrid along veins; upper glume as long as spikelet, 5-veined; lower floret staminate, longer than lower glume; upper floret 2–2.2 mm, lemma apex 2-denticulate, awned; awn geniculate with brown twisted column, 3–6 mm; callus hairs 1/4 length of lemma. Fl. and fr. Apr.

Shady rock fissures along river banks. Taiwan [Philippines].

19. Arundinella rupestris A. Camus, Bull. Mus. Natl. Hist. Nat. 25: 367. 1919.

岩生野古草 yan sheng ye gu cao

Arundinella fluviatilis var. *pachyathera* Handel-Mazzetti; *A. rupestris* var. *pachyathera* (Handel-Mazzetti) B. S. Sun & Z. H. Hu.

Perennial, tufted, rhizomes absent, base with persistent papery sheaths. Culms very slender, erect or decumbent and rooting at base, 30–80 cm tall, ca. 1 mm in diam., 7–10-noded, nodes glabrous or pubescent. Leaf sheaths longer than internodes, thinly pilose, glabrescent, one margin ciliate, bearded at mouth; leaf blades linear or often involute, 5–20 cm × 2–5 mm, glabrous or adaxial surface thinly pilose, apex finely acuminate; ligule ca. 0.25 mm. Panicle loosely contracted, 7–15 cm; central axis and branches scabrid-hispidulous; branches narrowly ascending, 3–7 cm, loosely spiculate; pedicels scabrid. Spikelets 3.5–4 mm, yellowish green or purplish; glumes glabrous, smooth or midvein scabrid; lower glume 2.5–3.5 mm, 3–5-veined; upper glume as long as spikelet, 5-veined; lower floret staminate, as long as lower glume; upper floret 2.5–3 mm, lemma apex 2-denticulate, awned; awn geniculate with brown twisted column, 2–5 mm; callus hairs 1/4–1/3 length of lemma. Fl. and fr. May–Oct.

River banks, floodlands, rock fissures; 300–500 m. Guangxi, Guizhou, Hunan [Thailand, Vietnam].

This is a lowland, riverine species with tufts of wiry, many-noded culms. The lower leaf blades and upper part of the lower sheaths are often broken away, exposing the nodes.

20. Arundinella intricata Hughes, Bull. Misc. Inform. Kew 1920(3): 112. 1920.

错立野古草 cuo li ye gu cao

Perennial, densely tufted, strongly rhizomatous. Culms erect or ascending, 35–80 cm tall, 1.5–2 mm in diam., 5–9-noded, nodes glabrous. Leaf sheaths longer than internodes, glabrous or pilose, one margin ciliate; leaf blades linear, 11–20 cm × 2–5 mm, glabrous or pilose, margins scabrid, apex finely acuminate; ligule ca. 0.5 mm. Panicle loosely contracted, narrowly elliptic in outline, 10–17 cm; central axis and branches scabrid-hispidulous; branches narrowly ascending, 3–6 cm, loosely spiculate; pedicels scabrid. Spikelets 3.8–4.5 mm, usually purple tinged; glumes glabrous, veins scaberulous; lower glume 2.5–3 mm, 3–5-veined; upper glume as long as spikelet, 5-veined; lower floret staminate, as long as lower glume; upper floret 2.2–3 mm, lemma apex subentire, awned; awn geniculate with brown twisted column, 2.7–5 mm; callus hairs ca. 1/2 length of lemma.

Cliffs, sandy river banks. Xizang [Bhutan, NE India].

This species is reputed to be a good soil binder.

28. Tribe ANDROPOGONEAE

高粱族 gao liang zu

Chen Shouliang (陈守良), Sun Bixing (孙必兴 Sun Bi-sin); Sylvia M. Phillips, Stephen A. Renvoize

Annual or perennial. Leaf blades linear, rarely lanceolate or filiform; ligule membranous, rarely ciliate. Inflorescence composed of fragile (infrequently tough) racemes, these arranged in a terminal panicle with elongate central axis, or more frequently subdigitate, paired or solitary, often axillary, subtended by spathes and spatheoles and gathered into a compound panicle. Racemes usually bearing paired spikelets (with a terminal triad), rarely spikelets single or in threes, usually one spikelet of a pair sessile and the other pedicelled, infrequently both pedicelled; rachis fracturing at maturity beneath each spikelet pair. Spikelets of a pair alike or more often dissimilar in shape and sex, when dissimilar sessile spikelet bisexual or female, pedicelled spikelet male or barren, rarely pedicelled spikelet vestigial or absent and sessile spikelet then apparently single; sometimes 1 or more of lowermost pairs in raceme infertile, resembling pedicelled spikelets, persistent (homogamous pairs); rachis internodes and pedicels filiform, linear or thickened, sometimes very stout and partially enclosing spikelet, falling with adjacent sessile spikelet, pedicelled spikelet falling separately; callus at base of sessile spikelet obtuse to pungent. Sessile spikelet with 2 florets, usually dorsally compressed; glumes enclosing florets, hardened, lower glume facing outward, very variable, convex or 2-keeled, upper glume boat-shaped, fitting between internode and pedicel; lower floret male or barren, lower lemma hyaline, 2-keeled, lower palea suppressed when floret barren; upper floret fertile, upper lemma hyaline, narrow, entire or 2-toothed, awnless or bearing a geniculate awn with twisted column, upper palea short or absent. Pedicelled spikelet usually lanceolate, papery, often smaller than pedicelled spikelet; pedicel resembling rachis internode, rarely absent or fused to internode. Leaf anatomy Kranz MS. $x = 5, 9$.

About 85 genera and ca. 1000 species: throughout the tropics, extending into warm-temperate regions; 41 genera (one or two introduced) and 204 species (42 endemic, seven or eight introduced) in China.

Members of this tribe can usually be readily recognized by their fragile racemes bearing paired spikelets, one sessile and the other pedicelled. The dispersal unit is thus composed of sessile spikelet, rachis internode, and pedicel (the pedicelled spikelet falls separately), all of which contribute to the protection of the seed and are frequently ornamented or modified.

In the more primitive members both spikelets of a pair are alike and fertile and are arranged in a terminal panicle. In most genera, however, the

pedicelled spikelet has lost its fertility and differs in shape and texture from the sessile one. In some genera the pedicelled spikelet is much reduced, and in extreme cases its pedicel is reduced to a vestige or fused to the adjacent internode. The sessile spikelets then appear single, but the fragile rachis gives a good clue to the correct tribe.

Another trend apparent throughout the tribe is the reduction of the large, terminal inflorescence to a few digitate or paired racemes, often arising from the axils of specialized leaves with inflated sheaths and reduced blades (spathes). In the most complex genera the ultimate unit is a boat-shaped sheath without a blade (spatheole) subtending 1 or 2 short racemes, and by repeated branching many of these units are gathered into a leafy compound panicle.

The spikelets contain 2 florets, but this is not obvious as the florets are delicate and usually reduced. However, it is seldom necessary to dissect the spikelets in order to identify a member of *Andropogoneae*. The apex of the upper lemma and position of the awn are sometimes important for identification. If the awn is gently drawn out, the small lemma at its base can be examined with a lens.

See the drawings of *Andropogoneae* features on page 3 of this volume.

Key 1

1a. Spikelets all unisexual, separated in different inflorescences or in different parts of the same inflorescence.
  2a. Male and female spikelets in different inflorescences, the female in sheathed axillary "cobs" (cultivated maize) ..... 226. *Zea*
  2b. Male and female spikelets in different parts of same inflorescence.
    3a. Female spikelets enclosed in a beadlike, bony utricle ..... 223. *Coix*
    3b. Female spikelets not enclosed in a bony utricle.
      4a. Female spikelets conspicuously transversely constricted; racemes all solitary, in spathate axillary clusters ..... 224. *Chionachne*
      4b. Female spikelets not transversely constricted; racemes digitate, at least the terminal ..... 225. *Polytoca*
1b. Spikelets all bisexual, or at least the sessile spikelet of a pair, male and female not separated.
  5a. Spikelets single, without an accompanying vestigial spikelet or pedicel (if spikelets awnlesss and rachis internodes stout, see Key 4).
    6a. Inflorescence of many racemes on an elongate central axis ..... 186. *Spodiopogon*
    6b. Inflorescence of solitary or digitate racemes.
      7a. Leaf blades linear; raceme rachis tough ..... 207. *Dimeria*
      7b. Leaf blades lanceolate; raceme rachis fragile ..... 208. *Arthraxon*
  5b. Spikelets paired, but sometimes pedicelled spikelet vestigial or represented only by the pedicel.
    8a. Rachis internodes and pedicels slender, filiform to linear, or if widened upward the upper lemma awned.
      9a. Spikelets of a pair similar in shape, usually both fertile ..... *Key 2*
      9b. Spikelets of a pair different in shape and sex (rarely pedicelled spikelet vestigial or reduced to pedicel) ..... *Key 3*
    8b. Rachis internodes and pedicels stout, angular, columnar or widening upward, internode and pedicel sometimes joined; upper lemma awnless ..... *Key 4*

Key 2

1a. Inflorescence with elongate central axis, longer than lowest raceme.
  2a. Lower glume papery, convex, the veins raised ..... 186. *Spodiopogon*
  2b. Lower glume membranous or leathery, the veins flat.
    3a. Raceme rachis fragile; 1 spikelet of the pair sessile ..... 187. *Saccharum*
    3b. Raceme rachis tough; all spikelets pedicelled.
      4a. Panicle loose; glumes cartilaginous to leathery ..... 188. *Miscanthus*
      4b. Panicle contracted or spikelike; glumes membranous ..... 189. *Imperata*
1b. Inflorescence of solitary or subdigitate racemes.
  5a. Inflorescences axillary.
    6a. Inflorescence a solitary raceme; spikelets laterally compressed; upper glume with long fine awn ..... 192. *Pogonatherum*
    6b. Inflorescence of 2–4 subdigitate racemes; spikelets dorsally compressed; upper glume awn-pointed ..... 193. *Eulaliopsis*
  5b. Inflorescence terminal.
    7a. Spikelets in groups of 3, 2 sessile and 1 pedicelled ..... 194. *Polytrias*
    7b. Spikelets paired.
      8a. Culms rambling; leaf blades lanceolate; spikelets sparsely hairy; lower glume concave to grooved along median line ..... 195. *Microstegium*
      8b. Culms erect; leaf blades linear; spikelets conspicuously hairy; lower glume convex to flat or slightly concave.
        9a. Slender annuals ..... 191. *Pseudopogonatherum*
        9b. Robust perennials.

10a. Raceme rachis tough, both spikelets of pair pedicelled ..... 188. *Miscanthus*
10b. Raceme rachis fragile; 1 spikelet of pair sessile ..... 190. *Eulalia*

Key 3

1a. Sessile spikelets male or barren, hard, involucrelike, awnless; pedicelled spikelets fertile, long awned ..... 197. *Germainia*
1b. Sessile spikelets fertile, often awned; pedicelled spikelets male, barren, or suppressed.
2a. Racemes borne on an elongate central axis or its branches, axis longer than lowest raceme, not supported by spathes.
3a. Rachis internodes and pedicels without a purple translucent median line.
4a. Lower glume of sessile spikelet laterally compressed; raceme often reduced to a triad ..... 200. *Chrysopogon*
4b. Lower glume of sessile spikelet dorsally compressed; raceme of several spikelet pairs below terminal triad.
5a. Glumes of sessile spikelet leathery; panicle usually loose, racemes of 2–7 spikelet pairs; lodicules ciliate ..... 198. *Sorghum*
5b. Glumes of sessile spikelets firmly cartilaginous; panicle dense, racemes of 5–15 spikelet pairs; lodicules glabrous ..... 199. *Pseudosorghum*
3b. Rachis internodes and pedicels with a purple translucent median line.
6a. Racemes of 1–5(–8) spikelet pairs, often reduced to triads ..... 202. *Capillipedium*
6b. Racemes of more than 8 spikelet pairs ..... 203. *Bothriochloa*
2b. Racemes solitary, paired or subdigitate, often supported by spathes.
7a. Rachis internodes and pedicels with a purple translucent median line ..... 203. *Bothriochloa*
7b. Pedicels and rachis internodes without a translucent median line.
8a. Lower floret of sessile spikelet staminate, with well-developed palea.
9a. Pedicel lacking a spikelet, partially fused to lower glume; sessile spikelet broadly truncate, apex with scarious colored band (*A. intermedius* with pedicelled spikelet) ..... 196. *Apocopis*
9b. Pedicel bearing a spikelet, free from lower glume.
10a. Ligule a line of hairs; raceme solitary; lower glume of sessile spikelet deeply grooved, apex elongate, scarious ..... 204. *Sehima*
10b. Ligule membranous; racemes often more than 1; lower glume of sessile spikelet not as above.
11a. Sessile spikelet laterally compressed, smooth; raceme solitary, reduced to spathate triad, these numerous, crowded into compound panicle ..... 206. *Apluda*
11b. Sessile spikelet dorsally compressed; racemes (1 or)2 or more, terminal or axillary.
12a. Rachis internodes and pedicels stoutly linear to thickly clavate; sessile spikelet often rugose or knobbly ..... 205. *Ischaemum*
12b. Rachis internodes and pedicels filiform to linear; sessile spikelet smooth, grooved along midline ..... 195. *Microstegium*
8b. Lower floret of sessile spikelet barren, reduced to a lemma, palea absent.
13a. Awn arising from low down on lemma back; culms slender, often trailing, leaf blades lanceolate ..... 208. *Arthraxon*
13b. Awn arising from apex of lemma, or from sinus of 2-lobed apex.
14a. Lower glume of sessile spikelet 2-keeled; callus inserted into hollowed internode apex.
15a. Racemes solitary ..... 209. *Schizachyrium*
15b. Racemes paired or digitate.
16a. Leaves not aromatic; racemes not deflexed, borne on unequal terete raceme bases ..... 210. *Andropogon*
16b. Leaves aromatic; racemes usually deflexed at maturity, borne on subequal flattened raceme bases ..... 211. *Cymbopogon*
14b. Lower glume of sessile spikelet convexly rounded without keels; callus attached obliquely, its apex visible.
17a. Upper lemma 2-toothed, awned from sinus ..... 212. *Hyparrhenia*
17b. Upper lemma entire, awned from apex.
18a. Raceme with 2 large homogamous spikelet pairs at base, forming an involucre ..... 213. *Themeda*
18b. Raceme with or without homogamous spikelet pairs, but not forming an involucre.
19a. Sessile spikelet with pungent callus ..... 214. *Heteropogon*
19b. Sessile spikelet with obtuse callus.

20a. Inflorescence terminal, composed of (1 or)2–8 subdigitate racemes ..... 201. *Dichanthium*
20b. Inflorescence a small spathate raceme, racemes grouped in bunches on flexuous peduncles, forming a compound panicle ..... 215. *Pseudanthistiria*

Key 4

1a. Inflorescence terminal, racemes solitary, subdigitate or spread along an elongate axis.
2a. Sessile spikelet with pectinate, often spinose margins, or margins tuberculate; raceme solitary ..... 220. *Eremochloa*
2b. Sessile spikelet without pectinate margins; racemes solitary to many.
3a. Pedicel joined to rachis internode; pedicelled spikelet absent ..... 218. *Mnesithea*
3b. Pedicel free; pedicelled spikelet present ..... 216. *Phacelurus*
1b. Inflorescence of axillary racemes from the upper leaf axils.
4a. Sessile spikelets alternating on raceme in 2 opposite rows; pedicelled spikelets absent; pedicel joined to rachis internode ..... 222. *Ophiuros*
4b. Sessile spikelets all on one side of raceme; pedicelled spikelets well developed to vestigial; pedicel free or partially or completely joined to rachis internode.
5a. Spikelets of a pair similar (if 2 sessile ornamented spikelets at each node, see *Mnesithea*); racemes tough or tardily disarticulating; rachis articulation line usually oblique without central peg ..... 217. *Hemarthria*
5b. Spikelets of a pair different; racemes easily disarticulating; rachis articulation line ± straight with central peg.
6a. Sessile spikelet globose, reticulately ornamented ..... 221. *Hackelochloa*
6b. Sessile spikelet not globose, smooth or with longitudinal slits or grooves between the veins.
7a. Lower floret of sessile spikelet staminate, its palea well developed; spikelets smooth ..... 219. *Rottboellia*
7b. Lower floret of sessile spikelet barren, its palea reduced or absent; spikelets with 2–7 longitudinal slots or grooves between the veins, rarely smooth ..... 218. *Mnesithea*

186. SPODIOPOGON Trinius, Fund. Agrost. 192. 1820.

大油芒属 da you mang shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Eccoilopus Steudel.

Perennials, often rhizomatous. Culms erect, many-noded, simple or branched. Leaf blades linear to lanceolate, flat, sometimes narrowed to a pseudopetiole; ligule membranous, often hairy on margin or back. Inflorescence terminal, an open or contracted panicle with elongate central axis, primary branches subverticillate, typically capillary, smooth, bearing 1 or more racemes; racemes short, rachis fragile or tough, sessile and pedicelled spikelet of a pair similar, both pedicelled when rachis tough, both fertile, rarely spikelets solitary; rachis internodes and pedicels slender or thickened upward, often with cupular apex. Spikelets usually lanceolate, scarcely compressed; callus subglabrous to shortly bearded; glumes equal, firmly papery, lower glume rounded on back, puberulous to villous, closely many-veined, veins prominent, raised into ridges, apex acute to shortly awned; upper glume usually resembling lower glume, sometimes keeled; lower floret often staminate, lemma lanceolate to ovate, palea usually present; upper lemma deeply 2-lobed, awned from sinus; awn geniculate. $x = 10$.

Fifteen species: Turkey eastward to India, Thailand, and Japan, one species extending northward to Siberia; nine species (six endemic) in China.

Species with a tough rachis and pedicellate spikelets are sometimes separated as the genus *Eccoilopus*. However, the racemes have distinct joints in these species, so the lack of disarticulation at maturity appears to be a secondary development. The spikelets are typical of *Spodiopogon*.

1a. Racemes not disarticulating at maturity; spikelets of a pair both pedicelled.
2a. Culms decumbent at base, branched; leaf blades lanceolate, 9–15 cm ..... 1. *S. bambusoides*
2b. Culms erect, not branched; leaf blades linear or linear-lanceolate, 15–60 cm.
3a. Spikelets narrowly lanceolate, 5–6 mm; awn 12–18 mm ..... 2. *S. cotulifer*
3b. Spikelets broadly lanceolate, 4–5 mm; awn 0–5 mm ..... 3. *S. formosanus*
1b. Racemes disarticulating at maturity; spikelets of a pair 1 sessile and 1 pedicelled, or spikelets solitary.
4a. Lower leaf blades sagittate with long pseudopetiole ..... 4. *S. sagittifolius*
4b. Lower leaf blades not sagittate, pseudopetiole present or not.
5a. Plant tufted; leaf blades pseudopetiolate; panicle branches 5–15 cm ..... 5. *S. duclouxii*
5b. Plant rhizomatous; leaf blades not pseudopetiolate; panicle branches 2–6(–8) cm.
6a. Primary branches of panicle much branched, branchlets many.

7a. Leaf blades villous; racemes of 7–11 spikelets ..... 6. *S. dubius*
7b. Leaf blades glabrous or abaxial surface tuberculate-hispid; racemes of 1–3 spikelets ..... 7. *S. yuexiensis*
6b. Primary branches simple or sparsely branched, branchlets few or none.
8a. Culms 60–200 cm tall, not branched; leaf blades 10–40 cm; awn 10–15 mm ..... 8. *S. sibiricus*
8b. Culms 20–50 cm tall, branched; leaf blades 4–8 cm; awn 7–10 mm ..... 9. *S. tainanensis*

1. Spodiopogon bambusoides (P. C. Keng) S. M. Phillips & S. L. Chen, Novon 15: 468. 2005.

竹油芒 zhu you mang

Eccoilopus bambusoides P. C. Keng, Guihaia 13: 320. 1993.

Perennial, tufted. Culms decumbent at base, rooting at lower nodes, hard, 1–1.4 m tall, 2–3 mm in diam., branched. Leaf sheaths smooth, glabrous, lower blades disarticulating from sheaths; leaf blades lanceolate, 9–15 × 1–1.7 cm, smooth, glabrous, base cuneate, apex acuminate; ligule ca. 1 mm, ciliolate. Panicle elliptic in outline, 10–12 cm; branches spreading, 3–5 cm, undivided below middle, much branched above, ultimate branchlets shortly bearded at apex and bearing a spikelet pair or 3 spikelets; spikelets of a pair both pedicellate, pedicels unequal, clavate upward, shorter pedicel stout. Spikelets 4–4.7 mm; callus hairs ca. 0.7 mm; lower glume lanceolate-oblong, pilose, veins scaberulous, apex subacute or minutely mucronate; upper glume obtuse; lower floret staminate, palea well developed; upper lemma 2-lobed to below middle; awn 6–8 mm. Anthers 2.8–3 mm. Fl. and fr. Sep–Nov.

● Grassy mountain slopes. Guangxi, Guizhou.

2. Spodiopogon cotulifer (Thunberg) Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 187. 1889.

油芒 you mang

Andropogon cotulifer Thunberg in Murray, Syst. Veg., ed. 14, 903. 1784; *Eccoilopus andropogonoides* Steudel; *E. cotulifer* (Thunberg) A. Camus; *E. cotulifer* var. *sagittiformis* Ohwi; *Eulalia cotulifera* (Thunberg) Munro; *Miscanthus cotulifer* (Thunberg) Bentham; *Saccharum cotuliferum* (Thunberg) Roberty.

Perennial. Culms solitary, erect, 60–150 cm tall, 3–8 mm in diam., unbranched. Leaf sheaths smooth, papery; leaf blades linear-lanceolate, 15–60 × 0.8–2 cm, scabrid, abaxial surface sparsely hispid, adaxial surface villous above ligule, base narrowed, lower blades pseudopetiolate, apex finely acute; ligule 2–3 mm. Panicle open, ovate-oblong in outline, 15–30 cm; branches capillary, flexuous, 3–10 cm, usually tipped by a single raceme, infrequently branched; racemes 3–10-noded, articulation lines present, shortly bearded, not disarticulating at maturity, spikelets of a pair both pedicellate; rachis internodes 4–7 mm, filiform, apices swollen; pedicels unequal, clavate upward, shorter pedicel stout. Spikelets 5–6 mm; callus hairs ca. 1 mm; lower glume narrowly lanceolate, subglabrous to hispid, veins scabrid, margins densely hispid, apex emarginate, shortly awned to 1.5 mm; upper glume similar; lower floret sterile, palea narrow; upper lemma 2-lobed to middle; awn 12–18 mm. Anthers 2.5–3 mm. Fl. and fr. Sep–Nov. 2*n* = 40.

Grassy hillsides, valleys, roadsides; 200–1000 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Sichuan, Taiwan, Yunnan, Zhejiang [N India, Japan, Kashmir, S Korea].

The spikelets drop very readily at maturity, leaving slender, articulated raceme axes bearing paired, clavate pedicels of distinctive and easily recognizable appearance.

3. Spodiopogon formosanus Rendle, J. Linn. Soc., Bot. 36: 351. 1904.

台湾油芒 tai wan you mang

Eccoilopus formosanus (Rendle) A. Camus; *E. formosanus* var. *tohoensis* (Hayata) Honda; *E. taiwanicus* Honda; *E. tohoensis* (Hayata) A. Camus; *Spodiopogon kawakamii* Hayata; *S. kawakamii* var. *sativus* Honda; *S. tohoensis* Hayata.

Perennial, shortly rhizomatous. Culms erect, 60–130 cm tall, 2.5–5 mm in diam., unbranched. Leaf sheaths glabrous, mouth tuberculate-hispid; leaf blades linear-lanceolate, 20–50 × 1–1.5 cm, glabrous, abaxial surface smooth, adaxial surface scabrid, base narrowed, lower blades pseudopetiolate, apex acute; ligule 2–3 mm. Panicle open, ovate in outline, 5–15 cm; branches 3–6 cm, distal part branched; racemes 1–3-noded, articulation lines present, not bearded, not disarticulating at maturity, spikelets of a pair both pedicellate; rachis internodes 2–4 mm; pedicels unequal, clavate upward, shorter pedicel stout. Spikelets 4–5 mm, plump; callus hairs 0.2–0.5 mm; lower glume broadly lanceolate, glabrous to hispid, veins smooth except near apex, apex emarginate, minutely mucronate; upper glume with mucro to 0.5 mm; lower floret sterile; upper lemma 2-lobed in upper 1/3; awn 0–5 mm. Anthers 2–3 mm. Fl. and fr. summer–autumn.

● Dry mountain slopes; 1000–2000 m. Taiwan.

This species has been cultivated as a grain crop in the uplands of Taiwan.

4. Spodiopogon sagittifolius Rendle, J. Linn. Soc., Bot. 36: 352. 1904.

箭叶大油芒 jian ye da you mang

Perennial from a short knotty rhizome. Culms erect, 60–100 cm tall, 2–3 mm in diam., 3–4-noded, unbranched. Leaf sheaths glabrous; leaf blades linear-lanceolate, 8–30 × 0.5–1.5 cm, abaxial surface tuberculate-pilose, adaxial surface glabrous, margins smooth, base of lower blades deeply sagittate with pilose pseudopetiole up to 10 cm and acuminate lobes to 1.5 cm, apex acuminate; ligule 2–6 mm. Panicle open, lanceolate in outline, 9–20 cm; branches 2–5 cm, pilose in axils, unbranched, tipped by a solitary spikelet, a spikelet pair, or 3 spikelets; disarticulating at maturity, rachis internodes (when present) and pedicels slenderly clavate, 3/4 as long to equaling spikelets, shortly ciliate. Spikelets 4–6 mm, yellowish green; callus hairs

ca. 1.5 mm; lower glume lanceolate-oblong, pilose, 11–13-veined, veins smooth, apex subacute; upper glume similar, 8–11-veined, emarginate; lower floret staminate, palea well developed; upper lemma 2-lobed to below middle; awn 12–20 mm. Anthers 3.5–4 mm. Fl. and fr. autumn.

● Mountain slopes, forests, grasslands; 1500–1800 m. Yunnan.

Spodiopogon lacei Hole, from Bhutan, NE India, N Myanmar, and N Thailand, is another species with sagittate leaf blades. It differs in its more robust culms to 2.5 m tall and 3–4 mm thick; denser, brownish panicle of 2- or 3-noded, dense racemes with shorter, clavate rachis internodes; and by the upper glume of the sessile spikelet, which is strongly keeled and smooth without prominent veins.

5. Spodiopogon duclouxii A. Camus, Bull. Mus. Natl. Hist. Nat. 27: 551. 1921.

滇大油芒 dian da you mang

Perennial, tufted from a tough rootstock. Culms erect, 120–160 cm tall, 3–5 mm in diam., 8–10-noded, unbranched. Leaf sheaths glabrous; leaf blades linear-lanceolate, 30–60 × 1.2–1.8 cm, abaxial surface thinly pilose, adaxial surface scaberulous, base of lower blades narrowed into up to 8 cm pseudopetiole, upper blades narrowed to sheath, apex finely acuminate; ligule 1.4–1.5 mm, back villous. Panicle open, 10–30 cm; branches in distant whorls, capillary, flexuous, 5–15 cm, mostly unbranched, tipped by a raceme; racemes 2–5-noded with 7–13 spikelets, sometimes branched with up to 40 spikelets, disarticulating at maturity, one spikelet of a pair sessile, the other pedicellate; rachis internodes and pedicels slenderly clavate, margins ciliate, hairs 0.7–1 mm. Spikelets 4.5–5 mm; callus hairs ca. 1 mm; lower glume lanceolate, thinly pilose, veins smooth below middle, scaberulous above, apex acuminate; upper glume ciliate on margins, acuminate or emarginate and mucronate; lower floret sterile, palea reduced; upper lemma 2-lobed to middle; awn 5.5–8 mm. Anthers 2–3 mm. Fl. and fr. Aug–Nov.

● Moist grasslands. Sichuan (Miyi), Yunnan.

This is a robust species lacking creeping, scaly rhizomes. The pseudopetiolate lower leaf blades are often missing on herbarium specimens, but the species can also be recognized by the long, flexuous panicle branches.

6. Spodiopogon dubius Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 186. 1889.

绒毛大油芒 rong mao da you mang

Perennial, with spreading scaly rhizomes. Culms solitary or tufted, erect, 1–2 m tall, 4–5 mm in diam., branched or unbranched. Leaf sheaths glabrous to villous, woolly at apex; leaf blades broadly linear, 20–30 × 1.2–1.5 cm, thinly appressed-pilose to densely villous, base rounded, apex long acuminate; ligule ca. 0.3 mm, margin densely ciliate. Panicle dense, narrowly oblong in outline, 10–22 cm; branches 2–5 cm, branchlets many, short, pilose in axils; racemes 2–4-noded with 7–11 spikelets, disarticulating at maturity, one spikelet of a pair sessile, the other pedicellate; internodes and pedicels 2–2.5 mm, slender with expanded tips, densely ciliate. Spikelets 4–5 mm; callus hairs 1.5–2 mm; lower glume narrowly lanceolate, villous with ca. 3 mm hairs, veins smooth, apex subacute or emarginate; upper glume villous on keel, apex acute; lower floret sterile, palea absent; upper lemma 2-lobed to middle; awn 8–10 mm. Anthers 1.8–2.3 mm. Fl. and fr. summer–autumn.

Mountain slopes, forest margins; ca. 2400 m. Xizang [NW India, Nepal].

The name *"Spodiopogon villosus* L. Liu" (Fl. Reipubl. Popularis Sin. 10(2): 58. 1997, not Nees, 1838) belongs here, but was not validly published because no Latin description was provided.

7. Spodiopogon yuexiensis S. L. Zhong, J. S. W. Agric. Coll. 1982(4): 77. 1982.

白玉大油芒 bai yu da you mang

Perennial, rhizomatous. Culms 0.6–2 m tall, 2–6 mm in diam. Leaf sheaths glabrous; leaf blades lanceolate or linear-lanceolate, 8–30 × 0.3–2.2 cm, glabrous or abaxial surface tuberculate-hispid, margins scabrid, base narrow, apex acuminate; ligule 0.5–1 mm. Panicle open, lanceolate-oblong in outline, 6–27 cm; branches 2–8 cm, much branched, ultimate branchlets articulated, bearded at articulation; racemes mostly reduced to a solitary, readily disarticulating spikelet, or 1 or 2 pedicelled spikelets also present; branchlets and pedicels slender, glabrous, 6–7 mm, as long as or longer than spikelets. Spikelets 4.5–5 mm; callus hairs 2–3 mm, soft; lower glume lanceolate, softly pilose, hairs ca. 2 mm, grayish white or purplish; lower floret staminate, palea well developed; upper lemma 2-lobed to below middle; awn 8–12 mm. Anthers 3–3.5 mm. Fl. and fr. Jul–Nov.

● Roadsides, river banks, thickets; 1600–3000 m. W Sichuan.

Most spikelets on the type of *Spodiopogon yuexiensis* fall singly without any trace of an attached rachilla segment or pedicel.

The name *"Spodiopogon baiyuensis* L. Liu" (Fl. Reipubl. Popularis Sin. 10(2): 57. 1997) belongs here, but was not validly published because no Latin description was provided.

8. Spodiopogon sibiricus Trinius, Fund. Agrost. 192. 1820.

大油芒 da you mang

Perennial, with spreading scaly rhizomes. Culms solitary, erect, 70–200 cm tall, 2–4 mm in diam., unbranched. Leaf sheaths glabrous; leaf blades linear-lanceolate, (10–)20–40 × 0.8–2 cm, glabrous or pubescent, base narrowed almost to midrib on lower blades, apex setaceously acuminate; ligule 1–2 mm. Panicle loosely contracted, narrowly lanceolate in outline, 10–20 cm; branches 2–6 cm, unbranched or lower branches branched once or twice, branchlets glabrous or pilose in axils; racemes 2–3-noded with 7–9 spikelets, disarticulating at maturity, one spikelet of a pair sessile, the other pedicellate; rachis internodes and pedicels 2.5–5 mm, slenderly clavate, ciliate, hairs 1.5–2 mm. Spikelets 4.5–6 mm; callus hairs 1.5–2.5 mm; lower glume broadly lanceolate, pilose with soft spreading hairs, veins smooth except near apex, apex acute or slightly emarginate, sometimes mucronate; upper glume acute or mucronate; lower floret staminate, palea well developed; upper lemma 2-lobed to lower 1/3; awn 10–15 mm. Anthers ca. 3 mm. Fl. and fr. summer–autumn. $2n = 40$.

Mountain slopes, roadsides, forest margins; below 1100 m. Anhui,

Gansu, Guangdong, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shanxi, Shandong, Sichuan, Zhejiang [Japan, Korea, Mongolia, Russia (Siberia)].

1a. Spikelets 4.5–6 mm ..... 8a. var. *sibiricus*
1b. Spikelets 6.5–8 mm ..... 8b. var. *grandiflorus*

8a. Spodiopogon sibiricus var. **sibiricus**

大油芒(原变种) da you mang (yuan bian zhong)

Andropogon sibiricus (Trinius) Steudel; *Saccharum sibiricum* (Trinius) Roberty; *Spodiopogon depauperatus* Hackel var. *purpurascens* Honda; *S. sibiricus* var. *purpurascens* (Honda) Honda; *S. sibiricus* var. *tenuis* (Kitagawa) Kitagawa; *S. sibiricus* var. *tomentosus* Koidzumi; *S. tenuis* Kitagawa.

Leaf blades 20–40 cm; rachis internodes 2.5–5 mm; spikelets 4.5–6 mm.

Mountain slopes, roadsides, forest margins. Anhui, Gansu, Guangdong, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Zhejiang [Japan, Korea, Mongolia, Russia (Siberia)].

8b. Spodiopogon sibiricus var. **grandiflorus** L. Liu ex S. M. Phillips & S. L. Chen, **var. nov.**

大花大油芒 da hua da you mang

Type: China. Sichuan: Barkam Xian, 2600 m, 1 Sep 1957, *Li Xin 71733* (holotype, PE).

Haec varietas a S. sibirico *var.* sibirico *spiculis majoribus 7–8 mm longis differt*.

Leaf blades 10–19 cm; rachis internodes 5–7 mm; spikelets 6.5–8 mm.

● 2400–2600 m. Sichuan.

This is a local variant with larger spikelets than usual. The type specimen was labeled at varietal rank by L. Liu, but the taxon was described at specific rank, as *"Spodiopogon grandiflorus* L. Liu" (Fl. Reipubl. Popularis Sin. 10(2): 57. 1997), which name was not validly published because no Latin description was provided.

9. Spodiopogon tainanensis Hayata, Bot. Mag. (Tokyo) 21: 53. 1907.

台南大油芒 tai nan da you mang

Spodiopogon gracilis Honda; *S. hayatae* Honda; *S. hogoensis* Hayata; *S. ramosus* Keng; *S. tainanensis* var. *hogoensis* (Hayata) Ohwi; *S. tainanensis* var. *takeoi* (Hayata) Honda; *S. takeoi* Hayata.

Perennial, rhizomatous. Culms erect or ascending, slender, 40–70 cm tall, 1–2 mm in diam., branched. Leaf sheaths glabrous or tuberculate-pilose upward and along margins; leaf blades linear-lanceolate, 6–14 × 0.3–0.8 cm, thinly pilose to glabrescent, narrowed to base, apex acuminate; ligule 1–2 mm. Panicle lax, narrowly lanceolate to ovate in outline, 5–12 cm; branches 2–4 cm, simple or once branched; racemes 1–3-noded with 3–9 spikelets, disarticulating at maturity, one spikelet of a pair sessile, the other pedicellate; rachis internodes 3–4 mm; pedicels 2.5–3 mm, ciliate, hairs up to 3 mm. Spikelets 4.5–6 mm; callus hairs 1–1.5 mm; lower glume lanceolate, softly pilose to silky villous, apex subacute or mucronate; upper glume acute, mucronulate; lower floret staminate, palea well developed; upper lemma 2-lobed to lower 1/4–1/3; awn 7–10 mm. Anthers 2.5–3.2 mm. Fl. and fr. Jun–Oct. 2*n* = 20*.

● Grassy mountain slopes; 2300–3400 m. S Gansu, Jiangsu, Sichuan, Taiwan, Xizang, Yunnan.

Species exclusae

The following two species names were not validly published because no Latin description was provided and no type was indicated. They do not appear to correspond with any known species of *Spodiopogon*. It has not been possible to validate the names here, as the specimens on which they were based have not been located.

"Spodiopogon ludingensis" L. Liu, Fl. Reipubl. Popularis Sin. 10(2): 55. 1997, nom. inval.

泸定大油芒 lu ding da you mang

Perennial. Culms erect, ca. 80 cm tall, 3–4 mm in diam., 3–5-noded. Leaf blades lanceolate, 10–20 × 0.5–1.2 cm; puberulous. Panicle purplish black, ca. 10 cm; branches 1–3 cm; racemes 2–3-noded, one spikelet of a pair sessile, the other pedicellate. Spikelets ca. 4 mm; callus glabrous; lower glume 9–11-veined, veins scabrid, puberulous between veins, apex obtuse or truncate; upper lemma 2-lobed to middle; awn 6–7 mm. Anthers ca. 1.5 mm. Fl. and fr. Aug–Oct.

● Dry mountain slopes; 1500–1600 m. W Sichuan.

"Spodiopogon paucistachyus" L. Liu, Fl. Reipubl. Popularis Sin. 10(2): 57. 1997, nom. inval.

寡穗大油芒 gua sui da you mang

Perennial. Culms erect, stiff, ca. 50 cm tall, 2–4 mm in diam., many-noded, farinose below node. Leaf sheaths purplish, longer than internodes; leaf blades lanceolate, 5–10 × 0.4–0.8 cm, puberulous, base contracted into false petiole, lower margin softly tuberculate-hairy, apex acute. Panicle lax, ca. 5 cm; branches 1–2 per node; racemes with 1 or 2 spikelet pairs; rachis internodes glabrous; pedicels pilose. Spikelets 6–6.5 mm; callus hairs ca. 2 mm; lower glume 9-veined, lower back softly pilose with ca. 3 mm hairs; upper lemma 2-lobed to middle; awn ca. 12 mm. Anthers ca. 2.5 mm. Fl. and fr. summer–autumn.

● Mountain slopes; 2600–2700 m. W Sichuan.

187. SACCHARUM Linnaeus, Sp. Pl. 1: 54. 1753.

甘蔗属 gan zhe shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Erianthus Michaux; *Narenga* Bor; *Ripidium* Trinius (1820), not Bernhardi (1801).

Perennials, rhizomatous or tufted. Culms robust, up to 7 m tall. Leaf blades cauline, narrowly to broadly linear, midrib usually broad, white; ligule membranous, margin ciliolate. Inflorescence terminal, a large plumose panicle with elongate central axis, its branches bearing numerous hairy racemes; racemes fragile, sessile and pedicelled spikelet of a pair similar, both fertile; rachis internodes and pedicels filiform with cupular apex, pedicels resembling internodes but often shorter. Spikelets usually small, lanceolate, dorsally compressed or pedicelled spikelet more rounded on back; callus short, obtuse, bearded, often with long silky hairs surrounding the spikelet; lower glume membranous, thinly cartilaginous, or becoming leathery below, flat to broadly convex, veins indistinct, laterally 2-keeled; upper glume boat-shaped, resembling lower glume in texture and color; lower floret reduced to an empty hyaline lemma; upper floret bisexual, lemma entire, rarely 2-toothed, sometimes very narrow or small, with or without a short straight awn; stamens 2–3. $x = 10$.

Between 35 and 40 species: throughout the tropics and subtropics, but mainly in Asia; 12 species (two endemic, two introduced) in China.

Species with awns are sometimes separated as the genus *Erianthus*, but this is an artificial distinction. *Saccharum* includes the important crop plant *S. officinarum* (sugarcane).

The fluffy callus hairs are an efficient aid to wind dispersal.

1a. Spikelets awned, awn clearly exserted from glumes.
  2a. Awn 4–8 mm.
    3a. Panicle much branched; racemes with 3–4 joints; culms 2–3 m tall, glabrous below panicle ..... 1. *S. ravennae*
    3b. Panicle simple; racemes with numerous joints; culms 0.7–1.5 m tall, hirsute below panicle ..... 2. *S. formosanum*
  2b. Awn 10–28 mm.
    4a. Spikelets 4–6 mm; awn 13–28 mm ..... 3. *S. longesetosum*
    4b. Spikelets 2–3.5 mm; awn 10–15 mm ..... 4. *S. rufipilum*
1b. Spikelets awnless or a short awn concealed within glumes (if exserted, awn up to 6 mm and panicle brown).
  5a. Lower glume glabrous on back; callus hairs much longer than spikelet.
    6a. Plant rhizomatous; leaf blades 0.2–0.8 cm wide, narrowed to midrib at base; wild plant ..... 5. *S. spontaneum*
    6b. Plant clump-forming; leaf blades 1–6 cm wide, laminate to base; cultivated plant.
      7a. Culm apex and axis of panicle glabrous; rachis internodes glabrous; spikelets 3.5–4 mm ..... 6. *S. officinarum*
      7b. Culm apex and axis of panicle pilose; rachis internodes pilose; spikelets ca. 4.5 mm.
        8a. Culms 3–4 m tall, 3–4 cm in diam.; leaf blades ca. 100 × 3–5 cm ..... 7. *S. sinense*
        8b. Culms ca. 2 m tall, 1–2 cm in diam.; leaf blades ca. 50 × 1–2 cm ..... 8. *S. barberi*
  5b. Lower glume hairy on back (if subglabrous, panicle purplish); callus hairs equal to or shorter than spikelet.
    9a. Lower glume with white hairs, hairs 2–3 times longer than spikelet.
      10a. Culms 1.5–4(–6) m tall; rachis internodes 3–5 mm; upper lemma mucronate or with awn to 3 mm ..... 9. *S. arundinaceum*
      10b. Culms up to 7 m tall, rachis internodes 6–7 mm; upper lemma awnless ..... 10. *S. procerum*
    9b. Lower glume subglabrous or with brown hairs, hairs shorter than spikelet.
      11a. Inflorescence coppery or purplish brown; nodes white bearded; callus hairs white or purplish; lower glume subglabrous ..... 11. *S. narenga*
      11b. Inflorescence golden brown; nodes brown bearded; callus hairs golden brown; lower glume hirsute .... 12. *S. fallax*

1. Saccharum ravennae (Linnaeus) Linnaeus in Murray, Syst. Veg., ed. 13, 88. 1774.

沙生蔗茅 sha sheng zhe mao

Andropogon ravennae Linnaeus, Sp. Pl., ed. 2, 2: 1481. 1763; *Erianthus ravennae* (Linnaeus) P. Beauvois.

Perennial, forming large clumps. Culms (1.5–)2–3(–4) m tall, ca. 1 cm in diam., lower nodes yellowish villous, glabrous below panicle. Lower leaf sheaths hirsute with tubercle-based hairs, upper sheaths smooth; leaf blades 50–120 × 0.5–1.8 cm, woolly above ligule with long yellowish hairs, otherwise glabrous, margins scabrid, tapering to midrib at base, apex filiform; ligule a narrow rim, back villous with ca. 2 mm hairs. Panicle dense, lobed, 30–50 × 10–15 cm, grayish sometimes tinged pink, axis glabrous, branches much branched; racemes short, crowded, with 3–4 joints; rachis internodes 2–3 mm, silky villous. Spikelets 3–6 mm, purplish; callus hairs as long as spikelet; lower glume lanceolate, membranous, back glabrous or pilose with spreading hairs, keels scabrid, apex attenuate, minutely notched; lower lemma 3/4 as long to subequaling glumes; upper lemma elliptic, apex acute, awned; awn almost straight, 4–8 mm. Anthers 3, 2.1–2.2 mm. Fl. and fr. autumn. $2n = 20, 60$.

Sandy places; 1200–3000 m. Xinjiang [Afghanistan, NW India, Kazakhstan, Kyrgyzstan, Pakistan, Tajikstan, Turkmenistan, Uzbekistan; SW Asia, S Europe; introduced in America].

This is a polymorphic species showing much variability in the disposition of hairs on the glumes. Sometimes the spikelets are slightly dimorphic, with the sessile spikelet almost glabrous and the pedicelled one strongly pilose. This species has a more profusely branched panicle with shorter racemes than others in China.

The stout clumps are useful in erosion control. This grass is also used for forage when young.

2. Saccharum formosanum (Stapf) Ohwi, Acta Phytotax. Geobot. 11: 152. 1942.

台蔗茅 tai zhe mao

Erianthus formosanus Stapf, Bull. Misc. Inform. Kew 1898: 228. 1898; *E. pollinioides* Rendle; *Saccharum formosanum* var. *pollinioides* (Rendle) Ohwi.

Perennial, rhizomatous. Culms 0.7–1.9 m tall, 2–5 mm in diam., nodes glabrous, hirsute below panicle. Leaf sheaths longer or upper shorter than internodes; leaf blades flat or involute, 30–100 × 0.3–0.6 cm, pilose at base, otherwise glabrous, margins scabrid, base straight, apex long acuminate; ligule ca. 0.5 mm, margin ciliolate. Panicle obovate in outline, 15–24 cm, grayish white or pinkish, unbranched, axis 8–12 cm, shorter than racemes or subequaling lowest racemes, silky pilose; racemes 15–30, 11–12 cm, ascending or spreading; rachis internodes ca. 2.5 mm, silky villous, hairs 2–3 times spikelet length. Spikelets 3–3.6 mm; callus hairs short, ca. 0.5 mm; lower glume lanceolate, papery, brown, membranous and pallid near apex, back pilose with white or purplish hairs 2–3 times spikelet length, keels scabrid above, apex attenuate, minutely notched; lower lemma equaling glumes; upper lemma lanceolate, upper margins ciliate, apex subentire, awned; awn slender, 6–8 mm. Anthers 2, 1.5–2 mm. Fl. and fr. Aug–Nov.

● Open grassy hillsides. Fujian, Guangdong, Guizhou, Hainan, Jiangxi, Taiwan, Yunnan, Zhejiang.

Saccharum formosanum is closely related to *Eulalia fastigiata* (Nees ex Steudel) Stapf ex Bor (*S. fastigiatum* Nees ex Steudel; *Erianthus fastigiatus* (Nees ex Steudel) Andersson) from Bhutan, NE India, and Nepal. The latter species differs in its slightly larger (3.5–4.7 mm) spikelets, shorter spikelet and internode hairs not much exceeding the spikelet, and possession of 3 anthers. The two species are undoubtedly congeneric, but lie on the boundary between *Saccharum* and *Eulalia*, and have been placed in different genera in recent Floras. The inflorescence axis is shorter than is usual in *Saccharum*, but longer than in *Eulalia*, in which genus the racemes are usually digitate. On balance, the two species seem best placed in *Saccharum*.

3. Saccharum longesetosum (Andersson) V. Narayanaswami in Bor, Fl. Assam 5: 461. 1940 [*"longisetosum"*].

长齿蔗茅 chang chi zhe mao

Erianthus longesetosus Andersson, Öfvers. Kongl. Vetensk.-Akad. Förh. 12: 163. 1855; *Eccoilopus hookeri* (Hackel) Grassl; *E. longesetosus* (Andersson) Grassl; *Erianthus hookeri* Hackel; *E. rockii* Keng; *Saccharum hookeri* (Hackel) V. Narayanaswami; *S. longesetosum* var. *hookeri* (Hackel) U. Shukla.

Perennial. Culms 1–3 m tall, 0.5–1 cm in diam., many-noded, glabrous or hairy below panicle. Leaf sheaths longer than internodes, mouth bearded; leaf blades linear-elliptic, 30–50 × 1.5–2(–4) cm, glabrous, abaxial surface glaucous, tapering to base and apex, apex acuminate; ligule 2.3–2.5 mm. Panicle elliptic or oblong in outline, nodding, 15–40 cm, golden brown, branched, axis glabrous or pilose; racemes 3–10 cm; rachis internodes 2.5–4 mm, ciliate with long silky hairs. Spikelets 4–6 mm; callus hairs slightly shorter to longer than spikelet, white or pale yellow; lower glume lanceolate to elliptic-oblong, cartilaginous, golden brown, glossy, thinner and paler near apex, back glabrous or sparsely to densely pilose below middle, upper margins ciliate, apex bidenticulate; lower lemma slightly shorter than glumes; upper lemma linear-oblong, margins ciliate, shortly 2-toothed, awned; awn 1.3–2.8 cm. Anthers 3, 2–3 mm. Fl. and fr. Aug–Oct. 2*n* = 30.

Grassy hillsides; 300–2700 m. Guangxi, Guizhou, Sichuan, Xizang, Yunnan [Bhutan, N India, Myanmar, Thailand].

This species is variable in spikelet length and hairiness of the panicle. The callus hairs vary from slightly shorter to considerably longer than the spikelet, and the lower glume may be glabrous, thinly hairy, or densely hairy. Sometimes the pedicelled spikelet is hairier than the sessile spikelet. Particularly hairy specimens may be separated as var. *hookeri*, but there are many intermediate forms. The species as a whole is recognizable by its broad leaf blades glaucous below and evenly tapering to each end, together with a nodding, golden brown panicle of long-awned spikelets.

Neither combination *"Erianthus longisetosus* [sic] var. *hookeri* Bor" (Grasses Burma, Ceylon, India, Pakistan, 151. 1960) nor *"Saccharum longisetosum* [sic] var. *hookeri* Bor" (loc. cit. 212) was validly published because Bor proposed them simultaneously for the same taxon and based on the same type (alternative names; Saint Louis Code, Art. 34.2).

4. Saccharum rufipilum Steudel, Syn. Pl. Glumac. 1: 409. 1854.

蔗茅 zhe mao

Erianthus fulvus Nees ex Hackel (1889), not (Bory) Kunth (1829); *E. lancangensis* Y. Y. Qian; *E. pallens* Hackel; *E. rufipilus* (Steudel) Grisebach; *Miscanthus rufipilus* (Steudel) Grassl.

Perennial, tussocky. Culms up to 3.5 m tall, 0.3–0.7 mm in diam., nodes bearded, silky villous below panicle. Leaf sheaths longer than internodes, smooth, margin and mouth hairy; leaf blades flat or involute, tough, 20–60 × 0.5–1.5 cm, glabrous, abaxial surface farinose, narrowed to base, apex acuminate; ligule 1–3 mm, ciliate. Panicle narrowly oblong in outline, very dense, 18–45 cm, cream or pinkish with long hairs obscuring the spikelets, unbranched or shortly branched at base, axis villous; racemes 2–4(–9) cm; rachis internodes 1.5–2.5 mm, villous. Spikelets 2.5–3.5 mm; callus hairs ca. 3 times spikelet length; lower glume lanceolate, thinly cartilaginous, dark brown at maturity, back subglabrous, margins shortly ciliate or occasionally with longer hairs, apex palely membranous, sharply acuminate; lower lemma slightly longer than glumes, apex attenuate, sometimes awnlike; upper lemma linear-lanceolate, entire, awned; awn 1–1.5 cm. Anthers (1–)3, 1–1.5 mm. Fl. and fr. Jun–Oct. 2*n* = 20.

Dry grassy and rocky hillsides; 1300–2600 m. Gansu, Guizhou, Henan, Hubei, Shaanxi, Sichuan, Xizang, Yunnan [Bhutan, N India, Myanmar, Nepal, Pakistan].

This species can be recognized by its elongate, narrow panicle of small, pointed, long-awned spikelets sunk among copious long hairs. Some specimens from Yunnan appear to have only one anther.

5. Saccharum spontaneum Linnaeus, Mant. Pl. 2: 183. 1771.

甜根子草 tian gen zi cao

Imperata spontanea (Linnaeus) P. Beauvois; *Saccharum spontaneum* var. *roxburghii* Honda.

Perennial, with long rhizomes. Culms 1–4 m tall, 0.4–1 cm in diam., 5–10-noded, often hollow in center, nodes bearded, softly pilose below inflorescence. Leaf sheaths pilose at mouth and margin, sometimes tuberculate-pilose throughout; leaf blades 60–180 × 0.2–0.8 cm, glaucous, glabrous, margins serrate, tapering to midrib at base, apex long attentuate; ligule brown, 2–8 mm. Panicle 20–40 cm, axis silky pilose; racemes 4–17 cm; rachis internodes 1.5–5 mm, pilose with long silky hairs. Spikelets 3–4 mm; callus hairs 3–4 times length of spikelet; lower glume papery and dark brown below middle at maturity, membranous and pallid above, back glabrous, margins ciliate above, apex acuminate; lower lemma ovate-lanceolate, equal to glumes; upper lemma linear or linear-oblong, awnless. Lodicules ciliate. Anthers 3, 1.5–2 mm. Fl. and fr. Jul–Sep. 2*n* = 40–128.

Mountain slopes, gravelly river beds, low grassy places, forming colonies; below 2000 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan, Zhejiang [Afghanistan, Bhutan, Cambodia, India, Indonesia, Japan, Malaysia, Myanmar, New Guinea, Pakistan, Philippines, Sri Lanka, Thailand, Turkmenistan, Vietnam; Africa, SW Asia, Australia, Pacific Islands].

There are numerous local strains comprising a complex series of chromosome numbers. This species hybridizes readily with cultivated sugarcane (*Saccharum officinarum*) and is used in sugarcane breeding programs. The name *S. spontaneum* var. *juncifolium* Hackel (*S. juncifolium* (Hackel) Janaki-Ammal) has been applied to extreme forms with the leaf blades narrowed to the midrib along their whole length.

This species is a good forage grass and an efficient soil binder.

6. Saccharum officinarum Linnaeus, Sp. Pl. 1: 54. 1753.

甘蔗 gan zhe

Perennial, forming tall clumps. Culms 3–6 m tall, 2–5 cm in diam., 20–40-noded, solid, nodes glabrous, glabrous below inflorescence. Leaf sheaths glabrous, pilose at mouth; leaf blades 70–150 × 4–6 cm, usually glabrous, midrib large, white, margins sharply serrate, base rounded, apex acuminate; ligule 2–3 mm, ciliate. Panicle 50–100 cm, axis glabrous but pilose at nodes; racemes 10–25 cm; rachis internodes 3–6 mm, glabrous. Spikelets 3.5–4 mm; callus hairs 2–3 times length of spikelet; lower glume oblong, uniformly firm throughout, buff-colored, back glabrous, margins membranous and ciliate above, apex acuminate; lower lemma oblong-lanceolate, subequal to glumes; upper lemma linear, awnless. Lodicules glabrous. Anthers 3. Fl. and fr. autumn. 2*n* = 80.

Cultivated. Fujian, Guangdong, Guangxi, Hainan, Sichuan, Taiwan, Xizang, Yunnan [SE Asia, Pacific Islands; widely cultivated elsewhere].

This is the commercial crop sugarcane, now widely cultivated in tropical regions of the world. Most present-day cultivars contain genes from *Saccharum spontaneum*. Sugar is extracted from the soft, central tissue of the culm. The dyed inflorescence is used as an ornament.

7. Saccharum sinense Roxburgh, Pl. Coromandel 3: t. 232. 1818.

竹蔗 zhu zhe

Saccharum officinarum Linnaeus subsp. *sinense* (Roxburgh) Burkill; *S. spontaneum* Linnaeus var. *sinense* (Roxburgh) Andersson.

Perennial. Culms 3–4 m tall, 3–4 cm in diam., many-noded, solid, softly pilose below inflorescence. Leaf blades ca. 100 × 3–5 cm, glaucous, glabrous, midrib large, white, margins serrate; ligule ca. 2 mm. Panicle 30–60 cm, axis with white silky hairs; rachis internodes pilose. Spikelets ca. 4.5 mm; callus hairs 2–3 times length of spikelet; lower glume lanceolate, dark brown; lower lemma oblong-lanceolate; upper lemma linear, 1.2–3 mm or reduced, awnless. Lodicules glabrous. Anthers 3, 1.5–2 mm. Fl. and fr. Nov–Mar. 2*n* = 106–120*.

● Cultivated. S Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangxi, Shaanxi, Sichuan, Taiwan, Yunnan, Zhejiang [of cultivated origin; cultivated elsewhere].

Canes of this form of cultivated sugarcane were sent from Guangzhou to Calcutta in 1796, establishing its cultivation in India. Like *Saccharum barberi*, this is a primitive form of sugarcane of hybrid origin with introgression from wild species. A number of different clones exists, and these are usually included in *S. officinarum* as the Pansahi group, of which the best known is the Uba cane. The clone Tekcha, which was cultivated in Taiwan for many years, also belongs here. *Saccharum sinense* clones have been used in breeding programmes, and many modern cultivars have this species in their ancestry.

The leaf blades and uppermost part of the culms are used for forage. The whole culm except the apex is used for sugar and medicine.

8. Saccharum barberi Jeswiet, Arch. Suikerindustr. Ned.-Indie 12: 396. 1925.

细秆甘蔗 xi gan gan zhe

Saccharum officinarum Linnaeus subsp. *barberi* (Jeswiet) Burkill.

Perennial with short stout rhizomes. Culms solid, up to 2 m tall, 1–2 cm in diam., solid, nodes bearded, softly pilose below inflorescence. Leaf sheaths longer than internodes; leaf blades ca. 50 × 1–2 cm, margins serrate; ligule well developed. Panicle very large, axis with white silky hairs. Spikelets oblong; callus hairs longer than spikelet; lower glume oblong, glabrous, margin infolded; lower lemma slightly shorter than glumes; upper lemma narrowly linear, awnless. Fl. and fr. summer and autumn. 2*n* = 82–124.

Cultivated. Guangxi, Taiwan, Yunnan [originating in Bangladesh and India].

This name covers a group of slender, relatively hardy, cultivated sugarcane clones originating in subtropical N India. These are ancient types not far removed from wild *Saccharum spontaneum* and now usually included in *S. officinarum* under cultivar names. They have mostly been superseded by modern, commercial varieties.

9. Saccharum arundinaceum Retzius, Observ. Bot. 4: 14. 1786.

斑茅 ban mao

Perennial, forming large clumps. Culms robust, (0.7–)1–6 m tall, 1–2 cm in diam., glabrous. Leaf sheaths glabrous or pubescent, ciliate at mouth and margins; leaf blades (60–)100–200 × 1–2 cm, abaxial surface glabrous, adaxial surface velvety

with long soft hairs on broad lower midvein, margins serrate, base narrow, apex long attenuate; ligule 1–2 mm. Panicle (25–) 30–80 cm, much branched, axis glabrous; racemes 3–5.5 cm; rachis internodes 3–5 mm, pilose with long silky hairs. Spikelets 3–4 mm, straw-colored tinged purple upward; callus hairs ca. 1 mm, shorter than spikelet; lower glume thinly cartilaginous, back pilose with silky hairs twice length of spikelet, keels scabrid, apex acuminate; upper glume usually glabrous in sessile spikelet, rarely thinly pilose, clearly pilose in pedicelled spikelet; lower lemma subequal to glumes; upper lemma lanceolate, apex mucronate or with awn to 3 mm. Lodicules glabrous. Anthers 1.8–2 mm. Fl. and fr. Aug–Dec. 2*n* = 30, 40, 50, 60.

Hill slopes, riversides, dry stream beds, often on sandy soils. S Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Henan, Hubei, Jiangxi, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, Sri Lanka, Thailand, Vietnam].

It is necessary to look carefully, preferably using a disarticulated spikelet, in order to distinguish the basal, short callus hairs from the long, silky hairs of the rachis internodes, pedicels, and glumes.

This species is used for forage in China.

Saccharum arundinaceum is similar to *S. bengalense* Retzius, from N India and Pakistan. The latter species is distinguished mainly by its rather narrow panicle and much narrower leaf blades, which are channeled and consist mostly of midrib.

1a. Culms up to 6 m; upper glume of sessile spikelet glabrous ..... 9b. var. *arundinaceum*
1b. Culms up to 1.5 m; upper glume of sessile spikelet thinly pilose ..... 9b. var. *trichophyllum*

9a. Saccharum arundinaceum var. **arundinaceum**

斑茅(原变种) ban mao (yuan bian zhong)

Erianthus arundinaceus (Retzius) Jeswiet; *Ripidium arundinaceum* (Retzius) Grassl; *Saccharum barbicostatum* Ohwi.

Culms up to 6 m tall. Inflorescence usually large, 30–80 × 6–17 cm. Upper glume of sessile spikelet glabrous.

Hill slopes, or along riversides, dry stream beds, often on sandy soils. S Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Henan, Hubei, Jiangxi, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, Sri Lanka, Thailand, Vietnam].

9b. Saccharum arundinaceum var. **trichophyllum** (Handel-Mazzetti) S. M. Phillips & S. L. Chen, Novon 15: 469. 2005.

毛颖斑茅 mao ying ban mao

Erianthus griffithii J. D. Hooker var. *trichophyllus* Handel-Mazzetti, Akad. Wiss. Wien, Math.-Naturwiss. Kl., Anz. 58: 154. 1921; *Erianthus trichophyllus* (Handel-Mazzetti) Handel-Mazzetti.

Culms up to 1.5 m tall. Inflorescence narrow, 25–50 × 4.5–6 cm. Upper glume of sessile spikelet thinly pilose with long silky hairs.

Open grassy places; 600–1900 m. Yunnan [India (Sikkim)].

This is a small variant, apparently of local distribution, distinguished mainly by the hairy upper glume of the sessile spikelet.

10. Saccharum procerum Roxburgh, Fl. Ind. 1: 248. 1820.

狭叶斑茅 xia ye ban mao

Erianthus procerus (Roxburgh) Raizada; *Ripidium procerum* (Roxburgh) Grassl.

Perennial, forming large clumps. Culms very robust, up to 7 m tall, glabrous. Leaf sheaths glabrous except at mouth and margins; leaf blades 60–150 × 2–5 cm, abaxial surface glabrous, adaxial surface velvety with long soft hairs on broad lower midvein, midrib white, thick, margins coarsely serrate, base narrow, apex long attenuate; ligule less than 1 mm. Panicle 30–80 cm, much branched, axis glabrous; racemes 4–5 cm; rachis internodes 6–7 mm, pilose with long silky hairs. Spikelets 3–4.3 mm, straw-colored or tinged purplish; callus hairs 1–2.5 mm, shorter than spikelet; lower glume thinly cartilaginous, back pilose with long silky hairs 2–3 times spikelet length, keels smooth, apex cuspidate; upper glume glabrous in sessile spikelet, pilose in pedicelled spikelet; lower lemma subequal to glumes; upper lemma lanceolate-oblong, apex apiculate, awnless. Lodicules glabrous. Anthers 3, ca. 1.6 mm.

Streams, valley bottoms; below 1500 m. Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Xizang, Yunnan [Bangladesh, NE India, Myanmar, Nepal, Thailand].

This very large and ornamental species is used for forage and fiber. It intergrades with *Saccharum arundinaceum*, but tends to have more widely spaced spikelet pairs and lacks a definite awnlet on the upper lemma.

11. Saccharum narenga (Nees ex Steudel) Wallich ex Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 119. 1889.

河八王 he ba wang

Eriochrysis narenga Nees ex Steudel, Syn. Pl. Glumac. 1: 411. 1854; *E. porphyrocoma* Hance; *Narenga porphyrocoma* (Hance) Bor; *Saccharum porphyrocomum* (Hance) Hackel; *Sclerostachya narenga* (Nees ex Steudel) Grassl.

Perennial from a short stout rhizome. Culms 1–3(–5) m tall, 5–8 mm in diam., nodes bearded, hirsute below panicle. Leaf sheaths hispid with tubercle-based hairs; leaf blades 1–1.5 m × 0.6–2 cm, adaxial surface thinly hispidulous, abaxial surface glabrous, margins scabrid, tapering to midrib at base, apex attenuate; ligule 3–4 mm, rounded. Panicle narrowly elliptic-oblong in outline, 20–50 cm, copper brown or purplish brown, axis white-pilose; racemes arising almost from main axis, stiffly ascending, densely spiculate, lowest 6–10 cm; rachis internodes 1.7–2.5 mm, ciliate. Spikelets 2.5–3 mm, brown, glossy; callus hairs about equaling spikelet, white or purplish; lower glume narrowly lanceolate-oblong, leathery, back glabrous or thinly pilose below middle, keels scabrid and margins ciliate near apex, apex narrowly truncate; lower lemma equal to glumes; upper lemma narrow, truncate, awnless. Anthers 3, 1.2–1.5 mm. Fl. and fr. Aug–Nov. 2*n* = 30.

Open mountain slopes, dry grassy places. Anhui, Fujian, Guangdong, Guizhou, Henan, Jiangsu, Sichuan, Taiwan, Yunnan, Zhejiang [Bangladesh, India, Myanmar, Nepal, Pakistan, Thailand, Vietnam].

12. Saccharum fallax Balansa, J. Bot. (Morot) 4: 80. 1890.

金猫尾 jin mao wei

Erianthus chrysothrix Hackel; *E. fallax* (Balansa) Ohwi; *Narenga fallax* (Balansa) Bor; *N. fallax* var. *aristata* (Balansa) L. Liu; *Saccharum fallax* var. *aristatum* Balansa; *Sclerostachya fallax* (Balansa) Grassl.

Perennial. Culms 1.5–3 m tall, 8–12 mm in diam., nodes bearded with golden-brown hairs, hirsute below panicle. Leaf sheaths usually longer than internodes, margin brown-hirsute; leaf blades stiff, 40–80 × 1–1.5 cm, uppermost usually very small, glabrous or tuberculate-pilose, margins scabrid, base narrowed, apex acuminate; ligule ca. 1.5 mm. Panicle loosely oblong in outline, 30–60 cm, golden or ferruginous brown, axis pilose, bearded at nodes, primary branches sparsely branched in lower part; racemes flexuously ascending, densely spiculate, 8–16 cm; rachis internodes 2–2.4 mm, ciliate. Spikelets 3–4 mm, brown; callus hairs a little shorter than spikelet, brown; lower glume oblong-lanceolate, papery becoming herbaceous toward apex, back brown-hirsute, apex narrowly truncate; lower lemma 3/4 length of glumes; upper lemma oblong, obtuse and awnless or minutely mucronate, varying to shortly 2-toothed and awned from sinus; awn twisted, bent, up to 6 mm. Anthers 3, 1.6–2.2 mm. Fl. and fr. Aug–Oct.

Hill slopes; 400–1000 m. Guangdong, Guangxi, Guizhou, Hainan, Yunnan [NE India, Indonesia, Laos, Myanmar, Vietnam].

This is a very handsome grass with a striking golden or rusty brown, softly hairy inflorescence. The racemes often contain a mixture of awned and awnless spikelets in varying proportions. Even adjacent spikelets may differ in this character, which is not related to whether the spikelet is sessile or pedicelled.

188. MISCANTHUS Andersson, Öfvers. Kongl. Vetensk.-Akad. Förh. 12: 165. 1855.

芒属 mang shu

Chen Shouliang (陈守良); Stephen A. Renvoize

Diandranthus L. Liu; *Imperata* subg. *Triarrhena* Maximowicz; *Rubimons* B. S. Sun; *Triarrhena* (Maximowicz) Nakai.

Perennial, tufted or rhizomatous. Culms slender to robust, erect, solid. Leaves basal or cauline; leaf blades large, linear, flat, broad or narrow; ligule membranous. Inflorescence a panicle, often large and plumose, of racemes arranged on a long or short axis; raceme axis tough, internodes slender, spikelets paired, both spikelets pedicelled, pedicels slender, flattened, slightly clavate. Spikelets similar, lanceolate, dorsally compressed; callus bearded with hairs shorter than, as long as, or longer than the spikelet; glumes papery or membranous; lower floret usually represented by a hyaline sterile lemma; upper floret bisexual, lemma hyaline, awned or awnless. Stamens 2–3. Caryopsis oblong or ellipsoid.

Fourteen species, mostly in SE Asia and the Pacific Islands, extending to tropical Africa; seven species (two endemic) in China.

This genus is readily recognized by its paniculate inflorescence of racemes, which have a tough rachis, and also by its paired spikelets, both of which are pedicelled.

1a. Stamens 2.
2a. Callus hairs longer than spikelet, golden brown in color ..... 6. *M. nepalensis*
2b. Callus hairs shorter than spikelet, purple or white in color ..... 7. *M. nudipes*
1b. Stamens 3.
3a. Panicle spikelike with short racemes appressed to the axis; spikelets straight-awned; lower glume distinctly 2-keeled ..... 1. *M. paniculatus*
3b. Panicle large, usually open with spreading racemes; spikelets awnless or geniculately awned; lower glume weakly 2-keeled.
4a. Spikelets awnless.
5a. Culms 300–700 cm tall, branching at nodes; inflorescence 20–40 cm ..... 2. *M. lutarioriparius*
5b. Culms 65–160 cm tall, unbranched; inflorescence 7–30 cm ..... 3. *M. sacchariflorus*
4b. Spikelets awned.
6a. Axis more than 2/3 the length of the panicle ..... 4. *M. floridulus*
6b. Axis up to 1/2 the length of the panicle ..... 5. *M. sinensis*

1. Miscanthus paniculatus (B. S. Sun) Renvoize & S. L. Chen, Kew Bull. 60: 607. 2006.

红山茅 hong shan mao

Rubimons paniculatus B. S. Sun, Acta Bot. Yunnan. 19: 239. 1997.

Plant rhizomatous. Culms 30–100 cm tall, 3–4 mm in diam., 3–4-noded, nodes puberulous. Leaf sheaths slightly compressed, usually shorter than internodes, glabrous, ciliate at apex; leaf blades linear, flat, 10–40 × 0.2–0.8 cm, glabrous or pilose, narrowed to midrib toward base, apex acuminate; ligule 0.5–1.5 mm, ciliate, obtuse. Panicle 5–15 cm; axis glabrous. Racemes short, 2–6 cm, appressed. Spikelets lanceolate, 5–6 mm, awned; callus hairs 0.5–2 mm; glumes unequal; lower glume ca. 5 mm, back scabrid, pilose, obscurely 2–3-veined between 2 keels, or veinless, keels hispidulous, upper margin pilose, apex 2-lobed or 2-toothed; upper glume ca. 6 mm, obscurely 3–5-veined or veinless, scabrid, margins pilose, apex acuminate; lower lemma linear-lanceolate, 4.5–6 mm, 3–5-

veined, puberulous; upper lemma ca. 5 mm, 1–3-veined, margins pilose, apex acuminate, awned; awn ca. 2 mm, straight. Anthers 3, ca. 3 mm. Caryopsis oblong.

● Dry mountain slopes; 2500–3100 m. W Guizhou, Sichuan, Yunnan.

This is a distinctive species easily recognized by its reduced inflorescence. The spikelets are typical of *Miscanthus*, and for this reason the recognition of the separate genus *Rubimons* is unjustified.

2. Miscanthus lutarioriparius L. Liu ex Renvoize & S. L. Chen, Kew Bull. 60: 605. 2006.

南荻 nan di

Plant robust, from a rhizomatous rootstock. Culms stout, canelike, 3–7 m tall, 10–20 mm in diam. in lower part, branching, branches ascending, branch buds invested with pubescent or pilose scales, internodes mostly hollow, becoming solid toward apex, nodes glabrous in lower part of culm, pubescent in upper part, lower nodes often bearing adventitious roots. Leaves cauline, glabrous; leaf blades linear, flat, 50–90 × 1.5–3 cm, midrib prominent, adaxial surface pilose at base behind ligule, margins scabrid, base rounded or tapering to a pseudopetiole, apex finely acuminate; ligule ca. 0.5 mm, margin pilose, auricles ca. 1 mm or absent. Panicle large, 20–40 × 10–15 cm; axis glabrous, 10–25 cm. Racemes 20–40, 10–30 cm, rachis puberulous at base, otherwise glabrous; lower pedicel 1.5–2 mm, upper pedicel 4.5–5.5 mm. Spikelets 4–6.5 mm, pilose, awnless; callus hairs ca. 10 mm, exceeding the spikelet; glumes subequal, membranous, apex attenuate; lower glume 3–5-veined, back pilose with ca. 10 mm hairs; upper glume 3-veined, back glabrous, margins pubescent; lower lemma lanceolate, hyaline, 3.5–4.5 mm, veinless, pilose; upper lemma similar to lower, 3–4 mm; upper palea hyaline, pilose, reduced to a small scale. Anthers 3, ca. 2 mm. Caryopsis lanceolate, ca. 2 mm.

● River banks, lakesides; below 100 m. Hubei, Hunan.

3. Miscanthus sacchariflorus (Maximowicz) Hackel in Engler & Prantl, Nat. Pflanzenfam. 2: 23. 1887.

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Imperata sacchariflora Maximowicz, Prim. Fl. Amur 331. 1859; *Triarrhena sacchariflora* (Maximowicz) Nakai.

Plant rhizomatous; rhizomes long, slender, covered by short, striate, glabrous or pubescent cataphylls. Culms slender, erect, 65–160 cm tall, solid, unbranched. Leaves cauline; leaf sheaths striate, glabrous; leaf blades linear, flat, 20–50 × 0.5–1.5 cm, glabrous, midrib prominent, base tapering, straight or rounded, margins scabrid, apex acuminate; ligule ca. 0.5 mm, fringed with 1–2 mm cilia. Panicle 7–30 cm; axis 5–15 cm, glabrous or pilose at base. Racemes 4–24, 5–20 cm; rachis internodes glabrous, nodes pilose or glabrous; lower pedicel 1–2.5 mm, upper pedicel 2–5 mm. Spikelets 4–6 mm, pilose, awnless; callus hairs 8–12 mm, exceeding the spikelet; glumes subequal, membranous, 4–6 mm, veins obscure, apex acuminate; lower glume densely pilose with long hairs on margins; upper glume shortly pilose at apex; lower lemma lanceolate, hyaline, ca. 3 mm, 0–1-veined, apex and margins puberulous; upper lemma similar to lower; upper palea a small, veinless, puberulous scale. Anthers 3, 2–2.5 mm. Caryopsis oblong.

Mountain slopes, river banks. Gansu, Hebei, Henan, Shaanxi [Japan, Korea, Russia].

4. Miscanthus floridulus (Labillardière) Warburg ex K. Schumann & Lauterbach, Fl. Schutzgeb. Südsee 166. 1901.

五节芒 wu jie mang

Saccharum floridulum Labillardière, Sert. Austro-Caledon. 13: t. 18. 1824; *Eulalia japonica* Trinius; *Miscanthus japonicus* (Trinius) Andersson.

Plant tufted, robust. Culms erect, 1.5–4 m tall, 6–15 mm in diam., unbranched, nodes usually glabrous, or uppermost sometimes bearded. Leaves cauline, congested; leaf sheaths longer than internodes, overlapping, glabrous, pilose at throat; leaf blades linear, flat, tough, 20–85 × 0.5–4 cm, glabrous, midrib prominent, margins scabrid, base rounded, apex acuminate; ligule 1–3 mm, densely pilose on back. Panicle oblong or elliptic, dense, 20–50 cm; axis 25–45 cm. Racemes numerous, 10–30 cm, appressed or ascending, glabrous, scaberulous; rachis internodes puberulous, nodes glabrous; lower pedicel 1–3.5 mm, upper pedicel 2.5–8 mm. Spikelets 2.5–4(–6) mm, awned; callus hairs 4–6 mm, white, spreading, as long as the spikelet; glumes subequal, membranous, golden brown, 2.5–4(–6) mm, margins pilose near apex, veins obscure, apex acuminate; lower lemma lanceolate, hyaline, 3–3.5 mm, veinless, pilose; upper lemma similar to lower, 2–2.5 mm; awn geniculate, 5–6(–10) mm; upper palea a small hyaline scale. Anthers 3, 1–1.5 mm. Caryopsis oblong, ca. 1.5 mm.

Slopes, valleys, grassy places. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Jiangsu, Sichuan, Taiwan, Yunnan, Zhejiang [SE Asia].

The plants are cultivated for hedges and as ornamentals, the rhizomes are used for medicine, the culms are used for papermaking, and the young leaves are used for forage.

5. Miscanthus sinensis Andersson, Öfvers. Kongl. Vetensk.-Akad. Förh. 12: 166. 1855.

芒 mang

Miscanthus condensatus Hackel; *M. flavidus* Honda; *M. kanehirae* Honda; *M. purpurascens* Andersson; *M. sinensis* subsp. *purpurascens* (Andersson) Tzvelev; *M. sinensis* var. *condensatus* (Hackel) Makino; *M. sinensis* var. *purpurascens* (Andersson) Matsumura; *M. transmorrisonensis* Hayata.

Plant tufted or shortly rhizomatous. Culms (30–)80–200 (–400) cm tall, 3–10 mm in diam., solid, unbranched, nodes glabrous or puberulous. Leaves basal and cauline; leaf sheaths glabrous or pilose; leaf blades linear, flat, 18–75 × 0.3–2(–4) cm, glabrous, glaucous or pilose, midrib prominent, margins scabrid or smooth, base tapering or broad and rounded, apex acuminate; ligule 0.5–4 mm, ciliolate. Panicle (10–)20–36 cm; axis 6–16 cm, subglabrous to pilose or puberulous. Racemes (4–)10–40(–100), (8–)10–30 cm; rachis internodes glabrous, scaberulous or smooth, nodes glabrous; lower pedicel 0.5–1.5 mm, upper pedicel 1.5–4 mm. Spikelets 4–6.5 mm, pilose or glabrous, awned; callus hairs 5–8 mm, exceeding the spikelet;

glumes subequal, membranous, 4–6.5 mm, 5-veined, back glabrous or pilose, puberulous at apex and along upper margins, apex acuminate; lower lemma lanceolate, hyaline, 3.5–4 mm, veinless, apex and margins puberulous, otherwise glabrous; upper lemma similar to lower, 2.5–3.5 mm; awn geniculate, 4–12 mm; upper palea a 1–2 mm scale. Anthers 3, ca. 2.5 mm. Caryopsis ellipsoid, ca. 2 mm.

Mountain slopes, coasts, disturbed places; below 2000 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Hubei, Jiangsu, Jiangxi, Jilin, Shaanxi, Shandong, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea].

This is a widespread species with a broad range of variation. Although the variants may be locally distinct, there are too many intermediates to allow a more detailed taxonomy to be followed. The main variants are as follows: *Miscanthus condensatus*: plants robust, 200–400 cm tall; leaf blades broad, 20–40 mm wide; panicle dense, of up to 100 racemes; Japan (including Ryukyu Islands), especially on coasts; *M. purpurascens*: glumes conspicuously pilose; throughout the range of *M. sinensis*; *M. transmorrisonensis*: panicles of 5–10 racemes; Taiwan.

The name *"Miscanthus jinxianensis* L. Liu" (Fl. Reipubl. Popularis Sin. 10(2): 7. 1997) was not validly published because no Latin description was provided. It probably refers to a slightly large form of *M. sinensis*. The specimen on which it is based has not been seen.

6. Miscanthus nepalensis (Trinius) Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 104. 1889.

尼泊尔芒 ni bo er mang

Eulalia nepalensis Trinius, Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 2: 333. 1833; *Diandranthus nepalensis* (Trinius) L. Liu.

Plant tufted. Culms erect, 20–200 cm tall, 2–7 mm in diam., glabrous or pilose immediately below inflorescence, nodes glabrous. Leaves basal and cauline; leaf sheaths glabrous, striate, pilose at throat; leaf blades linear, flat or folded, 15–60 × 0.3–2.5 cm, glabrous or pilose, margins scabrid, base tapering, straight or rounded, apex acuminate; ligule 1–3 mm, ciliolate, dorsally pilose. Panicle oblong or equidimensional, 8–24 cm; axis 1.5–16 cm, glabrous. Racemes 7–80, flexuous, 8–18 cm; rachis glabrous; lower pedicel 1–2 mm, upper pedicel 2.5–5.5 mm. Spikelets 2–3 mm, golden brown, awned; callus hairs 5–11 mm, much longer than spikelet, pale to golden brown; glumes subequal or upper slightly longer, membranous, 1–5-veined; lower glume glabrous or margins sparsely pilose with 4–6 mm hairs, apex emarginate; upper glume glabrous, margins and apex hyaline, apex acute; lower lemma ovate, hyaline, 1.5–2 mm, veinless; upper lemma lanceolate, hyaline, 1.5–2 mm; awn straight or flexuous, 5–17 mm; upper palea a ca. 1 mm scale. Anthers 2, 1–1.5 mm. Caryopsis ellipsoid, ca. 1.5 mm.

Mountain slopes; 1900–2800 m. Sichuan, Xizang, Yunnan [Bhutan, India, Myanmar, Nepal; introduced in Malaysia].

7. Miscanthus nudipes (Grisebach) Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 109. 1889.

双药芒 shuang yao mang

Erianthus nudipes Grisebach, Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ. 3: 92. 1868; ?*Diandranthus aristatus* L. Liu; *D. brevipilus* (Handel-Mazetti) L. Liu; *D. corymbosus* L. Liu; *D. eulalioides* (Keng) L. Liu; *D. nudipes* (Grisebach) L. Liu; ?*D. ramosus* L. Liu; *D. szechuanensis* (Keng ex S. L. Zhong) L. Liu; *D. taylorii* (Bor) L. Liu; *D. tibeticus* L. Liu; *D. wardii* (Bor) L. Liu; *D. yunnanensis* (A. Camus) L. Liu; *Miscanthus brevipilus* Handel-Mazzetti; *M. eulalioides* Keng; *M. nudipes* subsp. *yunnanensis* A. Camus; *M. szechuanensis* Keng ex S. L. Zhong; *M. taylorii* Bor; *M. wardii* Bor; *M. yunnanensis* (A. Camus) Keng.

Plant tufted. Culms erect, 25–120 cm tall, unbranched, 3–5-noded, nodes glabrous. Leaves basal and cauline; leaf sheaths pilose, glabrescent; leaf blades linear, flat or folded, 10–40 cm × 0.15–0.8 cm, pilose, base straight or rounded, apex tapering to a fine point; ligule 1–1.5 mm, dorsally ciliate. Panicle 10–30 cm; axis 3–20 cm, glabrous or pilose. Racemes 4–20, 5–20 cm; rachis pilose; lower pedicel 0.5–1.5 mm, or lower spikelet subsessile, upper pedicel 1.5–4 mm; pubescent apex. Spikelets 4–6.5 mm, pilose, awned; callus hairs 1–5 mm, purple or white; glumes subequal, membranous, 5–7-veined, pilose, margins hyaline, apex acute to 2-toothed or truncate; lower lemma membranous or hyaline, 3.5–6 mm, 0–1-veined, apex acute or obtuse; upper lemma membranous or hyaline, 2.5–5 mm, 0–1-veined, 2-toothed, the teeth finely acuminate, or apex entire; awn geniculate or flexuous, 6–11 mm; upper palea 2–5 mm. Anthers 2, 2–3.5 mm. Caryopsis fusoid, ca. 2 mm.

Mountain slopes; 1000–3600 m. Guizhou, Sichuan, Xizang, Yunnan [Bhutan, India (Assam, Sikkim), Nepal].

189. IMPERATA Cirillo, Pl. Rar. Neapol. 2: 26. 1792.

白茅属 bai mao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Perennials, strongly rhizomatous. Culms erect, unbranched. Leaf blades mainly basal, linear, flat or rolled; ligule membranous. Inflorescence a terminal, silky-white, spikelike panicle, branches bearing numerous very short racemes; racemes with tough rachis, spikelets of a pair both pedicelled with one pedicel longer than the other, deciduous at maturity within a plumose involucre of hairs; rachis internodes and pedicels persistent, densely silky hairy, tips expanded. Spikelets small, delicate, ± terete, enveloped in hairs; callus very small, pilose with long hairs usually exceeding the spikelet; glumes subqual, lanceolate, membranous or lower glume herbaceous, back long-pilose; lower floret reduced to an empty hyaline veinless lemma, shorter than spikelet; upper lemma similar to lower, apex obtuse, denticulate, ciliate, awnless; palea short, broad. Lodicules absent. Stamens 1 or 2. $x = 10$.

About ten species: throughout the tropics, extending to warm-temperate regions; three species (one endemic) in China.

Imperata conferta (Presl) Ohwi has been reported in the literature from Taiwan, but its presence has not been confirmed. It is native to Indochina, Indonesia, and the Philippines. Distinguishing characters are given in the key below.

1a. Callus hairs equal to or slightly shorter than spikelet; stigmas yellowish brown ..... 3. *I. flavida*
1b. Callus hairs 3 times longer than spikelet; stigmas purplish black.
2a. Panicle narrowly conical, loose, branches spreading; stamen 1 ..... *I. conferta* (see note above)
2b. Panicle cylindrical, dense, branches appressed; stamens 2.
3a. Culms up to 1.2 m tall; leaf blades 0.2–2 cm wide; panicle 6–20 cm ..... 1. *I. cylindrica*
3b. Culms up to 2.8 m tall; leaf blades 1.2–2.8 cm wide; panicle 40–50 cm ..... 2. *I. latifolia*

1. Imperata cylindrica (Linnaeus) Raeuschel, Nomencl. Bot., ed. 3, 3: 10. 1797.

白茅 bai mao

Perennial, basal sheaths becoming fibrous; rhizomes widely spreading, tough, scaly. Culms solitary or tufted, 25–120 cm tall, 1.5–3 mm in diam., 1–4-noded, nodes glabrous or bearded. Leaf sheaths glabrous or pilose at margin and mouth; leaf blades flat or rolled, stiffly erect, 20–100 × 0.8–2 cm, culm blades 1–3 cm, adaxial surface puberulous, margins scabrid, base straight or narrowed, apex long acuminate; ligule 1–2 mm. Panicle cylindrical, copiously hairy, 6–20 cm, lowermost branches sometimes loose. Spikelets 2.5–6 mm; callus with 12–16 mm silky hairs; glumes 5–9-veined, back with long silky hairs ca. 3 times glume length, apex slightly obtuse or acuminate; lower lemma ovate-lanceolate, 2/3 length of glumes, ciliate, acute or denticulate; upper lemma ovate, 1/2 length of glumes, denticulate, ciliate, palea equal to lemma. Anthers 2, 2–4 mm. Stigmas purplish black. Fl. and fr. Apr–Aug. 2*n* = 20.

River and seashore sands, disturbed grassy places, cultivations. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan, Zhejiang [Afghanistan, Bhutan, India, Indonesia, Japan, Kazakhstan, Korea, Kyrgyzstan, Malaysia, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Russia, Sri Lanka, Thailand, Turkmenistan, Uzbekistan, Vietnam; Africa, SW Asia, Australia, S Europe].

This species is extremely polymorphic, but nevertheless easily recognizable by its dense, narrowly cylindrical, silky white inflorescence. The blackish stigmas are persistent and very obvious among the white hairs. The species has been classified into three varieties, which show some geographic separation. Two occur in China and a third is found in Africa. However, there is a great deal of intergradation and also variation within the varieties.

This widespread, noxious weed of disturbed ground and cultivation spreads vigorously by its rhizomes, which are almost impossible to eradicate, and may cover large areas of ground. It flourishes in grasslands that are frequently burned, and the young shoots provide good fodder. It is also used for medicine and fiber.

1a. Leaf blades rolled; spikelets 4.5–6 mm; anthers 3–4 mm ..... 1a. var. *cylindrica*
1b. Leaf blades flat; spikelets 2.5–4(–4.5) mm; anthers 2–3 mm ..... 1b. var. *major*

1a. Imperata cylindrica var. **cylindrica**

白茅(原变种) bai mao (yuan bian zhong)

Lagurus cylindricus Linnaeus, Syst. Nat., ed. 2, 2: 878. 1759; *Imperata arundinacea* Cirillo; *I. arundinacea* var. *europaea* Andersson; *I. cylindrica* var. *europaea* (Andersson) Ascherson & Graebner; *Saccharum cylindricum* (Linnaeus) Lamarck.

Culm nodes usually glabrous. Leaf blades rolled, apex hard, spiny. Panicle very dense. Spikelets 4.5–6 mm; anthers 3–4 mm.

River and seashore sands, dry grassy places on lower mountain slopes. Xizang [Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Turkmenistan, Uzbekistan; N Africa, SW Asia, S Europe].

This variety has been reported in the literature from Xizang, but no specimens have been seen.

1b. Imperata cylindrica var. **major** (Nees) C. E. Hubbard in C. E. Hubbard & R. E. Vaughan, Grasses Mauritius Rodriguez, 96. 1940.

大白茅 da bai mao

Imperata koenigii var. *major* Nees, Fl. Afr. Austral. Ill. 90.1841; *Imperata arundinacea* var. *koenigii* (Retzius) Bentham; *I. cylindrica* subsp. *koenigii* (Retizus) Tzvelev; *I. cylindrica* var. *koenigii* (Retzius) Pilger; *I. koenigii* (Retzius) P. Beauvois; *Saccharum koenigii* Retzius.

Culm nodes often bearded, sometimes sparsely or occasionally glabrous. Leaf blades flat. Panicle slightly loose below. Spikelets 2.5–4(–4.5) mm; anthers 2–3 mm.

Open grassy places, cultivations. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan, Zhejiang [Afghanistan, India, Indonesia, Japan, Korea, Malaysia, Myanmar, New Guinea, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam; SW Asia (Iran), Australia].

2. Imperata latifolia (J. D. Hooker) L. Liu, Vasc. Pl. Hengduan Mts. 2: 2299. 1994.

宽叶白茅 kuan ye bai mao

Imperata arundinacea var. *latifolia* J. D. Hooker, Fl. Brit. India 7: 106. 1896 [“1897”]; *I. cylindrica* var. *latifolia* (J. D. Hooker) C. E. Hubbard.

Perennial, basal sheaths becoming fibrous; rhizomes widely spreading. Culms up to 2.8 m tall, 6–10 mm in diam., 3–8-noded, nodes glabrous. Leaf sheaths usually longer than internodes, crowded below, glabrous, bearded at mouth; leaf blades flat, up to 120 × 1.2–2.8 cm, adaxial surface with yellowish long soft hairs at base, otherwise glabrous, margins scabrid, base narrowed to midrib, apex long acuminate; ligule ca. 2 mm. Panicle cylindrical, copiously hairy with slight pinkish tinge, 40–50 cm. Spikelets 3–4.5 mm; callus with ca. 12 mm silky

hairs; lower glume 5–7-veined, back pilose below middle with long silky hairs ca. 3 times glume length, apex ciliate; upper glume 3-veined in lower part, scabrid, margin ciliate; lower lemma ca. 2.5 mm, margin ciliate; upper lemma resembling lower, palea broadly ovate, subequal to lemma. Anthers 2, 2–2.5 mm. Stigmas red. Fl. and fr. summer to autumn.

Swampy grasslands; ca. 800 m. SW Sichuan [N India].

3. Imperata flavida Keng ex S. M. Phillips & S. L. Chen, Novon 15: 469. 2005.

黄穗白茅 huang sui bai mao

Perennial, basal sheaths becoming fibrous; rhizomes spreading, internodes very short. Culms solitary or tufted, 70–125 cm tall, 3–7 mm in diam., 3- or more-noded, nodes glabrous. Leaf sheaths longer than internodes, crowded below, glabrous except for silky hairs at mouth; leaf blades flat, 20–60 × 0.5–1 cm, culm blades 1–7 cm, glabrous or adaxial surface puberulous, margins smooth, base narrowed to midrib, apex long acuminate; ligule 0.5–1 mm. Panicle cylindrical, silky hairy, 12–17 cm, branches short, erect or ascending, discrete below. Spikelets 3–4 mm; callus hairs ca. 4 mm, equal to spikelet; glumes 4–5(–7)-veined, back pilose in lower 1/3 with silky hairs about as long as spikelet, upper margins ciliate, apex obtuse or erose; lower lemma broadly oblong, ca. 1/2 length of glumes, ciliate, irregularly denticulate; upper lemma oblong, 1/3 length of glumes, 2–3-denticulate, ciliate, palea similar to lemma. Anthers 2, 2.5–2.8 mm. Stigmas yellowish brown. Fl. and fr. summer to autumn.

● Mixed forests, along rivers, valleys. Hainan.

This species, which appears to be confined to Hainan, can be readily distinguished from the more common *Imperata cylindrica* by its much shorter spikelet hairs and yellow-brown (vs. purple-black) stigmas.

190. EULALIA Kunth, Révis. Gramin. 1: 160. 1829.

黄金茅属 huang jin mao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Perennial, rarely annual. Culms tufted, usually erect and unbranched. Leaf blades linear to narrowly lanceolate; ligule short, membranous, margin ciliolate. Inflorescence terminal, composed of several to many racemes inserted digitately or along a short axis; racemes elongate with many spikelet pairs, hairy, fragile, sessile and pedicelled spikelets of a pair similar, pedicelled often slightly narrower, both fertile; rachis internodes linear, ciliate along angles; pedicels resembling internodes, usually slightly shorter and more slender. Spikelets lanceolate to narrowly oblong, dorsally compressed; callus short, bearded, hairs usually less than 1/2 spikelet length; glumes cartilaginous to leathery; lower glume flat or slightly concave, hairy, back veinless or inconspicuously veined, flanks rounded in lower half, keeled toward apex, acute to truncate; upper glume boat-shaped, 1-keeled down midline; lower floret reduced to an empty hyaline lemma, rarely absent; upper lemma linear to oblong, occasionally broader, shortly 2-toothed or 2-lobed to middle, awned (*E. manipurensis* awnless); awn geniculate, sometimes weakly; palea small or absent. Stamens 3. $x = 9, 10$.

About 30 species: tropical and subtropical regions of the Old World; 14 species (five endemic) in China.

1a. Basal leaf sheaths covered in dense woolly hairs.
  2a. Basal leaf sheath hairs creamy or golden brown.
    3a. Sessile spikelets 6–6.5 mm; raceme hairs pinkish ..... 1. *E. siamensis*
    3b. Sessile spikelets 4.6–5.7 mm; raceme hairs yellowish ..... 2. *E. speciosa*
  2b. Basal leaf sheath hairs dark brown or reddish brown.
    4a. Culms robust, 2–5 mm in diam.; leaf blades 25–50 cm ..... 2. *E. speciosa*
    4b. Culms slender, 1–1.7 mm in diam.; leaf blades 15–30 cm.
      5a. Culms 6–9-noded; spikelets 3–3.5 mm; lower glume pilose with whitish brown hairs, apex truncate ..... 3. *E. micranthera*
      5b. Culms 2–3-noded; spikelets 3.5–5 mm; lower glume densely villous with golden brown hairs, apex subacute ..... 4. *E. phaeothrix*
1b. Basal leaf sheaths glabrous, or appressed hairy between veins.
  6a. Sessile spikelet 5–7 mm; lower glume 2-veined between lateral keels, veins connected below apex.
    7a. Leaf blades 8–16 mm wide, apex acute ..... 1. *E. siamensis*
    7b. Leaf blades 4–6(–8) mm wide, apex acuminate-filiform ..... 5. *E. quadrinervis*
  6b. Sessile spikelet 3–5 mm; lower glume usually not or only obscurely veined between lateral keels.
    8a. Spikelets awnless ..... 6. *E. manipurensis*
    8b. Spikelets awned.
      9a. Plant with slender spreading stolons; raceme hairs brown; lower lemma absent ..... 7. *E. leschenaultiana*
      9b. Plant tufted or rhizomatous; raceme hairs white or purplish (spikelets often brown); lower lemma present.
        10a. Leaf blades conspicuously pruinose on abaxial surface, lanceolate or linear-lanceolate, 5–10 mm wide.
          11a. Leaf blades 3–8 cm, glabrous; upper lemma 2-lobed to middle ..... 8. *E. brevifolia*
          11b. Leaf blades 10–20 cm, tomentose; upper lemma very shortly 2-toothed ..... 9. *E. pruinosa*

10b. Leaf blades green or reddish, linear, 2–6 mm wide.
12a. Racemes with long silky hairs concealing the spikelets; plant with slender spreading rhizomes ..... 10. *E. mollis*
12b. Racemes with shorter hairs, spikelets obvious; plant without long rhizomes.
13a. Leaf blades inrolled, tough; upper glume with 2–2.5 mm awn ..... 11. *E. pallens*
13b. Leaf blades flat, herbaceous; upper glume not awned.
14a. Inflorescence with ca. 5 cm axis; upper lemma very shortly 2-toothed ..... 12. *E. splendens*
14b. Inflorescence digitate or axis less than 5 cm; upper lemma deeply 2-toothed.
15a. Culm glabrous below inflorescence; raceme hairs silvery white; upper lemma 2-toothed to middle ..... 13. *E. trispicata*
15b. Culm densely pilose below inflorescence; raceme hairs faintly mauve tinged; upper lemma 2-toothed in upper 1/4 ..... 14. *E. yunnanensis*

1. Eulalia siamensis Bor, Kew Bull. 1954: 499. 1954.

二色金茅 er se jin mao

Perennial; basal sheaths woolly with creamy brown or golden hairs, or appressed pilose. Culms tufted, robust, up to 2.5 m tall, 3–4 mm in diam., pilose below inflorescence, nodes glabrous or bearded. Leaf sheaths glabrous or pilose; leaf blades linear, tough, 60–100 × 0.5–1 cm, abaxial surface pinkish gray, subglabrous to villous or sericeous, adaxial surface green, villous throughout or just above ligule, margins scabrid, base narrowed, apex finely acuminate; ligule ca. 2 mm. Racemes 4–7, subdigitate, drooping, 15–21 cm, hairs silvery or pale mauve; rachis internodes and pedicels ca. 2/3 spikelet length, ciliate. Sessile spikelet 6–6.5 mm, brown; callus hairs 2/5 spikelet length; lower glume lanceolate-oblong, back flat, villous in lower 2/3, 2 anastomosing veins between keels below apex, margins long-ciliate in upper 1/3, narrowed to emarginate apex; upper lemma narrow, puberulous on back, shortly 2-toothed; awn 2.5–3.5 cm. Anthers 3.7–4.5 mm. Fl. and fr. autumn.

Dry grassy slopes, open woodlands; 500–1500 m. SW Yunnan [Myanmar, N Thailand].

This is a large, handsome species of apparently restricted distribution.

1a. Basal sheaths woolly with cream or golden hairs ..... 1a. var. *siamensis*
1b. Basal sheaths appressed pilose with white hairs ..... 1b. var. *latifolia*

1a. Eulalia siamensis var. **siamensis**

二色金茅(原变种) er se jin mao (yuan bian zhong)

Basal sheaths woolly with cream or golden hairs; leaf blades subglabrous to villous. Upper lemma 2-toothed in upper 1/5 or less.

Open woodlands. ?SW Yunnan [Myanmar, Thailand].

This variety is reported from SW Yunnan, but its presence in China has not been confirmed.

1b. Eulalia siamensis var. **latifolia** (Rendle) S. M. Phillips & S. L. Chen, **comb. nov.**

宽叶金茅 kuan ye jin mao

Basionym: *Pollinia quadrinervis* Hackel var. *latifolia* Rendle, J. Linn. Soc., Bot. 36: 357. 1904; *Eulalia wightii* (J. D. Hooker) Bor var. *latifolia* (Rendle) B. S. Sun & S. Wang.

Basal sheaths appressed pilose between veins with white silky hairs; leaf blades glabrous or abaxial surface appressed-sericeous. Upper lemma 2-toothed in upper 1/3.

Dry grassy slopes; 1800 m. Yunnan [N Thailand].

2. Eulalia speciosa (Debeaux) Kuntze, Revis. Gen. Pl. 2: 775. 1891.

金茅 jin mao

Erianthus speciosus Debeaux, Actes Soc. Linn. Bordeaux 32: 53. 1878; *Eulalia birmanica* (J. D. Hooker) A. Camus; *E. velutina* (Hackel) O. Kuntze; *Pollinia birmanica* J. D. Hooker; *P. phaeothrix* Hackel var. *aurea* A. Camus; *P. speciosa* (Debeaux) Hackel; *P. velutina* Hackel; *Pseudopogonatherum speciosum* (Debeaux) Ohwi.

Perennial, base swollen; basal sheaths woolly with golden brown hairs, becoming fibrous. Culms 0.7–2 m tall, 2–5 mm in diam., white-villous below inflorescence, nodes farinose, sometimes pilose. Leaf sheaths glabrous or pilose; leaf blades linear, 25–50 × 0.4–0.7 cm, adaxial surface farinose, white-pilose at base, otherwise glabrous, apex finely acuminate; ligule ca. 1 mm. Racemes 4–7(–13) on a 3–4 cm axis, 10–25 cm, hairs whitish, pale yellowish or golden brown; rachis internodes and pedicels 2/3 as long to subequaling spikelet, ciliate. Sessile spikelet 4.6–5.7 mm, dark brown; callus hairs 1/6–1/3 spikelet length; lower glume narrowly lanceolate-oblong, back concave, villous below middle, hairs evenly spread or concentrated at flanks, veinless between keels, upper keels stiffly ciliate, apex subobtuse; upper lemma narrow, margins pilose, 2-toothed in upper 1/3; awn 1.5–2 cm. Anthers ca. 3.5 mm. Fl. and fr. Aug–Nov.

Grassy hillsides. Anhui, Fujian, Guangdong, Guizhou, Hainan, Henan, Hubei, Jiangxi, Shaanxi, Shandong, Sichuan, Taiwan, Yunnan, Zhejiang [Cambodia, NE India, Japan, Korea, Malaysia, Myanmar, Philippines, Thailand, Vietnam].

This species is usually easy to recognize due to its swollen base clothed in golden brown, velvety sheaths, which split into fine fibers with age. Occasionally specimens occur with dark reddish brown or pallid basal hairs. These are simply color variants, and more than one color may even occur on the same specimen.

A particularly vigorous form from Yunnan, N Myanmar, and N Thailand has been separated as *Eulalia birmanica*. This has long, straight rachis internodes subequaling the spikelet. The type has dark brown basal sheath hairs, but other specimens with long rachis inter-

nodes have golden sheath hairs. It simply represents a rather extreme form of this variable species and intergrades with more typical forms.

3. Eulalia micranthera Keng & S. L. Chen, Fl. Hainan. 4: 539. 1977.

微药金茅 wei yao jin mao

Perennial; basal sheaths woolly with reddish brown hairs. Culms slender, 0.8–1 m tall, ca. 1.7 mm in diam., 6–9-noded, villous below inflorescence with whitish yellow hairs, brown-tomentose around lower nodes, upper nodes glabrous. Leaf sheaths glabrous or thinly pilose above nodes; leaf blades linear, 15–27 × 0.3–0.4 cm, glabrous or abaxial surface thinly pilose, apex long acuminate; ligule ca. 1 mm. Racemes 4–5, digitate, 10–12 cm, hairs whitish at first, becoming pale yellowish brown; rachis internodes and pedicels 3/4 spikelet length, ciliate. Sessile spikelet 3–3.5 mm, brown with pallid tips; callus hairs ca. 1/5 spikelet length; lower glume narrowly oblong, back concave, veinless between keels, pilose with spreading hairs increasing to 2 mm above middle, apex emarginate-truncate or bimucronulate; upper lemma narrow, 2-toothed in upper 1/3; awn 1.5–2 cm. Anthers 2.3–2.4 mm. Fl. and fr. autumn–winter.

● Along streams. Hainan.

This is a more slender species than *Eulalia speciosa*, with the same basal sheath hair color as *E. phaeothrix*. However, it lacks the tussocky habit of *E. phaeothrix* and has smaller spikelets of differing shape and hairiness.

4. Eulalia phaeothrix (Hackel) Kuntze, Revis. Gen. Pl. 2: 775. 1891.

棕茅 zong mao

Pollinia phaeothrix Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 168. 1889.

Perennial, forming dense tussocks; basal sheaths woolly with dark reddish brown hairs, finally fibrous. Culms slender, 0.3–0.8(–1) m tall, 1–1.5 mm in diam., 2- or 3-noded, white-villous below inflorescence, nodes sometimes farinose and bearded below. Leaf sheaths pilose or glabrescent; leaf blades narrowly linear, 15–30 × 0.1–0.4 cm, glabrous or pilose, apex acute; ligule 0.5–1 mm. Racemes (1–)2–6(–8), digitate, 4–11(–15) cm, hairs golden brown; rachis internodes and pedicels 1/2–2/3 spikelet length, densely ciliate. Sessile spikelet 3.5–5.5 mm, dark brown; callus hairs 1/8 spikelet length; lower glume oblong-lanceolate, back flat or slightly concave, lower 2/3 villous, hairs uniform or concentrated toward margins, veinless between keels, apex pallid, ciliate, subacute; upper lemma narrow, 2-lobed to about middle; awn 1–2 cm. Anthers 2.5–3 mm. Fl. and fr. Aug–Nov.

Grassy hillsides. Hainan, Sichuan, Yunnan [S India, Sri Lanka, Thailand, Vietnam].

This species is common in the hills of S India and Sri Lanka, where it forms dense tussocks of narrow leaves with velvety, dark reddish brown basal sheaths. The culms are wiry, and bear brown, densely golden-villous racemes.

5. Eulalia quadrinervis (Hackel) Kuntze, Revis. Gen. Pl. 2: 775. 1891.

四脉金茅 si mai jin mao

Pollinia quadrinervis Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 158. 1889; *Eulalia quadrinervis* var. *latigluma* B. S. Sun & S. Wang; *P. villosa* var. *chefuensis* Franchet; *Pseudopogonatherum quadrinerve* (Hackel) Ohwi.

Perennial, tufted from a short scaly rhizome; basal sheaths glabrous, rarely thinly appressed pilose between veins. Culms 0.6–1.2 m tall, 2–4 mm in diam., pilose below inflorescence, nodes glabrous. Leaf sheaths densely villous to hirsute with tubercle-based hairs, or subglabrous; leaf blades linear, 10–40 × 0.4–0.6 cm, glabrous to tuberculate-villous, abaxial surface glaucous, apex acuminate-filiform; ligule 1–1.5 mm. Racemes 2–7, subdigitate, 10–18 cm, hairs white or pale mauve; rachis internodes and pedicels 1/2–2/3 spikelet length, silky villous. Sessile spikelet 5–6.5 mm, golden brown; callus hairs 1/3 spikelet length, white; lower glume narrowly elliptic, back slightly concave and villous below middle, flat and glabrous above, 2–4 green veins between keels, connected by veinlets below apex and between lateral veins, upper keels shortly pectinate-ciliate, apex membranous, subacute; upper lemma ovate-oblong, 2-lobed in upper 1/3; awn 1.2–2 cm. Anthers 2.7–3.4 mm. Fl. and fr. Sep–Nov.

Dry mountain slopes, grassy places. Anhui, Fujian, Guangdong, Henan, Sichuan, Taiwan, Yunnan, Zhejiang [Bhutan, N India, Japan, Korea, Myanmar, Nepal, Philippines, Thailand, Vietnam].

Eulalia quadrinervis is very close to *E. villosa* (Sprengel) Nees (*E. wightii* (J. D. Hooker) Bor). The latter species is distributed from Africa to S India and differs in its acute leaf blades and leathery, broader lower glume, which is concave down the whole midline and usually hairy only on the flanks. A few specimens from Yunnan with acute leaf blades are better placed in *E. quadrinervis*.

6. Eulalia manipurensis Bor, Grasses Burma, Ceylon, India, Pakistan, 156. 1960.

无芒金茅 wu mang jin mao

Eulalia mutica B. S. Sun & M. Y. Wang.

Perennial, tufted; basal sheaths glabrous. Culms (0.35–)0.75–1 m tall, 2–4 mm in diam., glabrous at nodes and below inflorescence, nodes blackish. Leaf sheaths glabrous or margin ciliate; leaf blades linear, (13–)45–60 × 0.2–0.6 cm, abaxial surface glabrous, adaxial surface hispid with tubercle-based hairs, margins scabrid, apex finely acuminate; ligule ca. 0.5 mm, margin ciliate. Racemes 5–20 or more, subdigitate on an axis to 3 cm, 8–16 cm, hairs white; rachis internodes and pedicels ca. 2/3 spikelet length, densely woolly-ciliate. Spikelets 2.8–3.5 mm, chestnut brown, glossy; callus hairs short, ca. 0.5 mm; lower glume narrowly elliptic-oblong, cartilaginous, back flat, flanks villous in lower 2/3, upper keels stiffly ciliate, veinless between keels, apex acute; upper lemma oblong, apex truncate-denticulate, awnless. Anthers 1.8–2 mm. Fl. and fr. Jul–Nov.

Mountain slopes, wet grasslands; ca. 1600 m. W Yunnan (Tengchong) [Bangladesh, N Myanmar].

7. Eulalia leschenaultiana (Decaisne) Ohwi, Bull. Tokyo Sci. Mus. 18: 2. 1947.

龚氏金茅 gong shi jin mao

Andropogon leschenaultianus Decaisne, Nouv. Ann. Mus. Hist. Nat. 3: 357. 1834; *A. aureofulvus* Steudel; *Eulalia cumingii* (Nees) A. Camus; *Pollinia cumingii* Nees.

Perennial, forming tufts on long trailing stolons; basal sheaths glabrous. Culms very slender, 0.3–0.7 m tall, ca. 1 mm in diam., usually pilose below inflorescence, lower nodes bearded. Leaf sheaths ciliate along margin, bearded at mouth; leaf blades linear-lanceolate, 4–10 × 0.2–0.4 cm, glabrous or thinly hispid with tubercle-based hairs, apex acute; ligule ca. 0.5 mm, ciliolate. Racemes 1–3, solitary or digitate, 3–8 cm, hairs golden brown; rachis internodes and pedicels ca. 2/3 spikelet length, ciliate. Sessile spikelet 3–4 mm, golden brown; callus hairs 1/4 spikelet length; lower glume narrowly oblong, ± leathery, back flat, densely villous except below apex, obscurely 1–2-veined between keels, connected by veinlets below apex, apex broadly truncate, densely ciliolate; lower lemma absent; upper lemma oblanceolate, 2-toothed in upper 1/4, teeth ciliate; awn 8–15 mm, column pubescent. Anthers 1.7–2 mm. Fl. and fr. autumn.

Dry exposed hillsides. Fujian, Guangdong, Jiangxi, Taiwan [Indonesia, Malaysia, Philippines, Thailand, Vietnam].

This species is unusual in lacking a lower lemma. The purple stigmas are exserted at the apex of the spikelet, rather than laterally which is more usual, and are an obvious feature of the racemes.

A variant occurs in N India and Nepal with smaller spikelets (2.5–3 mm) and slightly swollen culm bases with white-hairy basal sheaths. This has been described as *Pollinia cumingii* Nees var. *parviflora* Hackel. It may occur in adjacent parts of China.

8. Eulalia brevifolia Keng ex P. C. Keng, Acta Bot. Yunnan. 4: 351. 1982.

短叶金茅 duan ye jin mao

Perennial, rhizomatous; rhizome short, branching, densely clothed in scale leaves. Culms with scales at base, 0.5–0.7 m tall, branched above base, glabrous. Leaf sheaths glabrous, lower longer but upper shorter than internodes; leaf blades lanceolate, reddish when dry, 3–8 × 0.5–0.7 cm, glabrous, abaxial surface pruinose, base subcordate, apex acute; ligule ca. 0.5 mm. Racemes 5, digitate, 3–4 cm, hairs whitish; rachis internodes (2–)3–4(–6) mm, densely ciliate. Sessile spikelet 4–4.5 mm, pinkish brown; callus hairs 1/3 spikelet length; lower glume oblong-lanceolate, back almost flat, villous below middle, finely 1-veined between keels, apex obtuse; upper lemma 2-lobed to below middle; awn ca. 6 mm, slightly twisted. Anthers ca. 2.5 mm. Fl. and fr. May–Dec.

● Dry mountain slopes; 1700–2600 m. Yunnan.

9. Eulalia pruinosa B. S. Sun & M. Y. Wang, J. Yunnan Univ. 21: 94. 1999.

粉背金茅 fen bei jin mao

Perennial; basal sheaths closely imbricate, appressed hispid between veins. Culms up to 1.8 m tall, ca. 3 mm in diam., glabrous, lower nodes waxy. Leaf sheaths firm, smooth, glabrous, lower longer but upper shorter than internodes, stiffly bearded at mouth; leaf blades linear-lanceolate, 10–20 × 0.8–1 cm, tomentose on both surfaces, abaxial surface glaucous, base rounded, apex acute; ligule ca. 1 mm. Racemes 5–7, digitate, 11–17 cm, hairs dirty white tinged purplish; rachis internodes and pedicels 3/4 spikelet length, ciliate. Sessile spikelet ca. 4.5 mm, purplish; callus hairs 1/3 spikelet length; lower glume narrowly elliptic-oblong, papery, back concave and villous below middle, flanks ciliate at upper 1/3, 2-veined between keels, connected by veinlets below apex, upper keels scabrid, apex narrowly truncate-emarginate; upper lemma narrowly ovate, very shortly 2-toothed; awn 0.9–1.3 cm, column glabrous. Anthers not seen. Fr. Oct.

● Mountain slopes, roadside banks; 1900–2700 m. Yunnan.

10. Eulalia mollis (Grisebach) Kuntze, Revis. Gen. Pl. 2: 775. 1891.

银丝金茅 yin si jin mao

Erianthus mollis Grisebach, Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ. 3: 92. 1868; *Pollinia mollis* (Grisebach) Hackel.

Perennial, loosely tufted, with slender spreading rhizomes. Culms ascending or decumbent, 0.25–0.5 m tall, 1–2 mm in diam., villous below inflorescence, nodes glabrous. Leaf sheaths glabrous with ciliate margin or pilose, bearded at mouth; leaf blades linear, 3–8 × 0.2–0.5 cm, glabrous or hispid with tubercle-based hairs, margins thickened, smooth, apex acuminate; ligule a ciliate rim. Racemes 3–7, digitate, 4–7 cm, hairs silvery white or pinkish; rachis internodes and pedicels 2/3 spikelet length, densely hairy with long silky hairs exceeding and obscuring spikelets. Spikelets 4–5 mm, dark brown, pallid near apex, keels green; callus hairs 1/2 spikelet length; lower glume lanceolate, back flat, densely hairy with silky hairs ca. 1.5 times spikelet length or more, veinless between keels, apex obscurely emarginate or 2-mucronate; upper lemma narrowly oblong, shortly 2-toothed; awn 0.8–1.5 cm, fine, almost straight. Anthers ca. 2 mm.

Dry grassy mountainsides; ca. 2000 m. Xizang [Bhutan, N India, Nepal].

This is a relatively small, Himalayan species.

11. Eulalia pallens (Hackel) Kuntze, Revis. Gen. Pl. 2: 775. 1891.

白健秆 bai jian gan

Pollinia pallens Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 156. 1889.

Perennial, densely tufted from a short rhizome; basal sheaths glabrous. Culms hard, 0.4–1 m tall, 1.5–2.5 mm in diam., glabrous. Leaf sheaths glabrous, lower longer and upper shorter than internodes; leaf blades tough, narrow, involute, pale green, lower 25–40 × 0.2–0.3 cm (when flattened), abaxial surface smooth, glabrous, adaxial surface strongly ribbed, hirsute, margin scabrid; ligule very short, densely ciliolate. Racemes 3–11, subdigitate, 6–13 cm, hairs white; rachis internodes and pedicels 1/2–3/4 spikelet length, ciliate. Sessile spikelet 3.5–4.5 mm, pallid; callus hairs 1/8 spikelet length; lower glume oblong-lanceolate, membranous, back slightly concave, villous except near apex, veinless between keels, upper keels smooth or pectinate-scabrid, apex narrowly trun-

cate or 2-toothed; upper glume apex with 2–2.5 mm awn; upper lemma narrow, 2-toothed in upper 1/4; awn ca. 1 cm, column ciliolate. Anthers purplish black, 1.8–2 mm. Fl. and fr. Oct–Nov.

Grassy places. NW Guangxi, S and W Guizhou, Yunnan [NE India].

This is a distinctive species, clearly differing from others in China by its tough, inrolled leaf blades and awned upper glume. The blackish anthers are striking among the white raceme hairs.

12. Eulalia splendens Keng & S. L. Chen, Bull. Bot. Res., Harbin 12: 315. 1992.

红健秆 hong jian gan

Perennial; basal sheaths glabrous. Culms ca. 1 m tall, ca. 4 mm in diam., pilose below inflorescence. Leaf sheaths longer than internodes, usually glabrous; leaf blades linear, hard, 15–30 × 0.3–0.4 cm, but uppermost less than 1 cm and basal longer than 40 cm, abaxial surface glabrous, adaxial surface pilose, margins scabrid; ligule ca. 0.5 mm. Inflorescence composed of 7–9 racemes on a ca. 5 cm axis, hairs white; rachis internodes and pedicels 2–3 mm, villous. Sessile spikelet ca. 4 mm, yellowish brown; callus hairs ca. 1 mm; lower glume oblong-lanceolate, membranous, lower back slightly concave, with ca. 4 mm soft hairs below middle, veinless between keels, margins ciliate, apex subhyaline, acute; upper lemma elliptic, very shortly 2-toothed; awn 5–8 mm, weakly geniculate. Anthers ca. 2 mm. Fl. and fr. autumn.

● Mountain slopes; ca. 800 m. Guangxi, Guizhou, Yunnan (Jinghong).

This species is very close to *Eulalia fastigiata* (Nees ex Steudel) Stapf ex Bor from Bhutan, NE India, and Nepal, but differs in the racemes being inserted singly or in pairs, rather than in whorls. These two species, and the related *Saccharum formosanum*, lie on the boundary between *Saccharum* and *Eulalia*. The presence of a central inflorescence axis, thin glumes, scarcely toothed upper lemma, and weak awn are all characters more typical of *Saccharum*.

13. Eulalia trispicata (Schultes) Henrard, Blumea 3: 453. 1940.

三穗金茅 san sui jin mao

Andropogon trispicatus Schultes, Mant. 2: 452. 1824; *Eulalia argentea* Brongniart; *E. tristachya* (Steudel) Kuntze; *Pollinia tristachya* (Steudel) Thwaites; *Pseudopogonatherum trispicatum* (Schultes) Ohwi; *Saccharum tristachyum* Steudel.

Perennial, tussocky; basal sheaths glabrous. Culms slender, 0.3–1.2 m tall, ca. 2 mm in diam., nodes glabrous, glabrous or infrequently thinly pilose below inflorescence. Leaf sheaths usually glabrous or upper margin pilose; leaf blades linear, 10–40 × 0.2–0.6 cm, abaxial surface glabrous, adaxial surface pilose especially at base, apex finely acuminate; ligule very short, ca. 0.5 mm, margin ciliate. Racemes 3–16, subdigitate or inserted on a short axis to 1.5 cm, 4–15 cm, hairs silvery white; rachis internodes and pedicels ca. 1/2 spikelet length, densely ciliate, hairs longer at apex. Sessile spikelet 2.5–4.5 mm, chestnut brown or purplish; callus hairs short, ca. 0.5 mm; lower glume narrowly oblong-lanceolate, papery, back flat, lower flanks villous, upper keels ciliate, veinless between keels, apex narrowly truncate, entire or bimucronate; upper lemma linear, 2-toothed to about middle; awn 0.7–2 cm. Anthers 2–2.8 mm. Fl. and fr. autumn. $2n = 20$.

Grassy mountainsides. Yunnan [Bangladesh, Bhutan, Cambodia, India, Indonesia, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; Australia].

This slender, small-spiculate species is widespread in tropical Asia and is to be expected elsewhere in S China.

14. Eulalia yunnanensis Keng & S. L. Chen, Bull. Bot. Res., Harbin 12: 316. 1992.

云南金茅 yun nan jin mao

Perennial; basal sheaths glabrous, finally fibrous. Culms slender, ca. 0.6 m tall, ca. 2 mm in diam., nodes glabrous, densely pilose below inflorescence. Leaf sheaths softly ciliate along margins, otherwise glabrous; leaf blades linear, 4–15 × 0.2–0.4 cm, apical blades much reduced, abaxial surface glabrous, adaxial surface villous at base, apex acuminate; ligule rounded, ca. 2 mm. Racemes 5–7, digitate, 8–10 cm, hairs silvery white with faint mauve tinge; rachis internodes ca. 3 mm, 3/4 spikelet length, densely ciliate, pedicel similar but shorter. Sessile spikelet ca. 4 mm, chestnut brown; callus with short soft hairs; lower glume narrowly oblong-lanceolate, papery, back flat, villous below middle, upper keels greenish, scabrid, veinless between keels, apex narrowly truncate, subentire or emarginate; upper lemma narrow, 2-toothed in upper 1/4; awn 1.3–1.5 cm. Anthers ca. 2 mm. Fl. and fr. autumn.

● Mountain slopes, grassy places; 1400–2200 m. Yunnan.

This species is very close to, and probably no more than an extreme local variant of, *Eulalia trispicata*.

191. PSEUDOPOGONATHERUM A. Camus, Ann. Soc. Linn. Lyon, n.s., 68: 204. 1921.

假金发草属 jia jin fa cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Eulalia sect. *Pseudopogonatherum* (A. Camus) Pilger; *Puliculum* Stapf ex Haines.

Annual. Culms solitary or tufted, slender, glabrous. Leaf blades narrowly linear, often inrolled; ligule a narrow membranous rim, margin densely ciliate. Inflorescence terminal, composed of several to many subdigitate racemes in a dense brushlike cluster; racemes tough or fragile, spikelets of a pair similar, usually both pedicelled on unequal pedicels (one sessile and the other pedicelled in *P. koretrostachys*), both fertile; rachis internodes and pedicels linear, hairy along angles. Spikelets lanceolate or lanceolate-oblong; callus obtuse to acuminate, shortly bearded; glumes membranous or papery; lower glume slightly convex, flanks rounded, 2-keeled upward, back usually hairy, veinless between keels, keels ciliate toward apex, apex truncate or bidentate; upper glume boat-shaped,

apex mucronate or awned; lower floret reduced to an oblong hyaline lemma or absent; upper lemma stipelike, entire or 2-toothed, awned; awn well developed, geniculate, column dark brown, hairy, limb pallid; palea usually absent. Stamens 1–3.

Three to five species: NE India and Myanmar through SE Asia to the Philippines, Australia, and the Pacific Islands; three species (one endemic) in China.

This genus has been included in *Eulalia*, but is distinguished by its delicate, annual habit, pedicelled spikelets on tough or only tardily fracturing racemes, and very narrow intercostal long cells in the leaf epidermis.

Pseudopogonatherum irritans (R. Brown) A. Camus is likely to occur in SE China. It is found from Myanmar, Thailand, Vietnam, and the Philippines through Indonesia to Australia.

1a. Spikelets of a pair with one sessile and the other pedicelled ..... 3. *P. koretrostachys*
1b. Spikelets of a pair both pedicelled.
2a. Spikelets 3.5–4 mm; anthers ca. 1 mm ..... *P. irritans* (see note above)
2b. Spikelets 2–3 mm; anthers ca. 0.5 mm.
3b. Awn of upper lemma 1.5–3 cm, clearly geniculate, pilose ..... 1. *P. contortum*
3a. Awn of upper lemma 0.6–0.7 cm, not geniculate, glabrous ..... 2. *P. filifolium*

1. Pseudopogonatherum contortum (Brongniart) A. Camus, Ann. Soc. Linn. Lyon, n.s., 68: 205. 1921.

笔草 bi cao

Pogonatherum contortum Brongniart in Duperrey, Voy. Monde 2(2): 90. 1831; *Erianthus contortus* (Brongniart) Kuntze.

Culms erect, 25–50 cm tall. Leaf sheaths glabrous; leaf blades becoming involute, 10–30 × 0.1–0.2 cm, abaxial surface glabrous, adaxial surface thinly pilose; ligule ca. 0.2 mm. Racemes 1–20, subdigitate, 3–6 cm, white hairy, tough, all spikelets pedicelled, disarticulating from pedicels at maturity; pedicels usually unequal, as long as or shorter than internode, villous. Spikelets 1.8–3 mm, brown, glossy; callus hairs up to 1/2 spikelet length; lower glume narrowly oblong or lanceolate-oblong, pubescent to villous except near apex, or sometimes glabrous, upper flanks pilose, apex 2-toothed; upper glume with mucro or awn 0.5–4(–12) mm; lower lemma ca. 1 mm; upper lemma entire or minutely toothed; awn 1.5–3 cm, column pilose, hairs ca. 1 mm. Anthers 1–3, ca. 0.5 mm.

Grassy places on mountain slopes, open and disturbed grassy hillsides, sometimes gregarious; 700–1700 m. Fujian, Guangdong, Guangxi, Hainan, Jiangxi, Sichuan, Yunnan [Bhutan, India, Indonesia, Myanmar, Nepal, Thailand, Vietnam; Australia, Pacific Islands].

This widespread, annual species comprises a variable complex of many intergrading forms, some of which have been accorded separate status, either at specific or infraspecific rank. Two varieties have been recognized in China; var. *contortum*, with callus hairs less than 1/2 the spikelet length and pedicels of the spikelet pairs unequal, occurs in Indonesia and Australia.

1a. Pedicels of spikelet pair unequal; upper glume with awn up to 4 mm ..... 1a. var. *linearifolium*
1b. Pedicels of spikelet pair equal, as long as rachis internode; upper glume with 0.5–1 mm mucro ..... 1b. var. *sinense*

1a. Pseudopogonatherum contortum var. **linearifolium** Keng ex S. L. Chen, Acta Phytotax. Sin. 18: 489. 1980.

线叶笔草 xian ye bi cao

Spikelet pair with unequal pedicels; callus hairs 1/2 spikelet length; upper glume with up to 4 mm awn. Fl. and fr. autumn.

● Grassy places on mountain slopes; 1100–1700 m. Guangxi, Sichuan, W Yunnan.

The name *"Eulalia contorta* var. *linearifolia* Keng" (Claves Gen. Sp. Gram. Prim. Sin. 237. 1957) belongs here, but was not validly published because no Latin description was provided.

1b. Pseudopogonatherum contortum var. **sinense** Keng & S. L. Chen, Fl. Hainan. 4: 540. 1977.

中华笔草 zhong hua bi cao

Spikelet pair with equal pedicels, rachis internode equaling pedicels; callus 0.2–0.3 mm, obtuse; upper glume with 0.5–1 mm mucro. Fl. and fr. autumn.

● Hill slopes; ca. 700 m. Fujian, Guangdong, Guangxi, Hainan, Jiangxi.

This is probably the same taxon as *Pseudopogonatherum collinum* (Balansa) A. Camus, from N Vietnam, which is often included within *P. contortum*.

The name *"Eulalia contorta* var. *sinensis* Keng" (Claves Gen. Sp. Gram. Prim. Sin. 237. 1957) belongs here, but was not validly published because no Latin description was provided.

2. Pseudopogonatherum filifolium (S. L. Chen) H. Yu, Y. F. Deng & N. X. Zhao, Novon 14: 242. 2004.

假金发草 jia jin fa cao

Eulalia filifolia S. L. Chen, Gram. Orient. Sin. 249. 1962; *Pseudopogonatherum capilliphyllum* S. L. Chen, nom. illeg. superfl.

Culms slender, 17–30 cm tall, 3–4-noded, glabrous. Leaf sheaths glabrous; leaf blades usually involute, 5–17 × ca. 0.1 cm, abaxial surface glabrous, adaxial surface puberulous and pilose; ligule ca. 0.1 mm. Racemes 1–3, 2–4.5 cm, white hairy, tough, all spikelets pedicelled, disarticulating from pedicels at maturity; rachis internodes ca. 1.3 mm, ciliate; pedicels of a pair equal. Spikelets ca. 2 mm, yellowish brown; callus hairs 0.3–1.7 mm; lower glume pilose on back, obtuse; upper glume boat-shaped, mucronate, mucro 0.1–1 mm; lower lemma ovate-oblong, ca. 1 × 0.5 mm; upper lemma entire; awn 6–7 mm, weakly geniculate, column glabrous. Anthers 3, ca. 0.7 mm. Fl. and fr. Sep–Dec.

● Grassy hillsides. Anhui.

3. Pseudopogonatherum koretrostachys (Trinius) Henrard, Blumea 4: 521. 1941.

刺叶假金发草 ci ye jia jin fa cao

Andropogon koretrostachys Trinius, Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 2: 273. 1833; *A. asthenostachys* Steudel; *Eulalia setifolia* (Nees) Pilger; *Pollinia setifolia* Nees; *Pseudopogonatherum setifolium* (Nees) A. Camus.

Culms erect or geniculately ascending, 30–60 cm tall. Leaf sheaths glabrous; leaf blades usually involute, 5–20 × 0.1–0.2 cm, glabrous or adaxial surface pilose; ligule ca. 0.5 mm. Racemes (1–)7–25 or more, subdigitate, 2–8 cm, white hairy, tardily fragile, one spikelet of a pair sessile, the other pedicelled; rachis internodes and pedicels 1/2 spikelet length, villous. Spikelets 2–3 mm, brown; callus hairs 1/5–1/4 spikelet length; lower glume narrowly lanceolate-oblong, villous except near apex, sometimes sparsely so or glabrous, upper flanks villous, apex 2-toothed or truncate and minutely 2-mucronate; upper glume with 3–6 mm awn; lower lemma ca. 1 mm; upper lemma shortly 2-toothed; awn 1.5–2 cm, column shortly ciliate, hairs ca. 0.25 mm. Anthers 3, 0.5–0.7 mm. Pedicelled spikelet easily deciduous, maturing before sessile spikelet. Fl. and fr. Sep–Nov.

Hill slopes, roadsides. Anhui (Tai Hu), Fujian, Guangdong, Guangxi, Hainan, Jiangxi, SE Yunnan, Zhejiang [Indonesia, Laos, Malaysia, Philippines, Thailand].

This is a variant from the *Pseudopogonatherum contortum* complex with one spikelet of the pair sessile. It also has short hairs on the column of the awn.

192. POGONATHERUM P. Beauvois, Ess. Agrostogr. 56. 1812.

金发草属 jin fa cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Pogonopsis J. Presl.

Perennials, densely tufted. Culms slender, branching, drooping or trailing, several- to many-noded. Leaf blades linear or linear-lanceolate, lower blades deciduous; ligule a membranous ciliate rim. Inflorescence a single raceme borne on a flexuous peduncle, racemes many, terminating the culm branches; raceme fragile, sessile and pedicelled spikelets of a pair similar, both fertile; rachis internodes and pedicels shorter than spikelets, linear with expanded apex, ciliate. Sessile spikelet oblong, laterally compressed; callus obtuse, bearded with long silky hairs; glumes subequal, membranous or thinly cartilaginous; lower glume strongly convex, 3–5-veined, apex truncate, 2–3-lobed, ciliate; upper glume slightly longer than lower glume, strongly keeled, apex 2-toothed, a long, fine, flexuous awn from sinus; lower floret male with palea or reduced to a hyaline lemma or absent; upper lemma oblong, hyaline, 2-lobed for 1/3–1/2 its length, awned; awn long, very slender, geniculate near base; upper palea subequal to lemma. Stamens 1–2. Pedicelled spikelet often smaller, lacking a lower floret, upper floret bisexual or female.

Four species: India to SE Asia, NE Australia, and Polynesia; three species (one endemic) in China.

1a. Sessile spikelet 1.3–2 mm; stamen 1; awn of upper lemma strongly reflexed above base ..... 1. *P. crinitum*
1b. Sessile spikelet 2.3–3 mm; stamens 2; awn of upper lemma slightly bent above base.
2a. Lower glume of pedicelled spikelet awnless; lower floret of sessile spikelet staminate; anthers ca. 1.8 mm ..... 2. *P. paniceum*
2b. Lower glume of pedicelled spikelet awned; lower floret of sessile spikelet absent or reduced to a small lemma; anthers ca. 0.5 mm ..... 3. *P. biaristatum*

1. Pogonatherum crinitum (Thunberg) Kunth, Enum. Pl. 1: 478. 1833.

金丝草 jin si cao

Andropogon crinitus Thunberg in Murray, Syst. Veg., ed. 14, 903. 1784; *A. monandrus* Roxburgh; *Homoplitis crinita* (Thunberg) Trinius; *Ischaemum crinitum* (Thunberg) Trinius; *Pogonatherum saccharoideum* P. Beauvois var. *crinitum* (Thunberg) F. N. Williams; *P. saccharoideum* var. *monandrum* (Roxburgh) Hackel.

Culms erect or geniculate, sometimes trailing, very slender, 10–30 cm tall, 0.5–0.8 mm in diam., branching from near base. Leaf sheaths glabrous or puberulous, mouth long ciliate; leaf blades 1.5–5 × 0.1–0.4 cm, scaberulous-puberulous, apex acute. Raceme 1.5–3 cm (excluding awns), yellowish; rachis internodes and pedicels 1/3–2/3 spikelet length, hairs silky white. Sessile spikelet 1.3–2 mm, membranous; callus hairs equal to or slightly longer than spikelet; lower glume scabrid on back, apex ciliate with ca. 0.2 mm hairs; upper glume awn 1.5–1.8 cm; lower floret absent or only lemma present; awn of upper lemma 1.8–2.4 cm, strongly geniculate near base, column very short, dark brown, limb fine, diverging at right angle or more from spikelet. Stamen 1, anther ca. 1 mm. Pedicelled spikelet similar to sessile but smaller; lower glume awnless. Fl. and fr. May–Sep.

Mountain slopes, forests, moist places along roadsides and streams; below 2000 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Bhutan, India, Indonesia, Japan, Malaysia, Nepal, New Guinea, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam; Australia (Queensland)].

This is a more delicate species than *Pogonatherum paniceum*, forming a uniform tuft lacking dense bunches of branchlets, with tiny spikelets and strongly bent lemma awns.

This species is used medicinally.

2. Pogonatherum paniceum (Lamarck) Hackel, Allg. Bot. Z. Syst. 12: 178. 1906.

金发草 jin fa cao

Saccharum paniceum Lamarck, Encycl. 1: 595. 1785; *Perotis polystachya* Willdenow; *Pogonatherum saccharoideum* P. Beauvois, nom. illeg. superfl.

Culms stiffly erect at base, 30–60 cm tall, 1–2 mm in diam., hard and unbranched in lower part, repeatedly branched forming dense fascicles of very slender branchlets in upper part. Leaf sheaths glabrous or puberulous, mouth long ciliate; leaf blades stiff, 1.5–5.5 × 0.15–0.4 cm, scabrid, apex acuminate. Raceme 1.3–3 cm (excluding awns), yellowish; rachis internodes and pedicels ca. 1/2 spikelet length, hairs silky white. Sessile spikelet 2.3–3 mm, thinly cartilaginous; callus hairs shorter than spikelet; lower glume scabrid or puberulous on back, apex ciliate with 0.5–1 mm hairs; upper glume awn 1.3–2 cm; lower floret staminate, lemma slightly shorter than lower glume, palea subequaling lemma; awn of upper lemma 1.5–1.8 cm, weakly geniculate near base, column not strongly demarcated, limb very fine. Stamens 2, anthers ca. 1.8 mm. Pedicelled spikelet similar to sessile but smaller; lower glume awnless. Fl. and fr. Mar–Oct.

Mountain slopes, roadsides, streams; 100–2300 m. Guangdong, Guangxi, Guizhou, Hubei, Hunan, Sichuan, Taiwan, Yunnan [Afghanistan, Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Pakistan, Thailand, Vietnam; SW Asia (Arabia), Australia (Queensland)].

3. Pogonatherum biaristatum S. L. Chen & G. Y. Sheng, Bull. Bot. Res., Harbin 13: 76. 1993.

二芒金发草 er mang jin fa cao

Culms 40–60 cm tall, 1–2 mm in diam., hard, unbranched in lower part, branched above; branches ascending. Leaf sheaths glabrous, mouth ciliate; leaf blades stiff, 2–4.5 × 0.1–0.3 cm, scabrid, puberulous at base, apex long acuminate. Raceme 2–3 cm (excluding awns), yellowish; rachis internodes and pedicels shorter than spikelet. Sessile spikelet ca. 3 mm; callus hairs 0.5–3 mm; lower glume scabrid and with scattered soft hairs on back, apex densely ciliate; upper glume awn ca. 1.6 cm; lower floret absent or represented by a small linear-lanceolate lemma; awn of upper lemma ca. 1.7 cm, weakly geniculate near base, column not strongly demarcated, limb very fine. Stamens 2, anthers ca. 0.5 mm. Pedicelled spikelet smaller than sessile; lower glume with straight ca. 1.5 cm awn. Fl. and fr. early summer.

● Forests. Hainan.

193. EULALIOPSIS Honda, Bot. Mag. (Tokyo) 38: 56. 1924.

拟金茅属 ni jin mao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Pollinidium Stapf ex Haines.

Perennial. Leaf blades narrow; ligule a long-ciliate rim. Inflorescences terminal and axillary from upper leaf sheaths, composed of a few subdigitate racemes; racemes conspicuously hairy, fragile, sessile and pedicelled spikelets of a pair similar, both fertile; rachis internodes and pedicels flat, ciliate. Spikelets elliptic-oblong, lightly laterally compressed below middle, flat above; callus densely bearded; glumes villous below middle; lower glume papery, convex, 5–9-veined, veins prominent, apex shortly 2–3-toothed; upper glume 3–9-veined, apex acute or 2-toothed, with or without an awn-point; lower floret male or sterile, lemma and palea well developed, hyaline; upper lemma lanceolate-oblong, hyaline, entire or minutely 2-toothed, awned; awn weakly geniculate; upper palea broadly ovate, glabrous or apex long ciliate. Stamens 3.

Two species: Afghanistan and India to China and Philippines; one species in China.

1. Eulaliopsis binata (Retzius) C. E. Hubbard, Hooker's Icon. Pl. 33: t. 3262, p. 6. 1935.

拟金茅 ni jin mao

Andropogon binatus Retzius, Observ. Bot. 5: 21. 1789; *A. involutus* Steudel; *A. notopogon* Steudel; *Eulaliopsis angustifolia* (Trinius) Honda; *Pollinia eriopoda* Hance; *Pollinidium binatum* (Retzius) C. E. Hubbard; *Spodiopogon angustifolius* Trinius; *S. binatus* (Retzius) Roberty.

Perennial; basal sheaths woolly with creamy hairs. Culms densely tufted, erect, 30–80 cm tall, nodes glabrous. Leaf sheaths glabrous, hairy at mouth; leaf blades tough, involute or rarely flat, 10–30 × 0.1–0.4 cm, uppermost very reduced, glabrous, adaxial surface and margins scabrid; ligule ca. 0.2 mm with hairs to 2 mm. Racemes 2–4, 2–5 cm, softly golden-villous; rachis internodes 2–2.5 mm, golden-villous on one or both margins, sometimes thinly. Spikelets 3.8–6 mm, yellowish; callus hairs up to 3/4 spikelet length; lower glume villous along lower margins and in tufts on back; upper glume slightly longer than lower, similarly villous, apex with a 0.3–2 mm awnlet; lower lemma narrowly oblong, equal to lower glume; upper lemma subequal to lower lemma; awn 4–9 mm. Anthers ca. 2.5 mm.

Dry mountain slopes; Guangdong, Guangxi, Guizhou, Henan, Hubei, Shaanxi, Sichuan, Taiwan, Yunnan [Afghanistan, Bhutan, India, Japan, Myanmar, Nepal, Pakistan, Philippines, Thailand].

This species is a source of fiber.

194. POLYTRIAS Hackel in Engler & Prantl, Nat. Pflanzenfam. 2(2): 24. 1887.

单序草属 dan xu cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Aethonopogon Kuntze; *Eulalia* sect. *Polytrias* (Hackel) Pilger.

Perennial, low, stoloniferous. Leaf blades broadly linear; ligule short, truncate, ciliolate. Inflorescence a single terminal raceme; raceme hairy, fragile, densely spiculate, the spikelets borne in threes, 2 sessile and 1 pedicelled at each node, sessile and pedicelled spikelets similar, both fertile or pedicelled spikelet male or barren, occasionally lowermost spikelets paired; rachis internodes broadly linear, densely ciliate on margins, shorter than spikelets; pedicel similar but more slender. Spikelets oblong; callus bearded; glumes cartilaginous becoming membranous in upper 1/3; lower glume flat, villous, flanks keeled, clasping upper glume, obscurely 2-veined between keels, apex truncate, ciliate; upper glume slightly longer than lower, 1–3-veined, keeled along midvein; lower floret absent; upper lemma small, broad, 2-cleft, awned; awn geniculate; palea very small or absent. Stamens 3.

One species: SE Asia, including China.

1. Polytrias indica (Houttuyn) Veldkamp, Blumea 36: 180. 1991.

单序草 dan xu cao

Perennial forming loose mats. Culms slender, decumbent, rooting and branching at nodes, erect shoots 10–30 cm tall, nodes glabrous or bearded. Leaf sheaths lightly compressed, glabrous or rarely pubescent; leaf blades purplish glaucous, 2–5 × 0.2–0.4 cm, stiffly pilose with tubercle-based hairs, margins scabrid, apex acuminate; ligule 0.2–0.5 mm. Raceme 2–7 cm, shortly exserted from uppermost leaf sheath at maturity; rachis internodes and pedicels golden-ciliate. Spikelets 3–4 mm, brown, densely hairy with soft golden hairs; callus hairs 1/3 spikelet length; lower glume villous below middle, hairs usually extending slightly beyond apex, keels green; upper glume densely pubescent except near base, villous on upper keel; upper lemma broadly oblong to ovate, teeth narrow, tipped with hairs; awn slender, 0.8–1.2 cm, puberulous. Anthers 2.5–3 mm. Stigmas exserted from apex of spikelet. Fl. and fr. summer to autumn.

Grassy places on mountain slopes, grassy spaces, lawns, wastelands, roadsides. Hainan, Hong Kong [Indonesia, Malaysia, Myanmar, New Guinea, Philippines, Vietnam; introduced elsewhere as a lawn grass].

1a. Lower glume with long hairs exceeding glume apex ..... 1a. var. *indica*
1b. Lower glume with shorter hairs not exceeding 2/3 of glume length ..... 1b. var. *nana*

1a. Polytrias indica var. **indica**

单序草(原变种) dan xu cao (yuan bian zhong)

Phleum indicum Houttuyn, Nat. Hist. 13: 198. 1782; *Andropogon amaurus* Buse, nom. illeg. superfl.; *A. diversiflorus* Steudel; *A. firmandus* Steudel; *Eulalia praemorsa* (Nees ex Steudel) Stapf ex Ridley; *Pollinia praemorsa* Nees ex Steudel; *Polytrias amaura* Kuntze, nom. illeg. superfl.; *P. diversiflora* (Steudel) Nash; *P. praemorsa* (Nees ex Steudel) Hackel.

Spikelets 3 per node; lower glume long villous, hairs extending beyond glume apex; upper lemma cordate.

Grassy spaces. Hong Kong [Indonesia, Malaysia, Myanmar, New Guinea, Philippines, Vietnam].

This grass has been widely known as *Polytrias amaura*, based on *Andropogon amaurus*, which is a superfluous name for *A. diversiflorus*.

1b. Polytrias indica var. **nana** (Keng & S. L. Chen) S. M. Phillips & S. L. Chen, Novon 15: 470. 2005.

短毛单序草 duan mao dan xu cao

Eulalia nana Keng & S. L. Chen, Fl. Hainan. 4: 539. 1977; *Polytrias amaura* var. *nana* (Keng & S. L. Chen) S. L. Chen.

Spikelets 2–3 per node; lower glume with hairs not extending to glume apex; upper lemma oblong.

● Grassy places on mountain slopes. Hainan.

195. MICROSTEGIUM Nees in Lindley, Nat. Syst. Bot., ed. 2, 447. 1836.

莠竹属 you zhu shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Ischnochloa J. D. Hooker.

Perennial or annual. Culms slender, creeping or rambling, usually much branched and rooting at lower nodes. Leaf blades broadly linear to lanceolate or elliptic, base narrow, apex acuminate to setaceous; ligule membranous, truncate, back pubescent. Inflorescence terminal, composed of 1 to many subdigitate racemes on a short axis; racemes elongate, sparsely hairy, usually fragile, sessile and pedicelled spikelets of a pair similar, rarely both spikelets unequally pedicelled; rachis internodes filiform to clavate or inflated; pedicels resembling internodes but shorter. Sessile spikelet lanceolate, dorsally compressed; callus shortly bearded; glumes herbaceous to cartilaginous; lower glume deeply grooved on back or with a broad median channel, margins inflexed, 2-keeled at least toward apex; upper glume boat-shaped, acute to shortly awned; lower floret almost always sterile, reduced to a single scale or absent; upper floret bisexual, lemma linear to cordate, deeply 2-lobed, shortly 2-toothed, or rarely entire, usually awned; awn flexuous or geniculate. Stamens 2–3. Pedicelled spikelet resembling the sessile but slightly narrower and less concave, occasionally slightly smaller and staminate.

About 20 species: India to Japan and SE Asia, a few species in Africa; 13 species (three endemic) in China.

The name *Microstegium glaberrimum* (Honda) Koidzumi (Bot. Mag. (Tokyo) 43: 394. 1929; *Pollinia glaberrima* Honda, Bot. Mag. (Tokyo) 39: 42. 1925), described from Taiwan, has been misapplied in recent literature to forms of *M. ciliatum*. The protologue describes a grass with only 2 or 3 short racemes of small (ca. 2 mm), awnless spikelets. The type has not been seen, and it has not proved possible to establish the identity of this taxon.

1a. Rachis internodes filiform, glabrous or villous, equaling or longer than spikelets.
2a. Rhizomatous perennial; raceme solitary; rachis internodes and pedicels long-ciliate ..... 1. *M. batangense*
2b. Annuals; racemes 2–7; rachis internodes and pedicels glabrous or almost so.
3a. Stamens 3; lower lemma reduced or absent ..... 2. *M. fauriei*
3b. Stamens 2; lower lemma well developed, slightly shorter than glumes.
4a. Spikelets of a pair one sessile, the other pedicelled; raceme rachis fragile ..... 3. *M. nudum*
4b. Spikelets of a pair both pedicelled, one pedicel long, the other short; raceme rachis tough.
5a. Spikelets 1-awned (from upper lemma); lower glume smooth, apex subentire; nodes of culm glabrous ..... 4. *M. japonicum*
5b. Spikelets 3-awned (from upper glume and both lemmas); lower glume scabrid, apex 2-cleft; nodes of culm pubescent ..... 5. *M. somae*
1b. Rachis internodes linear to clavate, inflated upward, hairy on angles, usually shorter than spikelets.
6a. Upper lemma well developed, 3–4 mm, split to about middle into 2 long, acute lobes.
7a. Culms rambling, up to 2 m; leaf blades 15–20 cm, pseudopetiolate, at least the lower; racemes 6–20; pedicelled spikelet awned ..... 6. *M. petiolare*
7b. Culms erect, up to 40 cm; leaf blades 3–8 cm, not pseudopetiolate; racemes 2–3; pedicelled spikelet awnless or almost so ..... 7. *M. lanceolatum*
6b. Upper lemma small, 1–2 mm, shortly 2-lobed or entire.
8a. Anthers 0.3–0.5 mm; awn often very short, included within spikelet; sessile spikelet 4–5 mm.
9a. Lower glume with transverse veinlets below apex; leaf blades 5–8 mm wide ..... 8. *M. vimineum*
9b. Lower glume with transverse veinlets below apex and down flanks; leaf blades 8–12 mm wide ..... 9. *M. reticulatum*
8b. Anthers 0.8–2.5 mm; awn clearly exserted from spikelet; sessile spikelet 2–4(–5) mm.
10a. Spikelets 2–2.5 mm; lower glume flat on back or almost so, veins obscure ..... 10. *M. delicatulum*
10b. Spikelets 2.8–5 mm; lower glume grooved on back, veins obvious.
11a. Anthers 0.8–1.5 mm; upper glume with 0.3–3 mm awnlet; awn flexuous, column obscure ..... 11. *M. ciliatum*
11b. Anthers 1.5–3.5 mm; upper glume acute or minutely mucronate; geniculate, column distinct.
12a. Sessile spikelet 2.8–4 mm; anthers 1.5–2.5 mm; upper lemma emarginate, glabrous ..... 12. *M. fasciculatum*
12b. Sessile spikelet 4.5–5 mm; anthers 3–3.5 mm; upper lemma bifid, ciliate ..... 13. *M. multiciliatum*

1. Microstegium batangense (S. L. Zhong) S. M. Phillips & S. L. Chen, **comb. nov.**

巴塘莠竹 ba tang you zhu

Basionym: *Arthraxon batangensis* S. L. Zhong, J. S. W. Agric. Coll. 1982(4): 97. 1982.

Perennial with tough, spreading rhizomes. Culms slender, much branched at lower nodes, sprawling, ascending to 20–45 cm, nodes glabrous. Leaf sheaths glabrous; leaf blades linear-lanceolate, firm, glaucous, 1–5.5 cm × 1.5–2 mm, smooth, abaxial surface glabrous, adaxial surface sparsely setose toward ligule with 2–3 mm bristles, apex acuminate; ligule 0.6–1 mm. Raceme solitary, 3.5–6.5 cm; rachis internodes filiform, ciliate with ca. 2 mm hairs, equaling spikelet. Sessile spikelets 6–7.8 mm; callus hairs 2–3 mm; lower glume linear-lanceolate, keels rounded in lower 2/3, sharp and scabrid above, deeply grooved between keels in middle 1/3, 5–7-veined with transverse veinlets, apex acuminate; upper glume with rounded keel, 7-veined with transverse veinlets, upper margins shortly ciliate, apex acute and mucronate; lower floret male with well-developed palea, anthers ca. 3 mm; upper lemma 3.5–4 mm, 2-lobed to below middle, lobes acuminate, ciliate on outer margins; awn geniculate, 1–1.4 cm; upper palea well developed. Pedicelled spikelet lanceolate, male and weakly awned or reduced and barren. Fl. and fr. Aug–Oct.

● Dry river valleys, under shrubs; 2600–3100 m. Sichuan.

This grass is not a species of *Arthraxon* because the awn arises from the sinus of the 2-lobed lemma, not from low down the lemma back. The habit, grooved lower glume of the sessile spikelet, and the usually well-developed pedicelled spikelet indicate that it is better placed in *Microstegium*.

2. Microstegium fauriei (Hayata) Honda, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 3: 410. 1930.

法利莠竹 fa li you zhu

Annual. Culms decumbent, rooting at lower nodes, up to 50–100 cm, nodes glabrous or pubescent. Leaf sheaths glabrous or pubescent; leaf blades narrowly lanceolate, 5–20 × 0.3–1 cm, thinly pilose to tomentose, apex acuminate; ligule ca. 2 mm. Racemes 3–10, spreading, 4–10 cm; rachis internodes filiform, glabrous or lower edges sparsely ciliate, equaling or slightly longer than spikelet. Spikelets 4–5.5 mm; callus shortly bearded; lower glume lanceolate, back shallowly concave, obscurely 2-veined between keels, glabrous, keels stoutly pectinate-ciliate, apex shortly 2-toothed; upper glume hispid on keel, apex attenuate into 1(–3) mm awnlet; lower floret absent; upper lemma ca. 1 mm, hyaline, minutely 2-toothed; awn fine, flexuous, 2–2.5 cm, apex hairlike; upper palea ca. 1.5 mm, irregularly toothed. Anthers 3, 1.5–1.8 mm. Fl. and fr. Aug–Oct.

Montane forests and forest margins, moist places on pathsides, clearings, streams, forming colonies; middle elevations. Fujian, Guangdong, Taiwan [Indonesia, Malaysia].

1a. Nodes of culm glabrous; leaf blades glabrous or sparingly pilose ..... 2a. subsp. *fauriei*
1b. Nodes of culm shortly bearded; leaf blades tomentose ..... 2b. subsp. *geniculatum*

2a. Microstegium fauriei subsp. **fauriei**

法利莠竹(原亚种) fa li you zhu (yuan ya zhong)

Pollinia fauriei Hayata, Icon. Pl. Formosan. 7: 73. 1918.

Culms 50–80 cm, nodes glabrous. Leaf blades glabrous or adaxial surface sparingly pilose with soft, tubercle-based hairs. Racemes 4–6, 5–9 cm.

● Montane forest margins. Taiwan.

2b. Microstegium fauriei subsp. **geniculatum** (Hayata) T. Koyama, Grasses Japan Neighboring Regions, 516. 1987.

膝曲莠竹 xi qu you zhu

Pollinia geniculata Hayata, Icon. Pl. Formosan. 7: 73. 1918; *Microstegium hendersonii* (C. E. Hubbard) C. E. Hubbard; *Pollinia hendersonii* C. E. Hubbard.

Culms up to 100 cm, nodes pubescent. Leaf blades tomentose on both surfaces. Racemes 5–10, 6–10 cm.

Montane forests, moist places on pathsides, clearings, streams. Fujian, Guangdong, Taiwan [Indonesia, Malaysia].

3. Microstegium nudum (Trinius) A. Camus, Ann. Soc. Linn. Lyon, n.s., 68: 201. 1921.

竹叶茅 zhu ye mao

Pollinia nuda Trinius, Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 2: 307. 1833; *Eulalia nuda* (Trinius) Kuntze; *Leptatherum royleanum* Nees; *Microstegium arisanense* (Hayata) A. Camus; *Pollinia arisanensis* Hayata.

Annual. Culms rambling, rooting at lower nodes, 20–80 cm long, nodes pubescent. Leaf sheaths glabrous, one margin ciliate; leaf blades narrowly lanceolate, thin, 3–8 × 0.5–1.1 cm, usually glabrous, midvein a white line below middle, apex acute; ligule ca. 0.5 mm. Racemes 2–7, very slender, slightly flexuous, lower becoming divaricate, 4–8 cm; rachis internodes filiform, glabrous, longer than spikelet. Sessile spikelet 3.5–5 mm; callus hairs 1–1.3 mm; lower glume narrowly lanceolate-oblong, back shallowly concave, glabrous or rarely hispidulous near apex, 2–4-veined, apex attenuate, hyaline, sometimes 2-toothed; upper glume weakly keeled or rounded on back, acuminate; lower lemma lanceolate, hyaline, slightly shorter than glumes; upper lemma linear, hyaline, 1.5–3 mm, emarginate; awn very fine, flexuous, 1–2 cm, apex hairlike, tangled; upper palea absent or minute. Anthers 2, 0.5–1 mm. Fl. and fr. Aug–Oct.

Moist mountainsides, forest undergrowth; ca. 3000 m. Anhui, Fujian, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Japan, Nepal, Pakistan, Philippines, Vietnam; Africa, Australia].

4. Microstegium japonicum (Miquel) Koidzumi, Bot. Mag. (Tokyo) 43: 394. 1929.

日本莠竹 ri ben you zhu

Pollinia japonica Miquel, Ann. Mus. Bot. Lugduno-Batavi 2: 290. 1866; *Leptatherum japonicum* (Miquel) Franchet & Savatier; *Microstegium nudum* (Trinius) A. Camus subsp. *japonicum* (Miquel) Tzvelev.

Annual. Culms trailing, rooting at lower nodes, up to 80 cm long, nodes glabrous. Leaf sheaths glabrous, one margin ciliate; leaf blades ovate-lanceolate, 2–5 × 0.6–1.2 cm, glabrous, midvein obscure except near base, base rounded, apex acute; ligule 0.2–0.5 mm. Racemes 3–7, very slender, slightly flexuous, lower becoming divaricate, 4–6 cm; rachis internodes filiform, glabrous, longer than spikelet; spikelets both pedicelled, shorter pedicel ca. 1 mm, longer 2.5–3 mm. Spikelets 3–4 mm; callus very shortly bearded or subglabrous in lower spikelet; lower glume narrowly lanceolate-oblong, back shallowly concave, 2–4-veined, keels scabrid, otherwise smooth, apex attenuate, hyaline, subacute or minutely 2-toothed; upper glume weakly keeled or rounded on back, apex acuminate; lower lemma lanceolate, hyaline, slightly shorter than glumes; upper lemma linear, hyaline, emarginate; awn very fine, flexuous, ca. 1 cm, apex hairlike, tangled; upper palea absent or minute. Anthers 2, 0.5–0.7 mm. Fl. and fr. Jul–Sep.

Mountainsides, forest margins, roadsides. Anhui, Hubei, Hunan, Jiangsu, Jiangxi, Zhejiang [Japan, Korea].

This species is very close to *Microstegium nudum*, but differs mainly in its pedicelled spikelets.

5. Microstegium somae (Hayata) Ohwi, Acta Phytotax. Geobot. 11: 155. 1942 [*"somai"*].

多芒莠竹 duo mang you zhu

Polliniopsis somae Hayata, Icon. Pl. Formosan. 7: 76. 1918 [*"somai"*]; *Microstegium japonicum* subsp. *somae* (Hayata) Koyama.

Annual. Culms slender, trailing, rooting at lower nodes, ascending to 30–40 cm, nodes bearded. Leaf sheaths glabrous, one margin ciliate; leaf blades ovate-lanceolate, 3–4 × 0.3–0.6 cm, glabrous, base rounded, apex acute; ligule 0.2–0.5 mm. Racemes 3–5, very slender, slightly flexuous, 3–8 cm; rachis internodes filiform, glabrous, equaling or longer than spikelets; spikelets both pedicelled, shorter pedicel 1–1.5 mm, longer 2.5–3 mm. Spikelets 4–5 mm; callus hairs 1/4–1/3 spikelet length; lower glume narrowly lanceolate-oblong, back shallowly concave, 4-veined, scabrid, apex 2-cleft, lobes usually mucronate; upper glume weakly keeled, scabrid, apex 2-toothed with 2–10 mm awn; lower lemma linear-lanceolate, hyaline, ca. 2 mm, 2-toothed with up to 1 cm awn; upper lemma similar to lower but slightly shorter; awn ca. 12 mm; upper palea absent. Anthers 2, 0.6–0.8 mm. Fl. and fr. autumn to winter.

Montane forests. Anhui, Fujian, Taiwan [Japan (Ryukyu Islands)].

This species may prove to be a variant of *Microstegium japonicum* with extra awns developed, but it seems sufficiently distinct on the basis of specimens available at present.

6. Microstegium petiolare (Trinius) Bor, Indian Forest Rec., Bot. 1(3): 87. 1938.

柄莠竹 bing you zhu

Spodiopogon petiolaris Trinius, Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 2: 301. 1833; *Andropogon petiolaris* (Trinius) Steudel; *Ischaemum petiolare* (Trinius) Hackel; *Microstegium yunnanense* R. J. Yang.

Perennial, clump-forming or rambling. Culms hard, up to 2 m long, farinose below nodes, nodes densely bearded in tuft at sheath margin or all round. Leaf sheaths glabrous or tuberculate-pilose, margins broad at apex, extended into ligule; leaf blades lanceolate, 15–20 × 1–1.5 cm (excluding pseudopetiole), adaxial surface glabrous, adaxial surface pilose, midvein white, margins scabrid, base narrowed to a pseudopetiole up to 4 cm in lower blades, apex setaceous; ligule 4–11 mm. Racemes 6–20, corymbiform on 2–5 cm axis, lower racemes sometimes on side branches, straw-colored tinged purplish, 6–10 cm; rachis internodes linear, shortly ciliate, equaling spikelet. Sessile spikelet 4.7–5 mm; callus hairs short, soft; lower glume oblong, back grooved, granular-scabrid, 6–8-veined, sharply keeled, keels slightly winged near apex, apex obtuse-denticulate; upper glume sharply keeled, granular-scabrid, apiculate; lower floret staminate, lemma narrowly oblong, subequaling glumes, palea well developed; upper lemma ovate-oblong, 3–4 mm, 2-lobed to about middle; awn geniculate, 0.8–1 cm. Anthers 3, ca. 3 mm. Fl. and fr. Aug–Oct.

Grassy places along roadsides, sometimes scrambling through shrubs; ca. 2100 m. Yunnan [NE India, Myanmar, Nepal].

This is a distinctive species used for forage. The hard, rambling culms, broad, pseudopetiole leaf blades with long ligules, and corymbose inflorescence of many racemes all contribute to a recognizable habit.

7. Microstegium lanceolatum (Keng) S. M. Phillips & S. L. Chen, **comb. nov.**

披针叶莠竹 pi zhen ye you zhu

Basionym: *Ischaemum lanceolatum* Keng, J. Wash. Acad. Sci. 21: 155. 1931.

Perennial, forming large tussocks. Culms stiff, up to 40 cm tall, branched below, many-noded, nodes glabrous. Leaf sheaths glabrous or pubescent at junction with blade; leaf blades lanceolate, tough, glaucous, 3–8 × 0.3–1 cm, uppermost much reduced, glabrous, base constricted, margins firm, closely scabrid, apex acute; ligule firm, 2–3 mm. Racemes 2–3, subdigitate, erect, slender, 3–6 cm, brownish or purplish; rachis internodes linear, ciliate along angles, shorter than spikelet. Sessile spikelet 5–6 mm; callus hairs ca. 1 mm; lower glume lanceolate-oblong, papery, 4–7-veined, flat across back but grooved between median veins, keels indistinctly winged and scaberulous near apex, apex subentire; upper glume 3-veined, acute; lower floret with well-developed lemma and palea, lemma margins pilose above middle; upper lemma oblong, ca. 4 mm, bifid to middle or slightly below, outer margins of lobes pilose; awn of upper lemma 0.8–1.2 cm. Pedicelled spikelet laterally compressed, resembling sessile or rudimentary, shortly awned or awnless.

● Habitat unknown; 2800–3000 m. Yunnan.

This species is known only from the type gathering. It was first described in *Ischaemum*, but is anomalous in that genus because of its slender, linear rachis internodes and pedicels, and grooved lower glume of the sessile spikelet.

8. Microstegium vimineum (Trinius) A. Camus, Ann. Soc. Linn. Lyon, n.s., 68: 201. 1921.

柔枝莠竹 rou zhi you zhu

Andropogon vimineus Trinius, Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 2: 268. 1833; *Arthraxon nodosus* Komarov; *Eulalia cantonensis* (Rendle) Hitchcock; *Microstegium cantonense* (Rendle) A. Camus; *M. dilatatum* Koidzumi; *M. imberbe* (Nees ex Steudel) Tzvelev; *M. nodosum* (Komarov) Tzvelev; *M. vimineum* subsp. *nodosum* (Komarov) Tzvelev; *M. vimineum* var. *imberbe* (Nees ex Steudel) Honda; *M. vimineum* var. *willdenowianum* (Nees ex Steudel) Sur; *M. willdenowianum* Nees ex Steudel; *Pollinia cantonensis* Rendle; *P. imberbis* Nees ex Steudel; *P. imberbis* var. *willdenowiana* (Nees ex Steudel) Hackel; *P. viminea* (Trinius) Merrill; *P. willdenowiana* (Nees ex Steudel) Bentham.

Annual. Culms decumbent, up to 1 m long. Leaf sheaths shorter than internodes, upper usually enclosing cleistogamous spikelets; leaf blades narrowly elliptic, 4–9 × 0.5–0.8 cm, pubescent, often sparsely, midvein white, apex acuminate; ligule ca. 0.5 mm. Racemes 1–6, ascending, 4–6 cm; rachis internodes linear-clavate, ciliate, shorter than spikelet. Sessile spikelet 4–5.5 mm; lower glume narrowly lanceolate-oblong, back deeply grooved, puberulous-scaberulous or occasionally hispidulous, 0–4-veined between keels, veins connected by veinlets below apex, apex subtruncate; upper glume scabrid on keel, acuminate; lower floret reduced to an inconspicuous linear-lanceolate scale or absent; upper lemma lanceolate or oblong, 1–1.5 mm, acute or bidenticulate, awnless or shortly awned; awn weakly geniculate, often included within spikelet, up to 6(–9) mm; upper palea ovate, ca. 1 mm. Anthers 3, 0.5–1.5 mm. Fl. and fr. Aug–Nov.

Forest margins, moist grassy places. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Bhutan, NE India, Japan, Korea, Myanmar, Nepal, Philippines, Russia, Vietnam; SW Asia (Iran); introduced in America and elsewhere].

This is a variable species, usually with apparently awnless spikelets, where in fact a weakly developed awn is enclosed within the glumes. Sometimes the awn is exserted and obvious; rarely it is completely absent. The fertile lemma is accompanied by an ovate upper palea, clasping the opposite side of the caryopsis. Additionally an inconspicuous, linear-filiform remnant of the lower floret is often present.

9. Microstegium reticulatum B. S. Sun ex H. Peng & X. Yang, Acta Phytotax. Sin. 34: 213. 1996.

网脉莠竹 wang mai you zhu

Annual. Culms very slender, weak, decumbent, up to 50 cm tall. Leaf sheaths glabrous, without cleistogamous spikelets; leaf blades lanceolate to narrowly ovate, thin, 5–6 × 0.8–1.2 cm, pilose with tubercle-based hairs, base narrow, apex acute; ligule ca. 0.8 mm. Racemes 1–3(–4), 3–5 cm; rachis internodes

linear-clavate, ciliolate or glabrous. Sessile spikelet 5–6 mm, pallid with green veins; lower glume cartilaginous, back grooved, smooth or minutely scaberulous, flanks keeled above middle, veins reticulately connected by veinlets below apex and along most of length of glume flanks; upper glume smooth, acuminate; lower floret reduced to a small lanceolate scale; upper lemma lanceolate, ca. 1.5 mm, acute, awnless; upper palea ovate, 0.5–0.8 mm. Anthers 3, ca. 0.5 mm. Fl. and fr. Sep–Oct.

Roadsides, ditches, grasslands; 1500–2500 m. Yunnan [NE India].

This taxon represents an extreme local variant from the *Microstegium vimineum* complex. It is distinguished from typical *M. vimineum* by the combination of a more delicate habit, broader leaf blades, and a conspicuously reticulately veined lower glume.

10. Microstegium delicatulum (J. D. Hooker) A. Camus, Ann. Soc. Linn. Lyon, n.s., 68: 200. 1921.

茬弱莠竹 ren ruo you zhu

Pollinia delicatula J. D. Hooker, Fl. Brit. India 7: 117. 1896 [“1897”].

Annual. Culms very slender, weak, rambling, ascending to ca. 50 cm, nodes pilose. Leaf sheaths glabrous or with scattered setae, one margin ciliate; leaf blades linear-elliptic, thin, flaccid, 6–10 × 0.5–0.8 cm, thinly hispid on adaxial surface with tubercle-based hairs, puberulous on abaxial surface, base setose, apex acuminate, setaceous; ligule ca. 0.5 mm. Racemes 3–5, pale, slender, erect, 3–6 cm; rachis internodes linear, inflated upward, shorter than spikelet, margins ciliate. Sessile spikelet 2–2.5 mm; callus hairs ca. 1 mm; lower glume oblong, back flat or shallowly grooved, smooth, glossy, scabrid near apex, veins obscure, keels shortly ciliolate above middle, apex broadly obtuse; upper glume sharply keeled, apex acute, minutely mucronate; lower floret absent; upper lemma tiny, ca. 0.2 mm, broad, rounded; awn geniculate, 6–8 mm; upper palea ca. 0.2 mm. Anthers 3, ca. 1 mm. Pedicelled spikelet similar to sessile or reduced and awnless. Fl. and fr. Oct–Dec.

Forest margins; ca. 600 m. Yunnan [Myanmar, Thailand].

11. Microstegium ciliatum (Trinius) A. Camus, Ann. Soc. Linn. Lyon, n.s., 68: 201. 1921.

刚莠竹 gang you zhu

Pollinia ciliata Trinius, Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 2: 305. 1833; *Andropogon biaristatus* Steudel; *A. formosanus* Rendle var. *minor* Rendle; *Microstegium biaristatum* (Steudel) Keng; *M. biforme* Keng; *M. ciliatum* var. *formosanum* (Hackel) Honda; *M. ciliatum* var. *integrum* Ohwi; *M. formosanum* (Hackel) A. Camus; *Pollinia ciliata* Trinius var. *formosana* (Hackel) Honda; *P. formosana* (Hackel) Hayata; *P. monantha* var. *formosana* Hackel.

Perennial. Culms wiry, creeping, 1 m or more long, pubescent below inflorescence, nodes glabrous or pilose. Leaf sheaths pilose or glabrous, one margin ciliate; leaf blades linear-elliptic, 6–16 × 0.5–1.5 cm, adaxial surface thinly pilose with short tubercle-based hairs, abaxial surface softly pilose, apex acuminate into a setaceous point; ligule 1–2 mm. Racemes 3–15, flexuous, usually pale green, fastigiate, 6–10 cm; rachis internodes linear, slightly inflated upward, shorter than spikelet, margins ciliate. Sessile spikelet 3–4 mm; callus hairs 1–1.5 mm; lower glume narrowly lanceolate, back sharply grooved at lower midline, glabrous or scaberulous toward apex, 2-veined between keels, upper keels stiffly pectinate-ciliate, apex 2-toothed; upper glume sharply keeled, apex acuminate into a 0.3–3 mm hairlike awnlet; lower lemma absent or very small; upper lemma linear or lanceolate, occasionally broader, 0.5–1 mm, apex usually entire; awn 1–2 cm, flexuous with weakly developed column and fine hairlike apex. Anthers 3, 0.8–1.5 mm. Fl. and fr. Sep–Dec.

Open woodlands, shady banks, pathsides, forming loose mats. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan [Bhutan, India, Malaysia, Myanmar, Nepal, Sri Lanka, Thailand, Vietnam].

This species is closely related to *Microstegium fasciculatum*, and the two are difficult to distinguish, at least in the herbarium. *Microstegium ciliatum* is a more slender species, forming loose mats rather than large, rambling colonies, usually with pale green rather than purplish inflorescences. The spikelets are narrower, with obviously longer, flexuous awns and an awned upper glume. Occasionally some spikelets in an inflorescence have tiny anthers (the basis of *M. biforme*).

The name *“Ischnochloa monostachya* L. Liu” (Fl. Reipubl. Popularis Sin. 10(2): 65. 1997) has been placed in synonymy under this species (in Fl. Yunnan. 9: 637. 2003), but was not validly published because no Latin description was provided.

12. Microstegium fasciculatum (Linnaeus) Henrard, Blumea 3: 453. 1940.

蔓生莠竹 man sheng you zhu

Andropogon fasciculatus Linnaeus, Sp. Pl. 2: 1047. 1753; *A. formosanus* var. *minor* Rendle; *Microstegium gratum* (Hackel) A. Camus; *M. monanthum* (Nees ex Steudel) A. Camus; *M. vagans* (Nees ex Steudel) A. Camus; *Pollinia ciliata* var. *breviaristata* Rendle; *P. grata* Hackel; *P. monantha* Nees ex Steudel; *P. vagans* Nees ex Steudel.

Perennial. Culms rambling, rooting at base, branching, up to 4 m long, internodes sometimes pubescent, nodes pilose. Leaf sheaths pubescent to tuberculate-hispid, at least below blade, one margin ciliate; leaf blades narrowly elliptic, 10–18 × (0.5–)0.8–2 cm, pilose, more densely on abaxial surface, base sometimes setose, apex acuminate into a setaceous point; ligule 1–2 mm. Racemes 3–12, purplish, flexuous, fastigiate, 7–12 cm; rachis internodes linear, slightly inflated upward, shorter than spikelet, margins ciliate. Sessile spikelet 2.8–4 mm; callus hairs 1–1.5 mm; lower glume elliptic-oblong, back shallowly grooved or almost flat, scabrid-hispidulous, 2-veined between keels, upper keels stiffly pectinate-ciliate, apex subentire; upper glume sharply keeled, apex acuminate or with a brief mucro; lower floret usually absent; upper lemma ovate, ca. 0.5 mm, rounded to emarginate; awn geniculate with distinct column, 5–8 mm; upper palea lanceolate, 0.7–1.2 mm, obtuse or 3-dentate. Anthers 3, 1.5–2.5 mm. Fl. and fr. Aug–Jan. $2n = 80$.

Forming extensive colonies, moist banks, slopes, usually in shade. Guangdong, Guizhou, Hainan, Hubei, Sichuan, Yunnan [Bhutan, India, Indonesia, Malaysia, Myanmar, Nepal, Thailand, Vietnam; Africa].

Normally the lower floret is completely absent in this species. In a few gatherings (including the type of *Pollinia vagans*) the lower floret is represented by a well-developed palea supporting stamens. A specimen from Hong Kong has a rudimentary lower lemma, but no lower palea. The presence or absence of parts of the lower floret appears to be of no taxonomic significance.

13. Microstegium multiciliatum B. S. Sun, J. Yunnan Univ. 21: 95. 1999 [*"multicilliatum"*].

多纤毛莠竹 duo xian mao you zhu

Perennial. Culms rambling, robust, thinly pilose, nodes pubescent. Leaf sheaths hispid with tubercle-based hairs; leaf blades oblong-elliptic, up to 23–25 × 2–2.5 cm, thinly pilose with tubercle-based hairs, base setose, apex acuminate into a setaceous point; ligule 1.5–2 mm. Racemes ca. 10, whitish tinged purple, 9–12 cm; rachis internodes linear, slightly inflated upward, equaling or shorter than spikelet, margins ciliate. Sessile spikelet 4.5–5 mm; callus hairs 1–1.5 mm; lower glume narrowly oblong, back grooved below middle, smooth except below apex, upper keels stiffly pectinate-ciliate, obscurely 2-veined between keels, apex subentire; upper glume sharply keeled, upper margins broadly hyaline, fimbriate, apex subacute; lower floret absent or represented by ca. 1 mm scale; upper lemma 0.8–1 mm, deeply 2-lobed, lobes lanceolate, ciliate; awn geniculate with distinct column, 10–12 mm; upper palea broad, ca. 1.5 mm, 3-dentate, apex ciliate with ca. 1.5 mm hairs. Anthers 3, 3–3.5 mm.

● Mountain slopes. W Yunnan (Tengchong).

196. APOCOPIS Nees, Proc. Linn. Soc. London 1: 93. 1841.

楔颖草属 xie ying cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Amblyachyrum Hochstetter ex Steudel.

Annual or perennial. Culms slender. Leaf blades linear; ligule short, membranous. Inflorescence terminal, composed of (1 or)2(–4) erect, closely appressed racemes; racemes fragile, spikelets imbricate, usually single, sessile spikelets present, pedicelled spikelets normally suppressed, sometimes a few basal spikelets enlarged, barren, awnless; rachis internodes shorter than spikelets, linear, ciliate; pedicels slender, partly adnate to margin of lower glume, occasionally bearing a rudimentary spikelet (developed in *A. intermedius*). Sessile spikelet dorsally compressed, florets 2; callus obtuse; lower glume papery to leathery, broad, flattened, 7(–9)-veined, apex broadly truncate or emarginate; upper glume narrowly lanceolate, 3-veined, 2-keeled, margins inflexed; lower floret staminate, lower lemma and palea similar, hyaline; upper floret variable, female, bisexual, male or barren, upper lemma linear-lanceolate, entire or 2-toothed, with geniculate puberulous awn, infrequently awnless, palea shorter and broader. Lodicules absent. Stamens 2.

Fifteen species: tropical Asia; four species (one endemic) in China.

1a. Lower glume dark brown with pale yellowish transverse apical band; awn usually absent ..... 1. *A. paleaceus*
1b. Lower glume pale greenish yellow with dark red transverse apical band; awn present.
2a. Sessile spikelet 6–9 mm, upper floret male or barren; pedicelled spikelet present, female, awned ..... 4. *A. intermedius*
2b. Sessile spikelet 3.5–6 mm, upper floret bisexual; pedicelled spikelet absent.
3a. Sessile spikelet 3.5–4 mm; lower glume papery, obovate-cuneate ..... 2. *A. breviglumis*
3b. Sessile spikelet 4.5–6 mm; lower glume herbaceous, obovate ..... 3. *A. wrightii*

1. Apocopis paleaceus (Trinius) Hochreutiner, Bull. New York Bot. Gard. 6: 262. 1910.

楔颖草 xie ying cao

Ischaemum paleaceum Trinius, Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 2: 293. 1833; *Andropogon himalayensis* Steudel; *A. paleaceus* (Trinius) Steudel; *Apocopis himalayensis* (Steudel) W. Watson; *A. royleanus* Nees.

Perennial with spreading rhizomes. Culms tufted, up to 60 cm tall, 3–7-noded. Leaf sheaths glabrous below middle, tuberculate-hispid toward blade; leaf blades linear-lanceolate, 2.5–7 × 0.2–0.6 cm, tuberculate-hispid, rarely glabrous, margins thickened, sometimes pectinate-hispid, apex acute; ligule 0.5–1 mm. Racemes 2–4, 2–4 cm; rachis internodes 2–2.5 mm, golden ciliate; pedicel golden bearded. Sessile spikelet 3.8–5 mm; callus golden bearded; lower glume broadly oblong, leathery, dark brown with a pale yellowish scarious band around apex and upper margins, glabrous, 2 outermost veins on each side connected below apex, connected vein minutely exserted, apex truncate, erose-denticulate, ciliolate; florets subequaling glumes; lower lemma lanceolate, apex obtuse to truncate; upper lemma apex truncate, awnless, or 2-denticulate, mucronate to shortly awned. Anthers 2.5–3 mm. Pedicelled spikelet absent. Fl. and fr. Apr–Aug.

Open hillsides. Guangdong, Guangxi, Hainan, Yunnan [Bhutan, N India, Laos, Malaysia, Myanmar, Nepal, Vietnam].

Some specimens from NE India have exserted, geniculate awns to 7 mm long.

2. Apocopis breviglumis Keng & S. L. Chen, Acta Phytotax. Sin. 13(1): 59. 1975.

短颖楔颖草 duan ying xie ying cao

Perennial. Culms loosely tufted, glabrous, ca. 50 cm tall, 7–9-noded. Leaf sheaths pilose, hairs denser toward ligule; leaf blades linear or linear-lanceolate, 3–13 × 0.25–0.6 cm, upper-

most very reduced, tuberculate-pilose, apex acuminate; ligule ca. 1 mm. Racemes 2, 2.5–4.5 cm, lowermost spikelets barren, awnless; rachis internodes ca. 2 mm, yellowish brown ciliate. Sessile spikelet 3.5–4 mm; callus yellowish brown bearded; lower glume obovate-cuneate, firmly herbaceous, glabrous, greenish yellow with a scarious red-brown band across apex, veins straight, terminating below apex, connected there by transverse veinlets, apex truncate, erose, ciliate; florets longer than upper glume, exserted apices red; lower lemma oblong, truncate-denticulate, ciliate; upper lemma apex subentire, awned; awn 2.2–2.8 cm. Pedicelled spikelet absent. Fl. and fr. summer–autumn.

● Grassy mountain slopes. S Sichuan, N Yunnan.

This species is similar to *Apocopis wrightii*, but with smaller, broader spikelets.

3. Apocopis wrightii Munro, Proc. Amer. Acad. Arts 4: 363. 1860.

瑞氏楔颖草 rui shi xie ying cao

Perennial. Culms tufted, wiry at base, 30–60 cm tall, branching above base, 6–7-noded. Leaf sheaths glabrous or pilose; leaf blades linear, 8–12 × (0.2–)0.3–0.6 cm, uppermost very reduced, tuberculate-pilose, rarely glabrous, apex acuminate; ligule ca. 1 mm. Racemes 2, 3–5 cm, lowermost spikelets barren, awnless; rachis internodes 1.5–2 mm, yellowish brown ciliate; pedicel yellowish brown bearded. Sessile spikelet 4.5–6 mm; callus yellowish brown bearded; lower glume obovate-oblong, firmly herbaceous, glabrous or thinly hispid, greenish yellow with a scarious red-brown band across apex, veins green, straight, terminating below apex, connected there by transverse veinlets, apex truncate, erose, ciliate; florets longer than lower glume, exserted apices red; lower lemma oblong-lanceolate; upper lemma apex 2-denticulate or subentire, awned; awn geniculate, 2–3 cm. Anthers ca. 2.5 mm. Pedicelled spikelet absent or rudimentary. Fl. and fr. Aug–Oct.

Dry grassy hillsides. Anhui, Fujian, Guangdong, Guangxi, Jiangxi, Yunnan, Zhejiang [Thailand].

4. Apocopis intermedius (A. Camus) Chai-Anan, Thai Forest Bull., Bot. 6: 46. 1972.

异穗楔颖草 yi sui xie ying cao

Lophopogon intermedium A. Camus, Bull. Mus. Natl. Hist. Nat. 25: 285. 1919; *Apocopis heterogamus* Keng & S. L. Chen; *A. tridentatus* Bentham var. *intermedius* (A. Camus) Roberty; *A. wrightii* Munro var. *macranthus* S. L. Chen; *Scleradrium intermedium* (A. Camus) C. E. Hubbard.

Perennial, shortly rhizomatous. Culms erect, ca. 50 cm tall, 7–9-noded. Leaf sheaths glabrous to hirsute; leaf blades linear-lanceolate, 6–15 × 0.3–0.5 cm, uppermost very reduced, tuberculate-pilose when young, or sometimes densely hispid; ligule ca. 1.5 mm. Racemes 2, 2–4 cm, lowermost spikelets barren, awnless; rachis internodes 2.5–3 mm, loosely ciliate with yellowish brown soft hairs. Sessile spikelet 6–9 mm; callus hairs yellowish brown; lower glume oblong, firmly herbaceous, glabrous or hispid, greenish yellow with a scarious brown or red band across apex, veins green, straight, terminating below apex, with transverse veinlets, apex truncate, ciliate; florets longer than lower glume, exserted apices red; lower lemma oblong-lanceolate; upper floret usually barren, lemma linear-lanceolate, apex entire or 2-toothed, awned; awn geniculate, 2–3 cm. Anthers 4–5 mm. Pedicelled spikelet developed, ca. 5 mm; glumes pilose, lower glume narrowly oblong-lanceolate, apex obtuse, upper floret female, lemma awned; awn 2–3 cm. Fl. and fr. autumn.

Streams, valleys, roadsides. Guangdong, S Yunnan, Zhejiang [Thailand, N Vietnam].

This species is anomalous in *Apocopis* in possessing a developed pedicelled spikelet, which is female with the stigmas often exserted and visible. This is typical of the related genus *Germainia*, but that has a tough rachis with the fertile pedicelled spikelets falling from the raceme. In *A. intermedius* the base of the pedicel is fused to the margin of the lower glume of the sessile spikelet, as is usual in *Apocopis*, and it appears to be very close to *A. wrightii*.

197. GERMAINIA Balansa & Poitrasson, Bull. Soc. Hist. Nat. Toulouse 7: 344. 1873.

吉曼草属 ji man cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Perennial or annual. Leaf blades linear; ligule short, membranous. Inflorescence terminal, composed of 1 or 2(–6) digitate racemes; racemes with large imbricate persistent sessile spikelets covering smaller pedicelled deciduous spikelets; rachis internodes tough, short, or almost absent and then inflorescence capitate and sessile spikelets forming an involucre, the lower sometimes lacking a pedicelled spikelet. Sessile spikelet male or barren, dorsally compressed, florets usually 2; lower glume lanceolate to oblong, leathery or papery, broadly convex, 7–9-veined, apex truncate or denticulate or retuse; upper glume longer and narrower than lower glume, membranous, 3-veined, apex truncate; upper lemma awnless or rarely mucronate. Pedicelled spikelet fertile, subterete, floret 1(–2); callus pungent, obliquely attached to pedicel; lower glume apex truncate; lower floret usually suppressed; upper lemma entire, stipitiform, awned; awn geniculate, pubescent. Lodicules absent. Stamens 2.

Nine species: NE India to SE Asia and Australia; one species in China.

1. Germainia capitata Balansa & Poitrasson, Bull. Soc. Hist. Nat. Toulouse 7: 344. 1873.

吉曼草 ji man cao

Perennial; basal sheaths persistent, glabrous to tomentose. Culms tufted, erect, 50–60 cm tall, unbranched. Leaf sheaths glabrous or pilose; leaf blades erect, stiff, 5–35 × 0.3–0.9 cm, pubescent to glabrous, margins scabrid, acuminate; ligule scari-

ous, ca. 1 mm. Raceme 1(–2) on a long stiff peduncle, 2–3 cm, greenish, narrowly capitulate. Sessile spikelets 4, involucrelike, 1.3–2.2 cm, 2 florets present; lower glume oblong, leathery, smooth, glabrous or sparsely pilose, apex retuse to obliquely 2-toothed; upper glume puberulous, apex rounded to truncate; lemmas and paleas reddish brown, subhyaline; stamens 2 in each floret; anthers 6–8 mm. Pedicelled spikelets 3, dark brown; pedicel 5–7 mm; callus stiffly bearded, hairs brown; lower glume narrowly lanceolate-oblong, leathery, puberulous; awn 2-geniculate, stout, 6–9.5 cm, column hispidulous, limb shorter than column, puberulous. Fl. and fr. autumn.

Dry hillsides; 800–1000 m. Guangdong, Yunnan (Lingchuan) [Indonesia, New Guinea, Thailand, Vietnam; Australia].

The elongate involucres of hard sessile spikelets, tipping the culms after the long-awned pedicellate spikelets have fallen, are an unmistakable feature of this grass.

198. SORGHUM Moench, Methodus, 207. 1794, nom. cons., not *Sorgum* Adanson (1763).

高粱属 gao liang shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Andropogon subg. *Sorghum* Hackel.

Perennial or annual, with or without rhizomes. Culms usually robust, erect. Leaf blades linear to linear-lanceolate; ligule a ciliate membrane. Inflorescence a large terminal panicle with elongate central axis; primary branches simple or branched, bearing short dense racemes of paired spikelets; racemes fragile (tough in cultivated species); rachis internodes and pedicels slender, ciliate. Sessile spikelet dorsally compressed; callus obtuse, bearded, inserted into internode apex; lower glume usually leathery, shallowly convex, rounded on flanks, becoming 2-keeled and winged upward, usually hairy, apex membranous; upper glume boat-shaped, keeled upward; lower floret reduced to an empty hyaline lemma; upper lemma 2-toothed, awned from sinus or infrequently awnless; awn bigeniculate, glabrous. Lodicules ciliate. Pedicelled spikelet well developed or reduced to a glume, usually much narrower than sessile spikelet, awnless.

About 30 species: tropics and subtropics of the Old World, one species endemic to Mexico, otherwise introduced in America; five species (three introduced) in China.

The genus includes species of agricultural importance, including the tropical cereal sorghum, and several species grown for forage.

1a. Nodes of culm conspicuously bearded; panicle branches simple ..... 1. *S. nitidum*
1b. Nodes of culms glabrous or shortly pubescent; panicle branches subdivided.
2a. Plants with rhizomes; wild.
3a. Culms slender, 0.5–1.5 m tall; panicle lanceolate, 20–40 cm; sessile spikelet elliptic; lower glume apex clearly 3-denticulate ..... 2. *S. halepense*
3b. Culms robust, 1.5–3 m tall; panicle ovate, 30–55 cm; sessile spikelet ovate; lower glume apex apiculate or obscurely denticulate ..... 3. *S. propinquum*
2b. Plants without rhizomes; usually cultivated.
4a. Panicle rather lax; racemes usually tardily fragile at maturity; sessile spikelets elliptic, 6–7.5 mm; grain enclosed by the glumes ..... 4. *S. sudanense*
4b. Panicle often dense; racemes tough at maturity; sessile spikelets ovate to subrotund, 3.5–6 mm; grain large, exposed between the gaping glumes ..... 5. *S. bicolor*

1. Sorghum nitidum (Vahl) Persoon, Syn. Pl. 1: 101. 1805.

光高粱 guang gao liang

Holcus nitidus Vahl, Symb. Bot. 2: 102. 1791; *Andropogon nitidus* (Vahl) Kunth; *A. serratus* Thunberg var. *nitidus* (Vahl) Hackel; *Holcus fulvus* R. Brown; *H. fulvus* var. *nitidus* (Vahl) Honda; *Sorghum fulvum* (R. Brown) P. Beauvois; *S. nitidum* var. *fulvum* (R. Brown) Handel-Mazzetti.

Perennial forming loose tufts. Culms erect, 0.6–2 m tall; nodes bearded with pale spreading hairs. Leaf sheaths glabrous or pilose; leaf blades linear, 10–40(–50) × 0.4–1 cm, glabrous to hispid, bearded at base; ligule 1–1.5 mm. Panicle lanceolate in outline, 15–30 cm, glabrous but with soft hairs at the nodes; primary branches whorled, simple, flexuous, 2–5 cm, lower part bare; racemes borne at branch ends, fragile, composed of 2–4 spikelet pairs; internodes and pedicels brown-ciliate. Sessile spikelet ovate-lanceolate, 3.5–5 mm; lower glume leathery, black-brown at maturity, glossy, glabrous below middle, upper part and margins hispid with brown hairs; upper lemma awnless or awned; awn 1–1.5 cm. Pedicelled spikelet usually staminate, elliptic, 3–3.7 mm, papery, light brown. Fl. and fr. summer–autumn. $2n = 10, 20$.

Meadows, grassy hillsides; 300–1400 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangsu, Jiangxi, Shandong, Sichuan, Taiwan, Yunnan, Zhejiang [Bhutan, India, Indonesia, Japan, Korea, Myanmar, New Guinea, Philippines, Sri Lanka, Thailand; NE Australia, Pacific Islands].

This is a distinctive species not closely related to others found in China. It is easily recognizable by its conspicuously bearded nodes and small, blackish, glossy spikelets. It occurs in both awned and awnless forms.

2. Sorghum halepense (Linnaeus) Persoon, Syn. Pl. 1: 101. 1805.

石茅 shi mao

Holcus halepensis Linnaeus, Sp. Pl. 2: 1047. 1753; *Andropogon halepensis* (Linnaeus) Brotero; *A. sorghum* (Linnaeus) Brotero subsp. *halepensis* (Linnaeus) Hackel.

Perennial with vigorous spreading rhizomes. Culms 0.5–1.5 m tall, 4–6 mm in diam.; nodes puberulous. Leaf sheaths glabrous; leaf blades linear or linear-lanceolate, 25–80 × 1–4 cm, glabrous; ligule 0.5–1 mm, glabrous. Panicle lanceolate to pyramidal in outline, 20–40 cm, soft white hairs in basal axil; primary branches solitary or whorled, spreading, lower part bare, upper part branched, the secondary branches tipped by racemes; racemes fragile, composed of 2–5 spikelet pairs. Sessile spikelet elliptic, 4–5 mm; callus obtuse, bearded; lower glume subleathery, often pale yellow or yellowish brown at maturity, shortly pubescent or glabrescent, 5–7-veined, veins distinct in upper part, apex 3-denticulate; upper lemma acute and mucronate or 2-lobed and awned; awn 1–1.6 cm. Pedicelled spikelet staminate, narrowly lanceolate, 4.5–7 mm, often violet-purple. Fl. and fr. summer–autumn. $2n = 40$.

Introduced. Streams, valleys, waste ground, a weed in fields. Anhui, Fujian, Guangdong, Hainan, Sichuan, Taiwan, Yunnan [India, Kazakhstan, Kyrgystan, Nepal, Pakistan, Sri Lanka, Tajikistan, Turkmenistan, Uzbekistan; SW Asia, S Europe].

This species is thought to have originated in the Mediterranean region, but is now widely distributed as a serious weed in warm-temperate regions of the world. The forage known as Johnson Grass is a selection of *Sorghum halepense*. It introgresses with grain sorghum (*S. bicolor*) where both species grow together.

3. Sorghum propinquum (Kunth) Hitchcock, Lingnan Sci. J. 7: 249. 1931 ["1929"].

拟高粱 ni gao liang

Andropogon propinquus Kunth, Enum. Pl. 1: 502. 1833; *A. halepensis* (Linnaeus) Brotero var. *propinquus* (Kunth) Hackel; *A. sorghum* (Linnaeus) Brotero var. *propinquus* (Kunth) Hackel.

Perennial, loosely tufted with a few stout rhizomes. Culms 1.5–3 m tall, up to 1 cm in diam., many-noded; nodes puberulous. Leaf sheaths glabrous, ciliate at mouth and margins; leaf blades yellowish green, linear or linear-lanceolate, 40–90 × 3–5 cm, glabrous, midvein robust, margins ciliolate; ligule 0.5–1 mm, puberulous. Panicle open, ovate or broadly ovate, 30–55 cm; primary branches in whorls of 3–6; lower part bare, upper part branched, branches tipped by racemes; racemes fragile, composed of 3–7 spikelet pairs. Sessile spikelet ovate, 3.8–4.5 mm; callus obtuse, pubescent with pale hairs; lower glume subleathery, pale or purple-tinged, thinly pilose, 9–13-veined, veins distinct in upper part, apex acute to apiculate or tridenticulate; upper lemma acute or emarginate, awnless, rarely with short awn. Pedicelled spikelet staminate, linear-lanceolate, 4–5.5 mm, yellowish to pale purple. Fl. and fr. summer–autumn. $2n = 20$.

Streamsides, moist places. Fujian, Guangdong, Hainan, Sichuan, Taiwan, Yunnan (Funing, Hekou) [S India, Indonesia, Malaysia, Philippines, Sri Lanka].

This species is closely related to *Sorghum halepense*, but is diploid, is larger with a more profuse panicle, and has a different geographic distribution. It is sometimes used for fodder. A form with larger (4.5–5 mm) sessile spikelets, *S. propinquum* var. *siamense* (Piper) Snowden, occurs from S India to Thailand, but has not been found in China.

4. Sorghum sudanense (Piper) Stapf in Prain, Fl. Trop. Africa 9: 113. 1917.

苏丹草 su dan cao

Andropogon sorghum subsp. *sudanensis* Piper, Proc. Biol. Soc. Washington 28(4): 33. 1915; *A. sudanensis* (Piper) Leppan & Bosman; *Sorghum vulgare* Persoon var. *sudanense* (Piper) Hitchcock.

Annual. Culms 1–2.5 m tall, 3–6 mm in diam. Leaf sheaths glabrous or pilose at mouth and base; leaf blades linear or linear-lanceolate; 15–30 × 1–3 cm, glabrous; ligule brown. Panicle lax, 15–30 × 6–12 cm; branches slender, branched; racemes usually tardily fragile at maturity, composed of 2–5 spikelet pairs. Sessile spikelet elliptic, 6–7.5 mm; callus hairy; lower glume leathery, thinner upward, thinly strigillose, distinctly 11–13-veined; upper lemma ovate or ovate-elliptic, apex 2-lobed, awned; awn 10–16 mm. Pedicelled spikelet male or barren, linear-lanceolate, persistent. Caryopsis elliptic or obovate-elliptic, 3.5–4.5 mm, enclosed within glumes. Fl. and fr. Jul–Sep. $2n = 20$.

Naturalized. Anhui, Beijing, Fujian, Guizhou, Heilongjiang, Henan, Nei Mongol, Ningxia, Shaanxi, Xinjiang, Zhejiang [native to Africa; now widely cultivated for forage].

This taxon is a cultivated selection (Sudan Grass) from *Sorghum* ×*drummondii* (Steudel) Millspaugh & Chase. It originated in Africa, but is widely grown for forage and is now naturalized in China. *Sorghum* ×*drummondii* is a general name given to the wide variety of weedy forms that have arisen in Africa by hybridization between the cereal *S. bicolor* and its wild progenitor *S. arundinaceum* (Desvaux) Stapf.

5. Sorghum bicolor (Linnaeus) Moench, Methodus, 207. 1794.

高粱 gao liang

Holcus bicolor Linnaeus, Mant. Pl. 2: 301. 1771; *Andropogon bicolor* (Linnaeus) Roxburgh; *A. sorghum* (Linnaeus) Brotero; *A. sorghum* var. *technicus* Körnicke; *Holcus cernuus* Arduino; *H. dochna* Forsskål; *H. sorghum* Linnaeus; *Sorghum cernuum* (Arduino) Host; *S. dochna* (Forsskål) Snowden; *S. nervosum* Besser ex Schultes; *S. technicum* (Körnicke) Roshevitz; *S. vulgare* Persoon, nom. illeg. superfl.

Annual. Culms erect, robust, 3–5 m tall, 2–5 cm in diam.; nodes glabrous or pubescent. Leaf sheaths glabrous or slightly farinose; leaf blades linear or linear-lanceolate, 40–70 × 3–8 cm, glabrous; ligule subrounded, ciliate. Panicle very variable, lax or dense, cylindrical or pyramidal to obovate in outline, up to 60 cm, main axis elongate to very short; primary branches ascending or spreading, lower branches sometimes almost as long as panicle, stiff or pendulous; racemes tough at maturity, composed of 2–6 spikelet pairs. Sessile spikelet variable, broadly obovate to subglobose, 3.5–5.5 mm; callus hispid; lower glume leathery to papery, glabrous to pilose, pale creamy-

green to dark brown or blackish at maturity, upper lemma usually awned; awn 0.4–1.5 cm. Pedicelled spikelet male or barren, linear-lanceolate, persistent or deciduous. Caryopsis large, often exposed between the gaping glumes. Fl. and fr. Jun–Sep. 2*n* = 20.

Cultivated in China [native to Africa; widely cultivated in the tropics].

Sorghum bicolor is the important, tropical cereal sorghum. Originating in Africa, its cultivation for both grain and fodder spread throughout the tropics and subtropics of the Old World. It was introduced with the slave trade to America, including warm parts of the United States. It is now cultivated throughout most of China.

There is a multiplicity of forms of cultivated sorghum, derived by human selection and all fully interfertile. Some forms have sweet culms. Many species names have been proposed in the past in an attempt to categorize this variation, but they represent no more than intergrading cultivars within the common species pool.

The name *Holcus saccharatus* Linnaeus (*Sorghum saccharatum* (Linnaeus) Moench) has been identified as this species, but its application is uncertain (see Davidse & Turland in Taxon 50: 577–580. 2001) and the name has been formally rejected.

The principal races grown in China are as follows.

‘bicolor’

高粱 gao liang

Panicle loose with long branches, to 40 cm. Sessile spikelets broadly obovate; glumes leathery, glossy. Grain relatively small, enclosed within the glumes or only the top protruding.

Cultivated for grain; a primitive type.

‘cernuum’

弯头高粱 wan tou gao liang

Panicle elliptic or ovate-elliptic, dense, 8–20 cm, curved or erect. Sessile spikelets broadly ovate, whitish; glumes thin, papery, transversely wrinkled, densely white-villous to glabrescent. Grain pale, subrotund to orbicular, usually much flattened, protruding beyond the glumes.

Cultivated in Xinjiang for grain and forage.

‘dochna’

甜高粱 tian gao liang

Culms with sweet juice. Panicle elongate, to 50 cm; branches racemose or corymbose, the lower ones half as long as panicle or more. Sessile spikelets broadly elliptic to obovate; glumes crustaceous, striately veined above middle. Grain elliptic or elliptic-oblong, enclosed by the glumes or only slightly protruding.

Cultivated for grain and forage throughout most of China, including forms used for making brooms.

‘nervosum’

多脉高粱 duo mai gao liang

Panicle elongate, dense, elliptic in outline, to 40 cm. Sessile spikelets elliptic to broadly elliptic; glumes papery, prominently veined ± throughout. Grain broadly elliptic, protruding beyond the glumes.

Cultivated for grain, mainly in N China.

199. PSEUDOSORGHUM A. Camus, Bull. Mus. Natl. Hist. Nat. 26: 662. 1920.

假高粱属 jia gao liang shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Annual. Leaf blades cauline, linear; ligule membranous, margin ciliate. Inflorescences terminal and also axillary, contracted, composed of a central axis bearing fascicles of racemes; racemes with several to many spikelet pairs, narrow, 1-sided, fragile; rachis internodes and pedicels slenderly linear, white ciliate on edges. Sessile spikelet dorsally compressed, lanceolate-oblong; callus very small, obtuse, bearded with long silky hairs, inserted into internode apex; glumes firmly cartilaginous, glossy, lower glume shallowly convex, rounded on flanks becoming keeled upward, apex narrowly truncate; upper glume boat-shaped; lower floret reduced to an empty hyaline lemma; upper lemma deeply 2-lobed, lobes ciliate, awned from sinus; awn geniculate, glabrous. Lodicules glabrous. Pedicelled spikelet male or barren, somewhat narrower than sessile, awnless.

One species: tropical Asia, including China.

1. Pseudosorghum fasciculare (Roxburgh) A. Camus, Bull. Mus. Natl. Hist. Nat. 26: 662. 1920.

假高粱 jia gao liang

Andropogon fascicularis Roxburgh, Fl. Ind. 1: 269. 1820; *A. tonkinensis* Balansa; *A. zollingeri* Steudel; *Bothriochloa gracilis* W. Z. Fang; *B. yunnanensis* W. Z. Fang; *Pseudosorghum zollingeri* (Steudel) A. Camus; *Sorghum fasciculare* (Roxburgh) Haines; *S. zollingeri* (Steudel) Kuntze.

Plant tufted. Culms slender, erect or ascending, up to 2 m, many-noded, simple or branched below, nodes glabrous. Leaf sheaths usually with tubercle-based hairs; leaf blades linear, 10–40 × 0.4–1 cm, glabrous on both surfaces, margins scaberulous, apex acute; ligule 2–4 mm. Inflorescence 4–13 cm, fascicles with up to 10 racemes; racemes composed of 5–15 spikelet pairs. Sessile spikelet 3.8–4.5 mm, yellowish or purplish; lower glume smooth, glossy, scabrid-puberulous near apex; upper slightly longer than lower; upper lemma ca. 2 mm; awn 1.2–1.8 cm. Pedicelled spikelet narrowly lanceolate, male or barren, glumes sometimes enclosing hyaline lemmas.

Damp places; below 1000 m. Yunnan [India, Indonesia, Myanmar, Philippines, Thailand, Vietnam].

200. CHRYSOPOGON Trinius, Fund. Agrost. 187. 1820, nom. cons.

金须茅属 jin xu mao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Centrophorum Trinius, nom. rej.; *Pollinia* Sprengel, nom. rej.; *Rhaphis* Loureiro, nom. rej.; *Vetiveria* Bory.

Perennial, tufted or with spreading rhizomes. Leaf blades mostly basal, usually narrow; ligule a short ciliolate rim or line of hairs. Inflorescence a lax terminal panicle; primary branches whorled, filiform, usually unbranched, each bearing a raceme; racemes composed of few to many spikelet pairs, or more usually reduced to a triad of 1 sessile bisexual spikelet flanked by 2 pedicellate male or barren spikelets; rachis internodes and pedicels slender. Sessile spikelet laterally compressed; callus elongate, acute to pungent, usually bearded; lower glume cartilaginous to leathery, often spinulose; upper glume boat-shaped, usually shortly awned; lower floret reduced to an empty hyaline lemma; upper lemma entire or 2-toothed, awned from apex or sinus or infrequently awnless; awn geniculate, glabrous to pubescent. Pedicelled spikelet dorsally compressed, well developed or reduced, male or barren.

Forty-four species: tropical and warm-temperate regions of the Old World, mainly in Asia and Australia, one species in the SE United States (Florida) and Cuba; four species (one introduced) in China.

Vetiveria has traditionally been separated from *Chrysopogon* on the basis of its longer racemes composed of a number of spikelet pairs in addition to the terminal triad. However, it has long been known that intermediates exist, and present knowledge of the group shows that separation into two genera is no longer tenable.

1a. Racemes composed of 5–13 spikelet pairs and a terminal triad; callus rounded, subglabrous; plant cultivated ..... 1. *C. zizanioides*
1b. Racemes reduced to a triad of 1 sessile and 2 pedicelled spikelets (rarely with 1–4 spikelet pairs); callus pungent, bearded; plant wild.
2a. Lower glume of sessile spikelet tuberculate-spinulose; sessile spikelets ca. 7 mm; culms robust, often more than 1 m tall ..... 2. *C. gryllus*
2b. Lower glume of sessile spikelet not spinulose; sessile spikelets 4–6 mm; culms 20–90 cm tall.
3a. Upper lemma of sessile spikelet with geniculate 4–6 cm awn; pedicels with golden hairs ..... 3. *C. orientalis*
3b. Upper lemma of sessile spikelet with straight 0.4–0.7 cm awn; pedicels glabrous ..... 4. *C. aciculatus*

1. Chrysopogon zizanioides (Linnaeus) Roberty, Bull. Inst. Franç. Afrique Noire 22: 106. 1960.

香根草 xiang gen cao

Phalaris zizanioides Linnaeus, Mant. Pl. 2: 183. 1771; *Vetiveria zizanioides* (Linnaeus) Nash.

Tussocky perennial; roots stout, aromatic. Culms robust, 1–2.5 m tall, ca. 5 mm in diam. Leaf sheaths glabrous, lower sharply keeled and imbricate in fanlike clusters; leaf blades linear, pale green, stiff, 30–90 × 0.5–1 cm, pilose on adaxial surface toward base, otherwise glabrous; ligule a scarious rim. Panicle oblong in outline, 20–30 cm, usually contracted, purplish; branches numerous, lowermost 5–20 cm, bare at base, smooth or slightly scaberulous; racemes slender, with 5–13 spikelet pairs and a terminal triad; internodes and pedicels slightly scabrid. Sessile spikelet linear-lanceolate to almost linear, 4–5 mm; callus rounded, subglabrous; lower glume muricate, 3–5-veined, veins spinulosely aculeate, apex acute; upper glume spinulosely aculeate on keel, not awned; upper lemma slightly 2-toothed, awnless or mucronate; mucro 0–2 mm, not exserted. Pedicelled spikelet staminate, sparingly aculeolate or almost smooth. Fl. and fr. Aug–Oct. $2n = 20$.

Commonly cultivated. Fujian, Guangdong, Hainan, Jiangsu, Sichuan, Taiwan, Yunnan (Xixhuangbanna), Zhejiang [native to India; cultivated elsewhere].

This species (Vetiver Grass) is said to have originated in India, but is now distributed throughout warm parts of the Old World and introduced into the S United States and West Indies. It has long been cultivated for the oil extracted from the aromatic roots, which is used in perfumery. More recently, its potential as a soil binder to prevent erosion has been recognized. It is planted in hedges for this purpose, particularly along the contours of sloping ground. The deep, non-invasive root system holds the plants firm, while the stiff, dense leaves trap soil and prevent it being washed away. It is also used as a forage grass.

2. Chrysopogon gryllus (Linnaeus) Trinius, Fund. Agrost. 188. 1820.

刺金须茅 ci jin xu mao

Andropogon gryllus Linnaeus, Cent. Pl. 2: 33. 1756; *A. echinulatus* Nees ex Steudel; *A. gryllus* subsp. *echinulatus* (Nees ex Steudel) Hackel; *Chrysopogon echinulatus* (Nees ex Steudel) W. Watson; *C. gryllus* subsp. *echinulatus* (Nees ex Steudel) Cope; *Rhaphis gryllus* (Linnaeus) Trinius.

Perennial forming tough tussocks. Culms robust, up to 1.5 m tall, scabrid below panicle. Leaf sheaths strongly keeled at base; leaf blades linear, glaucous, up to 30 × 0.2–0.4 cm, sparsely to densely hispid with tubercle-based hairs or glabrous, apex subacute to acuminate; ligule ca. 0.5 mm, a ciliate rim. Panicle open to contracted, 6–25 cm, purplish; branches stiffly ascending to loosely spreading, 3–15 cm, tipped by a single triad or also with 1–4 spikelet pairs below the triad. Sessile spikelet ca. 7 mm; callus subacute, 1.3–1.7 mm, bearded with golden hairs, obliquely attached to branch apex; lower glume narrowly oblong, tuberculate-spinose along inturned flanks, sometimes hispidulous at apex, apex truncate or 2-toothed; upper glume hispid on keel toward apex, awnless, mucronate or with an awn up to 10 mm; upper lemma minutely 2-toothed, awned; awn geniculate, 1.2–3.5 cm, column puberulous. Pedicelled spikelet staminate, 7–11 mm; lower glume with 3.5–7 mm awn. Pedicel 2/3–3/4 length of sessile spikelet, glabrous. Fl. and fr. autumn.

Mountain slopes; ca. 2500 m. S Xizang, Yunnan (Menghai) [Afghanistan, Bhutan, India, Nepal, Pakistan; SW Asia (Caucasus, Iraq), Europe].

3. Chrysopogon orientalis (Desvaux) A. Camus in Lecomte, Fl. Indo-Chine 7: 332. 1922.

金须草 jin xu cao

Rhaphis orientalis Desvaux, Opusc. Sci. Phys. Nat. 69. 1831; *Andropogon wightianus* Nees ex Steudel; *Chrysopogon sinensis* Rendle.

Perennial, tufted, shortly rhizomatous. Culms 30–90 cm tall, glabrous or puberulous below inflorescence. Leaf sheaths glabrous or puberulous; leaf blades linear, 3–10 × 0.2–0.4 cm, lower margins tuberculate-setose, otherwise glabrous, apex subacute; ligule 0.2–0.7 mm. Panicle open, 6–20 cm, purplish brown; branches laxly spreading, 3.5–6 cm, tipped by a single triad. Sessile spikelet 4.7–5.5 mm; callus pungent, 2–4 mm, bearded with golden hairs, obliquely attached to branch apex; glumes leathery; lower glume narrowly lanceolate, smooth, glabrous, pilosulous near apex, apex obtuse; upper glume setulose on upper keel, awned, awn 1.2–1.8 cm; upper lemma entire, awned; awn geniculate, 4–6 cm, column puberulous. Pedicelled spikelet male or barren, 5.3–7 mm; lower glume with 5–15 mm awn. Pedicel 3/4 length of sessile spikelet, ciliate with golden hairs. Fl. and fr. Jun–Sep.

Hill slopes, coastal sand at low elevations. Fujian, Guangdong, Hainan [India, Laos, Malaysia, Myanmar, Sri Lanka, Thailand, Vietnam].

4. Chrysopogon aciculatus (Retzius) Trinius, Fund. Agrost. 188. 1820.

竹节草 zhu jie cao

Andropogon aciculatus Retzius, Observ. Bot. 5: 22. 1789; *Centrophorum chinense* Trinius.

Perennial with extensively creeping rhizomes, sward forming; rhizomes stout, close-noded. Culms decumbent at base or ascending, 20–50 cm tall. Leaf sheaths glabrous or ciliate at mouth; leaf blades broadly linear, 3–5 × 0.4–0.6 cm, glabrous or adaxial surface pilose near base, margins serrate, apex subacute; ligule 0.1–0.3 mm. Panicle dense, oblong in outline, 5–9 cm, purplish brown; branches erect when dry, 1.5–3 cm, tipped by a single triad. Sessile spikelet 3.5–4 mm; callus acicular, 4–6 mm, bearded with golden hairs, obliquely attached to branch apex; glumes leathery; lower glume lanceolate, 2-keeled upward, lower back smooth, glabrous, upper back thinner, keels hispidulous, apex acute to 2-toothed; upper glume setulose on upper keel, acuminate or mucronate, mucro 1–2 mm; upper lemma entire, awned; awn straight, 4–7 mm. Pedicelled spikelet staminate, 4–5.7 mm; lower glume acuminate or with mucro to 1 mm. Pedicel 3/4 length of sessile spikelet, glabrous. Fl. and fr. Jun–Oct. 2*n* = 20.

Dry open grasslands, waste ground, lawns; 500–1000 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Taiwan, Yunnan [Afghanistan, Bangladesh, Bhutan, Cambodia, India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam; Australia, Pacific Islands (Polynesia)].

Rarely, racemes of this species may have one or more spikelet pairs below the triad.

This is a ground-cover grass used for erosion control and lawns. It sometimes becomes a noxious weed. The needle-sharp callus on the diaspore can injure cattle and other animals, catching in fur and then penetrating the skin.

201. DICHANTHIUM Willemet, Ann. Bot. (Usteri) 18: 11. 1796.

双花草属 shuang hua cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Eremopogon Stapf; *Lepeocercis* Trinius.

Perennial, rarely annual. Leaf blades often cauline, linear; ligule membranous. Inflorescence of single or subdigitate racemes, terminal or also axillary and sometimes supported by spathes; racemes usually with 1 or more basal homogamous spikelet pairs, spikelets often imbricate; rachis internodes and pedicels slender, solid, bearded, truncate or oblique at apex. Sessile spikelet dorsally compressed; callus short, obtuse; lower glume papery to cartilaginous, broadly convex to slightly concave, sometimes pitted, rounded on flanks, becoming 2-keeled upward, apex obtuse; upper glume boat-shaped, dorsally keeled, awnless; lower floret reduced to an empty hyaline lemma; upper lemma stipitiform, entire, awned from apex; awn geniculate, glabrous or puberulous. Stamens (2–)3. Pedicelled spikelet similar to the sessile, male or barren, awnless.

About 20 species: Africa through India to SE Asia and Australia; three species in China.

Dichanthium is closely related to *Bothriochloa*, but can be distinguished by its pedicels and rachis internodes being solid and lacking a median, purple line. The species present in China are not clear-cut and are also variable within themselves due to polyploidy and apomixis. All three species provide good grazing and now occur widely in tropical regions as introductions or escapes.

1a. Peduncle pilose below inflorescence ..... 1. *D. aristatum*
1b. Peduncle glabrous.
2a. Lower glume of sessile spikelet obovate, winged along keels; leaf sheaths compressed; ligule less than 1 mm, margin ciliate ..... 2. *D. caricosum*
2b. Lower glume of sessile spikelet oblong, not winged along keels; leaf sheaths terete; ligule 1–2 mm, margin lacerate ..... 3. *D. annulatum*

1. Dichanthium aristatum (Poiret) C. E. Hubbard, Bull. Misc. Inform. Kew 1939: 654. 1939.

毛梗双花草 mao geng shuang hua cao

Andropogon aristatus Poiret in Lamarck, Encycl., Suppl. 1: 585. 1811; *A. caricosus* Linnaeus var. *mollicomus* (Kunth) Hackel; *A. mollicomus* Kunth.

Perennial. Culms geniculate to suberect, 20–60 cm tall, nodes glabrous or pubescent. Leaf sheaths usually longer than internodes; leaf blades flat, 1.5–8(–20) × 0.3–0.6 cm, glabrous or thinly pilose on both surfaces; ligule ca. 0.6 mm, minutely fimbriate. Inflorescence terminal; peduncle softly pilose near the summit; racemes (1–)2–4, subdigitate, 2–5 cm, with 1–6 pairs of homogamous spikelets. Sessile spikelet 3–5 mm; lower glume obovate, subleathery, 8–10-veined, pubescent on lower back, slightly glossy, margins glabrous or shortly ciliate, keels often narrowly winged, apex rounded; upper glume glabrous or ciliate along margins and keel; awn 1.2–2 cm. Caryopsis ca. 1.8 mm. Pedicelled spikelet many-veined, resembling sessile. Fl. and fr. Jun–Nov. 2*n* = 20, 40, 60.

Hill slopes; 500–1500 m. Taiwan, Yunnan [India, Indonesia, Malaysia; introduced elsewhere].

This species is very close to, and may simply be a variant of, *Dichanthium caricosum*.

2. Dichanthium caricosum (Linnaeus) A. Camus, Bull. Mus. Natl. Hist. Nat. 27: 549. 1921.

单穗草 dan sui cao

Andropogon caricosus Linnaeus, Sp. Pl., ed. 2, 2: 1480. 1763.

Perennial, stoloniferous. Culms tufted at nodes of stolons, geniculately ascending, 30–60 cm tall, nodes glabrous or pubescent. Leaf sheaths compressed, keeled, shorter than internodes; leaf blades flat, 15–20 cm × 2.5–5 mm, glabrous or with a few hairs at base, margins smooth or scabrid, apex acuminate; ligule less than 1 mm, margin ciliate. Inflorescence terminal; peduncle glabrous; racemes (1–)2–4, 2.5–5 cm, with 1–3 pairs of homogamous spikelets. Sessile spikelet 3–3.5 mm; lower glume obovate-elliptic or obovate-oblong, papery, 8–12-veined, glabrous or often sparsely hirsute on lower back, slightly glossy, margins shortly ciliate, keels winged, apex rounded; upper glume ciliate above middle, apex obtuse; awn 1.5–2.5 cm, weakly geniculate. Caryopsis obovate-oblong. Pedicelled spikelet many-veined, resembling sessile. Fl. and fr. Oct–Mar. 2*n* = 20, 40.

Hill slopes, roadsides; 300–1000 m. Guizhou, Yunnan [India, Malaysia, Myanmar, Sri Lanka, Thailand; introduced elsewhere].

3. Dichanthium annulatum (Forsskål) Stapf in Prain, Fl. Trop. Africa 9: 178. 1917.

双花草 shuang hua cao

Andropogon annulatus Forsskål, Fl. Aegypt.-Arab. 173. 1775; *Bothriochloa tuberculata* W. Z. Fang; *Dichanthium annulatum* var. *bullisetosum* B. S. Sun & S. Wang.

Perennial. Culms tufted, erect or sometimes straggling, 30–100 cm tall, nodes bearded with spreading hairs. Leaf sheaths terete, shorter than internodes; leaf blades flat, 8–30 × 0.2–0.4 cm, glabrous or adaxial surface stiffly pilose, margins smooth or scaberulous, apex acuminate; ligule 1–2 mm, lacerate. Inflorescence terminal; peduncle glabrous; racemes 2–8, subdigitate, suberect, 4–5 cm, with 0–6 pairs of homogamous spikelets. Sessile spikelet 3–5 mm; lower glume elliptic-oblong or oblong, firmly papery, 5–9-veined, subglabrous or pubescent to villous on lower back, upper flanks often with long spreading hairs, keels shortly ciliate, not or barely winged, apex obtuse; upper glume ciliate along keel and margins, apex acute or obtuse; awn 1.6–2.4 cm. Caryopsis obovate. Pedicelled spikelet many-veined, pubescent to villous with spreading tubercle-based hairs. Fl. and fr. Jun–Nov. 2*n* = 20, 40.

Mountain slopes, disturbed ground; 100–2200 m. Guangdong, Guangxi, Guizhou, Hainan, Hubei, Sichuan, Taiwan, Yunnan [India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, Philippines; Africa, Pacific Islands; introduced in America and Australia].

202. CAPILLIPEDIUM Stapf in Prain, Fl. Trop. Africa 9: 169. 1917.

细柄草属 xi bing cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Perennial or annual. Culms erect, decumbent or rambling. Leaf blades linear, sometimes aromatic; ligule membranous, margin ciliolate. Inflorescence a terminal open panicle with elongate central axis; branches capillary, subdivided, each branchlet tipped by a short raceme; racemes with 1–5(–8) spikelet pairs, often reduced to triads of 1 sessile and 2 pedicelled spikelets, basal homogamous spikelet pairs absent; rachis internodes and pedicels slender, with a median translucent stripe between thickened margins. Sessile spikelet dorsally compressed; callus very short, obtuse, shortly bearded; lower glume cartilaginous, broadly convex to slightly concave, flanks rounded, keeled toward apex, apex acute to obtuse; upper glume boat-shaped, dorsally keeled; lower floret reduced to a small empty hyaline lemma; upper lemma stipitiform, entire, awned from apex; awn geniculate, glabrous or puberulous. Pedicelled spikelet male or barren, similar to the sessile or smaller, herbaceous.

About 14 species: E Africa, tropical Asia, Australia; five species (one endemic) in China.

This homogeneous genus is distinguished from *Bothriochloa* by the combination of an elongate inflorescence and few-spiculate racemes.

1a. Sessile spikelet 2.6–3 mm.
2a. Culms woody, 1.5–3.5 m tall; pedicelled spikelet 1/2–2 times longer than sessile spikelet ..... 1. *C. assimile*
2b. Culms herbaceous, 0.5–1.1 m tall; pedicelled spikelet equal to sessile spikelet or slightly longer ..... 2. *C. kuoi*

1b. Sessile spikelet 3–3.8 mm.
3a. Culms up to 30 cm, much branched; nodes glabrous; leaf blades 6–10 cm; lower glume of sessile spikelet acute or bidentate ..... 3. *C. kwashotense*
3b. Culms up to 120 cm, not or little branched; nodes bearded; leaf blades 15–30 cm; lower glume of sessile spikelet obtuse.
4a. Racemes 1(–3)-noded, with 1(–3) sessile spikelets; lower glume of sessile spikelet 2-veined and channeled on back ..... 4. *C. parviflorum*
4b. Racemes 3–8-noded, with more than 3 sessile spikelets; lower glume of sessile spikelet often 4–5-veined and flat on back ..... 5. *C. spicigerum*

1. Capillipedium assimile (Steudel) A. Camus in Lecomte, Fl. Indo-Chine 7: 314. 1922.

硬秆子草 ying gan zi cao

Andropogon assimilis Steudel, Syn. Pl. Glumac. 1: 397. 1854; *A. glaucopsis* Steudel; *A. subrepens* Steudel; *Bothriochloa assimilis* (Steudel) Ohwi; *B. picta* Ohwi; *Capillipedium glaucopsis* (Steudel) Stapf; *Dichanthium assimile* (Steudel) Deshpande.

Perennial, often straggling. Culms decumbent and rooting at base, woody, 1.5–3.5 m tall, 1.5–5 mm in diam., fastigiately branched, nodes glabrous or pubescent. Leaf sheaths glabrous, bearded at mouth; leaf blades linear-lanceolate, 6–15 × 0.3–0.6 cm, glabrous or hispidulous, base tapering, apex setaceously acuminate; ligule ca. 0.7 mm. Panicle pyramidal, 5–12 × ca. 4 cm; branches pilose in axils; racemes composed of triads, sometimes with 1 or 2 additional spikelet pairs, greenish or pinkish; rachis internodes and pedicels long ciliate. Sessile spikelet 2.1–2.9 mm; lower glume elliptic-oblong or lanceolate, back 2–5-veined, slightly convex, glossy, glabrous or hispidulous, upper margins keeled, ciliate-hispid; upper glume ciliate along margins; awn of upper lemma 0.6–1.5 cm. Pedicelled spikelet linear-lanceolate, up to twice length of sessile spikelet. Fl. and fr. Aug–Dec. 2*n* = 40.

Streams, forests, or mountain slopes. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangxi, Shandong, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bangladesh, Bhutan, India, Indonesia, Japan, Malaysia, Myanmar, Nepal, Thailand, Vietnam].

This grass is said to have the appearance of a small bamboo. It differs from the other common species, *Capillipedium parviflorum*, by its taller, woody, fasciculately branching culms, shorter leaf blades with narrowed base, smaller sessile spikelets, and pedicels ciliate along the length of both margins.

2. Capillipedium kuoi L. B. Cai, Acta Biol. Plateau Sin. 12: 34. 1994.

郭氏细柄草 guo shi xi bing cao

Perennial, loosely tufted. Culms erect or geniculate at base, herbaceous, 50–110 cm tall, 1.5–2.3 mm in diam., few branched, nodes pubescent. Leaf sheaths glabrous or sparsely tuberculate-hairy; leaf blades linear, 10–20 × 0.5–0.8 cm, adaxial surface scabrid or hispid at base, abaxial surface glabrous or sparsely pubescent; ligule ca. 1.6 mm. Panicle ovate in outline, 10–18 cm; branches pilose in axils; racemes composed of 1–3 spikelet pairs and a terminal triad; rachis internodes and pedicels ciliate. Sessile spikelet ca. 3 mm; lower glume elliptic-lanceolate, back 4–6-veined, slightly sulcate, pilose, margins keeled, thinly ciliate, apex denticulate; upper glume glabrous; awn of upper lemma 0.8–1.2 cm. Pedicelled spikelet equal to or slightly longer than sessile spikelet. Fl. and fr. Jun–Oct.

● Moist roadside thickets, ditch banks; 600–1900 m. SW Sichuan, SE Xizang, NW Yunnan.

3. Capillipedium kwashotense (Hayata) C. C. Hsu, J. Jap. Bot. 37: 280. 1962.

绿岛细柄草 lü dao xi bing cao

Andropogon kwashotensis Hayata, Icon. Pl. Formosan. 7: 80. 1918; *Bothriochloa kwashotensis* (Hayata) Ohwi.

Perennial, rhizomatous. Culms solitary or tufted, hard, 15–30 cm tall, ca. 1 mm in diam., much branched above base, nodes glabrous. Leaf sheaths glabrous; leaf blades linear-lanceolate, 6–11 × 0.3–0.5 cm, glabrous, long tubercle-based bristles above ligule, apex setaceously acuminate; ligule ca. 1 mm. Panicle small, elliptic in outline, 4–8 cm; branches simple or little branched; racemes composed of 3–4 spikelet pairs below the terminal triad, straw-colored; rachis internodes and pedicels long ciliate. Sessile spikelet 3–3.8 mm; lower glume narrowly lanceolate-oblong, back 5–7-veined, flat, not glossy, scaberulous on veins, margins keeled and scabrid above middle, apex acute or bidentate; upper glume scabrid on upper keel; awn of upper lemma 1–1.6 cm. Pedicelled spikelet resembling the sessile, staminate. Fl. and fr. autumn. 2*n* = 40*.

Cliffs and slopes near the sea. Taiwan [Japan (Iriomote Island in S Ryukyu Islands)].

This nearly endemic species is apparently confined to the eastern coast of Taiwan and a few offshore islands, where it is locally abundant and used for forage. It can withstand salt water.

4. Capillipedium parviflorum (R. Brown) Stapf in Prain, Fl. Trop. Africa 9: 169. 1917.

细柄草 xi bing cao

Holcus parviflorus R. Brown, Prodr. 199. 1810; *Andropogon cinctus* Steudel; *Bothriochloa parviflora* (R. Brown) Ohwi; *Chrysopogon pictus* Hance.

Perennial. Culms tufted, 50–120 cm tall, 0.5–2 mm in diam., not or little branched, nodes bearded. Leaf sheaths glabrous or pilose, ciliate at mouth; leaf blades 15–30 × 0.3–0.8 cm, scaberulous or pubescent, usually hispid with tubercle-based hairs toward base, base rounded, apex acuminate; ligule 0.5–1 mm. Panicle oblong in outline, 9–20 × 2–5 cm; branches untidily flexuous, pilose in axils; racemes usually composed of triads, occasionally with 1–2 additional spikelet pairs, purple;

rachis internodes and pedicels shortly ciliate at base. Sessile spikelet 3–4 mm; lower glume oblong-lanceolate, slightly glossy, back 2-veined, shallowly concave between veins, hispidulous, margins keeled, pectinate-ciliate above middle, apex narrowly obtuse; upper glume ciliate along upper margins; awn of upper lemma 1–1.5 cm. Pedicelled spikelet equaling the sessile and often staminate, or smaller and barren. Fl. and fr. Aug–Dec. 2*n* = 20, 40, 60.

Mountain slopes, streams. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Henan, Hubei, Shaanxi, Shandong, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Indonesia, Japan, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Thailand; Africa, SW Asia, Australia].

Capillipedium parviflorum introgresses with *C. assimile* at the tetraploid level where both species are sympatric, resulting in apomictic hybrids. Tetraploid *C. parviflorum* also introgresses extensively with tetraploid *Bothriochloa bladhii*, likewise forming apomictic, hybrid races that cause much taxonomic difficulty. The name *B. glabra* has been applied to these hybrids.

5. Capillipedium spicigerum S. T. Blake, Pap. Dept. Biol. Univ. Queensland 2(3): 43. 1944.

多节细柄草 duo jie xi bing cao

Andropogon micranthus Kunth var. *spicigerus* (Bentham) Hackel; *A. parviflorus* Roxburgh var. *spicigerus* (Bentham) Domin; *A. spicigerus* (S. T. Blake) Reeder; *Bothriochloa spicigera* (Bentham) T. Koyama; *Capillipedium parviflorum* (R. Brown) Stapf var. *spicigerum* (Bentham) C. Hsu; *Chrysopogon parviflorus* (R. Brown) Bentham var. *spicigerus* Bentham.

Perennial. Culms tufted, up to 150 cm tall, unbranched, nodes bearded. Leaf sheaths usually pilose, ciliate at mouth; leaf blades 15–40 × 0.5–0.8 cm, scaberulous or pubescent, usually hispid with tubercle-based hairs toward base, base rounded, apex acuminate; ligule 0.5–1 mm. Panicle oblong-ovate in outline, 10–18 × 5–8 cm; branches untidily flexuous, pilose in axils; racemes composed of 3–7 spikelet pairs below the terminal triad, purple; rachis internodes and pedicels ciliate. Sessile spikelet 3–4 mm; lower glume oblong-lanceolate, slightly glossy, back 4–5-veined, scarcely depressed along midline, sparsely hispidulous, margins keeled, pectinate-ciliate above middle, apex narrowly obtuse; upper glume ciliate along upper margins; awn of upper lemma 1.2–1.8 cm. Pedicelled spikelet equaling the sessile and often staminate, or smaller and barren. Fl. and fr. autumn. 2*n* = 40.

Mountain slopes. Hong Kong, Taiwan, Zhejiang [Indonesia, Japan (Ryukyu Islands), Philippines; Australia].

This species is thought to have arisen by hybridization between *Capillipedium parviflorum* and *Bothriochloa bladhii*, resulting in intermediates with several spikelet pairs per raceme. It tends to be slightly more robust than *C. parviflorum*.

203. BOTHRIOCHLOA Kuntze, Revis. Gen. Pl. 2: 762. 1891.

孔颖草属 kong ying cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Amphilophis Nash; *Gymnandropogon* (Nees) Duthie.

Perennial. Leaf blades linear or lanceolate, sometimes aromatic; ligule membranous, margin ciliolate. Inflorescence terminal, usually of digitate, subdigitate, or corymbiform racemes, infrequently paniculate; racemes shortly pedunculate, composed of several spikelet pairs (if paniculate, more than 8 spikelet pairs present), basal homogamous spikelet pairs absent; rachis internodes and pedicels slender with a median translucent stripe between thickened margins. Sessile spikelet dorsally compressed; callus short, obtuse, bearded; lower glume cartilaginous with herbaceous apex, occasionally herbaceous throughout, broadly convex to slightly concave, flanks rounded, back sometimes with 1–3 deep circular pits, apex subacute; upper glume boat-shaped, dorsally keeled; lower floret reduced to an empty hyaline lemma; upper lemma stipitiform, entire, awned from apex; awn geniculate, glabrous. Pedicelled spikelet similar to the sessile or smaller, herbaceous.

About 30 species: throughout the tropics and subtropics; three species in China.

The rachis internodes and pedicels of the closely related genera *Bothriochloa* and *Capillipedium* are most distinctive, providing an easy diagnostic character for these genera. The central cells, between the thickened margins, are translucent and frequently purple pigmented. *Dichanthium* also belongs to this group, but has normal, solid internodes and pedicels. Circular, pitted glands on the lower glume are another remarkable feature of some species in this group.

1a. Inflorescence with an elongate central axis ..... 1. *B. bladhii*
1b. Inflorescence subdigitate.
2a. Lower glume of sessile spikelet without a circular pit ..... 2. *B. ischaemum*
2b. Lower glume of sessile spikelet with a circular pit ..... 3. *B. pertusa*

1. Bothriochloa bladhii (Retzius) S. T. Blake, Proc. Roy. Soc. Queensland 80: 62. 1969.

臭根子草 chou gen zi cao

Perennial, tufted. Culms erect or decumbent at base, fairly robust, up to 130 cm tall, many-noded, nodes glabrous or appressed bearded. Leaf sheaths glabrous; leaf blades linear, 10–40 × 0.2–1 cm, hairy with tubercle-based hairs on both surfaces or abaxial surface glabrous, apex finely acuminate; ligule 0.5–1.5 mm. Inflorescence 9–20 cm, composed of many racemes borne in loose whorls along an elongate central axis, axis usually longer than lowest raceme, sometimes paniculate with

branched peduncles; racemes 2–5 cm, often purplish, not obviously hairy; rachis internodes and pedicels thinly ciliate, shortly bearded at apex. Sessile spikelet 3–4 mm; lower glume narrowly oblong-lanceolate, herbaceous or cartilaginous and glossy, 5–7-veined, back slightly concave, glabrous or pubescent below middle, sometimes with a pit, margins keeled and scabrid near apex; awn of upper lemma 1–2.5 cm. Pedicelled spikelet barren or rarely staminate, narrower than sessile spikelet, sometimes pitted. Fl. and fr. Jul–Oct. 2*n* = 40, 60, 80.

Exposed slopes, waste ground; 400–1600 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Shaanxi, Sichuan, Taiwan, Xinjiang, Yunnan [Bhutan, India, Indonesia, Japan, Malaysia, Nepal, New Guinea, Pakistan, Thailand, Vietnam; Africa, SW Asia, Australia; introduced in America].

Bothriochloa bladhii hybridizes easily and frequently with some other species of *Bothriochloa*, and also with *Capillipedium parviflorum* and *Dichanthium annulatum*, blurring the boundaries between these genera and leading to a host of intermediates. New, apomictic races have arisen from among these products of introgression, causing much taxonomic difficulty. The name *B. glabra* has been applied to hybrids between *B. bladhii* and *C. parviflorum*.

Bothriochloa bladhii is most practicably treated in a broad sense to include all forms with an elongate inflorescence axis. Additionally, the habit is usually not stoloniferous, and the racemes are less obviously hairy than in *B. ischaemum* and *B. pertusa*.

1a. Lower glume of sessile and pedicelled spikelet without pits on back ..... 1a. var. *bladhii*
1b. Lower glume of sessile and pedicelled spikelet with 1–3 pits on back ..... 1b. var. *punctata*

1a. Bothriochloa bladhii var. **bladhii**

臭根子草(原变种) chou gen zi cao (yuan bian zhong)

Andropogon bladhii Retzius, Observ. Bot. 2: 27. 1781; *Amphilophis intermedia* Stapf; *Andropogon glaber* Roxburgh; *A. intermedius* R. Brown; *A. vachellii* Nees; *Bothriochloa anamitica* Kuntze; *B. glabra* (Roxburgh) A. Camus; *B. intermedia* (R. Brown) A. Camus; *Dichanthium bladhii* (Retzius) Clayton.

Lower glume of both sessile and pedicelled spikelets usually without pits on back. Fl. and fr. Jul–Oct.

Exposed slopes, waste ground. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Shaanxi, Sichuan, Taiwan, Xinjiang, Yunnan [Bhutan, India, Indonesia, Japan, Malaysia, Nepal, New Guinea, Pakistan, Thailand, Vietnam; Africa, SW Asia, Australia; introduced in America].

1b. Bothriochloa bladhii var. **punctata** (Roxburgh) R. R. Stewart, Kew Bull. 29: 444. 1974.

孔颖臭根子草 kong ying chou gen zi cao

Andropogon punctatus Roxburgh, Fl. Ind. 1: 268. 1820; *Bothriochloa intermedia* (R. Brown) A. Camus var. *punctata* (Roxburgh) Keng; *B. punctata* (Roxburgh) L. Liu.

Lower glume of sessile and pedicelled spikelets with 1–3 pits on back. Fl. and fr. Jul–Nov.

Exposed slopes, waste ground; 400–1600 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Shaanxi, Sichuan, Taiwan, Xinjiang, Yunnan [Bhutan, India, Indonesia, Japan, Malaysia, Nepal, New Guinea, Pakistan, Thailand, Vietnam; Africa, SW Asia, Australia; introduced in America].

2. Bothriochloa ischaemum (Linnaeus) Keng, Contr. Biol. Lab. Chin. Assoc. Advancem. Sci., Sect. Bot. 10: 201. 1936.

白羊草 bai yang cao

Andropogon ischaemum Linnaeus, Sp. Pl. 2: 1047. 1753; *Amphilophis ischaemum* (Linnaeus) Nash; *Andropogon ischaemum* var. *songaricus* Ruprecht ex Fischer & Meyer; *Bothriochloa ischaemum* var. *songarica* (Ruprecht ex Fischer & Meyer) Celarier & J. R. Harlan.

Perennial, tussocky from a branching rootstock. Culms slender, erect or geniculately ascending, 25–70 cm tall, 3–6-noded, nodes glabrous or appressed bearded. Leaf sheaths keeled, congested at plant base; leaf blades linear, 5–16 × 0.2–0.3 cm, usually sparingly hairy with tubercle-based hairs, apex acuminate; ligule ca. 1 mm. Inflorescence composed of 5–15 racemes, subdigitate or inserted on a brief axis; racemes 3–7 cm, silvery-green or tinged purplish brown; rachis internodes and pedicels ciliate with long white or pinkish silky hairs. Sessile spikelet 4–5 mm; lower glume oblong-lanceolate, usually cartilaginous, sometimes herbaceous, back flat to slightly concave, 5–7-veined, silky-pilose below middle, lacking a pit, margins keeled and stiffly ciliate near apex; awn of upper lemma 1–1.5 cm. Pedicelled spikelet male or barren, subequal to sessile spikelet, glabrous. Fl. and fr. autumn. 2*n* = 40, 50, 60.

Rocky and sandy slopes, roadsides, disturbed places. Anhui, Fujian, Guangdong, Guizhou, Hainan, Hebei, Henan, Hubei, Hunan, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan, Zhejiang [Afghanistan, Bhutan, N India, Kazakhstan, Korea, Kyrgystan, Mongolia, Nepal, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan; N Africa, SW Asia, Europe; introduced in United States].

Dichanthium annulatum is similar, but can be distinguished by its conspicuously bearded nodes with spreading hairs and by the broadly obtuse sessile spikelet with long hairs on the upper margins. It also lacks a purple stripe on the pedicels.

Bothriochloa ischaemum introgresses with *B. bladhii*, leading to a range of intermediates. The name *Andropogon taiwanensis* Ohwi (J. Jap. Bot. 12: 652. 1936), described from Taiwan, has been applied to one of these intermediates. The name *"Bothriochloa taiwanensis"* (Ohwi, loc. cit.) was not validly published because it was merely cited as a synonym of *A. taiwanensis*.

3. Bothriochloa pertusa (Linnaeus) A. Camus, Ann. Soc. Linn. Lyon, n.s., 76: 164. 1931 ["1930"].

孔颖草 kong ying cao

Holcus pertusus Linnaeus, Mant. Pl. 2: 301. 1771; *Amphilophis pertusa* (Linnaeus) Stapf; *Andropogon pertusus* (Linnaeus) Willdenow; *Bothriochloa nana* W. Z. Fang; *Dichanthium pertusum* (Linnaeus) Clayton.

Perennial, often stoloniferous, sward forming. Culms erect or geniculately ascending, up to 100 cm tall, 5- or more-noded, nodes bearded. Leaf sheaths keeled; leaf blades linear, 5–20 × 0.1–0.4 cm, tubercle-based hairs on both surfaces or abaxial surface glabrous, apex acute; ligule 0.5–2 mm. Inflorescence

composed of 3–5(–)8 racemes, subdigitate; racemes 3–8 cm, tinged purplish; rachis internodes and pedicels ciliate with long silky hairs. Sessile spikelet 3–4.5 mm; lower glume narrowly elliptic, cartilaginous, back concave, 5–7-veined, glossy, sparsely hirtellous to silky-pilose below middle, a circular pit above hairs, 2-keeled, margins keeled and scabrid near apex; awn of upper lemma 1–2 cm. Pedicelled spikelet male or barren, purplish, subequal to sessile spikelet, glabrous. Fl. and fr. Jul–Oct. $2n = 40, 60$.

Grassy hills, disturbed ground; 1200–1500 m. Guangdong, Sichuan, Yunnan [India, Indonesia, Malaysia, Nepal, Pakistan, Thailand, Vietnam; introduced in Australia and United States].

The type of *Bothriochloa nana* is a stunted specimen of *B. pertusa* with the spikelets infected by a smut fungus.

204. SEHIMA Forsskål, Fl. Aegypt.-Arab. 178. 1775.

沟颖草属 gou ying cao shu

Sun Bixing (孙必兴 Sun Bi-sin); Sylvia M. Phillips

Perennial or annual. Culms tufted, simple or sparingly branched. Leaf blades narrowly linear; ligule a line of hairs. Inflorescence a single terminal raceme, spikelets paired, dissimilar; rachis internodes and pedicels subinflated, stoutly linear to subclavate, densely white-ciliate along margins. Sessile spikelet bisexual, narrow, compressed between internode and pedicel; callus rounded, inserted into shallowly hollowed internode apex; lower glume leathery, back concave or longitudinally grooved, strongly veined on either side of groove but midvein absent, 2-keeled, keels lateral or becoming dorsal toward base, barely winged, apex elongate, scarious, 2-toothed; upper glume boat-shaped, finely awned; lower floret staminate, well developed with palea; upper lemma 2-lobed, awned from sinus; awn geniculate, column glabrous or ciliolate. Pedicelled spikelet large, conspicuous, usually staminate, lanceolate, strongly dorsally compressed, distinctly veined, midvein present, awnless. $x = 10$ and 20.

Five species: E Africa through India to SE Asia and Australia; one species in China.

1. Sehima nervosum (Rottler) Stapf in Prain, Fl. Trop. Africa 9: 36. 1917.

沟颖草 gou ying cao

Andropogon nervosus Rottler, Ges. Naturf. Freunde Berlin Neue Schriften 4: 218. 1803 [*"nervosum"*]; *Ischaemum laxum* R. Brown; *I. nervosum* (Rottler) Thwaites.

Perennial. Culms erect, wiry, 30–100 cm tall, nodes bearded or glabrous. Leaf sheaths glabrous or hispid with tubercle-based hairs; leaf blades linear, flat, tough, pale green, 10–45 × 0.2–0.7 cm, scabrid, tapering to a filiform apex; ligule 2–3 mm. Raceme 3–12(–18) cm, straight or gently curved; rachis internodes and pedicels stoutly linear, 3.5–5 mm. Sessile spikelet yellowish green, 7–9 mm; lower glume narrowly oblong, deeply grooved between keels in lower part, with 6 prominent laterally placed intercarinal veins, inner veins anastomosing toward apex, apex scarious, 1/4–1/3 glume length, shortly 2-toothed; upper glume with straight, 7–13 mm awn; awn of upper lemma stout, 1.7–3.5 cm, column brown, ciliolate along spiral, limb pallid. Pedicelled spikelet usually flushed purple, 7–10 mm, lower glume conspicuously 7-veined, margins ciliate. Fl. and fr. Jul–Oct.

Dry grasslands; at low elevations. Hainan, Yunnan [India, Indonesia, Laos, Myanmar, New Guinea, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam; E Africa, SW Asia, Australia].

205. ISCHAEMUM Linnaeus, Sp. Pl. 2: 1049. 1753.

鸭嘴草属 ya zui cao shu

Sun Bixing (孙必兴 Sun Bi-sin); Sylvia M. Phillips

Perennial, or sometimes annual. Culms often decumbent and much branched. Leaf blades linear to lanceolate, narrowed to ligule, sometimes pseudopetiolate; ligule membranous; sheath auricles often present. Inflorescence of paired racemes, or occasionally subdigitate, terminal and axillary, exserted or sometimes supported by a spatheole; racemes 1-sided, when paired often locked back to back and appearing as a single cylindrical raceme, spikelets of a pair similar or not; rachis internodes and pedicels stoutly linear to thickly clavate, U-shaped or triquetrous in cross section. Sessile spikelet dorsally compressed; callus truncate or obtuse, inserted into hollowed internode apex; lower glume papery to leathery, shallowly convex or almost flat, 2-keeled or rounded on flanks, sometimes winged, often rugose; upper glume boat-shaped, awnless or with straight awn from apex; lower floret male, well developed with palea; upper lemma usually deeply 2-lobed, awned from sinus, rarely awnless; awn geniculate, glabrous. Pedicelled spikelet as large as sessile or much smaller, upper lemma sometimes geniculately awned.

About 70 species: throughout the tropics but mainly in Asia, especially India; 12 species (one endemic) in China.

1a. Margins of lower glume of sessile spikelet broadly rounded in lower part, narrowly inflexed and keeled above, not coarsely rugose or knobbly.
  2a. Spikelets of a pair without obvious awns, or only sessile spikelet awned.
    3a. Inflorescence base enclosed in uppermost sheath; plant strongly rhizomatous ..... 1. *I. muticum*
    3b. Inflorescence long exserted from uppermost sheath; plant loosely tufted.

4a. Racemes villous; sessile spikelet 8–10 mm ..... 2. *I. anthephoroides*
4b. Racemes glabrous; sessile spikelet 5.5–8 mm ..... 3. *I. aristatum*
2b. Spikelets of a pair both clearly awned.
5a. Lower glume of sessile spikelet winged on keels, apex rounded, emarginate.
6a. Racemes paired; rhizomes absent; culms less than 60 cm ..... 4. *I. ciliare*
6b. Racemes (2–)3–6; rhizomes present; culms 60–100 cm ..... 5. *I. polystachyum*
5b. Lower glume of sessile spikelet not winged on keels, apex sharply bicuspidate.
7a. Spikelets ± glabrous; upper glume of sessile spikelet not winged on keel; callus hairs less than 1 mm ..... 6. *I. timorense*
7b. Spikelets hispid; upper glume of sessile spikelet winged on keel; callus hairs ca. 2 mm ..... 7 *I. thomsonianum*
1b. Margins of lower glume of sessile spikelet narrowly and evenly inflexed and keeled along entire length, often coarsely rugose or knobbly.
8a. Lower glume of sessile spikelet not transversely rugose or knobbly.
9a. Lower glume of sessile spikelet wingless, keels pilose; awn 1.8–2.5 cm ..... 8. *I. aureum*
9b. Lower glume of sessile spikelet winged, glabrous; awn 1–1.2 cm ..... 9. *I. setaceum*
8b. Lower glume of sessile spikelet transversely rugose or knobbly on flanks.
10a. Plant annual; lower glume of sessile spikelet coarsely rugose with 4–7 sharp transverse ridges across back ..... 10. *I. rugosum*
10b. Plant perennial; lower glume of sessile spikelet with rounded knobs on keels in lower part, sometimes also with 2–4 weak ridges across back.
11a. Culms up to 1 m tall; sessile spikelet 5–7 mm, awned, awn 1–1.5 mm ..... 11. *I. barbatum*
11b. Culms 1–2 m tall; sessile spikelet 6.5–8 mm, awnless or awn less than 1 mm ..... 12. *I. magnum*

1. Ischaemum muticum Linnaeus, Sp. Pl. 2: 1049. 1753.

无芒鸭嘴草 wu mang ya zui cao

Perennial, strongly rhizomatous; rhizomes clothed in cataphylls. Culms often red, much branched, stoloniferous or scrambling, several meters long, flowering culms erect, up to 60 cm, nodes glabrous. Leaf sheaths ciliate along outer margin, otherwise glabrous or sparingly appressed hairy; leaf blades lanceolate, tinged reddish brown, 2–10(–18) × 0.3–1.7 cm, glabrous or abaxial surface sparingly pilose, margins smooth or scaberulous, base cordate, very shortly pseudopetiolate, apex acute; ligule 0.2–0.6 mm. Racemes usually paired, appressed back to back, 2–5 cm, base enclosed by subtending sheath; rachis internodes and pedicels oblong, triquetrous, outer angle narrowly winged, inner angles glabrous or ciliolate. Sessile spikelet lanceolate, 4.8–7 × 2.5–2.8 mm; lower glume leathery with expanded rounded flanks in lower 2/3, herbaceous, strongly veined and sharply 2-keeled below apex, glabrous, winged from near base, apex entire; upper glume winged on upper keel; upper lemma subentire, mucronate or with ca. 1 mm awnlet. Pedicelled spikelet laterally compressed, otherwise resembling sessile or smaller, awnless.

Sands near the sea; below 100 m. Taiwan [Cambodia, India, Indonesia, Japan (S Ryukyu Islands), Malaysia, Myanmar, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; Australia (Queensland)].

This seashore plant forms extensive colonies that bind the sand at the back of sandy beaches.

2. Ischaemum anthephoroides (Steudel) Miquel, Ann. Mus. Bot. Lugduno-Batavi 3: 193. 1867 [*"antephoroides"*].

毛鸭嘴草 mao ya zui cao

Rottboellia anthephoroides Steudel, Flora 29: 22. 1846 [*"antephoroides"*]; *Andropogon anthephoroides* (Steudel) Steudel; *A. anthephoroides* var. *eriostachyus* (Hackel) Honda; *Ischaemum eriostachyum* Hackel.

Perennial. Culms loosely tufted, geniculately ascending to shortly decumbent and rooting at lowest nodes, 30–70 cm tall, branching in lower part, nodes bearded. Leaf sheaths loose, villous; leaf blades linear-lanceolate, 5–20 × 0.3–0.9 cm, villous, margins thickened, smooth, base constricted, apex acuminate; ligule 1–3 mm. Racemes terminal, paired, appressed back to back, 5–8 cm, long exserted; rachis internodes and pedicels stoutly cuneate, triquetrous, villous. Sessile spikelet broadly oblong or obovate, 8–10 × 2.5–3.5 mm; lower glume leathery toward base, flanks rounded in lower 1/3, villous with stiff ca. 3 mm hairs, papyraceous and puberulous above, keeled and winged above middle, wings ca. 0.8 mm wide with ciliolate margin, apex truncate-denticulate; upper glume keeled and winged above middle, villous on midline below wing; awn of upper lemma weakly geniculate, up to 1.5 cm. Pedicelled spikelet laterally compressed, otherwise resembling sessile, awnless. Fl. and fr. Jun–Sep.

Sand dunes, sandy slopes, near the sea. Hebei, Shandong, Zhejiang (Dachen Dao) [Japan, Korea].

This species occupies a similar seashore habitat to *Ischaemum muticum*, but has a much more limited, more northerly distribution. It is a much hairier species, with exserted racemes of larger spikelets, and lacks the widely spreading, scaly rhizomes of *I. muticum*.

3. Ischaemum aristatum Linnaeus, Sp. Pl. 2: 1049. 1753.

有芒鸭嘴草 you mang ya zui cao

Perennial. Culms loosely tufted, erect or geniculately ascending, 40–80 cm tall, simple or branching, nodes glabrous. Leaf sheaths glabrous or pilose; leaf blades linear-lanceolate, 5–25 × 0.4–1 cm, glabrous or thinly pilose, margins smooth becoming scabrid toward apex, base attenuate or contracted, apex acuminate; ligule 2–3 mm. Racemes terminal, paired, appressed back to back, 4–7 cm; rachis internodes clavate, triquetrous, scabrid or ciliate along outer angle, inner angles glabrous or shortly ciliate. Sessile spikelet oblanceolate to obovate, 5.5–8 × 2–2.3 mm; lower glume leathery with rounded flanks below

middle, herbaceous, broader and 2-keeled above, 5–7-veined, keels narrowly to broadly winged, wing margin scabrid; upper lemma awnless or shortly awned; awn well developed or imperfect, up to 1.2 cm. Pedicelled spikelet dorsally compressed, resembling sessile, asymmetrical, 2-keeled, keels winged, one wing incurled. Fl. and fr. Jul–Oct. 2*n* = 56, 72.

Open grassy sandy places, often near the sea; 100–1000 m. S Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Shandong, Taiwan, NE Yunnan, Zhejiang [Japan, Korea, Vietnam].

This species usually has awnless or only inconspicuously awned racemes, but occasionally the awns are a little longer and more obvious. Longer awns are weakly associated with a more broadly winged sessile spikelet, and the type of the species name falls within this less frequent variant.

1a. Lower glume of sessile spikelet obovate, broadly winged; awn present, geniculate, exserted from spikelet ..... 3a. var. *aristatum*
1b. Lower glume of sessile spikelet oblanceolate, winged; awn absent or imperfect, included within spikelet ..... 3b. var. *glaucum*

3a. Ischaemum aristatum var. **aristatum**

有芒鸭嘴草(原变种) you mang ya zui cao (yuan bian zhong)

Ischaemum crassipes (Steudel) Thellung var. *aristatum* Nakai; *I. crassipes* var. *formosanum* (Hackel) Nakai; *I. crassipes* var. *hondae* (Matsuda) Nakai; *I. guangxiense* Zhao; *I. hondae* Matsuda; *I. sieboldii* Miquel var. *formosanum* Hackel.

Rachis internodes and pedicels often ciliate along outer angle, inner angles glabrous or shortly ciliate. Sessile spikelet obovate, broadly winged, awned; awn exserted, 0.8–1.2 cm, geniculate. 2*n* = 72.

Open grassy sandy places, often near the sea; 100–1000 m. S Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Taiwan, NE Yunnan, Zhejiang [Japan, Korea].

This awned form of *Ischaemum aristatum* is very similar to *I. ciliare*, and the two have been much confused. *Ischaemum ciliare* clearly differs by its laterally compressed, geniculately awned pedicelled spikelets. It also has bearded nodes and a slightly smaller (4–6 mm) sessile spikelet.

3b. Ischaemum aristatum var. **glaucum** (Honda) T. Koyama, J. Jap. Bot. 37: 239. 1962.

鸭嘴草 ya zui cao

Ischaemum crassipes var. *glaucum* Honda, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 3: 355. 1930; *Andropogon crassipes* Steudel; *Ischaemum aristatum* subsp. *glaucum* (Honda) T. Koyama; *I. aristatum* var. *momiyamae* (Honda) Hsu; *I. crassipes* (Steudel) Thellung; *I. crassipes* var. *hainanense* Keng; *I. crassipes* var. *momiyamae* Honda; *I. sieboldii* Miquel.

Rachis internodes and pedicels scabrid or shortly ciliate on outer angle, inner angles glabrous or shortly ciliate. Sessile spikelet oblanceolate, narrowly to broadly winged, mucronate or shortly awned; awn included, 0.1–0.3 cm, straight. 2*n* = 56.

Sandy places, usually near the sea. S Anhui, Hebei, Jiangsu, Liaoning, Shandong, Zhejiang [Japan, Korea, Vietnam].

4. Ischaemum ciliare Retzius, Observ. Bot. 6: 36. 1791.

细毛鸭嘴草 xi mao ya zui cao

Andropogon patentivillosus Steudel; *Ischaemum ciliare* var. *villosum* (Nees) Hackel; *I. indicum* (Houttuyn) Merrill var. *breviaristatum* Zhao; *I. indicum* var. *guangdongense* Zhao; *Spodiopogon obliquivalvis* Nees var. *villosus* Bentham; *S. villosus* Nees.

Perennial. Culms slender, loosely tufted, erect, spreading or prostrate and rooting at lower nodes, up to 60 cm tall, nodes bearded. Leaf sheaths sparsely to densely pilose with tubercle-based hairs, or glabrous; leaf blades linear-lanceolate, 5–15 × 0.3–1 cm, tuberculate-villous or sometimes glabrous, base contracted, apex acuminate; ligule 1–2 mm. Racemes terminal, paired, often slightly separated, 2–9 cm; rachis internodes and pedicels oblong, triquetrous, ciliate along angles. Sessile spikelet obovate-oblong, 4–6 × 1.2–1.5 mm; lower glume smooth, glossy, leathery with rounded flanks in lower half, upper half flat, papyraceous, sometimes wrinkled, asperulous, flanks keeled, winged, wings 0.2–0.7 mm wide, forming 2 rounded lobes at apex; upper glume swollen and keeled above middle, keel narrowly winged, apex shortly awned; awn of upper lemma 1–1.5 cm. Pedicelled spikelet laterally compressed; lower glume with a single median winged keel; upper lemma awned.

Moist meadows, field margins, hill thickets; near sea level to 1300 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangsu, Sichuan, Taiwan, Yunnan, Zhejiang [India, Indonesia, Malaysia, Myanmar, Sri Lanka, Thailand, Vietnam; introduced in America].

This grass has been widely known as *Ischaemum indicum* (Houttuyn) Merrill (*Phleum indicum* Houttuyn), but that name in fact refers to a species of *Polytrias*. *Ischaemum ciliare* is a very variable species, widespread in tropical Asia, and a number of varieties has been described over its range.

5. Ischaemum polystachyum J. Presl in C. Presl, Reliq. Haenk. 1: 328. 1830.

簇穗鸭嘴草 cu sui ya zui cao

Ischaemum digitatum Brongniart; *I. duthiei* Stapf ex Bor; *I. fasciculatum* Brongniart.

Perennial, rhizomatous. Culms loosely tufted, sometimes stoloniferous and rooting at lower nodes, 60–100 cm tall, nodes bearded or glabrous. Leaf sheaths glabrous or sparsely to densely pilose with tubercle-based hairs; leaf blades broadly linear, 5–20 × 0.5–1.5 cm, pubescent, rarely glabrescent, base rounded to subcordate, apex acute; ligule 1–2 mm. Racemes (2–)3–6 or more, mostly terminal, subdigitate, 2–9 cm; rachis internodes and pedicels broadly linear, triquetrous, ciliate on outer angle, shortly ciliate on inner angles. Sessile spikelet lanceolate, 4–5 × 1.2–1.4 mm; lower glume leathery with expanded rounded flanks below middle, herbaceous, strongly veined and sharply 2-keeled above, glabrous or villous, keels usually winged, apex 2-toothed; upper glume attenuate into mucro or awnlet to 2 mm; awn of upper lemma 1.2–1.5 cm. Pedicelled spikelet laterally compressed, similar to sessile, upper lemma awned.

Moist places on grassy plains and hillsides; 100–400 m. Guangdong, Guizhou, Yunnan [India, Malaysia, Myanmar, Sri Lanka, Thailand; Africa, Mauritius, Pacific Islands].

This is a widespread, polymorphic species, long known by different names in various parts of its range.

6. Ischaemum timorense Kunth, Révis. Gramin. 1: 369. 1830.

帝汶鸭嘴草 di wen ya zui cao

Andropogon timorensis (Kunth) Steudel.

Annual or short-lived perennial. Culms slender, loosely tufted or stoloniferous, rooting at lower nodes, branching, flowering shoots 15–50 cm tall, nodes bearded. Leaf sheaths glabrous except toward throat, sometimes margins ciliate; leaf blades linear-lanceolate, 2–8 × 0.2–1 cm, glabrous or pilose with tubercle-based hairs, margins scabrid, base attenuate, apex acuminate; ligule 1–2 mm. Racemes terminal and axillary, paired (rarely 3), loosely arranged, 2–10 cm; rachis internodes and pedicels columnar, triquetrous, ciliate along angles. Sessile spikelet broadly elliptic, 3.5–6 × 1.2–1.5 mm; callus hairs 0.5–1 mm, white; lower glume smooth, glossy, leathery with rounded flanks in lower half, upper half papyraceous, prominently many-veined, asperulous, flanks keeled, keels scabrid, wingless, abruptly narrowed to bicuspidate apex; upper glume keeled above middle, keel wingless, apex narrowed into 2–4 mm awnlet; awn of upper lemma 1–1.6 cm. Pedicelled spikelet laterally compressed, resembling sessile, upper lemma awned.

Fields, damp wayside places; below 100 m. Guangdong, Taiwan [India, Indonesia, Malaysia, Myanmar, Sri Lanka, Thailand; introduced in Africa and America].

The lower glume of the sessile spikelet occasionally has very narrowly winged keels, but the narrowed, sharply bicuspidate apex is characteristic, differing from the more rounded lower glume apex of *Ischaemum ciliare*. Axillary inflorescences are also uncommon in *I. ciliare*.

7. Ischaemum thomsonianum Stapf ex C. E. C. Fischer in Gamble, Fl. Madras 1722. 1934.

尖颖鸭嘴草 jian ying ya zui cao

Ischaemum murinum J. D. Hooker, Fl. Brit. India 7: 135. 1896 [“1897”], not G. Forster (1780).

Annual. Culms slender, shortly stoloniferous at base, branching, 20–45 cm tall, nodes bearded. Leaf sheaths glabrous; leaf blades linear, 2–8.5 × 0.2–0.6 cm, glabrous or a few long tubercle-based bristles toward ligule on adaxial surface, base narrowed or shortly pseudopetiolate, apex setaceously acuminate; ligule 3–5 mm. Racemes terminal and axillary, paired, loosely arranged, 1–3 cm; rachis internodes and pedicels columnar, triquetrous, densely ciliate along angles with yellowish hairs. Sessile spikelet lanceolate, 4.5–5.5 × ca. 1 mm; callus densely bearded, hairs ca. 2 mm; lower glume smooth, glossy, leathery with rounded flanks in lower half, upper half herbaceous, many-veined, bristly, flanks keeled, keels scabrid, wingless, narrowed to bicuspidate apex; upper glume markedly longer than lower, awned, keeled above middle, winged on keel, a tuft of bristles below wing, apex elongate, excurrent into an awn up to 6 mm; awn of upper lemma 1–1.8 cm. Pedicelled spikelet laterally compressed, resembling sessile, bristly, upper lemma awned.

Flatlands; ca. 700 m. W Yunnan [India, Myanmar].

This slender, annual grass is very close to *Ischaemum timorense*, but has hairier racemes, narrower, hairy spikelets, and longer awned upper glumes than are usual for that species. It may simply be an extreme variant of *I. timorense*.

8. Ischaemum aureum (Hooker & Arnott) Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 224. 1889.

金黄鸭嘴草 jin huang ya zui cao

Spodiopogon aureus Hooker & Arnott, Bot. Beechey Voy. 273. 1838.

Perennial from short rhizome. Culms loosely tufted, 20–30 cm tall, internodes short and leaves crowded in lower part, nodes glabrous. Leaf sheaths smooth, glabrous; leaf blades broadly linear, 3–12 × 0.3–0.8 cm, smooth, glabrous or a few setae on adaxial surface above ligule, base contracted, apex acuminate; ligule ca. 1 mm, truncate. Racemes terminal, paired, erect but usually separate, 2–5 cm, yellowish hairy; rachis internodes oblong-clavate, triquetrous, outer angle densely ciliate with long yellowish hairs, inner angles shortly ciliate or glabrous. Sessile spikelet lanceolate, 4–5 × ca. 1 mm, yellowish; lower glume subleathery in lower part, 2-keeled, wingless, keels thickened, ciliolate, also pilose with ca. 2 mm yellow hairs, sometimes sparsely or ciliolate throughout, papery and asperulous toward apex with obvious anastomosing veins, apex bicuspidate; upper glume pilose on upper keel, apex 2-toothed, 2–3 mm awn from between teeth; awn of upper lemma 1.8–2.5 cm. Pedicelled spikelet ± equaling sessile, usually bisexual, slightly laterally compressed, both glumes 1-keeled, shortly awned, upper lemma awned.

Coral rocks and bluffs of the seashore. Taiwan [Japan (Ryukyu Islands)].

This is a very locally distributed grass, with yellowish-hairy racemes and contrasting, reddish brown stigmas. The pedicelled spikelets are usually bisexual, exserting their stigmas and maturing before the sessile spikelets, but otherwise the species is typical of the genus *Ischaemum*.

9. Ischaemum setaceum Honda, Bot. Mag. (Tokyo) 38: 54. 1924.

小金黄鸭嘴草 xiao jin huang ya zui cao

Perennial. Culms slender, stoloniferous and rooting at base, ascending to 25 cm, lower internodes short with crowded leaves, nodes glabrous. Leaf sheaths glabrous; leaf blades linear-lanceolate, 3–6 × 0.3–0.7 cm, glabrous, apex acuminate; ligule rounded, tonguelike, ca. 1.5 mm. Racemes paired, 2–5 cm; rachis internodes thick, outer angle ciliate with long hairs, inner angles shortly ciliate or glabrous. Sessile spikelet narrowly lanceolate, ca. 4 mm, tinged reddish brown; lower glume subleathery in lower part, 2-keeled, papery and asperulous toward apex with obvious anastomosing veins, keels winged upward, apex bicuspidate; upper glume pilose on keel, apex acuminate or with 1–2 mm awnlet; awn of upper lemma 1–1.2 cm. Pedicelled spikelet resembling sessile, both glumes 1-keeled, cuspidate or mucronate.

● Seashores. S Taiwan (Lan Yu).

No specimens of this narrow endemic have been seen by the authors.

10. Ischaemum rugosum Salisbury, Icon. Stirp. Rar. 1, t. 1. 1791.

田间鸭嘴草 tian jian ya zui cao

Andropogon rugosus (Salisbury) Steudel; *A. segetum* (Trinius) Steudel; *Ischaemum akoense* Honda; *I. rugosum* var. *segetum* (Trinius) Hackel; *I. segetum* Trinius.

Annual. Culms loosely tufted, erect to decumbent, 20–100 cm tall, often branching, nodes pubescent. Leaf sheaths loose, papery, lightly keeled, glabrous or pilose with scattered tubercle-based hairs, margins ciliate; leaf blades linear-lanceolate, 10–30 × 0.5–2 cm, glabrous or thinly pilose, margins scabrid, base variable, rounded and constricted, or attenuate and sometimes briefly pseudopetiolate, apex acuminate; ligule 2–5 mm. Racemes terminal and axillary, paired, appressed back to back or slightly separated, 3–11(–13) cm; rachis internodes inflated, thickly clavate, ciliate along midline, inner angles glabrous. Sessile spikelet oblong-ovate, 4–6 × ca. 2 mm; lower glume 2-keeled throughout, crustaceous, yellowish and transversely 4–7-ridged below, ridges sharp, mostly continuous, herbaceous above with many anastomosing green veins, keels scabrid, wingless or winged on one side, apex obliquely obtuse; awn of upper lemma 1.2–2 cm. Pedicelled spikelet dorsally compressed, variable in size, often much reduced especially toward raceme apex, awnless; pedicel elongate when spikelet rudimentary.

Marshy fields, ditch banks, river banks, other wet often slightly saline grassy places; 100–1800 m. Guangdong, Guangxi, Guizhou, Hainan, Sichuan, Taiwan, Yunnan [Bhutan, India, Indonesia, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand; Australia (Queensland); introduced in Africa and America].

This native of tropical Asia is now widespread as a weed in tropical parts of the world, especially as a weed of rice fields.

11. Ischaemum barbatum Retzius, Observ. Bot. 6: 35. 1791.

粗毛鸭嘴草 cu mao ya zui cao

Andropogon lodicularis (Nees) Steudel; *A. meyenianus* (Nees) Steudel; *Ischaemum aristatum* Linnaeus subsp. *barbatum* (Retzius) Hackel; *I. aristatum* var. *lanuginosum* A. Camus; *I. aristatum* var. *lodiculare* (Nees) Hackel; *I. aristatum* var. *meyenianum* (Nees) Hackel; *I. barbatum* var. *hainanense* Keng & H. R. Zhao; *I. barbatum* var. *scabridulum* Keng & H. R. Zhao; *I. cylindricum* Keng & H. R. Zhao; *I. goebelii* Hackel; *I. imbricatum* var. *pubescens* Keng & H. R. Zhao; *I. lanuginosum* (A. Camus) Keng & H. R. Zhao; *I. lanuginosum* var. *enodulosum* Keng & H. R. Zhao; *I. lanuginosum* var. *erianthum* Keng & H. R. Zhao; *I. nodulosum* Honda; *I. nodulosum* var. *glabriflorum* Keng & H. R. Zhao; *I. rugosum* Salisbury var. *humidum* Keng & H. R. Zhao; *I. sinense* Keng & H. R. Zhao; *I. tientaiense* Keng & H. R. Zhao; *I. yunnanense* Keng & H. R. Zhao; *Meoschium lodiculare* Nees; *M. meyenianum* Nees.

Perennial. Culms erect or ascending, 30–100 cm tall, often branched at base, nodes glabrous or bearded. Leaf sheaths glabrous to villous, margins ciliate or glabrous; leaf blades linear or narrowly lanceolate, 5–30 × 0.3–0.8 cm, glabrous to villous, margins scaberulous, base variable, cordate to attenuate or pseudopetiolate, apex acute; ligule 2–5 mm. Racemes terminal, paired, usually appressed back to back, 4–10 cm; rachis internodes oblong, triquetrous, ciliate along outer angle, inner angles glabrous or shortly ciliate. Sessile spikelet lanceolate-oblong, 5–7 × 1.6–2 mm; lower glume 2-keeled throughout, glabrous to villous, leathery, marginal nodules in lower 2/3, these sometimes extended into weak transverse ridges, herbaceous above with many anastomosing green veins, keels asymmetrically winged, one wing wider than the other; awn of upper lemma 1–1.5 cm. Pedicelled spikelet dorsally compressed, as large as sessile but marginal nodules less developed, awnless or awned.

Hill slopes, open grasslands, marshes; near sea level to 1000 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangsu, Jiangxi, Taiwan, Yunnan, Zhejiang [Cambodia, India, Indonesia, Japan, Laos, Malaysia, Myanmar, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; W Africa, Australia].

This is a widespread, polymorphic species, to which many specific and infraspecific names have been applied. Variation depends mainly on the degree of hairiness of the leaves and spikelets and the number and prominence of the nodules and ridges on the sessile spikelet. In extreme cases the ridges are particularly well developed and approach the condition in *Ischaemum rugosum*, but such plants can be recognized as *I. barbatum* by their more robust, perennial habit and more oblong sessile spikelets.

12. Ischaemum magnum Rendle, J. Bot. 32: 102. 1894.

大穗鸭嘴草 da sui ya zui cao

Ischaemum laeve Ridley.

Perennial. Culms erect, 1–2 m tall, sparingly branched in upper part, nodes glabrous. Leaf sheaths longer than internodes, pilose with tubercle-based hairs, especially along margins and toward blade; leaf blades broadly linear, 5–33 × 0.5–1.8 cm, abaxial surface densely to sparsely appressed pubescent, adaxial surface glabrous, margins scabrid, base narrowed, apex acuminate; ligule 3–5 mm. Racemes terminal, paired, appressed back to back, 6–12 cm; rachis internodes columnar, slightly expanded upward, triquetrous, ciliate along outer angle, sometimes only at base, inner angles glabrous. Sessile spikelet oblong-lanceolate, 6.5–8 × 1.7–2 mm; lower glume 2-keeled throughout, leathery except near apex, usually with 2–4 marginal tubercles in lower half, sometimes almost smoooth, or tubercles transversely connected into coarse shallow ridges, herbaceous above with anastomosing green veins, keels narrowly winged; upper lemma entire, awnless or mucronate, or 2-lobed and awned; awn up to 1 cm, weakly geniculate. Pedicelled spikelet dorsally compressed, equaling or slightly longer than sessile, strongly asymmetrical, winged on one keel only, wing 0.3–1.5 mm wide, awnless; pedicel very short, stout.

Moist meadows, field margins; 800–1000 m. W Yunnan [Malaysia, Myanmar].

206. APLUDA Linnaeus, Sp. Pl. 1: 82. 1753.

水蔗草属 shui zhe cao shu

Sun Bixing (孙必兴 Sun Bi-sin); Sylvia M. Phillips

Perennial, rambling. Leaf blades linear-lanceolate, often pseudopetiolate; ligule membranous. Inflorescence a single short raceme encircled by a small boat-shaped spatheole; raceme comprising 1 sessile and 2 pedicelled spikelets; spatheoles numerous, crowded into a leafy compound panicle; peduncle very short, spikelet triad deciduous from it at maturity; pedicels both broad, strongly flattened, together with lower glume of sessile spikelet forming a triangular box around fertile floret. Sessile spikelet bisexual, slightly laterally compressed; callus broad, swollen; lower glume herbaceous or subleathery toward base, convex, without keels or wings, 2-toothed; upper glume strongly convex, laterally compressed, membranous with hyaline margins, 1-keeled, awnless; lower floret staminate, well developed with palea; upper lemma deeply 2-lobed and awned from sinus, or entire to emarginate and awnless; awn 4–12 mm. Pedicelled spikelets awnless, unequal, one well developed, staminate, as large as sessile spikelet, the other rudimentary.

One species: S Arabia and Mauritius through India to SE Asia, Australia, and New Caledonia.

1. Apluda mutica Linnaeus, Sp. Pl. 1: 82. 1753.

水蔗草 shui zhe cao

Apluda aristata Linnaeus; *A. communis* Nees; *A. geniculata* Roxburgh; *A. microstachya* Nees; *A. mutica* var. *aristata* (Linnaeus) Hackel; *A. varia* Hackel, nom. illeg. superfl.

Culms rooting from lower nodes, up to 3 m long, smooth, glabrous, much branched in upper part, branches flexuous. Leaf sheaths usually glabrous; leaf blades flat, 10–30 × 0.5–2 cm, attenuate to a setaceous apex; ligule 1–2 mm. Spathate panicle up to 50 cm, branches very slender with spaced spathes subtending small clusters of spatheoles; spatheole ovate in side view, herbaceous, multiveined, up to 1 cm, often tipped by a fimbriate ligule and narrow vestigial blade; peduncle 1–1.5 mm; raceme 7–10 mm; pedicels oblong, 3–4 mm, glabrous or ciliate upward. Sessile spikelet 4–5 mm; lower glume narrowly elliptic-lanceolate; lower lemma as long as or shorter than lower glume; upper lemma deeply 2-lobed with 4–12 mm awn, or entire to emarginate and awnless. Pedicelled spikelets lanceolate, awnless. Fl. and fr. Jul–Dec.

Common in thickets and along forest margins, sometimes forming large masses; below 1800 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Afghanistan, Bhutan, Cambodia, India, Indonesia, Japan (Ryukyu Islands), Laos, Malaysia, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam; SW Asia (Oman, Socotra), Australia (Queensland), Indian Ocean Islands (Mascarenes), Madagascar, Pacific Islands (New Caledonia)].

This is a polymorphic species widespread in tropical Asia.

207. DIMERIA R. Brown, Prodr. 204. 1810.

觿茅属 xi mao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Didactylon Zollinger & Moritzi; *Haplachne* Presl; *Psilostachys* Steudel; *Pterygostachyum* Nees ex Steudel.

Annual or perennial. Culms often delicate, erect to decumbent, nodes bearded, the hairs directed upward. Leaf blades linear; ligule short, membranous. Inflorescence terminal, composed of solitary or subdigitate racemes. Racemes 1-sided, spikelets single, shortly pedicelled, usually overlapping in 2 rows; rachis tough, triquetrous or flattened, spikelets disarticulating from pedicels at maturity; pedicels very short, broad, apex concave, margin truncate. Spikelets lanceolate or narrowly oblong, strongly laterally compressed; callus truncate, shortly bearded; glumes herbaceous or thinly papery, folded with a median keel, keel often winged, lower glume narrower and slightly shorter than upper glume; lower floret reduced to a narrow hyaline lemma; upper floret bisexual, lemma hyaline, a little shorter than upper glume, apex shortly 2-toothed, awned from sinus; awn geniculate, sometimes weakly or almost straight, glabrous; upper palea normally absent. Stamens 2. Caryopsis narrowly oblong, laterally compressed.

About 40 species: India, China, and Japan to Indonesia, the Philippines, and Australia; six species (three endemic) in China.

1a. Raceme with triquetrous rachis.
  2a. Awn 0.5–2.5 mm; raceme rachis smooth on angles ..... 2. *D. parva*
  2b. Awn 6–11 mm; raceme rachis scabrid on angles ..... 1. *D. ornithopoda*
1b. Raceme with flattened rachis.
  3a. Perennial; racemes (1–)2–3; rachis usually glabrous along margins.
    4a. Anthers 1.7–2 mm; upper glume obscurely keeled except below apex, or if keeled throughout, wing narrow ..... 3. *D. falcata*
    4b. Anthers ca. 0.8 mm; upper glume distinctly keeled and broadly winged from base to apex ..... 4. *D. guangxiensis*
  3b. Annual; raceme solitary; rachis densely ciliate along margins.
    5a. Upper glume broadly winged from base to apex ..... 5. *D. sinensis*
    5b. Upper glume narrowly winged only in upper 1/3 ..... 6. *D. solitaria*

1. Dimeria ornithopoda Trinius, Fund. Agrost. 167. 1820.

鱵茅 xi mao

Annual, delicate. Culms very slender, erect, 3–40(–60) cm tall, 2–17-noded. Leaf sheaths keeled, usually hispid, hairs scattered, tubercle-based; leaf blades green when young, becoming reddish, soft, 1.5–5 × 0.1–0.25 cm, hispid with scattered tubercle-based hairs or glabrescent; ligule 0.5–1 mm, lacerate. Racemes 2–3(–5), subdigitate, 1–6(–10) cm, ascending at first, then divergent; rachis triquetrous, scabrid on angles, internodes 1–3 mm; pedicels ca. 0.2 mm, glabrous. Spikelets linear-oblong, 1.7–3.2(–4.5) mm, usually purple or reddish brown; glumes herbaceous with broad scarious margins, scabrid, sometimes with a few long stiff hairs near top of keel, or stiffly pilose throughout, keel usually wingless, occasionally upper glume narrowly winged, apex acute; upper lemma elliptic-lanceolate, 1.6–2 mm; awn 6–11 mm, geniculate; upper palea absent. Anthers 0.4–0.6 mm. Fl. and fr. Sep–Nov.

Streams, moist places, often gregarious; below 2000 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Henan, Jiangsu, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [India, Indonesia, Japan, Korea, Laos, Malaysia, Myanmar, Nepal, Philippines, Thailand, Vietnam; SW Asia (Oman), Australia, Pacific Islands (Polynesia)].

This is a widespread, polymorphic species, in which a number of infraspecific taxa has been recognized.

1a. Upper glume with rounded midline or sharply keeled only at apex, wingless ..... 1a. subsp. *ornithopoda*

1b. Upper glume sharply keeled throughout, keel narrowly winged ..... 1b. subsp. *subrobusta*

1a. Dimeria ornithopoda subsp. **ornithopoda**

鱵茅(原亚种) xi mao (yuan ya zhong)

Dimeria hirtella B. S. Sun; *D. tenera* Trinius.

Culms 3–40 cm tall. Racemes 2–3, 1–6 cm. Spikelets 1.7–3 mm; lower glume shorter than spikelet, dorsally scabrid, papery, margin membranous; upper glume with rounded midline or sharply keeled only at apex. Fl. and fr. Oct–Nov.

Streams, moist places; below 2000 m. Anhui, Guangdong, Guangxi, Jiangsu, Jiangxi, Taiwan, Yunnan, Zhejiang [India, Japan, Korea, Malaysia, Philippines; Australia].

1b. Dimeria ornithopoda subsp. **subrobusta** (Hackel) S. L. Chen & G. Y. Sheng, Fl. Reipubl. Popularis Sin. 10(2): 172. 1997.

具脊鱵茅 ju ji xi mao

Dimeria ornithopoda var. *subrobusta* Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 82. 1889; *D. heterantha* S. L. Chen & G. Y. Sheng.

Culms up to 60 cm tall. Racemes 2–5, 2–8.5(–10) cm. Spikelets (2.5–)3–3.5(–4.5) mm; lower glume slightly shorter or equal to spikelet; upper glume sharply keeled throughout, keel narrowly winged. Fl. and fr. Sep–Oct.

Mountain slopes, streams, valleys; below 1100 m. E, S, and SW China [Japan].

Three varieties have been recognized under this subspecies in China, as follows: var. *subrobusta* Hackel, with culms 9–60 cm tall; spikelets reddish brown or pale, 3–3.5 mm; throughout the range of the subspecies; var. *nana* Keng & Y. L. Yang (J. Nanjing Univ., Nat. Sci. Ed. 1980(4): 109. 1980), with culms 4–12 cm tall, 5–13-noded; spikelets yellow, 3–4 mm; from Anhui; and var. *plurinodis* Keng & Y. L. Yang (loc. cit.), with culms 20–60 cm tall, 8–17-noded; spikelets 2.5–3 mm; from Taiwan.

The name *Dimeria heterantha* is based on an aberrant specimen of *D. ornithopoda*. The lower lemma is a small, hyaline scale, and the upper lemma is geniculately awned as usual. The upper floret possesses a minute palea, and a third awned lemma is placed above it.

2. Dimeria parva (Keng & Y. L. Yang) S. L. Chen & G. Y. Sheng, Fl. Reipubl. Popularis Sin. 10(2): 175. 1997.

小鱵茅 xiao xi mao

Dimeria ornithopoda Trinius var. *parva* Keng & Y. L. Yang, J. Nanjing Univ., Nat. Sci. Ed. 1980(4): 108. 1980.

Annual. Culms erect, 5–11 cm tall, 5–15-noded, much branched, nodes slightly pubescent or subglabrous. Leaf sheaths glabrous, longer than internodes except the uppermost; leaf blades linear-lanceolate, 1–3.5 × 0.1–0.25 cm, adaxial surface brownish, abaxial surface pale brown, loosely tuberculate-hairy at base, otherwise glabrous; ligule 0.5–0.7 mm. Racemes 2, 1–2.5 cm; rachis triquetrous, smooth on angles. Spikelets 3–3.5 mm, reddish brown; glumes papery with membranous margins, glabrous, upper glume winged along keel, apex acute or acuminate; upper lemma subentire; awn flexuous, 0.5–2.5 mm, usually exserted from spikelet; upper palea absent. Anthers yellow, ca. 0.5 mm. Caryopsis ca. 1.5 mm.

● Streams. Taiwan.

This species differs from *Dimeria ornithopoda* by its much-branched habit, subglabrous nodes, and subentire upper lemma with a straight awn included within the spikelet.

3. Dimeria falcata Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 85. 1889.

镰形鱵茅 lian xing xi mao

Perennial. Culms tufted, wiry, erect or rooting at lowest nodes, 20–70 cm tall, branching, 2–9-noded. Leaf sheaths hirsute with short tubercle-based hairs; leaf blades dark green or reddish, linear, 10–20 × 0.2–0.3 mm, hirsute, adaxial surface with broad white midrib, apex finely acuminate; ligule 0.4–0.5 mm. Racemes 2–3, slightly curved, 2–7 cm, divergent; rachis flattened, margins winged, wing margin scabrid or white-ciliate, internodes 1.5–2 mm; pedicels 0.4–0.5 mm, bearded on outer or both margins. Spikelets linear-oblong, 3.5–4.5 mm, reddish brown or nearly purplish; glumes papery, upper glume with broad scarious margins, back rounded, keeled and scabrid or narrowly winged below apex, or keeled and winged throughout, white-pilose near margins and on keel, apex acute; upper lemma oblanceolate, ca. 2.5 mm; awn 7–10 mm, geniculate; upper palea absent. Anthers 1.7–2 mm. Fl. and fr. autumn.

Swampy slopes, lakesides. Fujian, Guangdong, Guangxi, Taiwan [India, Myanmar, Thailand, Vietnam].

1a. Raceme rachis scabrid along margins; upper glume obscurely keeled except below apex, winged only below apex ..... 3a. var. *falcata*
1b. Raceme rachis white-ciliate along margins; upper glume sharply keeled throughout, keel narrowly winged ..... 3b. var. *taiwaniana*

3a. Dimeria falcata var. **falcata**

镰形觿茅(原变种) lian xing xi mao (yuan bian zhong)

Dimeria falcata var. *tenuior* Keng & Y. L. Yang.

Rachis of raceme scabrid along margins. Upper glume rounded on back, only keeled below apex, keel winged or not. Fl. and fr. autumn.

Swampy slopes, lakesides. Fujian, Guangdong, Guangxi, Taiwan [India, Myanmar, Thailand].

3b. Dimeria falcata var. **taiwaniana** (Ohwi) S. L. Chen & G. Y. Sheng, Fl. Reipubl. Popularis Sin. 10(2): 179. 1997.

台湾觿茅 tai wan xi mao

Dimeria taiwaniana Ohwi, Acta Phytotax. Geobot. 4: 58. 1935.

Rachis of raceme white-ciliate along margins. Upper glume distinctly keeled from base to apex, keel narrowly winged.

Moist slopes. Fujian, Taiwan [Vietnam].

4. Dimeria guangxiensis S. L. Chen & G. Y. Sheng, Bull. Bot. Res., Harbin 13: 77. 1993.

广西觿茅 guang xi xi mao

Annual. Culms erect, 35–40 cm tall, 6–8-noded, branching. Leaf sheaths densely hairy, hairs tubercle-based; leaf blades linear-lanceolate, 2–5 × 0.15–0.35 cm, adaxial surface reddish brown, abaxial surface yellowish brown, puberulous, hairs tubercle-based, apex acuminate; ligule ca. 0.5 mm. Racemes 1–2, 2.5–3.5 cm; rachis ca. 0.8 mm wide, usually glabrous. Spikelets oblong, ca. 3.5 mm, brown; lower glume shortly ciliate along keel, upper glume broadly winged along keel, wing margin shortly ciliate; upper lemma ca. 2.5 mm; awn ca. 8 mm, almost straight. Anthers ca. 0.8 mm. Caryopsis ca. 2 mm. Fl. and fr. Oct.

● Grassy hillsides; below 500 m. Guangxi.

5. Dimeria sinensis Rendle, J. Linn. Soc., Bot. 36: 359. 1904.

华觿茅 hua xi mao

Annual. Culms slender, erect, 12–40 cm tall, usually unbranched, 5–8-noded. Leaf sheaths reddish with age, hispid, hairs tubercle-based; leaf blades linear, 1.5–9 × 0.2–0.4 cm, abaxial surface green, smooth and glabrous, adaxial surface reddish, setose with tubercle-based 3–5 mm bristles, especially near margins; ligule ca. 0.5 mm. Raceme solitary, 2–5.5 cm, slightly flexuous; rachis flattened, 0.4–0.7 mm wide, margins narrowly winged, densely ciliate with white silky hairs; internodes ca. 1.5 mm; pedicels 0.3–0.5 mm, white bearded on outer margin. Spikelets oblong, 3.5–4 mm, reddish brown or purplish brown; glumes papery, sharply keeled, keel of upper glume broadly winged from base to apex, lower glume keel and upper glume wing margin densely white-ciliate, abaxial flank silky-white villous near margin, adaxial flank sparsely hairy, apex acute; upper lemma oblong, ca. 2.7 mm; awn 12–14 mm, geniculate; upper palea absent. Anthers ca. 1.2 mm. Caryopsis oblong, ca. 2.5 mm. Fl. and fr. autumn.

Hillsides, roadsides, damp waste ground; below 1000 m. Anhui, Fujian, Guangdong, Guangxi, Jiangsu, Jiangxi, Zhejiang [Thailand].

6. Dimeria solitaria Keng & Y. L. Yang, J. Nanjing Univ., Nat. Sci. Ed. 1980(4): 106. 1980.

单生觿茅 dan sheng xi mao

Annual. Culms erect or slightly geniculate at base, 9–19 cm tall, 3–6-noded. Leaf sheaths puberulous, hairs tubercle-based; leaf blades linear, 1–3 × 0.1–0.25 cm, abaxial surface and margins loosely tuberculate-hairy; ligule ca. 0.4 mm. Raceme solitary, 1.5–2.5 cm; rachis flattened, ca. 1 mm wide, margins densely ciliate. Spikelets oblong, ca. 3 mm, reddish brown; glumes papery, lower glume densely ciliate along keel, densely pubescent near margins; upper glume densely ciliate along keel, narrowly winged along upper 1/2 of keel; upper lemma ca. 2 mm; awn 8–10 mm, geniculate. Anthers ca. 0.8 mm.

● Damp waste ground. Guangdong.

This species is related to *Dimeria sinensis*, but is a smaller plant, with the upper glume winged only in the upper third.

208. ARTHRAXON P. Beauvois, Ess. Agrostogr. 111. 1812.

荩草属 jin cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Batratherum Nees; *Lucaea* Kunth; *Pleuroplitis* Trinius.

Annual or perennial. Culms slender, much branched, often trailing, nodes bearded or infrequently glabrous. Leaf blades lanceolate to ovate, cordate, often clasping culm, usually pectinate-setose on lower margins; ligule membranous, hairy on margin and back. Inflorescence of subdigitate, slender, fragile racemes, these terminal on culms and branches, not spathate; rachis internodes and pedicels filiform to linear, glabrous or ciliate on angles; spikelets of a pair dissimilar, or spikelets apparently solitary. Sessile spikelet linear to lanceolate, dorsally or laterally compressed; callus short, truncate; lower glume membranous to leathery, back flat or convex, several-veined, with or without lateral keels, scaberulous to spinulose; upper glume boat-shaped, keel herbaceous, margins hyaline, apex acute to mucronate; lower floret reduced to an empty hyaline lemma; upper lemma hyaline, entire or shortly 2-toothed, awned from near base; awn geniculate, glabrous. Stamens 2 or 3. Caryopsis terete. Pedicelled spikelet variable, awnless, well developed, reduced, or represented by the pedicel only, sometimes almost completely suppressed. $x = 9$.

About 26 species: Old World tropics, mainly in India; introduced in America; 12 species (one endemic) in China.

Arthraxon is a rather isolated genus with no obvious close relatives, distinguished from the other awned *Andropogoneae* by its broad, clasping leaf blades on slender, branching culms, together with a sub-basally awned fertile lemma. It is superficially similar to *Microstegium*, but that genus has awned pedicelled spikelets.

1a. Lower glume of sessile spikelet laterally 2-keeled, margins inflexed; perennial; anthers 3.
2a. Keels of lower glume stoutly pectinate-spinose, intercarinal veins usually muricate; leaf blades pubescent; uppermost sheath inflated, spathelike ..... 1. *A. echinatus*
2b. Keels of lower glume tuberculate or almost smooth, intercarinal veins smooth or scaberulous; leaf blades glabrous or sparsely hispid; uppermost sheath tightly cylindrical.
3a. Plant with knotty rootstock covered in velvety scales; lower glume of sessile spikelet with 2 rows of tubercles along each keel, intercarinal veins obscure except near apex ..... 2. *A. prionodes*
3b. Plant with spreading branching rhizomes; lower glume of sessile spikelet with 1 row of tubercles along each keel, intercarinal veins visible from base ..... 3. *A. epectinatus*
1b. Lower glume of sessile spikelet without lateral keels, margins flat; annual or perennial; anthers 2 or 3.
4a. Sessile spikelets 1.2–2.1 mm ..... 6. *A. junnarensis*
4b. Sessile spikelets 2–8 mm.
5a. Pedicelled spikelets present, at least at raceme apex.
6a. Sessile spikelets lanceolate, strongly scabrid to spinulose ..... 7. *A. hispidus*
6b. Sessile spikelets smooth to scaberulous.
7a. Lower glume of sessile spikelet linear, obscurely veined, smooth below middle ..... 11. *A. lancifolius*
7b. Lower glume of sessile spikelet lanceolate or elliptic, strongly 6- or 7-veined with deep grooves between ..... 12. *A. microphyllus*
5b. Pedicelled spikelets absent or vestigial, represented by the pedicel only, this sometimes reduced to a minute stump.
8a. Stamens 2.
9a. Culms 10–30 cm tall; lower glume 5–9-veined ..... 7. *A. hispidus*
9b. Culms 30–60 cm tall; lower glume 9–11-veined ..... 8. *A. multinervis*
8b. Stamens 3.
10a. Sessile spikelets 4–8 mm; anthers (1.5–)2–3.5 mm.
11a. Raceme bases terete, pubescent all over; upper glume broad, leathery, hyaline margins 0.1–0.2 mm; lemma margins ciliate ..... 4. *A. castratus*
11b. Raceme bases flattened on inner face, only flattened surface pubescent; upper glume narrow, leathery, hyaline margins 0.6–0.7 mm; lemma margins glabrous ..... 5. *A. typicus*
10b. Sessile spikelets 2.8–4.2 mm; anthers 0.4–2 mm.
12a. Sessile spikelets apparently awnless; anthers 1.5–2 mm ..... 9. *A. submuticus*
12b. Sessile spikelets with exserted awn; anthers 0.4–0.5 mm ..... 10. *A. nudus*

1. Arthraxon echinatus (Nees) Hochstetter, Flora 39: 188. 1856.

粗刺荩草 cu ci jin cao

Andropogon echinatus (Nees) Heyne; *Arthraxon lanceolatus* (Roxburgh) Hochstetter var. *echinatus* (Nees) Hackel; *A. spathaceus* J. D. Hooker; *Batratherum echinatum* Nees.

?Perennial (base not seen). Culms straggling, ascending to 60 cm. Leaf sheaths tuberculate-hispid, uppermost sheath slightly inflated, spathelike with reduced blade; leaf blades lanceolate, 3–6 cm × 7–13 mm, both surfaces pubescent, base amplexicaul, margins closely pectinate-ciliate along whole length, apex acuminate; ligule ca. 1 mm. Racemes 2–3, ca. 5 cm, suberect, yellowish green, enclosed at base in uppermost sheath or finally shortly exserted; rachis internodes ca. 2/3 length of sessile spikelets, shortly ciliate, hairs 0.3–1 mm. Sessile spikelet 5.2–7 mm; lower glume lanceolate, shallowly convex, laterally keeled, margins inflexed, keels stoutly pectinate-spinose, back 3–7-veined between keels, muricate along length of veins, or only toward apex, or occasionally completely absent; upper lemma acuminate or shortly 2-toothed; awn 8–13 mm. Pedicelled spikelet narrowly lanceolate, 4–4.5 mm, sterile, infrequently reduced toward raceme base; pedicel stout, less than half internode length. Fl. and fr. Aug–Oct. 2*n* = 18.

Mountain slopes, streams; 1900–2300 m. Yunnan [India, Nepal].

2. Arthraxon prionodes (Steudel) Dandy in Andrews, Fl. Pl. Sudan 3: 399. 1956.

茅叶荩草 mao ye jin cao

Andropogon prionodes Steudel, Syn. Pl. Glumac. 1: 383. 1854, based on *A. serrulatus* A. Richard, Tent. Fl. Abyss. 2: 458. 1850, not Link (1827); *Arthraxon lanceolatus* (Roxburgh) Hochstetter var. *glabratus* S. L. Chen & Y. X. Jin; *A. pilophorus* B. S. Sun.

Perennial, loosely tufted, base knotty, covered in silky-tomentose scales. Culms stiff, erect or straggling, 40–60 cm long. Leaf sheaths glabrous or tuberculate-hispid; leaf blades lanceolate to narrowly ovate, tough, glaucous, 2–7 cm × 5–15 mm, usually glabrous, base rounded, margins cartilaginous and pec-

tinate-setose from stout tubercles, apex setaceously acuminate; ligule 0.5–1 mm. Racemes 2–11, 2–7 cm, pale green or tinged purple, suberect; rachis internodes 1/3–2/3 length of sessile spikelets, pilose, hairs increasing to 2–3 mm at apex. Sessile spikelet 5.8–7.2 mm; lower glume linear, strongly convex, laterally keeled, margins inflexed, back obscurely veined below middle, glabrous or puberulous, rarely shortly pubescent, 5 scaberulous veins between keels toward apex, keels stoutly tuberculate-spinose, a second row of smaller tubercles on inner side of keels; upper lemma subentire to shortly denticulate, teeth 0.1–0.4 mm; awn 10–15 mm; palea absent. Anthers 3, 2.4–3.8 mm. Pedicelled spikelet narrowly lanceolate, 4–5 mm, staminate. Fl. and fr. Jul–Oct. 2*n* = 16, 36.

Rocky mountain slopes, streamsides, roadsides. Anhui, Beijing, Henan, Hubei, Jiangsu, Shaanxi, Shandong, Sichuan, Xizang, Yunnan, Zhejiang [Afghanistan, Bhutan, India, Myanmar, Pakistan, Thailand, Vietnam; E Africa, SW Asia].

Arthraxon prionodes has often been confused with *A. lanceolatus* (Roxburgh) Hochstetter, from the hills of S India. The latter species differs in its slightly broader, linear-lanceolate sessile glume with a flat back between the tuberculate lateral keels and obvious, raised intercarinal veins clearly visible from the glume base upward.

Occasionally the sessile glume is shortly pubescent, and the name *Arthraxon pilophorus* is based on such a plant. The name *A. lanceolatus* var. *raizadae* (Jain et al.) Welzen has been misapplied in China to this variant. It correctly applies to a low annual from peninsular India with long (6–7 mm), velutinous sessile spikelets.

3. Arthraxon epectinatus B. S. Sun & H. Peng, Guizhou Sci. 9: 289. 1991.

光脊荩草 guang ji jin cao

Arthraxon guizhouensis S. L. Chen & Y. X. Jin; *A. xinanensis* S. L. Chen & Y. X. Jin; *A. xinanensis* var. *laxiflorus* S. L. Chen & Y. X. Jin.

Perennial with spreading branching rhizomes. Culms stiff, erect or decumbent, 30–70 cm long. Leaf sheaths glabrous or tuberculate-hispid; leaf blades lanceolate, firm, green or glaucous, 3–10 cm × 4–15 mm, glabrous or sparsely hispid, base subcordate, margins serrulate, pectinate-setose near base, apex slenderly acuminate; ligule 0.5–1.5 mm. Racemes 2–6, 3–10 cm, yellowish green, lax, slightly flexuous; rachis internodes slightly shorter to equaling sessile spikelets, margins villous. Sessile spikelet 5–7 mm; lower glume linear-lanceolate, herbaceous, shallowly convex, laterally keeled, margins inflexed, glabrous, 5–7-veined between keels, veins visible along length of glume, keels scabrid to tuberculate in a single row, tubercles spinescent toward apex; upper lemma awned from 0.75–1.3 mm above base, apex subentire or 2-denticulate, teeth (0.1–) 0.5–0.7 mm; awn 7.5–13 mm; palea 0.5–1 mm. Anthers 3, 2.4–3.5 mm. Pedicelled spikelet narrowly lanceolate, 4.5–6 mm, staminate; pedicel villous. Fl. and fr. Jul–Nov.

Grassy slopes, among rocks, roadsides; 700–2500 m. Gansu (Wenxian), Guizhou, Shaanxi, Sichuan, Yunnan [Bhutan, Nepal].

This grass is easily confused with *Arthraxon prionodes* when the base is absent. However, besides the key characters of the lower glume, *A. epectinatus* is also distinguished by some less obvious differences. The leaf blades are usually a little narrower with the cartilaginous margin serrulate (vs. smooth) between the tubercle-based bristles, the awn arises slightly higher up the back of the upper lemma, and an upper palea is present. The apex of the upper lemma is not deeply 2-toothed as reported in Chinese literature. The delicate hyaline tissue is easily split down the midline during dissection.

Like *Arthraxon prionodes*, this grass has often been misidentified as the S Indian species *A. lanceolatus* (Roxburgh) Hochstetter, which has flatter, lower glumes with fewer, more prominent intercarinal veins, and a sub-basally awned upper lemma.

4. Arthraxon castratus (Griffith) V. Narayanaswami ex. Bor, Fl. Assam 5: 376. 1940.

海南荩草 hai nan jin cao

Andropogon castratus Griffith, Not. Pl. Asiat. 3: 89. 1851; *A. pilipes* Backer; *A. rudis* Nees ex Steudel; *Arthraxon hainanensis* Keng & S. L. Chen; *A. rudis* (Nees ex Steudel) Hochstetter.

Perennial. Culms straggling, decumbent, rooting from lower nodes, 60–200 cm long, culm apex pubescent. Leaf sheaths glabrous to densely papillose-hispid; leaf blades lanceolate, 3–11 cm × 7–15 mm, glabrous or sparsely appressed-hispid, base cordate, margins pectinate-setose, apex acuminate; ligule 1–2 mm. Racemes 2–5, 3–7 cm, brownish green or purplish brown, raceme bases slenderly terete, pubescent; rachis internodes 1/3–4/5 length of sessile spikelets, softly pilose, hairs 0.4–1.5 mm. Sessile spikelet 4–8 mm; lower glume broadly lanceolate, leathery, weakly convex, not laterally keeled, margins flat, back asperulous, 7–9-veined, tuberculate-spinulose above middle especially near margins, spicules longer toward apex; upper glume longer than lower glume, broadly leathery, hyaline margins 0.1–0.2 mm, spicules present along upper midline; lemma margins ciliate; upper lemma 2-toothed, teeth ca. 0.4 mm; awn 10–14 mm; palea lanceolate, 1/2 length of lemma. Anthers 3, 2–3.8 mm. Pedicelled spikelet absent; pedicel subulate, 1–3 mm, pilose. Fl. and fr. autumn–winter. 2*n* = 18, 36.

Dry mountain slopes. Hainan [India, Indonesia, Myanmar, Sri Lanka, Thailand, Vietnam; Australia (Queensland)].

Arthraxon castratus has a distinctive, narrowly elongate, pubescent base to each raceme, and the pubescence is carried down onto the upper part of the culm. The unusually broad, leathery upper glume also imparts a characteristic, broad side view to the spikelets.

5. Arthraxon typicus (Buse) Koorders, Exkurs.-Fl. Java 1: 110. 1911.

洱源荩草 er yuan jin cao

Lucaea typica Buse in Miquel, Pl. Jungh. 467. 1854; *Arthraxon breviaristatus* Hackel; *A. hispidus* (Thunberg) Makino var. *robustior* Welzen; *A. junghuhnii* (Steudel) Hochstetter; *A. maopingensis* S. L. Chen & Y. X. Jin; *Lucaea junghuhnii* Steudel.

Perennial. Culms decumbent, rooting from lower nodes, 60 cm or more long. Leaf sheaths glabrous or tuberculate-hispid; leaf blades ovate or lanceolate, 6–10 cm × 10–23 mm, both surfaces subglabrous to hispid, base amplexicaul, margins pectinate-setose at least toward base, apex cuspidate; ligule 0.5–1 mm. Racemes 5–13, 3–8 cm, pale green or purplish, raceme

bases flattened on inner face, flattened surface pubescent; rachis internodes 1/2–4/5 length of sessile spikelets, glabrous or thinly ciliate, hairs 0.2–0.5 mm. Sessile spikelet 4–5.5 mm; lower glume lanceolate, leathery, weakly convex, margins not inflexed, back asperulous, 7–9-veined, small spinulose tubercles along veins, rarely tubercles sparse; upper glume equaling or slightly longer than lower glume, narrowly leathery, hyaline margins 0.6–0.7 mm, midline smooth; lemma margins not ciliate; upper lemma subentire or 2-toothed, teeth 0.1–0.35 mm; awn 5–11 mm; palea absent. Anthers 3, (1.5–)2–3 mm. Pedicelled spikelet absent; pedicel subulate, glabrous or thinly ciliate, up to 2 mm.

Moist places; 1300–2000 m. Guangdong, Yunnan [NE India, Indonesia, N Myanmar, Nepal, Thailand].

Arthraxon typicus resembles *A. castratus*, but, besides the key characters, differs by its shorter awns and lack of a palea. It is also similar to *A. hispidus*, but is a more vigorous perennial and can be clearly distinguished by the presence of 3 longer anthers. Awn length is variable and, when short, the awn may be exserted from the spikelet by less than ca. 2 mm.

6. Arthraxon junnarensis S. K. Jain & Hemadri, J. Bombay Nat. Hist. Soc. 68: 300. 1971.

微穗荩草 wei sui jin cao

Arthraxon hispidus (Thunberg) Makino var. *junnarensis* (Jain & Hemadri) Welzen.

Culms very slender, much branched, 5–30 cm tall. Leaf sheaths glabrous; ligule ca. 0.5 mm; leaf blades lanceolate to ovate, 0.6–3 cm × 3–12 mm, glabrous on both surfaces or laxly tuberculate-hispid, margins pectinate-ciliate below middle. Racemes 2–3, 0.7–0.9 cm; rachis internodes 0.6–1.5 mm, glabrous or pilose. Sessile spikelet 1.2–2.1 mm; lower glume broadly lanceolate, papery, convex, margins not inflexed, 7-veined above middle, veins hispidulous; upper glume glabrous, smooth; lower lemma usually absent, if present, then ca. 1 mm; awn ca. 6 mm. Anthers 2, ca. 0.5 mm. Pedicelled spikelet absent.

Stream banks, damp places; ca. 1100 m. W Yunnan (Zhenkang) [W India].

This is apparently a rare species, otherwise known only from the state of Maharashtra in W India. Specimens from Yunnan have not been seen by the authors.

7. Arthraxon hispidus (Thunberg) Makino, Bot. Mag. (Tokyo) 26: 214. 1912.

荩草 jin cao

Annual. Culms slender, sprawling, decumbent, rooting from lower nodes, weakly ascending up to 30 cm or more. Leaf sheaths glabrous to tuberculate-hispid, margin ciliate; leaf blades ovate to narrowly ovate, 2–5 cm × 6–15 mm, glabrous or hispid, base amplexicaul, margins pectinate-setose at least around base, apex sharply acute; ligule 0.5–3 mm. Racemes 2–10 or more, 1.5–4 cm, pale green or purple; rachis internodes (1/2–) 2/3–3/4 length of sessile spikelets, glabrous or sparsely to densely pilose, hairs less than 0.5 mm. Sessile spikelet 3–5 mm; lower glume lanceolate, weakly convex, margins not inflexed, 6–9-veined, veins scabrid-hispidulous to spinulose; upper glume slightly longer than lower, apex cuspidate; awn up to 11 mm, well developed and exserted from glumes, or sometimes reduced and included; palea absent. Anthers 2, 0.7–1 mm. Pedicelled spikelet usually absent; pedicel reduced to a minute stump, sometimes up to 2 mm or more at raceme apex, glabrous, sparsely ciliate, or infrequently densely pilose. Fl. and fr. Sep–Nov. 2*n* = 10, 18, 36.

Streamsides, damp meadows, among crops, other moist places; 100–2300 m. Anhui, Fujian, Guangdong, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Jiangsu, Jiangxi, Nei Mongol, Ningxia, Shaanxi, Shandong, Sichuan, Taiwan, Xinjiang, Yunnan, Zhejiang [Bhutan, India, Indonesia, Japan, Kazakhstan, Korea, Kyrgyzstan, Malaysia, Nepal, New Guinea, Pakistan, Philippines, Russia (Far East), Sri Lanka, Tajikistan, Thailand, Uzbekistan; Africa, SW Asia (Caucasus, Oman), Australia].

Arthraxon hispidus is an extremely polymorphic, polyploid species, to which many names have been applied, both at specific and infraspecific rank. It is now a widespread weed, occurring in many warm-temperate and tropical parts of the world.

Arthraxon hispidus is based on a gathering from Japan with rather small (ca. 3.5 mm), spinulose spikelets and glabrous raceme internodes and pedicel stumps. *Arthraxon micans* is based on a gathering from NE India with slightly longer (ca. 4.2 mm), merely scabrid spikelets and densely pilose internodes and pedicels. These two entities are often maintained as separate species. While populations at the margins of the distribution of this widespread taxon are often fairly uniform, over the main part of its distribution in SE Asia and China there is every possible combination of characters. It has proved impossible to recognize more than one species in China.

The awn is usually well developed and clearly exserted, but there is continuous variation through more shortly awned forms to those with the awn included within the glumes, thereby making the spikelets appear awnless. The name *Arthraxon hispidus* var. *cryptatherus* has been applied in China to apparently awnless forms, but in fact the type of the species name, from Japan, has included awns. *Arthraxon langsdorffii* is based on a Japanese specimen with well-exserted awns.

Pubescence of the rachis internodes and pedicels, spikelet length, and degree of development of spinules on the lower glume are also very variable and without clear discontinuities. Spikelet length given here applies to specimens seen from China. Elsewhere, spikelets may be as long as ca. 8 mm. Infrequently, lanceolate pedicelled spikelets up to 3.5 mm are present at the raceme apex, including on the type of *Arthraxon micans*. Such specimens are easily distinguished from *A. lancifolius* by their flatter, broader, spinulose sessile spikelets.

1a. Leaf blades glabrous or puberulous on abaxial surface; tubercle-based bristles present on lower 1/3 of leaf margins only ..... 7a. var. *hispidus*

1b. Leaf blades thinly hispid on both surfaces; tubercle-based bristles present on margins for most of length from base ..... 7b. var. *centrasiaticus*

7a. Arthraxon hispidus var. **hispidus**

荩草(原变种) jin cao (yuan bian zhong)

Phalaris hispida Thunberg, Syst. Veg., ed 14, 104. 1784; *Alectoridia quartiniana* A. Richard; *Andropogon micans* (Nees) Steudel; *Arthraxon ciliaris* P. Beauvois; *A. ciliaris* var. *cryp-*

tatherus Hackel; *A. ciliaris* var. *hookeri* Hackel; *A. cryptatherus* (Hackel) Koidzumi; *A. cuspidatus* Hochstetter ex A. Richard var. *micans* (Nees) Hackel; *A. hispidus* Humboldt & Bonpland ex Willdenow subsp. *langsdorffii* (Thunberg) Tzvelev; *A. hispidus* var. *cryptatherus* (Hackel) Honda; *A. hispidus* var. *muticus* (Honda) Ohwi; *A. hookeri* (Hackel) Henrard; *A. langsdorffii* (Trinius) Hochstetter ex Roshevitz; *A. micans* (Nees) Hochstetter; *A. okamotoi* Ohwi; *A. pauciflorus* Honda; *A. pauciflorus* var. *muticus* Honda; *A. quartinianus* (A. Richard) Nash; *Batratherum micans* Nees; *Digitaria hispida* (Thunberg) Sprengel; *Lasiolytrum hispidum* (Thunberg) Steudel; *Pleuroplitis langsdorffii* Trinius; *P. langsdorffii* var. *chinensis* Regel.

Leaf blades ovate, glabrous or abaxial surface occasionally puberulous, lower 1/3 of margins pectinate with tubercle-based bristle; awn variable, well developed or reduced. Fl. and fr. Sep–Nov.

Streamsides, damp meadows, among crops, other moist places; 100–2300 m. Anhui, Fujian, Guangdong, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Jiangsu, Jiangxi, Nei Mongol, Ningxia, Shaanxi, Shandong, Sichuan, Taiwan, Xinjiang, Yunnan, Zhejiang [Bhutan, India, Indonesia, Japan, Kazakhstan, Korea, Kyrgyzstan, Malaysia, Nepal, New Guinea, Pakistan, Philippines, Russia (Far East), Sri Lanka, Tajikistan, Thailand, Uzbekistan; Africa, SW Asia (Caucasus, Oman), Australia].

7b. Arthraxon hispidus var. **centrasiaticus** (Grisebach) Honda, Bot. Mag. (Tokyo) 39: 278. 1925.

中亚荩草 zhong ya jin cao

Pleuroplitis centrasiatica Grisebach in Ledebour, Fl. Ross. 4: 477. 1853; *Arthraxon centrasiaticus* (Grisebach) Gamajuova; *A. ciliaris* P. Beauvois var. *centrasiaticus* (Grisebach) Hackel; *A. hispidus* (Thunberg) Makino subsp. *centrasiaticus* (Grisebach) Tzvelev; *Pleuroplitis langsdorffii* Trinius var. *centrasiatica* (Grisebach) Regel.

Leaf blades lanceolate, 1–3 cm, sparsely hispid on both surfaces, margins pectinate with tubercle-based bristles for most of length from base; awn well developed, long exserted. Fl. and fr. Aug–Sep.

Moist places. C, E, and N China [Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan; C and SW Asia].

This is a primarily C Asian variant, now adventive elsewhere.

8. Arthraxon multinervis S. L. Chen & Y. X. Jin, Bull. Bot. Res., Harbin 13: 102. 1993 [*"multinervus"*].

多脉荩草 duo mai jin cao

Annual. Culms robust, decumbent at base, 30–60 cm tall. Leaf sheaths densely hispid with tubercle-based hairs, margin densely ciliate; leaf blades narrowly ovate, 4–7 cm × 12–18 mm, glabrous on both surfaces, base cordate, margins pectinate-spinose, apex slenderly acuminate. Racemes 2–7, 3–4 cm; rachis internodes 2/3–3/4 length of sessile spikelets, pilose. Sessile spikelet 4–4.5 mm; lower glume lanceolate, weakly convex, margins not inflexed, 9–11-veined, veins scabrid or tuberculate-hairy, apex acuminate; upper glume shorter than lower, apex acuminate; awn 1.5–4 mm, included or rarely slightly exserted; palea absent. Anthers 2, ca. 0.8 mm. Pedicelled spikelet absent, pedicel ca. 0.4 mm. Fl. and fr. Oct–Dec.

● Mountain slopes; 1200 m. Guizhou.

This is a rather robust segregate from the polymorphic species *Arthraxon hispidus*.

9. Arthraxon submuticus (Nees ex Steudel) Hochstetter, Flora 39: 188. 1856.

无芒荩草 wu mang jin cao

Andropogon submuticus Nees ex Steudel, Syn. Pl. Glumac. 1: 382. 1854; *Arthraxon ciliaris* P. Beauvois subsp. *submuticus* (Nees ex Steudel) Hackel; *Batratherum submuticum* (Nees ex Steudel) W. Watson.

Annual, loosely tufted. Culms decumbent, moderately branched, 10–30 cm tall. Leaf sheaths shorter than internodes, densely tuberculate-hispid to glabrous, margin tuberculate-ciliate; leaf blades ovate, 2–6 cm × 5–20 mm, hispid with scatterd hairs or glabrous, base amplexicaul, margins densely pectinate-setose, apex sharply acuminate; ligule ca. 2 mm. Racemes 3–10, 2–4(–8) cm, pale green or purplish; rachis internodes ca. 3/4 length of sessile spikelets, glabrous. Sessile spikelet 2.8–4.2 mm; lower glume narrowly elliptic, herbaceous, convex, margins not inflexed, 6–8-veined, veins strongly scabrid, apex subacute; upper glume subequal to lower glume, scabrid along keel, apex acute; upper lemma lanceolate, acute; awn rudimentary, shorter than lemma, not exserted; palea present, small. Anthers 3, 1.5–2 mm. Pedicelled spikelet absent; pedicel up to 2 mm at raceme apex, glabrous.

River banks, moist places; 1600–2100 m. Yunnan [NW India, Nepal].

This species is similar to awnless forms of *Arthraxon hispidus*, but has a slightly plumper sessile spikelet with a broader apex, as well as three longer anthers.

10. Arthraxon nudus (Nees ex Steudel) Hochstetter, Flora 39: 188. 1856.

光轴荩草 guang zhou jin cao

Andropogon nudus Nees ex Steudel, Syn. Pl. Glumac. 1: 383. 1854; *Arthraxon ciliaris* P. Beauvois subsp. *nudus* (Nees ex Steudel) Hackel; *A. hispidus* (Thunberg) Makino var. *nudus* (Nees ex Steudel) Ohwi.

Annual. Culms rather stiff, decumbent, ascending to 50 cm. Leaf sheaths glabrous or tuberculate-hispid; leaf blades narrowly ovate, 2–8 cm × 5–20 mm, glabrous on both surfaces, base amplexicaul, margins scabrid or pectinate-setose at base, apex sharply acuminate to caudate; ligule 2–3 mm. Racemes very slender, 3–9, often rebranched and hence up to 20, 2–8 cm, suberect when young, stiffly divergent at maturity; rachis internodes 4/5 as long to equaling spikelets, glabrous. Sessile spikelet 3–4.5 mm; lower glume linear-lanceolate, leathery, strongly convex, margins not inflexed, back minutely granular, obscurely 6–7-veined below middle, veins scabrid above middle, apex acute; upper glume with acute apex; awn 5.7–9 mm. Anthers 3, 0.4–1 mm. Pedicelled spikelet absent; pedicel 1–2 mm, glabrous.

Swamps, shady places, roadsides; 1200–1300 m. Yunnan [India, Malaysia, Myanmar, Thailand; SW Asia (Oman)].

When anthers are absent, *Arthraxon nudus* is best distinguished from *A. hispidus* by its very slender racemes of narrow spikelets spaced

almost their own distance apart. The racemes finally spread divaricately as they disarticulate.

11. Arthraxon lancifolius (Trinius) Hochstetter, Flora 39: 188. 1856.

小叶荩草 xiao ye jin cao

Andropogon lancifolius Trinius, Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 2: 271. 1833; *Arthraxon microphyllus* (Trinius) Hochstetter var. *lancifolius* (Trinius) Hackel; *A. mollis* (Nees) Duthie; *A. schimperi* (Hochstetter ex A. Richard) Hochstetter; *Batratherum lancifolium* (Trinius) W. Watson; *B. molle* Nees; *Lucaea schimperi* (Hochstetter ex A. Richard) Steudel; *Pleuroplitis lancifolia* (Trinius) Regel; *Psilopogon schimperi* Hochstetter ex A. Richard.

Annual, delicate. Culms loosely tufted, very slender, decumbent, much branched, up to 30 cm long, glabrous or pubescent. Leaf sheaths loose, margin ciliate; leaf blades elliptic to narrowly ovate, thin, flaccid, 0.5–4 cm × 2–9 mm, puberulent to densely pubescent, often with scattered tubercle-based hairs, base cordate, basal margins pectinate-setose, apex setaceously acuminate; ligule 0.7–1.5 mm. Racemes 2–9, 1–2.5 cm; rachis internodes 1/2 length of sessile spikelets, margins silky ciliate, hairs increasing to 1.5–2.5 mm at apex. Sessile spikelet 2–3.3 mm; lower glume linear, strongly convex, margins not inflexed, veins indistinct in lower part, scaberulous toward apex, apex finely 2-toothed; upper glume extended into 0.5–1.5 mm apical mucro; awn 4–8 mm; palea absent. Anthers 2, 0.5–0.7 mm. Pedicelled spikelet usually present at least at raceme apex, lanceolate, 1.5–2.5 mm, sterile, usually composed of 2 empty glumes. Fl. and fr. Sep–Nov. 2*n* = 18, 36.

Damp rocky places on mountain slopes. Guizhou, Sichuan, Yunnan [Bhutan, India, Indonesia, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam; E Africa, SW Asia (S Arabia)].

Young inflorescences should be examined for pedicelled spikelets, as these may be present only at the tips of the racemes and soon disarticulate.

12. Arthraxon microphyllus (Trinius) Hochstetter, Flora 39: 188. 1856.

小荩草 xiao jin cao

Andropogon microphyllus Trinius, Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 2: 275. 1833; *A. lancifolius* Trinius var. *microphyllus* (Trinius) Kuntze; *A. sikkimensis* Bor; *Pleuroplitis microphylla* (Trinius) Regel.

Ephemeral, delicate. Culms solitary or loosely tufted, very slender, 10–25 cm tall, glabrous. Leaf sheaths glabrous to hispid; leaf blades lanceolate to ovate, 0.5–1.5 cm × ca. 5 mm, tuberculate-hispid on both surfaces, base rounded, margins tuberculate-setose, apex acuminate; ligule 1.5–2 mm. Racemes 1–3, 1–2.5 cm; rachis internodes 2/3 length of sessile spikelets, margins ciliate, hairs increasing to 1–1.3 mm at apex. Sessile spikelet 3–4 mm; lower glume elliptic or lanceolate, shallowly convex or almost flat, margins not inflexed, strongly 6- or 7-veined with deep grooves between, veins smooth except below apex, apex emarginate; upper glume with acute apex; awn 8–10.5 mm; palea absent. Anthers 2, 0.6–0.8 mm. Pedicelled spikelet present throughout, linear, 2–3.5 mm, male or sterile and reduced to 2 empty glumes. Fl. and fr. Sep–Nov. 2*n* = 18.

Dry mountain slopes; 2000–3000 m. Yunnan [Bhutan, NE India, Nepal, N Thailand].

209. SCHIZACHYRIUM Nees, Fl. Bras. Enum. Pl. 2: 331. 1829.

裂稃草属 lie fu cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Perennial or annual. Leaf blades linear or oblong-linear; ligule membranous. Inflorescence a solitary slender fragile raceme, racemes axillary, supported by a spatheole; rachis internodes and pedicels filiform to clavate, glabrous to ciliate or villous, apex cupular with scarious lobed rim; spikelets of a pair dissimilar. Sessile spikelet dorsally compressed or squeezed between internode and pedicel; callus obconical, obtuse, shortly bearded, inserted into internode apex; lower glume papery to leathery, convex, linear to lanceolate, flanks inflexed, often 2-keeled, usually wingless, intercarinal veins several, sometimes faint; upper glume boat-shaped, cuspidate to mucronate; lower floret reduced to a hyaline lemma; upper lemma hyaline, deeply 2-lobed, awned from sinus; awn geniculate, column glabrous. Stamens 3. Caryopsis linear. Pedicelled spikelet male or barren, usually smaller than sessile, sometimes much reduced.

About 60 species: throughout the tropics and subtropics; four species in China.

Schizachyrium is closely related to *Andropogon*, differing mainly by its single racemes. The convex lemma of the sessile spikelet and scarious, cupular internode apex are additional features characteristic of *Schizachyrium*.

1a. Perennial; leaf blades 5–50 cm.
2a. Racemes 3–9 cm; sessile spikelet linear, 5–8 mm ..... 1. *S. sanguineum*
2b. Racemes 1–4 cm; sessile spikelet lanceolate-oblong, 3.6–6 mm ..... 2. *S. delavayi*
1b. Annual; leaf blades 1.5–8 cm.
3a. Sessile spikelet 2.5–4 mm; leaf blades (1–)2–7 mm wide, apex obtuse ..... 3. *S. brevifolium*
3b. Sessile spikelet 6–7 mm; leaf blades 1–2 mm wide, apex subacute ..... 4. *S. fragile*

1. Schizachyrium sanguineum (Retzius) Alston in Trimen, Handb. Fl. Ceylon 6: 334. 1931.

红裂稃草 hong lie fu cao

Rottboellia sanguinea Retzius, Observ. Bot. 3: 25. 1783; *Andropogon hirtiflorus* (Nees) Kunth; *A. sanguineus* (Retzius) Merrill; *Schizachyrium hirtiflorum* Nees.

Perennial, tussocky, whole plant often reddish brown. Culms erect, hard, 50–120 cm tall, 2–4 mm in diam., simple or branched, glabrous. Leaf sheaths keeled, glabrous; leaf blades linear, flat, 5–20 × 0.1–0.5 cm, glabrous, margins scabrid, apex acute; ligule ca. 1 mm. Raceme very slender, erect, distant, 3–9 cm, dark purplish red, finally long exserted from spatheole; rachis internodes and pedicels linear-clavate, equaling or slightly shorter than sessile spikelet, glabrous or white-ciliate. Sessile spikelet 5–8 mm; lower glume linear, leathery, convex with inflexed margins, keeled from below middle to apex, back scabrid, veins obscure, keels very narrowly winged toward apex, apex 2-toothed; upper lemma 2-lobed to near base; awn 1–2 cm. Pedicelled spikelet lanceolate, reduced to 1 or 2 glumes, 2.8–4 mm, lower glume with awn up to 3 mm. Fl. and fr. Jul–Dec.

Dry hillsides; near sea level to 3600 m. Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangxi, Sichuan, Xizang, Yunnan [India, Indonesia, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand, Vietnam; Africa, America, Australia].

This grass is widely distributed in tropical and warmer, subtropical parts of the world.

2. Schizachyrium delavayi (Hackel) Bor, Indian Forest Rec., Bot. 1: 95. 1938.

旱茅 han mao

Andropogon delavayi Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 404. 1889; *A. bootanensis* J. D. Hooker; *Eremopogon delavayi* (Hackel) A. Camus; *Schizachyrium bootanense* (J. D. Hooker) A. Camus.

Perennial from a knotty rootstock. Culms loosely tufted, erect, wiry, 40–150 cm tall, upper internodes keeled, hirsute along keel, nodes glabrous. Leaf sheaths glabrous or thinly hirsute near mouth; leaf blades linear, 20–50 × 0.2–0.5 mm, glabrous or abaxial surface hirsute, apex finely acuminate; ligule truncate, 0.5–1 mm, margin ciliolate. Raceme 1–4 cm, purplish; spatheole narrow, glabrous or sparsely hirsute; rachis internodes and pedicels filiform, ca. 2/3 length of sessile spikelet, white-ciliate. Sessile spikelet 3.6–6 mm; callus obtuse, ca. 0.5 mm; lower glume narrowly lanceolate-oblong, leathery, glossy, back convex to almost flat, minutely asperulous, 5-veined, flanks keeled and narrowly winged above middle, wings ciliolate, apex erose; upper lemma 2-lobed in upper 1/4–1/3; awn 0.6–1 cm. Pedicelled spikelet male or barren, 4–5.3 mm, elliptic-oblong, papery, flat, back 3-veined, margins keeled and ciliolate above middle, apex acute. Fl. and fr. Jun–Nov.

Dry mountainsides, dry open forests; 1200–3400 m. Guangxi, Guizhou, Hunan, Sichuan, Xizang, Yunnan [Bhutan, India (Naga Hills, Sikkim), N Myanmar, Nepal].

This grass has been placed in *Eremopogon* (a synonym of *Dichanthium*), but differs from that genus in its keeled lower glume and the absence of homogamous spikelet pairs.

3. Schizachyrium brevifolium (Swartz) Nees ex Buse in Miquel, Pl. Jungh. 3: 359. 1854.

裂稃草 lie fu cao

Andropogon brevifolius Swartz, Prodr. 26. 1788; *Pollinia brevifolia* (Swartz) Sprengel.

Annual. Culms delicate, erect or trailing, 10–70 cm long, copiously branched, glabrous. Leaves cauline; leaf sheaths keeled, glabrous; leaf blades yellowish green becoming reddish brown, oblong-linear, flat or folded, 1.5–4 × (0.1–)0.2–0.7 cm, glabrous, base subrounded, apex obtuse; ligule 0.5–0.8 mm, lacerate. Raceme slender, 1–2 cm, enclosed at base by spatheole, borne along most of culm length, usually several flexuous peduncles arising from each leaf axil; rachis internodes and pedicels inflated upward, ca. 3/4 length of sessile spikelet, glabrous to villous. Sessile spikelet 2.5–4 mm; lower glume linear-lanceolate, subleathery, back flat, glabrous to thinly pilose, indistinctly 4–5-veined, flanks keeled toward apex, keels wingless, apex minutely 2-toothed; upper lemma 2-lobed to near base; awn 0.7–1 cm. Pedicelled spikelet reduced to 1 or 2 glumes, up to 0.5 mm, lower glume with 3–5 mm awn. Fl. and fr. Jul–Dec.

Open grassy banks, field margins, weedy places, sometimes gregarious; below 2000 m. Anhui, Fujian, Guangdong, Guizhou, Hainan, Hebei, Henan, Hubei, Jiangsu, Shandong, Sichuan, Taiwan, Xizang, Zhejiang [Bangladesh, Bhutan, India, Indonesia, Japan, Korea, Laos, Malaysia, Myanmar, Nepal, Philippines, Thailand, Vietnam; Africa, America, SW Asia (Oman)].

This is a slender, weedy annual, occurring widely in warm parts of the world. The whole plant turns reddish brown at maturity. The delicate, branching habit, with very obtuse leaf blades, is distinctive.

4. Schizachyrium fragile (R. Brown) A. Camus, Ann. Soc. Linn. Lyon, n.s., 70: 87. 1924.

斜须裂稃草 xie xu lie fu cao

Andropogon fragilis R. Brown, Prodr. 202. 1810; *A. brevifolius* Swartz var. *fragilis* (R. Brown) Hackel; *A. fragilis* var. *sinensis* Rendle; *A. obliquiberbis* Hackel; *Schizachyrium fragile* var. *sinense* (Rendle) Jansen; *S. obliquiberbe* (Hackel) A. Camus; *Eulalia simplex* Hosokawa.

Annual. Culms tufted, wiry, erect or geniculate, 15–60 cm tall, sparingly branched, glabrous. Leaves mainly basal; leaf sheaths lightly keeled, glabrous or a few hairs at mouth; leaf blades linear, usually folded, 4–8 × 0.1–0.2 cm, glabrous, apex acute or subacute; ligule 0.2–0.5 mm. Raceme 4–8 cm, enclosed at base by spatheole; rachis internodes and pedicels columnar, broadened distally, slightly shorter than sessile spikelet, a dense band of white ca. 3 mm hairs from lower part of one margin slanting obliquely across upper part of internode, then transversely across apex to top of other margin, pedicel often similarly obliquely bearded. Sessile spikelet 6–7 mm; lower glume linear-lanceolate, 2-keeled throughout, subleathery and white-villous below middle, membranous and glabrous above, keels winged for most of length but broadest on membranous

part, apex narrow, keels minutely extended; upper lemma 2-lobed to near base; awn 1–1.5 cm. Pedicelled spikelet reduced to 1 or 2 glumes, 1.5–3.5 mm, ciliate on both margins, lower glume with ca. 3 mm awn. Fl. and fr. Aug–Dec.

Hillsides; below 1000 m. S Anhui, Fujian, Guangdong, Guangxi, Hunan, Jiangxi, Taiwan [Indonesia; Australia, Pacific Islands].

This species is similar to *Schizachyrium exile* (Hochstetter) Pilger, from India and Africa, which is another slender annual with reddish racemes and conspicuous, contrasting, white hairs. However, *S. exile* has rachis internodes villous on the back and glabrous near the apex, and the lower glume of the sessile spikelet is wingless. The dense beard curling across the rachis internode from one side to the other in *S. fragile* is curious and quite distinctive.

210. ANDROPOGON Linnaeus, Sp. Pl. 2: 1045. 1753.

须芒草属 xu mang cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Annual or perennial. Leaf blades linear, not aromatic; ligule scarious or reduced to a line of hairs. Inflorescence simple or compound; racemes fragile, usually paired, occasionally digitate or single, terminal on the culm or axillary and gathered into a spathate compound panicle; spikelets of a pair dissimilar; raceme bases not deflexed, without homogamous spikelets (present in *A. munroi*); rachis internodes filiform to linear or clavate, sometimes inflated, ciliate on margins. Sessile spikelet usually dorsally compressed; callus short, obtuse, shortly bearded, inserted into internode apex; lower glume membranous to leathery, 2-keeled, lanceolate, flat to concave with lateral keels, these sometimes narrowly winged, with or without intercarinal veins, or linear with dorsal keels and a deep veinless median groove; upper glume awned or awnless; lower floret reduced to a hyaline lemma; upper lemma hyaline, 2-lobed, awned from sinus; awn geniculate, column glabrous or puberulous. Stamens 1–3. Pedicelled spikelet variable, large to much reduced, male or barren. $x = 10$.

About 100 species: tropical and warm-temperate regions of both hemispheres, especially Africa and America; two species in China.

1a. Upper glume awned; pedicelled spikelet 2-awned ..... 1. *A. chinensis*
1b. Upper glume awnless; pedicelled spikelet awnless ..... 2. *A. munroi*

1. Andropogon chinensis (Nees) Merrill, Philipp. J. Sci. 12: 101. 1917.

华须芒草 hua xu mang cao

Homoeatherum chinense Nees in Lindley, Nat. Syst. Bot., ed. 2., 448. 1836; *Andropogon apricus* Trinius var. *chinensis* (Nees) Hackel; *A. ascinodis* C. B. Clarke.

Perennial. Culms tufted, 40–100 cm tall. Leaf sheaths glabrous or pilose; leaf blades linear, flat or involute when dry, 8–25 × 0.2–0.3 cm, both surfaces pilose or abaxial surface glabrous; ligule 1–2.5 mm. Inflorescence a scanty spathate compound panicle; spatheoles linear; racemes paired, 1.5–3(–5) cm, exserted from spatheole; peduncle puberulous; rachis internodes and pedicels cuneate, margins ciliate with 1–3 mm hairs, tips cupular, obliquely toothed. Sessile spikelet linear, ca. 5 mm; lower glume deeply concave between dorsal keels, glabrous, apex acute or 2-toothed; upper glume awned, awn 6–10 mm; upper lemma 2-lobed; awn 2–3 cm. Anthers ca. 3 mm. Pedicelled spikelet oblong-lanceolate, 3.5–4.5 mm, 2-awned; awn of lower glume 4–10 mm, awn of upper glume much shorter. Fl. and fr. Aug–Dec.

Open grassy hillsides; below 800 m. Guangdong, Guangxi, Hainan, Sichuan, Yunnan [Cambodia, India, Laos, Myanmar, Thailand, Vietnam; Africa, SW Asia (Yemen)].

2. Andropogon munroi C. B. Clarke, J. Linn. Soc., Bot. 25: 87. 1889.

西藏须芒草 xi zang xu mang cao

Andropogon gyirongensis L. Liu; *A. hookeri* Munro ex Hackel; *A. tristis* Nees ex Hackel; *A. yunnanensis* Hackel; *Cymbopogon hookeri* (Munro ex Hackel) Stapf ex Bor; *C. tibeticus* Bor.

Perennial from tough rootstock, rhizomatous; basal sheaths crowded, pale yellow, papery, strongly keeled. Culms tufted, 30–100 cm tall. Leaf sheaths glabrous; leaf blades narrowly linear, flat or folded, tough, 15–25 × 0.2–0.4 cm, scaberulous, often with scattered long tubercle-based hairs especially on adaxial surface, midrib white, apex finely acuminate; ligule 1.5–4 mm. Inflorescence a sparse spathate panicle, spathate clusters few, often purplish; spatheoles very slender, terete, 2.5–4 cm; racemes paired or frequently branching, then subdigitate along a short axis, 2–4 cm, finally reflexing, lowest spikelet pair homogamous; peduncle glabrous or pilose; rachis internodes and pedicels slender, ciliate, tips cupular, irregularly toothed. Sessile spikelet narrowly oblong, 4.5–6.5 mm; lower glume leathery, deeply to shallowly concave, keels rounded below middle, sharp and scabrid above, glabrous or puberulous in groove, veinless or 1-veined above groove, apex 2-toothed; upper glume awnless; upper lemma 2-lobed, lobes filiform; awn 1–1.6 cm. Pedicelled spikelet 4.5–6 mm, awnless. Fl. and fr. Jun–Nov.

Mountainsides, dry open places in scrub; 2000–4500 m. Sichuan, S Xizang, Yunnan (Yongsheng, Ninglang) [Bhutan, N India, Nepal, Pakistan].

This species lies on the boundary between *Andropogon* and *Cymbopogon* and is sometimes placed in the latter genus on account of its reflexing racemes and homogamous spikelets. However, the slender, unequal raceme bases and frequently subdigitate, longer racemes are typical of *Andropogon*. As far as is known, the leaf blades do not contain aromatic oils. The yellowish, strongly keeled basal sheaths are characteristic of this species.

Robust specimens, often with several racemes per spathe, a hairy peduncle, and shallowly grooved sessile spikelets, have been separated as *Andropogon tristis*. However, there are many intermediates, which make a division into two species impracticable.

211. CYMBOPOGON Sprengel, Pl. Min. Cogn. Pug. 2: 14. 1815.

香茅属 xiang mao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Perennial, rarely annual. Culms often tall, robust. Leaf blades aromatic, filiform to broadly linear; ligule scarious. Inflorescence a dense spathate compound panicle, each ultimate spatheole subtending a pair of short racemes on a short peduncle; spatheoles boat-shaped; each raceme borne on a short, flattened raceme base, often deflexed at maturity, lower raceme with one basal pair of homogamous spikelets below the fertile pairs; rachis internodes and pedicels linear, white-ciliate on margins, sometimes pedicel of homogamous pair swollen and fused to adjacent internode. Sessile spikelet dorsally compressed; callus obtuse, shortly bearded, inserted into internode apex; lower glume papery, flat or concave, sometimes grooved or wrinkled, 2-keeled, keels lateral, often winged above middle, with or without intercarinal veins; upper glume boat-shaped, awnless; lower floret reduced to a hyaline lemma; upper lemma narrowly oblong, usually 2-lobed to near middle, lobes slender, ciliate, awned from sinus, occasionally subentire and awnless; awn geniculate, sometimes weakly, short, glabrous. Pedicelled spikelet male or sterile, narrowly lanceolate, awnless. x = 10, 20, 40, 60.

About 70 species: tropics and subtropics of Africa, Asia, and Australia, predominantly in Asia; introduced in tropical America; 24 species (seven endemic, up to five introduced) in China.

Cymbopogon, with its inserted callus but frequently deflexed raceme bases, provides a link between *Andropogon* and *Hyparrhenia*, although its aromatic leaves distinguish it from both these genera. Many of the species are both variable and intergrading, based on inconstant characters, leading to much taxonomic difficulty. Specimens showing intermediate or extreme characteristics are common.

Several species are cultivated commercially for the aromatic oils that are distilled from their leaves. The oils are often lemon scented and are used as perfume. Some species are also used medicinally and in cooking. Oil of citronella is used as an insect repellant.

1a. Rachis internodes and pedicels villous on margins and back with long silky hairs surrounding and obscuring spikelets ..... 1. *C. jwarancusa*
1b. Rachis internodes and pedicels ciliate on margins, back glabrous or pubescent, hairs shorter than spikelets.
2a. Lower glume of sessile spikelet flat with a slitlike median groove below middle (appearing as a line or keel on inside).
3a. Pedicel of homogamous spikelet pair linear to slightly cuneate, not fused to adjacent rachis internode ..... 2. *C. mekongensis*
3b. Pedicel of homogamous spikelet pair swollen, barrel-shaped, fused to adjacent rachis internode at base.
4a. Culms up to 1 m; leaf blades 0.5–1 cm wide, base rounded ..... 3. *C. annamensis*
4b. Culms up to 3 m; leaf blades 1–3 cm wide, base cordate, often amplexicaul ..... 4. *C. martini*
2b. Lower glume of sessile spikelet almost flat to deeply concave, the depression uniformly rounded.
5a. Homogamous spikelet pair reduced or absent; pedicelled spikelet small, reduced to barren glumes.
6a. Racemes not deflexing at maturity; spatheoles narrowly lanceolate, 2–2.5 cm ..... 5. *C. liangshanensis*
6b. Racemes deflexing at maturity; spatheoles linear, 1.2–1.5 cm ..... 6. *C. minor*
5b. Homogamous spikelet pair well developed; pedicelled spikelet well developed, often staminate.
7a. Lower glume of sessile spikelet with keels rounded in lower half, wingless or almost so.
8a. Raceme bases slender, unequal; racemes often more than 2 per spatheole ..... 2. *Andropogon munroi* (see p. 623)
8b. Raceme bases flat, subequal; racemes always paired.
9a. Lower glume of sessile spikelet deeply concave, depression with a prominent swelling at base ..... 7. *C. gidarba*
9b. Lower glume of sessile spikelet shallowly concave to almost flat, without a swelling at base ..... 8. *C. pospischilii*
7b. Lower glume of sessile spikelet with keels sharp throughout, narrowly to broadly winged.
10a. Sessile spikelet awnless or with short awn included within spikelet; cultivated plants.
11a. Sessile spikelet 5–6 mm; lower glume linear-lanceolate, ca. 0.7 mm wide ..... 9. *C. citratus*
11b. Sessile spikelet 3–5 mm; lower glume elliptic-oblong, 1–1.2 mm wide.
12a. Inflorescence densely congested; leaf blades tough, scabrid, drooping for 1/3 of their length ..... 10. *C. nardus*
12b. Inflorescence lax, branches spreading; leaf blades softer, smooth, drooping for 2/3 of their length ..... 11. *C. winterianus*
10b. Sessile spikelet with exserted geniculate awn; wild plants (*C. flexuosus* also cultivated).
13a. Culms slender to moderately robust, up to 1.5 m tall, 2–5 mm in diam.; spathate panicle 1–3-times branched.
14a. Sessile spikelet (6–)7–8 mm; leaf blades filiform, 1.5–3 mm wide ..... 12. *C. distans*
14b. Sessile spikelet 3.5–6.3 mm; leaf blades linear, 2–7 mm wide.
15a. Lower glume of sessile spikelet 5–7-veined between keels, obviously transversely wrinkled ..... 13. *C. nervosus*

15b. Lower glume of sessile spikelet 2–5-veined between keels; smooth or slightly wrinkled.
16a. Old basal leaf sheaths curling, reddish brown or orange inside; racemes 1–2 cm.
17a. Racemes 1–1.5 cm; sessile spikelet narrowly lanceolate-oblong, 3.5–4.5 mm, wings on keels 0.15–0.25 mm; awn 7–10 mm ..... 14. *C. tortilis*
17b. Racemes 1.5–2 cm; sessile spikelet narrowly obovate, 4.5–6 mm, wings on keels 0.25–0.45 mm wide; awn 10–12 mm ..... 15. *C. goeringii*
16b. Old basal leaf sheaths neither noticeably curling nor reddish inside; racemes 1.7–3 cm.
18a. Racemes 2–3 cm; sessile spikelet ca. 6 × 1.3 mm ..... 16. *C. tungmaiensis*
18b. Racemes 1.7–2 cm; sessile spikelet ca. 5 × 1 mm ..... 17. *C. fibrosus*

13b. Culms robust, up to 3 m tall, 5–10 mm in diam.; spathate panicle repeatedly branched.
19a. Sessile spikelet 5–9 mm (if less than 5.5 mm, lower glume clearly concave).
20a. Sessile spikelet 5–6 mm; lower glume clearly concave in lower 2/3, not wrinkled; wings on keels 0.15–0.35 mm ..... 18. *C. pendulus*
20b. Sessile spikelet 5.5–9 mm; lower glume flat or slightly concave, transversely wrinkled; wings on keels 0.3–0.5 mm.
21a. Compound panicle very large, open, drooping; racemes 3–4 cm, yellow-green; sessile spikelet 7–9 mm ..... 19. *C. xichangensis*
21b. Compound panicle narrow, erect, subdense; racemes 2–2.5 cm, purple; sessile spikelet 5.5–7 mm ..... 20. *C. traninhensis*
19b. Sessile spikelet 3.5–5.5 mm.
22a. Racemes 1–1.3 cm; sessile spikelet 3.5–4 mm; lower glume 0–2-veined between keels; awn 6–8 mm ..... 21. *C. microstachys*
22b. Racemes 1–2.5 cm; sessile spikelet 4–5 mm; lower glume 3–7-veined between keels; awn 8–12 mm.
23a. Panicle effuse, grayish green, branches with raceme clusters long, lax, drooping; lower glume of sessile spikelet obscurely 3-veined between keels, narrowly winged (wings 0.1 mm or less) ..... 22. *C. flexuosus*
23b. Panicle not effuse, often purplish, branches with raceme clusters dense, erect; lower glume of sessile spikelet distinctly 5(–7)-veined between keels, winged (wings more than 0.1 mm).
24a. Leaf blades 0.7–1 cm wide; leaf sheath auricles up to 0.6 mm .... 23. *C. khasianus*
24b. Leaf blades ca. 1.6 cm wide; leaf sheath auricles ca. 10 mm ..... 24. *C. auritus*

1. Cymbopogon jwarancusa (Jones) Schultes, Mant. 2: 458. 1824.

辣薄荷草 la bo he cao

Perennial, shortly rhizomatous; old basal sheaths papery, ribbonlike, often spirally curling. Culms densely tufted, moderately robust to wiry, 0.2–1.5 cm tall, lower internodes short, crowded. Leaf sheaths smooth, glabrous, congested and overlapping at base; leaf blades glaucous, involute or flat, 20–50 × 0.1–0.5 cm, glabrous, apex filiform; ligule 0.5–4 mm. Spathate compound panicle narrow, 10–40 cm; spatheoles in dense woolly clusters, straw-colored or becoming purplish, 1–2 cm; racemes 1–1.8(–2.2) cm; rachis internodes and pedicels ca. 2 mm, densely white-villous, hairs as long as spikelets; pedicel of homogamous pair not swollen. Sessile spikelet narrowly lanceolate, 4.5–5.5 mm; lower glume thin, concave, glabrous, sharply 2-keeled, keels scabrid upward, not winged, 0(–3)-veined between keels; upper lemma 2-lobed; awn almost straight, column and limb weakly differentiated, 0.5–1 cm. Pedicelled spikelet 5–6 mm. Fl. and fr. Mar–May and Jul–Aug. 2*n* = 20.

Mountain slopes, dry valleys. SW Sichuan, Xizang, Yunnan (Yuanmou) [Afghanistan, Bhutan, N India, Nepal, Pakistan; SW Asia (Iran, Iraq, Oman)].

1a. Culms up to 150 cm tall; ligule 0.5–1 mm ..... 1a. subsp. *jwarancusa*
1b. Culms 20–40 cm tall; ligule (1–)2–4 mm ..... 1b. subsp. *olivieri*

1a. Cymbopogon jwarancusa subsp. **jwarancusa**

辣薄荷草(原亚种) la bo he cao (yuan ya zhong)

Andropogon jwarancusa Jones, Asiat. Res. 4: 109. 1795.

Culms up to 150 cm tall; old basal leaf sheaths often spirally curling; ligule 0.5–1 mm.

Grassy slopes, dry valleys; below 1400 m. SW Sichuan, Xizang, Yunnan (Yuanmou) [Afghanistan, Bhutan, N India, Nepal, Pakistan; SW Asia (Iran)].

This subspecies is used medicinally.

1b. Cymbopogon jwarancusa subsp. **olivieri** (Boissier) Soenarko, Reinwardtia 9: 307. 1977.

西亚香茅 xi ya xiang mao

Andropogon olivieri Boissier, Diagn. Pl. Orient., ser. 1, 5: 76. 1844; *A. ariani* Edgeworth; *Cymbopogon ariani* (Edgeworth) Aitchison; *C. ladakhensis* B. K. Gupta.

Culms 20–40 cm tall; old basal sheaths only infrequently curling; ligule (1–)2–4 mm.

Mountain slopes, dry valleys; 2900–3500 m. W Xizang, Yunnan (Yuanmou) [Afghanistan, NW India, Pakistan; SW Asia (Iran, Iraq, Oman)].

This taxon is somewhat smaller than subsp. *jwarancusa*, and its distribution extends further westward from Pakistan. The basal parts are required for a positive identification. It has been confused in the past with *Cymbopogon schoenanthus* (Linnaeus) Sprengel, from Africa and Arabia, which has a swollen lowermost pedicel fused to the adjacent internode.

2. Cymbopogon mekongensis A. Camus, Bull. Mus. Natl. Hist. Nat. 26: 563. 1920.

青香茅 qing xiang mao

Perennial. Culms densely tufted, wiry, 30–80 cm tall. Leaf sheaths glabrous; leaf blades linear, glaucous, 10–25 × 0.2–0.6 cm, glabrous, base narrowly rounded, apex filiform; ligule 0.7–3 mm. Spathate compound panicle narrow, 10–30 cm, spathes densely clustered; spatheoles reddish brown, 1.4–2 cm; racemes reddish brown, 0.7–1.4 cm; rachis internodes and pedicels ca. 1.5 mm, ciliate on margins; pedicel of homogamous pair linear to columnar, not or only very slightly swollen, not fused to internode. Sessile spikelet oblanceolate, 3–4.3 mm; lower glume flat, deeply grooved below middle (appearing as a line or keel on inside), keels broadly winged above middle, veinless or obscurely 2-veined between keels; upper lemma deeply 2-lobed; awn 1.1–1.5 cm. Pedicelled spikelet 3–4 mm. Fl. and fr. Jul–Sep.

Roadsides, hill slopes. Guangdong, Guangxi, Guizhou, Hainan, Hunan, Sichuan, Yunnan, Zhejiang [Laos, Thailand, Vietnam].

Cymbopogon mekongensis is very close to *C. caesius* (Nees ex Hooker & Arnott) Stapf, which occurs down the eastern side of Africa through Arabia to Pakistan and in S India and Sri Lanka. *Cymbopogon caesius* differs by the markedly swollen, barrel-shaped pedicel of the homogamous spikelet pair, which is fused to the swollen adjacent internode. It also tends to have greenish yellow rather than reddish inflorescences.

3. Cymbopogon annamensis (A. Camus) A. Camus, Bull. Mus. Natl. Hist. Nat. 26: 563. 1920.

圆基香茅 yuan ji xiang mao

Cymbopogon martini (Roxburgh) Will. Watson var. *annamensis* A. Camus, Bull. Mus. Natl. Hist. Nat. 25: 670. 1919; *C. bassacensis* A. Camus.

Perennial. Culms tufted, wiry, up to 1 m tall. Leaf sheaths glabrous; leaf blades linear or linear-lanceolate, glaucous, 10–30 × 0.5–1 cm, glabrous, margin scabrid, base rounded, apex filiform; ligule 0.5–1.5 mm. Spathate panicle narrow, lax, 6–20 cm; spatheoles reddish brown, 2–2.5 cm; racemes reddish brown to purplish, 1.5–2 cm; rachis internodes and pedicels white-ciliate on margins; pedicel of homogamous pair swollen, barrel-shaped or broadly columnar, shiny, fused to internode at base. Sessile spikelet oblanceolate, 3.6–4.5 mm; lower glume flat, deeply grooved below middle (appearing as a line or keel on inside), keels winged above middle, veinless or obscurely 2-veined between keels; upper lemma deeply 2-lobed; awn ca. 1.6 cm. Pedicelled spikelet 3.5–4 mm.

Open forests, forest margins. Yunnan [Laos, Thailand, Vietnam].

This species is taken here in a broad sense to include all slender, narrow-leaved specimens from S China and Indochina with a flat, grooved, winged sessile spikelet and a swollen lowermost pedicel. The differences from *Cymbopogon caesius* (Nees ex Hooker & Arnott) Stapf, from E Africa to India, are very slight. *Cymbopogon caesius* tends to have a longer ligule, to 4 mm, and paler inflorescences. Likewise, *C. annamensis* hardly differs from *C. mekongensis*, except in the swollen lowermost pedicel.

4. Cymbopogon martini (Roxburgh) Will. Watson in E. T. Atkinson, Himalayan Districts N.W. Prov. India, 392. 1882.

鲁沙香茅 lu sha xiang mao

Andropogon martini Roxburgh, Fl. Ind. 1: 280. 1820; *A. schoenanthus* Linnaeus var. *martini* (Roxburgh) J. D. Hooker.

Perennial from a short woody rootstock. Culms tufted, up to 3 m tall, lower nodes often swollen, mealy. Leaf sheaths glabrous; leaf blades lanceolate, usually glaucous below, dark green above, up to 50 × 2–3 cm, glabrous, base cordate, often amplexicaul, apex filiform; ligule 2–4 mm. Spathate panicle narrow, dense, erect, 20–30 cm; spatheoles green becoming reddish, 2–4 cm; racemes 1.5–2 cm; rachis internodes and pedicels ciliate on margins, back sometimes pubescent; pedicel of homogamous pair swollen, barrel-shaped, shiny, fused to internode at base. Sessile spikelet oblong, 3.5–4.5 mm; lower glume flat, deeply grooved below middle (appearing as a line or keel on inside), keels winged above middle, veinless or 2-veined between keels; upper lemma 2-lobed; awn 1.4–1.8 cm. Pedicelled spikelet 3.5–4 mm. Fl. and fr. Jul–Oct. $2n = 20, 40$.

Grassy slopes; ca. 1000 m. Sichuan, Yunnan [native to India].

This grass is native to India, but is cultivated elsewhere in the tropics for its oils. Two forms can be distinguished in the field, each with a different oil content, but the habit differences are not evident in herbarium material. The cultivar ‘Motia’ yields palmerosa oil and ‘Sofia’ yields ginger-grass oil.

The name *“Cymbopogon lanceifolium* L. Liu” (Fl. Reipubl. Popularis Sin. 10(2): 194. 1997) was not validly published because no Latin description was provided. It appears to be based on a specimen of *C. martini* with a rather lax panicle.

5. Cymbopogon liangshanensis L. Liu ex S. M. Phillips & H. Peng, Novon 15: 471. 2005.

凉山香茅 liang shan xiang mao

Perennial. Culms solitary or in small tufts, slender, 50–110 cm tall. Leaf sheaths glabrous; leaf blades linear, glaucous, 20–30 × 0.3–0.5 cm, slightly scaberulous, glabrous, lower blades narrowed almost to midrib toward base; ligule 1.5–2.5 mm. Spathate panicle open, 30–40 cm, branches slender, laxly ascending; spatheoles narrowly lanceolate, greenish brown, 2–2.5 cm; racemes green, 1.5–1.8 cm, raceme bases linear, not deflexing; homogamous pair reduced, vestigial or often absent; rachis internodes and pedicels slenderly linear, margins ciliate with ca. 0.5 mm hairs increasing to 1.5 mm at apex, apices expanded,

cupular, scarious, toothed. Sessile spikelet narrowly elliptic-oblong, 3.7–4 mm; lower glume shallowly concave below middle, sharply keeled, keels scabrid, wingless, 2–4-veined between keels above middle; upper lemma 2-lobed; awn 1.3–1.5 cm. Pedicelled spikelet narrow, 2–3 mm, reduced to the glumes, lower glume enclosing a much smaller upper glume. Fl. and fr. Jul–Sep.

● Mountain slopes. SW Sichuan.

This species resembles *Andropogon* in its non-deflexing racemes and the lack of an obvious homogamous spikelet pair, although this is usually present as a vestige. It is not known whether the leaves are aromatic. The enlarged, toothed, cupular tips to the raceme bases, raceme internodes, and pedicels are a distinctive character of this species.

6. Cymbopogon minor B. S. Sun & R. Zhang ex S. M. Phillips & H. Peng, Novon 15: 473. 2005.

细小香茅 xi xiao xiang mao

Perennial. Culms tufted, wiry, 60–70 cm tall. Leaf sheaths glabrous; leaf blades narrowly linear, pale green, ca. 20 × 0.1–0.2 cm, smooth, glabrous, narrowed toward base; ligule 1.3–2 mm. Spathate panicle moderately dense, up to 30 cm; spatheoles linear, reddish, 1.2–1.5 cm; racemes green, deflexed at maturity, homogamous pair reduced to 1 short narrow spikelet; rachis internodes and pedicels slenderly linear, margins ciliate with ca. 0.7 mm hairs increasing to 2–3 mm at apex, internode apex expanded, cupular, scarious, toothed. Sessile spikelet narrowly oblong, 3.8–4 mm; lower glume herbaceous, shallowly concave below middle, a short tuft of callus hairs in base of concavity, lightly keeled below middle, sharply keeled above, keels scabrid, wingless, 2–4-veined between keels above middle; upper lemma 2-lobed; awn 1.2–1.3 cm. Pedicelled spikelet narrow, 0.5–2.5 mm, reduced to the empty lower glume. Fr. Oct.

● Roadsides in grasslands; ca. 900 m. NE Yunnan.

This species is known only from the type. It shares with *Cymbopogon liangshanensis* the unusual character, not otherwise seen in Chinese species, of reduced homogamous and pedicelled spikelets.

7. Cymbopogon gidarba (Buchanan-Hamilton ex Steudel) A. Camus var. **burmanicus** Bor, J. Bombay Nat. Hist. Soc. 52: 157. 1954.

缅甸浅囊香茅 mian dian qian nang xiang mao

Perennial. Culms tufted, slender, 50–100 cm tall. Leaf sheaths glabrous; leaf blades linear, flat or folded, 18–30 × 0.2–0.5 cm, abaxial surface glabrous, adaxial surface scabrid-puberulous, sometimes with long scattered hairs, base straight, apex finely acuminate; ligule 1–2 mm. Spathate panicle sparsely branched, very lax, 15–30 cm; spatheoles linear, tightly convolute, 2–3 cm; peduncle exserted up to 1.5 cm from near spatheole apex; racemes pinkish gray, ca. 2 cm; rachis internodes and pedicels stoutly cuneate, margins shortly but densely ciliate or woolly, back pubescent or subglabrous; pedicel of homogamous pair and lowest internode swollen. Sessile spikelet narrowly lanceolate, 4–4.5 mm; lower glume deeply concave in lower 2/3, channel puberulous with a prominent swelling at base, keels rounded alongside channel, sharp and scabrid above, wingless, 2–3-veined between keels; upper lemma 2-lobed; awn 1–1.3 cm. Pedicelled spikelet 4–5 mm.

Grassy hillsides; 1000–2200 m. Yunnan (Kaiyang) [Myanmar].

In Myanmar this grass occurs on calcareous clay soils.

Cymbopogon gidarba var. *gidarba* occurs on uplands in India. It has a narrower, more contracted compound panicle and shorter, 2–2.5 mm, narrowly elliptic spatheoles, with the peduncle not or only very shortly exserted from near the middle of the spatheole. The spikelets are also slightly smaller, with the sessile spikelet 3.2–4 mm.

8. Cymbopogon pospischilii (K. Schumann) C. E. Hubbard, Kew Bull. [4] 1949: 175. 1949.

喜马拉雅香茅 xi ma la ya xiang mao

Andropogon pospischilii K. Schumann, Bot. Jahrb. Syst. 24: 328. 1897; *A. nardus* var. *stracheyi* J. D. Hooker; *Cymbopogon stracheyi* (J. D. Hooker) Raizada & S. K. Jain.

Perennial. Culms densely tufted, wiry, erect or geniculate, 60–100 cm tall. Leaf sheaths glabrous; leaf blades narrow, folded or involute, glaucous, 15–30 × 0.2–0.3 cm, glabrous, scabrid, apex filiform; ligule ca. 1–2 mm. Spathate panicle open, 15–25 cm, raceme pairs few; spatheoles 2–3 cm; racemes 1.5–2 cm; rachis internodes and pedicels ciliate on margins, glabrous on back; pedicel of homogamous pair not swollen, oblong, free from adjacent internode. Sessile spikelet narrowly lanceolate-oblong, 4.5–6 mm; lower glume papery, concave or almost flat below middle, keels rounded below middle, sharp and scabrid above, wingless or almost so, 3–5-veined between keels above middle; upper lemma 2-lobed; awn 1.4–1.8 cm. Pedicelled spikelet 4.5–6 mm. Fl. and fr. Jul–Dec. $2n = 20, 40$.

Mountain slopes, mixed forests, valleys; 1600–3000 m. Xizang, Yunnan [NW India, Nepal, Pakistan; Africa, SW Asia (S Arabia)].

9. Cymbopogon citratus (Candolle) Stapf, Bull. Misc. Inform. Kew 1906: 357. 1906.

香茅 xiang mao

Andropogon citratus Candolle, Cat. Pl. Horti Monsp. 78. 1813.

Perennial, shortly rhizomatous. Culms tufted, robust, up to 2 m tall, ca. 4 mm in diam., farinose below nodes. Leaf sheaths glabrous, greenish inside; leaf blades glaucous, 30–90 × 0.5–2 cm, both surfaces scabrid, base gradually narrowed, apex long acuminate; ligule ca. 1 mm. Spathate compound panicle large, lax, up to 50 cm, drooping, branches slender; spatheoles reddish or yellowish brown, 1.5–2 cm; racemes 1.5–2 cm; rachis internodes and pedicels 2.5–4 mm, loosely villous on margins; pedicel of homogamous pair not swollen. Sessile spikelet linear-lanceolate, 5–6 × ca. 0.7 mm; lower glume flat or slightly concave toward base, sharply 2-keeled, keels wingless, scabrid, veinless between keels; upper lemma narrow, entire and awnless, or slightly 2-lobed with ca. 0.2 mm mucro. Pedicelled spikelet 4–5 mm. Fl. and fr. summer. $2n = 40$.

Commonly cultivated. Fujian, Guangdong, Guizhou, Hainan, Hubei, Taiwan, Yunnan, Zhejiang [origin unknown; cultivated in tropical Asia and elsewhere].

This species (Lemon Grass), known only from cultivation, is

grown on a large scale in parts of tropical Asia and South America for the lemon-scented oil extracted from its leaves. The oil is used for both medicinal and culinary purposes. Flowers are seldom produced.

10. Cymbopogon nardus (Linnaeus) Rendle in Hiern, Cat. Afr. Pl. 2: 155. 1899.

亚香茅 ya xiang mao

Andropogon nardus Linnaeus, Sp. Pl. 2: 1046. 1753.

Perennial from a stout rootstock. Culms tufted, robust, up to 2.5 m tall, 1–2 cm in diam. Leaf sheaths reddish purple at base, smooth, glabrous; leaf blades dark green or dark brown when dry, drooping for 1/3 of their length, 30–100 × 1–2 cm, glabrous, abaxial surface scabrid, adaxial surface smooth, base narrow, apex long acuminate; ligule 2–3 mm. Spathate panicle large, narrow, congested, interrupted, 60–90 cm; spatheoles reddish brown, 1.2–2.5 cm; racemes 1–1.5 cm; rachis internodes and pedicels ciliate on margins; pedicel of homogamous pair not swollen. Sessile spikelet oblong-lanceolate, 3–4.5 × 1–1.2 mm; lower glume flat or slightly concave, reddish brown or purplish upward, sharply 2-keeled, keels narrowly winged, obscurely 0–3-veined between keels; upper lemma linear, entire or slightly 2-lobed, mucronate or very shortly awned. Pedicelled spikelet 3.5–7 mm. Fl. and fr. Nov–Apr. 2*n* = 40.

Commonly cultivated. Fujian, Guangdong, Hainan, Taiwan, Yunnan [native to S India and Sri Lanka; introduced elsewhere as a crop plant].

This species yields citronella oil.

11. Cymbopogon winterianus Jowitt ex Bor, Oesterr. Bot. Z. 112: 185. 1965.

枫茅 feng mao

Perennial from a shallowly rooted rhizome. Culms tufted, robust, up to 2 m or more tall. Leaf sheaths glabrous, reddish inside; leaf blades relatively thin, drooping for 2/3 of their length, 40–80(–100) × 1–1.5(–2.5) cm, abaxial surface glaucous, adaxial surface light green, margins scabrid, base narrow, apex long acuminate; ligule 2–3 mm. Spathate compound panicle large, lax, up to 50 cm, much branched, main axis zig-zag, finally nodding; spatheoles reddish brown, 1.2–2.5 cm; racemes 1.5–2.5 cm; rachis internodes and pedicels softly ciliate on margins; pedicel of homogamous pair not swollen. Sessile spikelet elliptic-lanceolate, 4–5 × ca. 1 mm; lower glume flat or slightly concave, sharply 2-keeled, keels narrowly winged, 3-veined between keels; upper lemma very shortly 2-lobed, awn short or absent, not exserted from spikelet. Pedicelled spikelet 3.5–5 mm. 2*n* = 20, 40.

Commonly cultivated. Guangdong, Hainan, Sichuan, Yunnan [origin unknown; cultivated mainly in Indonesia].

This species, known only from cultivation, produces citronella oil of a higher quality than that from *Cymbopogon nardus*.

12. Cymbopogon distans (Nees ex Steudel) Will. Watson in E. T. Atkinson, Himalayan Districts N.W. Prov. India, 392. 1882.

芸香草 yun xiang cao

Andropogon distans Nees ex Steudel, Syn. Pl. Glumac. 1: 387. 1854; *A. nardus* Linnaeus var. *distans* (Nees ex Steudel) Hackel.

Perennial, shortly rhizomatous with age; basal sheaths closely overlapping in tight bundles, not curling. Culms densely tufted, erect or ascending, tinged purple, 50–100 cm tall, nodes glabrous. Leaf sheaths glabrous; leaf blades narrowly linear to filiform, flexuous, 10–50 × 0.15–0.3 cm, glaucous, glabrous, margins scabrid; ligule 2–3 mm. Spathate compound panicle narrow, open, 15–30 cm, usually simple, rarely with second tier of branching, raceme pairs few; spatheoles gray-green, 2–3.5 cm; racemes 2–3.5 cm; rachis internodes and pedicels 2–3 mm, margins densely ciliate with white soft hairs up to 3 mm; pedicel of homogamous pair not swollen. Sessile spikelet linear-lanceolate, (6–)7–8 × 0.8–1.2 mm; lower glume flat or shallowly concave in lower part with 1–2 transverse wrinkles, sharply 2-keeled throughout, keels wingless or narrowly winged, wings 0.15–0.25 mm, 2–4-veined between keels in upper part, apex long acuminate, 2-toothed; upper lemma 2-lobed; awn 1.5–2 cm. Pedicelled spikelet 5–9 mm. Fl. and fr. Jun–Oct. 2*n* = 20, 40.

Mountain slopes, valleys, open grassy places; 2000–3500 m. S Gansu, Guizhou, Shaanxi, Sichuan, Xizang, Yunnan [NW India, Nepal, Pakistan].

Aromatic oils are extracted from this species for medicinal and industrial purposes.

13. Cymbopogon nervosus B. S. Sun, J. Yunnan Univ. 21: 95. 1999.

多脉香茅 duo mai xiang mao

Perennial, shortly rhizomatous; basal sheaths papery, pale brown, slightly curling. Culms tufted, 50–120 cm tall, 2–3 mm in diam., nodes glabrous. Leaf sheaths glabrous; leaf blades linear, 10–20 × 0.4–0.7 cm, glabrous, margins scabrid, base rounded, apex acuminate to a setaceous point; ligule 1–3 mm. Spathate compound panicle narrow, lax, 20–30 cm, 1–3 tiers of branching; spatheoles green or tinged purple, 3–3.5 cm; racemes greenish or dark purple, 2.5–3.3 cm; rachis internodes and pedicels ca. 3.5 mm, margins ciliate; pedicel of homogamous pair not swollen. Sessile spikelet narrowly obovate, 5.8–6.5 × 1.5–1.7 mm; lower glume flat or shallowly concave in lower part, transversely wrinkled, sharply 2-keeled throughout, keels winged above middle, wings 0.25–0.4 mm, 5–7-veined between keels; upper lemma 2-lobed; awn ca. 1.5 cm. Pedicelled spikelet 6–6.3 mm. Fl. Aug.

● Mountain slopes; ca. 2500 m. Yunnan.

There is very little besides the lack of red coloration in the basal sheaths and a more wrinkled sessile spikelet to distinguish this taxon from *Cymbopogon goeringii*. It occurs at higher elevations.

14. Cymbopogon tortilis (J. Presl) A. Camus, Rev. Bot. Appl. Agric. Colon. 5: 206. 1925.

扭鞘香茅 niu qiao xiang mao

Anthistiria tortilis J. Presl in C. Presl, Reliq. Haenk. 1: 347. 1830; *Andropogon hamatulus* Hooker & Arnott; *A. nardus* Linnaeus subsp. *hamatulus* (Hooker & Arnott) Hackel; *Cymbopogon hamatulus* (Hooker & Arnott) A. Camus; *C. jinshaensis* R. Zhang & C. H. Li; *C. nardus* (Linnaeus) Rendle subsp. *hamatulus* (Hooker & Arnott) Rendle.

Perennial from a short rootstock; basal sheaths reddish brown inside, lax, curling when dry. Culms tufted, slender, 50–150 cm tall, 2–4 mm in diam., nodes glabrous or pubescent, often farinose. Leaf sheaths smooth, glabrous, leaf blades linear, 25–60 × 0.2–0.7 cm, glabrous, margins scabrid, base gradually narrowed, apex finely acuminate; ligule 2–3(–6) mm. Spathate compound panicle narrow or somewhat spreading, 20–35 cm, 2–3 tiers of branching; spatheoles reddish brown, 1.2–1.5 cm; racemes 1–1.5 cm; rachis internodes and pedicels 1.5–2 mm, margins ciliate; pedicel of homogamous pair not swollen. Sessile spikelet narrowly lanceolate-oblong, 3.5–4.5 × 0.9–1.2 mm; lower glume flat, smooth or slightly wrinkled, sharply 2-keeled throughout, keels narrowly winged above middle, wings 0.15–0.25 mm wide, (2–)3(–5)-veined between keels; upper lemma 2-lobed; awn 0.7–1 cm. Pedicelled spikelet 3–3.5 mm. Fl. and fr. Jul–Oct. 2*n* = 20.

Grassy places on light dry soils; below 600 m. S Anhui, Fujian, Guangdong, Guizhou, Hainan, Taiwan, Yunnan, Zhejiang [Philippines, Vietnam].

15. Cymbopogon goeringii (Steudel) A. Camus, Rev. Bot. Appl. Agric. Colon. 1: 286. 1921.

橘草 ju cao

Andropogon goeringii Steudel, Flora 29: 22. 1846; *A. nardus* Linnaeus var. *goeringii* (Steudel) Hackel; *Cymbopogon goeringii* var. *hongkongensis* Soenarko; *C. nardus* (Linnaeus) Rendle var. *goeringii* (Steudel) Rendle; *C. tortilis* (J. Presl) A. Camus subsp. *goeringii* (Steudel) Koyama; *C. tortilis* var. *goeringii* (Steudel) Handel-Mazzetti.

Perennial; basal sheaths orange inside, lax, curling when dry. Culms tufted, slender, 50–100 cm tall, 1–2.5 mm in diam., nodes glabrous or puberulous, often farinose. Leaf sheaths smooth, glabrous; leaf blades linear, 15–40 × 0.3–0.5 cm, glabrous, margins scabrid, base gradually narrowed, apex finely acuminate; ligule 1–3(–4.5) mm. Spathate compound panicle narrow, 15–30 cm, 2 tiers of branching; spatheoles 1.5–2.2 cm; racemes often purplish, (1.3–)1.5–2 cm, rachis internodes and pedicels 2–3.5 mm, margins ciliate; pedicel of homogamous pair not swollen. Sessile spikelet narrowly obovate, 4.5–6 × 1.2–1.7 mm; lower glume flat or slightly concave toward base, smooth or slightly wrinkled, sharply 2-keeled throughout, keels broadly winged above middle, wings 0.25–0.45 mm wide, (1–)3–5-veined between keels; upper lemma 2-lobed; awn (0.8–)1–2 cm. Pedicelled spikelet 4–6.5 mm. Fl. and fr. Jul–Oct. 2*n* = 20.

Grassy slopes, roadsides; below 1500 m. Anhui, Fujian, Guizhou, Hebei, Henan, Hong Kong, Hubei, Hunan, Jiangsu, Jiangxi, Shandong, Taiwan, Yunnan, Zhejiang [Japan, S Korea].

Cymbopogon goeringii and *C. tortilis* form an intergrading complex, and the former species is sometimes treated at infraspecific rank under the latter. *Cymbopogon goeringii* tends to have a slightly more northern distribution and can usually be distinguished by its longer racemes of larger, often purplish spikelets.

A local variant in Hong Kong has racemes, spikelets, and awns at the lower end of the size range, perhaps due to introgression from *Cymbopogon tortilis*, but has the obovate lower glume and broadly winged keels of *C. goeringii*. It has been distinguished as var. *hongkongensis*, but scarcely merits separate status.

The name *"Cymbopogon eugenolatus* L. Liu" (Fl. Reipubl. Popularis Sin. 10(2): 206. 1997) has been applied to another variant with intermediate measurements, but was not validly published because no Latin description was provided. The specimen on which it was based has not been seen.

16. Cymbopogon tungmaiensis L. Liu, Fl. Xizang. 5: 331. 1987.

通麦香茅 tong mai xiang mao

Perennial. Culms densely tufted, erect, 1–1.5 m tall, 2–7 mm in diam., nodes glabrous. Leaf sheaths glabrous; leaf blades narrowly linear, 20–40 × 0.2–0.3(–0.6) cm, adaxial surface scabrid, abaxial surface scabrid, puberulous at narrow base; ligule 1–2 mm. Spathate compound panicle 20–50 cm, simple or with second tier of branching; spatheoles 2–5 cm; racemes 2–3 cm, base swollen. Sessile spikelet elliptic, ca. 6 × 1.3 mm; lower glume concave along midline, keels winged above middle, wings 0.2–0.5 mm wide, margins scabrid, 2–4-veined between keels; upper lemma awned; awn ca. 1.5 cm. Pedicelled spikelet ca. 0.6 cm. Fl. and fr. Jul–Oct.

● Valleys; 2000–2500 m. SW Sichuan, Xizang (Tungmai), NW Yunnan.

This species is known only from the type, which has not been seen.

17. Cymbopogon fibrosus B. S. Sun, J. Yunnan Univ. 21: 95. 1999.

纤鞘香茅 xian qiao xiang mao

Perennial; old basal sheaths fibrous. Culms tufted, 0.5–1 m tall, 3–4 mm in diam., nodes glabrous. Leaf sheaths glabrous; leaf blades narrowly linear, flat or folded, 50–70 × 0.3–0.5 cm, scabrid, base narrowed to midrib, apex filiform; ligule 2–3 mm. Spathate compound panicle ca. 30 cm, slightly dense, 2–3 tiers of branching; spatheoles 2.5–2.8 cm; racemes green, 1.7–2 cm; rachis internodes and pedicels ciliate along margins with 0.5–1.5 mm hairs; pedicel of homogamous pair not swollen. Sessile spikelet oblong-lanceolate, 4.8–5.3 × 1–1.1 mm; lower glume concave in lower half, smooth or slightly transversely wrinkled, sharply 2-keeled throughout, keels winged above middle, wings 0.15–0.2 mm wide, 2–3-veined between keels; upper lemma awned; awn ca. 10 mm. Pedicelled spikelet 4.7–5 mm. Fl. Oct.

● Mountain slopes. SW Sichuan, SE Yunnan.

18. Cymbopogon pendulus (Nees ex Steudel) Will. Watson in E. T. Atkinson, Himalayan Districts N.W. Prov. India, 392. 1882.

垂序香茅 chui xu xiang mao

Andropogon pendulus Nees ex Steudel, Syn. Pl. Glumac. 1: 388. 1854.

Perennial from short rhizome. Culms tufted, robust, up to 3 m tall, 8–12 mm in diam., nodes glabrous. Leaf sheaths glabrous, auricles to 3 mm at mouth; leaf blades linear, glaucous, up to 100 × 0.7–1.5 cm, glabrous, margins scabrid, base gradually narrowed, apex filiform; ligule ca. 2 mm. Spathate compound panicle rather lax, decompound, yellowish tinged pale red, up to 1 m, branches drooping, clusters of racemes

dense; spatheoles pale reddish brown, 2–3 cm; racemes 1.5–2.2 cm; rachis internodes and pedicels densely ciliate; pedicel of homogamous pair not swollen. Sessile spikelet narrowly oblong, 5–6 × 1–1.4 mm; lower glume concave in lower 2/3, not wrinkled, sharply 2-keeled throughout, keels narrowly winged above middle, wings 0.15–0.35 mm, obscurely 2–4-veined between keels toward apex, midvein often absent; upper lemma awned; awn 1–1.7 cm. Pedicelled spikelet 5–6 mm.

Stream banks. Yunnan [Bhutan, NE India, Nepal].

This species has a lemon scent. Outside China it occurs on dry, grassy hillsides below 2000 m. It intergrades with *Cymbopogon flexuosus* and *C. khasianus*, but can usually be recognized by the relatively long, narrow, channeled lower glume of the sessile spikelet.

19. Cymbopogon xichangensis R. S. Zhang & B. S. Sun, J. Pl. Res. Environm. 2(2): 40. Fig. 2. 1993.

西昌香茅 xi chang xiang mao

Perennial. Culms tufted, robust, up to 2.5 m tall, 3–5 mm in diam., nodes glabrous. Leaf sheaths glabrous; leaf blades linear, up to 60 × 0.5–1.2 cm; ligule ca. 1.5 mm. Spathate compound panicle very large, open, 80–180 cm, branches lax, drooping, spathes not densely clustered; spatheoles reddish at maturity; racemes 3–4 cm; rachis internodes and pedicels ciliate on margins; pedicel of homogamous pair not swollen. Sessile spikelet elliptic, 7–9 mm; lower glume flat, sharply 2-keeled throughout, keels broadly winged above middle, 2–5-veined between keels; upper lemma awned; awn ca. 1.2 cm. Pedicelled spikelet linear-lanceolate. Fl. and fr. Sep.

● Grasslands; ca. 2000 m. Sichuan (Xichang).

20. Cymbopogon traninhensis (A. Camus) Soenarko, Reinwardtia 9: 347. 1977.

横香茅 heng xiang mao

Cymbopogon confertiflorus (Steudel) Stapf var. *traninhensis* A. Camus, Bull. Mus. Natl. Hist. Nat. 26: 565. 1920; *C. khasianus* (Munro ex Hackel) Stapf ex Bor var. *nagensis* Bor.

Perennial. Culms tufted, 1.5–2 cm tall, ca. 5 mm in diam., nodes glabrous or pubescent. Leaf sheaths glabrous or pubescent at base above node; leaf blades linear, up to 75 × 1–1.3 cm, abaxial surface bearded at sheath junction, otherwise glabrous, margins scabrid, base gradually narrowed, apex finely acuminate; ligule 3–6 mm. Spathate compound panicle narrow, erect or slightly spreading, usually purplish, ca. 50 cm or more, branched several times, spathes in lax clusters; spatheoles 1–2 cm; racemes 2–2.5 cm; rachis internodes and pedicels ciliate on margins; pedicel of homogamous pair not swollen. Sessile spikelet narrowly obovate, 5.5–7 × 1–1.5 mm; lower glume flat or shallowly concave below middle, frequently pubescent in depression, often transversely wrinkled, sharply 2-keeled throughout, keels winged above middle, wings 0.3–0.5 mm wide, 2–5-veined between keels; upper lemma awned; awn 1–2 cm. Pedicelled spikelet 5–5.5 mm.

Dry rocky or grassy hill slopes. Yunnan [NE India, Laos, Myanmar, N Thailand].

This species is very close to *Cymbopogon khasianus*, with the erect, purplish compound panicle typical of that species, but has slightly longer, more broadly winged spikelets.

21. Cymbopogon microstachys (J. D. Hooker) Soenarko, Reinwardtia 9: 364. 1977.

细穗香茅 xi sui xiang mao

Andropogon nardus Linnaeus var. *microstachys* J. D. Hooker, Fl. Brit. India 7: 207. 1896 [“1897”]; *Cymbopogon flexuosus* (Nees ex Steudel) Will. Watson var. *microstachys* (J. D. Hooker) Bor.

Perennial from a stout rootstock. Culms fairly slender to robust, 1.5–2 m tall, up to 1 cm in diam., nodes glabrous. Leaf sheaths glabrous, shortly auriculate; leaf blades linear, glaucous, 40–75 × 1–1.2 cm, glabrous, scabrid, base narrowed nearly to midrib on lower blades, apex finely acuminate; ligule 5–6 mm. Spathate compound panicle narrow or somewhat spreading, decompound, yellowish green or tinged purplish, up to 60 cm or more, branches lax, raceme pairs not densely clustered; spatheoles narrowly elliptic, 1–1.5 cm; racemes 1–1.3 cm; rachis internodes and pedicels pilose on margins; pedicel of homogamous pair not swollen. Sessile spikelet narrowly lanceolate-oblong, 3.5–4 × ca. 0.8 mm; lower glume flat or shallowly concave below middle, frequently slightly transversely wrinkled, sharply 2-keeled throughout, keels scarcely winged, wings not more than 0.1 mm wide, obscurely 1–3-veined between keels or veinless; upper lemma awned; awn 0.6–0.8 cm. Pedicelled spikelet 3–4 mm. Fl. and fr. Aug–Oct. $2n = 30$.

Rocky hill slopes, forest margins; ca. 1200 m. S Yunnan [India, Myanmar, Thailand].

This species is part of the complex centered around *Cymbopogon khasianus* and is distinguished mainly by its small racemes and spikelet parts.

22. Cymbopogon flexuosus (Nees ex Steudel) Will. Watson in E. T. Atkinson, Himalayan Districts N.W. Prov. India, 392. 1882.

曲序香茅 qu xu xiang mao

Andropogon flexuosus Nees ex Steudel, Syn. Pl. Glumac. 1: 388. 1854; *A. nardus* Linnaeus var. *flexuosus* (Nees ex Steudel) Hackel.

Perennial from a short stout rhizome. Culms robust, up to 3 m tall, 1–2 cm in diam., nodes glabrous or pubescent. Leaf sheaths glabrous, auricles often present; leaf blades linear, up to 100 × 1.5 cm, scabrid, abaxial surface tomentose at sheath junction, adaxial surface pilose at base, otherwise glabrous, base gradually narrowed, apex filiform; ligule 2–5 mm. Spathate compound panicle very large, lax, decompound, grayish green, up to 60 cm or more, nodes bearded, branches numerous, drooping; spatheoles 1–2 cm; racemes 1–1.7 cm; rachis internodes and pedicels ciliate on margins; pedicel of homogamous pair not usually swollen. Sessile spikelet narrowly elliptic-oblong, 4–4.5 × 0.8–1 mm; lower glume flat or shallowly concave, usually slightly transversely wrinkled, sharply 2-keeled throughout, keels narrowly winged, wings 0.1 mm wide or less, obscurely 3-veined between keels; upper lemma awned; awn 0.8–1 cm. Pedicelled spikelet 3.5–4 mm. Fl. and fr. summer to autumn. $2n = 20, 40$.

Grassy slopes; below 1000 m. SW Yunnan [probably native to In-

dia; naturalized in Indonesia, Malaysia, Myanmar, Nepal, and Thailand].

This grass is cultivated in tropical regions for "oil of lemon grass." It is thought to be native to India, but is now widely naturalized in Indonesia and elsewhere. It is usually easily recognizable by its very large compound panicle of drooping branches, with numerous short, deflexed racemes of small, narrowly winged spikelets. In Bhutan and NE India the branches are looser with more widely spaced raceme pairs than usual, approaching *Cymbopogon pendulus* in habit. This form has been recognized as *C. flexuosus* var. *sikkimensis* Bor.

23. Cymbopogon khasianus (Munro ex Hackel) Stapf ex Bor, Indian Forest Rec., Bot. 1: 92. 1938.

卡西香茅 ka xi xiang mao

Andropogon nardus Linnaeus var. *khasianus* Munro ex Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 603. 1889.

Perennial from a stout rootstock. Culms fairly slender to robust, up to 2 m tall, 3–6 mm in diam., nodes purple, glabrous, or puberulous to tomentose with creamy hairs. Leaf sheaths glabrous or basal part above node pubescent, auricles to 6 mm at mouth; leaf blades linear, slightly glaucous or sometimes purplish, 40–60 × 0.7–1 cm, abaxial surface usually tomentose at sheath junction, otherwise glabrous, base gradually narrowed, apex filiform; ligule 1.5–4 mm. Spathate compound panicle narrow, erect, decompound, often purplish, ca. 50 cm or more, much branched, spathate compound clusters dense; spatheoles 1.2–2 cm; racemes 1.2–1.5(–2) cm; rachis internodes and pedicels ciliate on margins, hairs ca. 1.5 mm; pedicel of homogamous pair not swollen. Sessile spikelet elliptic-oblong, 4–5 × 0.9–1.2 mm; lower glume flat or shallowly concave below middle, occasionally puberulous in depression, often transversely wrinkled, sharply 2-keeled throughout, keels winged above middle, wings 0.1–0.3 mm wide, (2–)5(–7)-veined between keels; upper lemma awned; awn 0.8–1.1 cm. Pedicelled spikelet 3–5 mm. Fl. and fr. Sep–Nov. 2*n* = 60.

Hill slopes, forest margins; 800–2000 m. Guangxi, Yunnan [Bhutan, India, Myanmar, N Thailand].

This is a variable species intergrading with several related species, including *Cymbopogon flexuosus*, *C. microstachys*, and *C. pendulus*. *Cymbopogon khasianus* can be recognized by its erect, often purplish compound panicle and sessile spikelets with a wrinkled, winged, several-veined lower glume. The wing width and number of veins can vary even within the same panicle.

24. Cymbopogon auritus B. S. Sun, J. Yunnan Univ. 21: 95. 1999.

长耳香茅 chang er xiang mao

Perennial. Culms robust, ca. 1.2 m tall, ca. 6 mm in diam., nodes pubescent. Leaf sheaths glabrous, auriculate, auricles broadly lanceolate, ca. 10 mm; leaf blades linear-lanceolate, papery, ca. 50 × 1.6 cm, smooth, glabrous, abaxial surface glaucous, pubescent at sheath junction, adaxial surface green, base gradually narrowed, apex finely acuminate; ligule 6–7 mm. Spathate compound panicle ca. 50 cm, open, branches elongate, erect or drooping, spathes not clustered; spatheoles light reddish, 1.8–2 cm; racemes yellow-green, 1.3–1.8 cm; rachis internodes and pedicels ca. 3 mm, ciliate on margins; pedicel of homogamous pair not swollen. Sessile spikelet narrowly elliptic, ca. 5 × 1.3 mm; lower glume shallowly concave below middle, transversely wrinkled, sharply 2-keeled throughout, keels winged above middle, wings 0.15–0.3 mm wide, 4–6-veined between keels; upper lemma awned; awn 0.9–1 cm. Pedicelled spikelet 4–4.5 mm. Fl. Jun.

● Grassy slopes; ca. 1000 m. W Yunnan.

This taxon is closely related to *Cymbopogon khasianus*, but has broader leaf blades and longer sheath auricles.

212. HYPARRHENIA Andersson ex Fournier, Mexic. Pl. 2: 51, 67. 1886.

苞茅属 bao mao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Perennial, infrequently annual. Culms usually tufted, often tall and robust. Leaf blades not aromatic, linear, midvein distinct, apex acuminate; ligule scarious. Inflorescence a compound spathate panicle, each ultimate spatheole subtending a peduncle bearing a pair of short racemes; spatheoles linear to ovate, often brightly colored; peduncle shorter or longer than spatheole, often bearded; raceme pairs 2- to many-awned, often reflexed at maturity. Each raceme of a pair supported on a short stalk ("raceme base") arising from the peduncle apex (termed "upper" and "lower" raceme base), these subequal or the upper longer, terete or flattened. Racemes with 0–2 pairs of homogamous spikelets below the fertile pairs, these resembling the pedicelled spikelets; pedicels and internodes slender. Sessile spikelet dorsally compressed or subterete; callus obtuse to pungent, bearded, its apex exposed; lower glume lanceolate to linear, leathery, convex, glabrous to villous, flanks rounded, incurving, keeled only near apex; upper glume boat-shaped, 3-veined, awnless; lower floret reduced to a hyaline lemma; upper lemma stipiform, 2-toothed, awned between the teeth; awn geniculate with hairy column. Pedicelled spikelet male or barren, narrowly lanceolate, slightly longer than the sessile, acute to aristulate.

Sixty-four species: mainly in Africa, a few species extending to other tropical regions; five species in China.

As a genus *Hyparrhenia* is easy to recognize, with its short, paired racemes grouped in a spathate panicle, exposed callus tip below the sessile spikelet, and hairy awns. Identification of the species depends on a careful inspection of the details of the pairs of racemes ("raceme pairs"). Homogamous spikelets are pairs of male or barren spikelets, generally resembling the pedicelled spikelets, often found at the base of one or both racemes. Their number and position are relatively stable within a species and provide a useful aid to identification.

1a. Racemes not reflexed at maturity; raceme bases terete, slender, clearly unequal.
2a. Awns 2(–4) per raceme pair; spikelets white-hairy ..... 1. *H. filipendula*
2b. Awns 6–13 per raceme pair; spikelets brown or golden-hairy ..... 2. *H. yunnanensis*

1b. Racemes reflexed at maturity; raceme bases subequal or unequal.
3a. Raceme with narrow, oblong, purple 1–3 mm scale at base; 1 homogamous spikelet pair at base of lower raceme only ..... 3. *H. newtonii*
3b. Raceme without linear scale at base.
4a. Spatheoles linear, 4–7 cm; 1 homogamous spikelet pair at base of each raceme ..... 4. *H. griffithii*
4b. Spatheoles lanceolate, 2–4.5 cm; 2 homogamous spikelet pairs at base of each raceme ..... 5. *H. diplandra*

1. Hyparrhenia filipendula (Hochstetter) Stapf var. **pilosa** (Hochstetter) Stapf in Prain, Fl. Trop. Africa 9: 324. 1919.

毛穗苞茅 mao sui bao mao

Andropogon filipendulus Hochstetter var. *pilosus* Hochstetter, Flora 29: 115. 1846.

Perennial. Culms loosely tufted, slender, 1–2 m tall, branching. Leaf sheaths glabrous; leaf blades tough, 15–40 × 0.3–0.6 cm, glabrous, margins scabrid; ligule ca. 2 mm. Spathate panicle with many slender spatheoles in crowded fascicles from each spathe; spatheoles very narrowly linear, 4–6 × 0.1–0.3 cm, becoming reddish; peduncle filiform, flexuously exserted near spatheole tip, glabrous or thinly white bearded. Racemes 2(–4)-awned per pair, awns often twisted together, not reflexed at maturity; raceme bases very unequal, glabrous, the upper filiform, 5–8 mm; 1 pair of homogamous spikelets at base of lower raceme, 2 pairs at base of upper raceme. Sessile spikelet oblong-lanceolate, 5–6 mm; callus pungent, 2–3 mm, white bearded; lower glume linear-oblong, pubescent to villous with white hairs; awn 3–5 cm, the column hirsute with brown 0.7–1.2 mm hairs. Pedicelled spikelet 5–6.5 mm, tipped with a 1–5 mm bristle. Fl. and fr. Jul–Dec.

Hill slopes, grassy places, thickets; 900–1600 m. Yunnan [Indonesia, New Guinea, Philippines, Sri Lanka; Africa, Australia].

Hyparrhenia filipendula may be recognized by the combination of a slender, delicate habit, 2-awned raceme pairs, an elongate, filiform upper raceme base bearing 2 homogamous spikelet pairs, a pungent callus, and a hirsute awn.

Hyparrhenia filipendula var. *filipendula* is distinguished by the glabrous lower glume of the sessile spikelet. In Africa both varieties are common and may grow together, but in Asia nearly all specimens belong to var. *pilosa*.

2. Hyparrhenia yunnanensis B. S. Sun, J. Yunnan Univ. 21: 95. 1999.

泰国苞茅 tai guo bao mao

Hyparrhenia rufa (Nees) Stapf var. *siamensis* Clayton.

Perennial. Culms erect, slender to robust, 1–3 m tall. Leaf sheaths glabrous; leaf blades 30–60 × 0.2–0.8 cm, glabrous, margins scabrid; ligule subrounded, ca. 2 mm. Spathate panicle variable, lax or contracted; spatheoles linear-lanceolate, 3–5 × 0.3–0.5 cm, finally reddish and rolled; peduncle shorter or longer than spatheole, usually flexuously exserted at least on panicle periphery, glabrous or white bearded. Racemes 6–7-awned per pair, rufous, not reflexed at maturity; raceme bases unequal, terete, glabrous, upper 3–5 mm; 1 pair of homogamous spikelets at base of lower raceme, 1–2 pairs at base of upper raceme. Sessile spikelet 4–5 mm; callus narrowly cuneate, 1–1.2 mm, densely white or golden bearded; lower glume oblong-lanceolate, brownish, glossy, typically with scanty stiff rufous hairs, but sometimes glabrous or pubescent; awn 2–3 cm, the column pubescent with stiff brown hairs. Pedicelled spikelet 3–5 mm, acute.

Hill slopes; 800–1200 m. Yunnan [Myanmar, Thailand].

This taxon is a uniform, local segregate from the gene pool of the extremely variable, African species *Hyparrhenia rufa* (Nees) Stapf. *Hyparrhenia rufa* s.s. has been introduced to warm parts of America and elsewhere as a pasture grass and is recorded from Yunnan. It has 7–14 awns per raceme pair, a shorter (0.2–0.8 mm) callus, and a slightly shorter sessile spikelet.

Hyparrhenia yunnanensis can be distinguished from the other species in China (except *H. griffithii*) by its long, slender upper raceme base, which may sometimes be partially connate with the shorter lower raceme base. The brown color of the spikelet hairs is also distinctive, although it may sometimes be rather pale.

3. Hyparrhenia newtonii (Hackel) Stapf in Prain, Fl. Trop. Africa 9: 363. 1919.

苞茅 bao mao

Andropogon newtonii Hackel, Bol. Soc. Brot. 3: 137. 1885; *A. lecomtei* Franchet; *Hyparrhenia lecomtei* (Franchet) Stapf.

Perennial. Culms tufted, erect or geniculate at base, 50–200 cm tall, glabrous or pilose just below nodes. Basal leaf sheaths tomentose or glabrous; leaf blades 20–60 × 0.2–0.6 cm, pilose on both surfaces or adaxial surface glabrous, margins scabrid; ligule reddish brown, truncate, 0.5–2 mm. Spathate panicle narrow, 30–40 cm; spatheoles narrowly lanceolate, 2–4 cm, reddish brown; peduncle slightly shorter than spatheole, setose with yellow or creamy hairs. Racemes 2–4-awned per pair, purple, reflexed at maturity; raceme bases unequal, stiffly setose, upper 1.5–3 mm, prolonged into a 1–3 mm, lanceolate, purple appendage below the lowest spikelet pair; 1 pair of homogamous spikelets at base of lower raceme only. Sessile spikelet 4–6 mm, purplish; callus 1.5–2 mm, acute to pungent, bearded; lower glume narrowly oblong, glabrous; awn 2–4 cm, column with short brown hairs. Pedicelled spikelet 5–10 mm, tipped with a 1–5 mm bristle.

Hill slopes; 600–1200 m. Guangdong, Guangxi [Indonesia, Thailand, Vietnam; Africa, Madagascar].

This species has a distinctively colored panicle, with purple spikelets and yellowish hairs. Asian material identified as *Hyparrhenia bracteata* (Willdenow) Stapf belongs here. True *H. bracteata* is restricted to Africa.

4. Hyparrhenia griffithii Bor, Indian Forest Rec., Bot. 1: 92. 1938.

大穗苞茅 da sui bao mao

Perennial. Culms erect, 1–2 m tall. Leaf sheaths pilose along margin and mouth, becoming glabrescent; leaf blades up

to 40 × 0.4–0.8 cm, white pilose near base on adaxial surface; ligule ca. 3 mm. Spathate panicle lax, narrow; spatheoles linear, 4–7 cm, inrolled, brown; peduncle 2/3 as long to slightly longer than spatheole, flexuous, white setose. Racemes 5–10-awned per pair, white hairy, loose, reflexed at maturity; raceme bases unequal, terete, glabrous, the upper filiform, 3.5–8 mm; 1 pair of homogamous spikelets at base of both lower and upper raceme of pair. Sessile spikelet 6–7 mm; callus pungent, 1.5–2 mm, white bearded; lower glume lanceolate, brownish to dark violet, white hirsute; awn 4–6 cm, the column pubescent with brown 0.4–0.6 mm hairs. Pedicelled spikelet 6–8 mm, villous, tipped with a 1–4 mm bristle.

Usually in forest understory; ca. 700 m. SW Yunnan (Gengma) [NE India, N Myanmar; Africa].

This species resembles *Hyparrhenia filipendula* in its white-hairy racemes, long, slender upper raceme base, and long awns. It can be distinguished by the sparser panicle, strongly reflexing racemes at maturity, and the greater number of awns per raceme pair.

5. Hyparrhenia diplandra (Hackel) Stapf in Prain, Fl. Trop. Africa 9: 368. 1919.

短梗苞茅 duan geng bao mao

Andropogon diplandrus Hackel, Flora 68: 123. 1855; *Cymbopogon eberhardtii* A. Camus; *Hyparrhenia eberhardtii* (A. Camus) Hitchcock.

Perennial. Culms tufted, coarse, 1–2 m tall, sometimes glaucous. Leaf sheaths glabrous; leaf blades 30–60 × 0.3–0.6 cm, glabrous or hirsute at base, margins scabrid; ligule reddish brown, ca. 2 mm. Spathate panicle loose, narrow; spatheoles narrowly lanceolate, 3–5 cm, brownish red; peduncle scarcely exserted from spatheole, glabrous or shortly bearded. Racemes 4–8-awned per pair, reflexed at maturity; raceme bases subequal, flattened, short, broadly oblong, glabrous on outer face, upper 1.5–3 mm; usually 2 pairs of homogamous spikelets at base of both lower and upper raceme of pair; homogamous spikelets scabrid-pectinate on upper keels. Sessile spikelet 6–8 mm; callus 1–1.5 mm, sharply acute, white bearded; lower glume lanceolate, glabrous or pilose; awn 2.5–4.5 cm, column with white or brown 0.2–0.5 mm hairs. Pedicelled spikelet 6–7.5 mm, acute or tipped with a mucro up to 1.5 mm. Fl. and fr. Aug–Nov.

Hill slopes, thickets; 100–200 m. Guangdong, Guangxi, Hainan, Yunnan [Indonesia, Thailand, Vietnam; tropical Africa].

This species can be recognized by its short, flat raceme bases and the pectinately margined homogamous spikelets, which form an involucre at the base of the raceme pair.

213. THEMEDA Forsskål, Fl. Aegypt.-Arab. 178. 1775.

菅属 jian shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Anthistiria Linnaeus f.

Perennial or annual, often coarse. Culms tufted. Leaf sheaths keeled; leaf blades linear; ligule short, membranous or papery. Inflorescence a leafy compound panicle composed of short racemes; each raceme on a short peduncle subtended by a sheathing spatheole, loosely arranged or gathered into fan-shaped spathate fascicles. Raceme comprising 2 pairs of large sessile homogamous spikelets at base forming an involucre, with 1–2(–5) fertile pairs above and a terminal triad, these usually deciduous, rarely raceme shed as a whole; internodes and pedicels linear. Sessile spikelet subterete or dorsally compressed; callus mostly acute to pungent, sometimes obtuse, bearded; lower glume usually leathery, margins rounded, incurving, keeled only near apex, obtuse; upper glume awnless; lower floret reduced to a hyaline lemma; upper lemma stipitiform, entire, passing into a geniculate awn with pubescent column, occasionally awnless. Pedicelled spikelet mostly larger than sessile, narrowly lanceolate, resembling homogamous; callus slender, pedicel-like; true pedicel reduced. $x = 10$.

Twenty-seven species: tropical and subtropical regions of the Old World, mainly in Asia; 13 species (four endemic) in China.

The number of spikelets in a raceme refers to the total of homogamous, sessile, and pedicelled spikelets. Hence racemes with seven spikelets (division 1a of the key) have only one fertile sessile spikelet and one awn. Racemes with more than one awn have more than seven spikelets.

Most species of this genus are used for forage when young.

1a. Raceme with 7 spikelets; homogamous spikelets all at same level; racemes congested in dense fascicles.
  2a. Homogamous spikelets 7–14 mm ..... 1. *T. triandra*
  2b. Homogamous spikelets 4–6 mm.
    3a. Involucral spikelets densely hairy with soft hairs; awn poorly developed, ca. 4 mm ..... 2. *T. minor*
    3b. Involucral spikelets conspicuously setose with a few long bristles from large tubercles; awn well developed, 3–4.5 cm.
      4a. Fascicles of racemes from upper leaf axils; sessile spikelet pubescent toward apex ..... 3. *T. quadrivalvis*
      4b. Fascicles of racemes from all leaf axils; sessile spikelet pubescent throughout ..... 4. *T. helferi*
1b. Raceme with (7 or)9–17 spikelets; homogamous spikelets at slightly different levels; racemes loosely arranged.
  5a. Homogamous spikelets pubescent, thinly hispid or glabrous.
    6a. Culms slender, 20–60 cm; racemes few ..... 5. *T. hookeri*
    6b. Culms robust, 1–3.5 m; racemes numerous.
      7a. Sessile spikelet awnless or with awn less than 1 cm ..... 7. *T. villosa*

7b. Sessile spikelet with 2–8 cm awn.
8a. Culms and leaves hirsute ..... 8. *T. trichiata*
8b. Culms and leaves glabrous ..... 9. *T. caudata*
5b. Homogamous spikelets setose with tubercle-based bristles.
9a. Sessile spikelet awnless or with awn less than 1 cm.
10a. Homogamous spikelets 0.5–0.8 cm; culms slender ..... 6. *T. anathera*
10b. Homogamous spikelets 1–4 cm; culms robust ..... 10. *T. intermedia*
9b. Sessile spikelet awned.
11a. Raceme with 13–17 spikelets; homogamous spikelets 2.5–4 cm ..... 11. *T. unica*
11b. Raceme with 7–9 spikelets; homogamous spikelets 1–1.5 cm.
12a. Glumes of homogamous and pedicelled spikelets with golden hairs; lower glume of sessile spikelet convex ..... 12. *T. arundinacea*
12b. Glumes of homogamous and pedicelled spikelets with long soft white hairs; lower glume of sessile spikelet with shallow median groove ..... 13. *T. yunnanensis*

1. Themeda triandra Forsskål, Fl. Aegypt.-Arab. 178. 1775.

黄背草 huang bei cao

Anthistiria japonica Willdenow; *Themeda barbinodis* B. S. Sun & S. Wang; *T. japonica* (Willdenow) Tanaka; *T. triandra* var. *japonica* (Willdenow) Makino.

Perennial from a knotty rootstock. Culms tussocky, yellowish, usually farinose near nodes, 0.5–1.5 m tall. Leaf sheaths usually hispid with tubercle-based hairs; leaf blades 10–50 × 0.4–0.8 cm, glabrous or pilose, finely acuminate; ligule 1–2 mm, truncate, ciliate. Compound panicle lax, open, with spaced, often nodding spathate fascicles; spathes and spatheoles narrowly lanceolate, glabrous or thinly to densely tuberculate-hispid, innermost 2–3.5 cm. Raceme composed of a triad of 1 sessile and 2 pedicelled spikelets above the involucre of 2 homogamous pairs. Homogamous spikelets all sessile, arising at same level, staminate, both glumes present, 7–14 mm, oblong-lanceolate with lateral scarious wings, glabrous or hispid with tubercle-based hairs. Sessile spikelet 5–7 mm; callus 1.5–3 mm, pungent, brown bearded; lower glume dorsally rounded, dark brown, glossy, hispidulous in upper 1/3, smooth below; awn 3.7–7 cm. Pedicelled spikelet 7–12 mm, male or barren. Fl. and fr. Jun–Dec. 2*n* = 20, 40, 50, 60, 70, 80.

Dry mountain slopes, roadsides, forest margins; 100–3000 m. Anhui, Fujian, Guizhou, Hainan, Hebei, Henan, Hubei, Jiangsu, Jiangxi, Shaanxi, Shandong, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Indonesia, Japan, Korea, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam; Africa, SW Asia, Australia].

This is a highly polymorphic, predominantly apomictic species with a wide range of chromosome numbers.

The name *Themeda arguens* (Linnaeus) Hackel has been misapplied to this species in Yunnan. True *T. arguens* is not yet known from China. It occurs from Thailand and Vietnam to Australia, and can be distinguished by its reddish culms, very large, spathate fascicles with awns 7–9 cm, and longer callus 3–4 mm. It also differs from *T. triandra* by its glabrous leaf sheaths, blunter leaf blades, and homogamous spikelets consisting only of the lower glume.

2. Themeda minor L. Liu, Fl. Xizang. 5: 343. 1987.

小菅草 xiao jian cao

Perennial, with short scaly rhizomes. Culms slender, stiff, 30–50 cm, many-noded, branching. Leaf sheaths softly pilose on margins; leaf blades 3–8 × 0.1–0.2 cm, pilose with tubercle-based hairs, densely long-pilose at narrowed base, margins scabrid; ligule ca. 1 mm, ciliate. Compound panicle narrow, erect, spathate fascicles arising singly on 1.5–2 cm branches from upper leaf axils; spathes ca. 1.5 cm. Raceme composed of a triad of 1 sessile and 2 pedicelled spikelets above the involucre of 2 homogamous pairs. Homogamous spikelets 4–5 mm, densely hirsute with whitish, tubercle-based soft hairs. Sessile spikelet ca. 4 mm; callus bearded; lower glume dorsally compressed, pallid, puberulous, acute; awn poorly developed, ca. 4 mm. Pedicelled spikelet ca. 5 mm, staminate, densely white-hirsute, hairs ca. 3 mm. Fl. and fr. Jun–Sep.

● Mountain slopes, under rather open thickets; ca. 2000 m. SE Xizang (Zayü).

3. Themeda quadrivalvis (Linnaeus) Kuntze, Revis. Gen. Pl. 793. 1891.

中华菅 zhong hua jian

Andropogon quadrivalvis Linnaeus in Murray, Syst. Veg., ed. 13, 758. 1774; *Themeda chinensis* (A. Camus) S. L. Chen & T. D. Zhuang; *T. ciliata* (Linnaeus f.) Hackel subsp. *chinensis* A. Camus; *T. echinata* Keng; *T. yuanmounensis* S. L. Chen & T. D. Zhuang.

Annual. Culms moderately robust, erect or geniculate at base, ca. 1 m tall. Leaf sheaths glabrous or with tubercle-based bristles at mouth; leaf blades flat or folded, up to 30 × 0.3–0.9 cm, glabrous, abruptly acute to acuminate; ligule ca. 3 mm. Compound panicle large, dense; spathes and spatheoles lanceolate-caudate, glabrous, innermost 1.3–1.7 cm. Raceme composed of a triad of 1 sessile and 2 pedicelled spikelets above the involucre of 2 homogamous pairs. Homogamous spikelets all sessile, arising at same level, barren, both glumes present, 4.5–6 mm, lanceolate, stiffly setose in upper half with 3–4 mm, tubercle-based bristles. Sessile spikelet 4–4.5 mm; callus 0.8–1 mm, subacute, brown bearded; lower glume dorsally rounded, dark brown at maturity, pubescent, often thinly or glabrous on lower back; awn 3.5–4 cm. Pedicelled spikelet 4–6 mm, barren. Fl. and fr. Jun–Dec.

Dry hill slopes; 400–2000 m. Guangdong, Guangxi, Guizhou, Hainan, Yunnan [India, Indonesia, Myanmar, Nepal, Thailand, Vietnam; Australia].

This species has dense fascicles of racemes similar to those of *Themeda triandra*, but with smaller spikelet parts and conspicuously

setose homogamous spikelets with long, patent bristles from very large tubercles. It can also generally be separated by its annual habit.

4. Themeda helferi Munro ex Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 665. 1889.

无芒菅 wu jing jian

Themeda acaulis B. S. Sun & S. Wang; *T. ciliata* (Linnaeus f.) Hackel subsp. *helferi* (Munro ex Hackel) A. Camus; *T. quadrivalvis* (Linnaeus) Kuntze var. *helferi* (Munro ex Hackel) Bor.

Annual. Culms very slender, solitary or in small loose tufts, up to 30 cm tall. Leaf sheaths shorter than internodes, glabrous; leaf blades flat or folded, 5–10 × 0.2–0.4 cm, a few tubercle-based bristles on lower margins, otherwise glabrous, acute; ligule ca. 1 mm, truncate, ciliolate. Spathate fascicles arising from all leaf axils from base to apex of culm, fascicles congregated on slender 1–3-noded branches; spathes and spatheoles narrowly lanceolate-caudate, glabrous, innermost ca. 2 cm. Raceme composed of a triad of 1 sessile and 2 pedicelled spikelets above the involucre of 2 homogamous pairs. Homogamous spikelets all sessile, arising at same level, male with both glumes present, 4–5 mm, narrowly lanceolate, stiffly setose in upper half with ca. 3 mm, tubercle-based bristles, upper keels scabrid. Sessile spikelet ca. 4 mm; callus 0.5–1 mm, obtuse, brown bearded; lower glume dorsally slightly flattened, pubescent throughout; awn 3.5–4.5 cm. Pedicelled spikelet 5–6 mm, barren.

Stream banks; ca. 600 m. Yunnan (Longling, Zhenkang) [Myanmar (Tenasserim)].

This slender, annual species is remarkable in that fascicles of racemes are borne all the way down to the base of the plant, so that the whole culm in effect forms the compound inflorescence. It appears to be rare and fairly localized in its distribution.

5. Themeda hookeri (Grisebach) A. Camus, Bull. Mus. Natl. Hist. Nat. 26: 425. 1920.

西南菅草 xi nan jian cao

Anthistiria hookeri Grisebach, Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ. 3: 91. 1868.

Perennial, with slender rhizomes. Culms very slender, decumbent at base, 20–60 cm tall. Leaf sheaths glabrous; leaf blades 3–13 × 0.2–0.5 cm, scabrid, glabrous or thinly hispid with long, fine, tubercle-based hairs, apex filiform; ligule ca. 0.5 mm, ciliolate. Compound panicle sparse, composed of single racemes arising from upper leaf axils, usually subtended only by a spatheole without accompanying spathes; spatheoles linear, 3–6 cm, glabrous; peduncle glabrous. Raceme composed of 1–2 spikelet pairs and a terminal triad above the involucre of 2 homogamous pairs. Homogamous spikelets arising at different levels, staminate, 12–18 mm, lanceolate with narrow lateral wings, glabrous or thinly hispid. Sessile spikelet 4.5–5.5 mm; callus ca. 1.5 mm, narrowly cuneate; lower glume pallid, dorsally compressed, shortly pubescent especially near apex or subglabrous; awn 2.5–4 cm, weakly geniculate. Pedicelled spikelet 10–11 mm. Fl. and fr. Jun–Nov.

Mountain slopes, rocky places, in the open or in shade; 1100–3400 m. Guizhou, Sichuan, Xizang, Yunnan [India (Sikkim), Nepal].

This slender, upland species is recognizable by its few racemes, which usually arise singly from the upper leaf axils instead of being gathered into spathate clusters.

6. Themeda anathera (Nees ex Steudel) Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 669. 1889.

瘤菅 liu jian

Anthistiria anathera Nees ex Steudel, Syn. Pl. Glumac. 1: 402. 1854; *Androscepia anathera* (Nees ex Steudel) Andersson; *A. anathera* var. *glabrescens* Andersson; *A. anathera* var. *hirsuta* Andersson; *Themeda anathera* var. *glabrescens* (Andersson) Hackel; *T. anathera* var. *hirsuta* (Andersson) Hackel.

Perennial, with rhizomes. Culms densely tufted, slender, erect or ascending, 30–120 cm tall. Leaf sheaths glabrous or loosely hairy; leaf blades narrow, 4–20 × 0.2–0.4 cm, scabrid, setose with scattered, long, tubercle-based hairs, apex filiform; ligule ca. 2 mm, margin ciliate. Compound panicle loose, open, branches ascending, bearing up to 5 small spathate racemes; spatheoles linear, 1–2 cm, glabrous; peduncle glabrous. Raceme composed of 1–3 spikelet pairs and a terminal triad above the involucre of 2 homogamous pairs. Homogamous spikelets arising at different levels, male or barren, 5–8 mm, lanceolate, sparsely to densely setose with tubercle-based bristles or sometimes glabrous. Sessile spikelet 5–7 mm; callus ca. 1 mm, obtuse; lower glume firmly herbaceous to subleathery, lightly dorsally compressed, puberulous or subglabrous to tuberculate-hairy; upper lemma narrowly lanceolate, awnless (rarely with reduced ca. 1 cm awn). Pedicelled spikelet 6–8 mm. Fl. and fr. Aug–Oct.

Mountain slopes, usually in forests; 1500–3000 m. Xizang [Afghanistan, N India, Nepal, Pakistan].

This is a slender, Himalayan species similar to *Themeda hookeri*, but with a more western distribution. It has a more densely tufted habit than *T. hookeri* and can easily be distinguished by its more numerous, awnless, usually setose racemes of smaller spikelets.

7. Themeda villosa (Poiret) A. Camus in Lecomte, Fl. Indo-Chine 7: 364. 1922.

菅 jian

Anthistiria villosa Poiret, Encycl. Suppl. 1: 396. 1812 [“1810”]; *A. gigantea* Cavanilles subsp. *villosa* (Poiret) J. D. Hooker; *A. mutica* Steudel; *Pseudanthistiria emeinica* S. L. Chen & T. D. Zhuang; *Themeda gigantea* (Cavanilles) Hackel subsp. *villosa* (Poiret) Hackel; *T. gigantea* var. *villosa* (Poiret) Hackel.

Perennial. Culms tufted, stout, 2–3.5 m tall, 1–2 cm in diam. Leaf sheaths glabrous, basal sheaths strongly compressed; leaf blades ca. 100 × 0.7–1.5 cm, scabrid, gradually narrowed to the thick white midrib toward base, acuminate; ligule ca. 1 mm, ciliate. Compound panicle up to 1 m with many drooping branches, branches bearing several spathes, each spathe subtending a further spathe and usually a single spatheole with raceme; spatheoles 2–3.5 cm, minutely hispidulous; peduncle pilose at apex. Raceme composed of (1–)2 spikelet pairs and a terminal triad above the involucre of 2 homogamous pairs. Homogamous spikelets arising at slightly

different levels, male or barren, 10–15 mm, narrowly lanceolate, wingless, shortly pubescent. Sessile spikelet 7–8 mm; callus 1–2 mm, acute; lower glume oblong-lanceolate, dorsally compressed with shallow central groove, densely brown strigose; upper lemma lanceolate, midvein produced into mucro or poorly developed short awn. Pedicelled spikelet 10–15 mm. Fl. and fr. Aug–Jan.

Hill slopes, forest margins, disturbed moist grassy places; 300–2500 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangxi, Sichuan, Xizang, Yunnan, Zhejiang [Bangladesh, Bhutan, NE India, Indonesia, Malaysia, Nepal, Philippines, Sri Lanka (introduced), Thailand].

This is a giant grass with stout culms and a large, spathate panicle lacking prominent, geniculate awns. The name *Pseudanthistiria emeinica* is based on a few anomalous specimens from Sichuan (Emei Shan) in which one or both of the homogamous spikelet pairs have been replaced by a normal spikelet pair.

8. Themeda trichiata S. L. Chen & T. D. Zhuang, Bull. Bot. Res., Harbin 9(2): 58. 1989.

毛菅 mao jian

Perennial. Culms tufted, stout, ca. 1.5 m tall, 0.7 mm or more in diam., loosely hirsute especially below nodes. Leaf sheaths glabrous or hirsute along margins, hirsute on back near blade; leaf blades 40–80 × 0.4–0.6 cm, abaxial surface hirsute, contracted at base, acuminate; ligule ca. 1.5 mm, margin lacerate. Compound panicle open, branches pilose, spathes hirsute at least on margins, each subtending a further spathe and up to 3 spatheoles with racemes; spatholes 2.5–3 cm, glabrous; peduncle villous at apex. Raceme composed of 1 spikelet pair and a terminal triad above the involucre of 2 homogamous pairs. Homogamous spikelets arising at slightly different levels, one pair subsessile, barren, the other pair staminate, 12–15 mm, narrowly lanceolate, minutely puberulous. Sessile spikelet dorsally compressed, 7–7.5 mm; callus ca. 2 mm, acute; lower glume oblong-lanceolate, slightly flattened, densely brown strigose; upper lemma stipitiform; awn 2–4.5 cm. Pedicelled spikelet 12–15 mm. Fl. and fr. Aug–Dec.

● Dry mountain slopes. Guangxi, Hainan, Yunnan.

This species is very close to *Themeda caudata*, but has hairs on the leaves and culms, and shorter, more slender awns.

9. Themeda caudata (Nees) A. Camus in Lecomte, Fl. Indo-Chine 7: 364. 1922.

苞子草 bao zi cao

Anthistiria caudata Nees in Hooker & Arnott, Bot. Beechey Voy. 245. 1838; *A. gigantea* Cavanilles subsp. *caudata* (Nees) J. D. Hooker; *Themeda gigantea* (Cavanilles) Hackel subsp. *caudata* (Nees) Hackel.

Perennial. Culms tufted, robust, 1–3 m tall, 0.5–1 cm in diam. Leaf sheaths glabrous, basal sheaths strongly compressed; leaf blades 20–80 × 0.5–1 cm, scabrid, midvein distinct, narrowed to subrounded at base, acuminate; ligule subrounded, ca. 1 mm, ciliate. Compound panicle large, much branched, branches bearing several spathes, each spathe subtending a further spathe and up to 3 spatheoles with racemes; spatheoles 2.5–5 cm, minutely scaberulous-puberulous; peduncle pilose at apex. Raceme composed of 1(–2) spikelet pairs and a terminal triad above the involucre of 2 homogamous pairs. Homogamous spikelets arising at slightly different levels, 12–15 mm, linear-lanceolate, wingless, minutely scaberulous-puberulous. Sessile spikelet 6–7.5 mm; callus 2–3 mm, acuminate; lower glume dorsally compressed, oblong-lanceolate, densely golden strigose; upper lemma stipitiform; awn 4–8 cm. Pedicelled spikelet 12–15 mm, male or barren. Fl. and fr. Jul–Dec.

Dry hillsides, forest margins; 400–2500 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Jiangxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Indonesia, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam].

The name *"Themeda gigantea* var. *caudata* (Nees) Keng" (Fl. Ill. Pl. Prim. Sin. Gram. 845. 1959) belongs here, but was not validly published because no Latin description was provided.

10. Themeda intermedia (Hackel) Bor, Indian Forest Rec., Bot. 1: 96. 1938.

居中菅 ju zhong jian

Themeda gigantea (Cavanilles) Hackel subsp. *intermedia* Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 675. 1889.

Perennial. Culms tufted, stout, 1.5–5 m tall, 0.8–1.5 cm in diam. Leaf sheaths glabrous; leaf blades up to 100 × 0.6–1.5 cm, narrowed toward base, scabrid, acuminate; ligule ca. 1 mm. Compound panicle large with many drooping branches, each branch bearing several spathes subtending 1–3 spatheoles; spatheoles 2–3 cm, glabrous; peduncle villous at apex. Raceme composed of 0–2 spikelet pairs and a terminal triad above the involucre of 2 homogamous pairs. Homogamous spikelets arising at slightly different levels, male or barren, 11–14 mm, narrowly oblong-lanceolate, hirsute with long, golden or pallid tubercle-based hairs, acuminate. Sessile spikelet ca. 7 mm; callus 1.5–2 mm, narrowly cuneate; lower glume oblong-lanceolate, dorsally compressed, densely strigose with brown hairs; upper lemma lanceolate, awn absent or less than 1 cm. Pedicelled spikelet 10.5–14 mm.

Light forest shade; ca. 700 m. SW Yunnan (Gengma) [Bhutan, N India, Myanmar].

This is probably just an awnless, small-spiculate form from the *Themeda arundinacea* gene pool or a product of introgression from *T. villosa*.

11. Themeda unica S. L. Chen & T. D. Zhuang, Bull. Bot. Res., Harbin 9(2): 56. 1989.

浙皖菅 zhe wan jian

Perennial. Culms erect or geniculate at base, 1–2.5 m tall, 4–10 mm in diam., farinaceous near nodes when young. Leaf sheaths loosely hispid with tubercle-based hairs; leaf blades 30–60 × 0.4–1 cm, glabrous or adaxial surface with tubercle-based setae near base; ligule 2–7 mm. Compound panicle elongate, 3–4-noded, 1–3 solitary spathate racemes arising directly from nodes; spatheoles 4–9 cm, glabrous; peduncle 4–7 cm, glabrous. Raceme composed of 3–5 spikelet pairs and a terminal triad above the involucre of 2 homogamous pairs. Homogam-

ous spikelets arising at slightly different levels, staminate, 25–40 cm, lanceolate, margins with stiff white tubercle-based hairs, acuminate. Sessile spikelet 7–10 mm; callus ca. 2.5 mm, acute; lower glume elliptic-oblong, densely strigose with brown hairs, awn 2–4 cm. Pedicelled spikelet ca. 20 mm. Fl. and fr. Aug–Oct.

● Hill slopes, roadsides; 200–1000 m. Anhui, Zhejiang.

12. Themeda arundinacea (Roxburgh) A. Camus in Lecomte, Fl. Indo-Chine 17: 363. 1922.

韦茅 wei jian

Anthistiria arundinacea Roxburgh, Fl. Ind. 1: 256. 1820; *A. subsericans* Nees ex Steudel; *Cymbopogon arundinaceus* (Roxburgh) Schultes; *Themeda gigantea* (Cavanilles) Hackel subsp. *arundinacea* (Roxburgh) Hackel; *T. gigantea* var. *subsericans* (Nees ex Steudel) Hackel; *T. subsericans* (Nees ex Steudel) Ridley.

Perennial. Culms tufted, reedlike, stout, up to 6 m tall, 1–1.5 cm in diam. Leaf sheaths glabrous; leaf blades 50–100 × 1–1.5 cm, scabrid, gradually narrowed to the thick white midrib toward base, acuminate; ligule 1–2 mm. Compound panicle large with many drooping branches, each branch bearing spathes subtending 2–3 spatheoles; spatheoles 2–3.5 cm, glabrous; peduncle pubescent at apex. Raceme composed of 0–2 spikelet pairs and a terminal triad above the involucre of 2 homogamous pairs. Homogamous spikelets arising at slightly different levels, male or barren, 12–20 mm, linear-lanceolate, densely hispid with long, golden, tubercle-based hairs, finely acuminate. Sessile spikelet 7–9.5 mm; callus 2–3.5 mm, narrowly cuneate; lower glume oblong-lanceolate, densely strigose with golden or brown hairs, hairs usually deciduous; awn 4–9 cm. Pedicelled spikelet 13–20 mm. Fl. and fr. Sep–Apr.

Mountain slopes, valley grasslands; 700–2000 m. Guangxi, Guizhou, Yunnan [Bangladesh, Bhutan, N India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Philippines, Thailand, Vietnam].

Themeda arundinacea belongs to a group of giant *Themeda* species with stout, solid, reedlike culms and large, drooping panicles, also including *T. caudata*, *T. intermedia*, *T. trichiata*, and *T. villosa*. Most were treated in old literature at infraspecific rank under *T. gigantea* (Cavanilles) Hackel, which name is now applied only to a form endemic in the Philippines with awnless racemes of small, hairy spikelets. The species of this complex probably intergrade, and variation is not well understood.

Smaller forms of *Themeda arundinacea* with culms to 3 m tall, shorter spikelets, and shorter, weaker awns (3–4.5 cm) are sometimes separated as *T. subsericans*.

13. Themeda yunnanensis S. L. Chen & T. D. Zhuang, Bull. Bot. Res., Harbin 9(2): 58. 1989.

云南菅 yun nan jian

Perennial. Culms slender, erect, up to 1 m tall. Leaf sheaths glabrous; leaf blades 15–30 × 0.3–0.5 cm, glabrous, margins scabrid, acuminate; ligule lacerate. Compound panicle loose, each branch bearing a few spathes subtending 1 or more spatheoles; spatheoles 3–6 cm, glabrous; peduncles glabrous. Raceme composed of 1 spikelet pair and a terminal triad above the involucre of 2 homogamous pairs. Homogamous spikelets arising at different levels, staminate, ca. 15 mm, lanceolate, villous with white long soft tubercle-based hairs, acuminate. Sessile spikelet ca. 7 mm, pallid; callus ca. 2.5 mm, narrowly cuneate; lower glume subleathery, densely pubescent with yellowish white soft hairs, back with shallow median groove; awn 3–6 cm. Pedicelled spikelet ca. 15 mm, villous. Fl. and fr. Sep–Nov.

● Dry mountain slopes; 600–1900 m. Yunnan.

Themeda yunnanensis resembles the Indian species *T. mooneyi* Bor in its slender habit and softly white-hairy homogamous spikelets, but the latter species has glabrous sessile spikelets (except for short prickles at the apex) and glabrous pedicelled spikelets.

214. HETEROPOGON Persoon, Syn. Pl. 2: 533. 1807.

黄茅属 huang mao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Perennial or annual. Culms tufted. Leaf sheaths usually keeled; leaf blades linear; ligule membranous, sometimes with ciliate fringe. Inflorescence of solitary racemes, these terminal or axillary and loosely aggregated into a spathate panicle; peduncle included to long-exserted. Racemes linear, dense, spikelets imbricate, 1 to several pairs of homogamous spikelets at base of raceme below fertile pairs, fragile between fertile pairs; internodes and pedicels reduced to short oblique stumps obscured by hairs from backside of sessile spikelet callus. Homogamous spikelets herbaceous, flat, lanceolate-oblong. Sessile spikelet subterete; callus long, pungent, bearded; lower glume leathery, obtuse; upper glume awnless; lower floret reduced to a hyaline lemma; upper lemma stipitiform, entire, passing into a stout geniculate awn with hairy column. Pedicelled spikelet larger than sessile, resembling homogamous spikelets, awnless; callus slender, pedicel-like; true pedicel reduced to a stump.

Six species: throughout the tropics and subtropics; three species in China.

1a. Annual; leaf sheaths with rows of glands along veins ..... 1. *H. melanocarpus*
1b. Perennial; leaf sheaths without glands.
2a. Culms up to 1 m tall; raceme 3–7 cm (excluding awns); 3–10(–12) pairs of homogamous spikelets ..... 2. *H. contortus*
2b. Culms 1–3 m tall; raceme 8–15 cm (excluding awns); 12–15 pairs of homogamous spikelets ..... 3. *H. triticeus*

1. Heteropogon melanocarpus (Elliott) Bentham, J. Linn. Soc., Bot. 19: 71. 1881.

黑果黄茅 hei guo huang mao

Andropogon melanocarpus Elliott, Sketch Bot. S. Carolina 1: 146. 1816 [“1821”]; *A. polystictus* Steudel; *Cymbopogon melanocarpus* (Elliott) Sprengel; *Heteropogon acuminatus* Tri-

nius; *H. polystictus* (Steudel) Hochstetter; *H. roylei* Nees ex Steudel.

Annual. Culms robust, erect, usually solitary, 0.5–2 cm tall, supported by stilt roots. Leaf sheaths spotted with rows of glands along veins, long soft hairs at mouth; leaf blades flat, 10–40 × 0.5–1 cm, pilose, apex acuminate; ligule lacerate. Inflorescence of racemes gathered into a copious spathate panicle; spatheoles linear-lanceolate, glandular; peduncle ca. 1/2 spatheole length, scarcely exserted. Racemes 2–4 cm (excluding awns), 3–8-awned, 1–3 pairs of green homogamous spikelets below the awned fertile pairs. Sessile spikelet 6–8 mm, blackish brown; callus 3–4.5 mm, sharply pungent, brown bearded; lower glume narrowly oblong, densely pilose with soft brown hairs; awn 6–9 cm, stout, column blackish when mature, hirtellous. Pedicelled spikelet 15–25 mm, lower glume light green, oblong-lanceolate, laterally asymmetrically winged, glabrous, pitted with glands and transversely pucked along midvein, lanceolate-caudate. Fl. and fr. Jun–Nov.

Mountain slopes; 1000–1500 m. Yunnan [India; Africa, tropical and subtropical America, SW Asia].

This species is immediately recognizable by the large, caudate pedicelled spikelets with a conspicuous, median, glandular band.

2. Heteropogon contortus (Linnaeus) P. Beauvois ex Roemer & Schultes, Syst. Veg. 2: 836. 1817.

黄茅 huang mao

Andropogon contortus Linnaeus, Sp. Pl. 2: 1045. 1753; *Heteropogon fertilis* B. S. Sun & S. Wang.

Perennial. Culms slender, tufted, usually geniculate at base, 20–100 cm tall. Leaf sheaths keeled; leaf blades flat or folded, 10–20 × 0.3–0.6 cm, scabrid or adaxial surface pilose at base, apex obtuse or shortly acute to apiculate; ligule ciliate along margin. Inflorescence terminal or racemes gathered into a scanty panicle; spatheoles linear, tightly rolled around peduncle; peduncles mostly long-exserted. Racemes 3–7 cm (excluding awns), narrowly cylindrical, 7–12-awned, (1–)3–10(–12) pairs of flat green homogamous spikelets below the awned fertile pairs. Sessile spikelet 5–7 mm, dark brown; callus 2–3 mm, fiercely pungent, brown bearded; lower glume linear becoming cylindrical at maturity, sometimes hispidulous between veins; awn 6–10 cm, dark brown, column white-hirtellous, tips of successive awns often twisting together. Pedicelled spikelet 6–11 mm, lower glume oblong-lanceolate, greenish, laterally asymmetrically winged, glabrous or sparsely to densely pilose or tuberculate-hispid or white setose. Fl. and fr. Apr–Dec. $2n$ = 20, 40, 44, 50, 60, 80.

Dry hillsides, roadsides, grassy places, in the open or light shade; 400–4500 m. Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangxi, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [tropics and subtropics of the world, extending to Mediterranean and other warm-temperate areas].

The narrowly cylindrical racemes of overlapping, green spikelets with stout, brown, intertwining awns emerging from the upper part are very characteristic of this species. It is a very widespread and extremely polymorphic species, varying in habit, hairiness of the spikelets, and also physiologically in response to differing rainfall regimes. It is apomictic and includes a range of chromosome numbers. The name *Heteropogon fertilis* has been applied to an atypical, stunted specimen lacking homogamous spikelet pairs at the base of the raceme. It was described from Yunnan, but similar forms with only a single homogamous spikelet pair are known from Hong Kong and elsewhere.

This species provides good forage when young, but the needle-sharp spikelet calluses can cause damage to livestock when mature. The leaves and stems are utilized in papermaking.

3. Heteropogon triticeus (R. Brown) Stapf ex Craib, Bull. Misc. Inform. Kew 1912: 432. 1912.

麦黄茅 mai huang mao

Andropogon triticeus R. Brown, Prodr. 201. 1810; *A. ischyranthus* Steudel; *A. lianatherus* Steudel; *A. segaenensis* Steudel; *Heteropogon ischyranthus* (Steudel) Miquel; *H. lianatherus* (Steudel) Miquel; *Sorghum triticeum* (R. Brown) Kuntze.

Perennial from a tough rootstock. Culms stout, erect, hard, 1–3 m tall. Leaf sheaths keeled and flabellate at plant base, glabrous to hispidulous; leaf blades flat, stiff, 30–60 × 0.4–0.8 cm, glabrous to hirsute, apex acuminate; ligule very short, truncate, lacerate. Inflorescence a terminal raceme, sometimes with a few axillary racemes below it. Racemes 8–15 cm (excluding awns), 5–11-awned, 12–15 pairs of flat green homogamous spikelets below awned fertile pairs. Sessile spikelet 6–10 mm, dark brown at maturity; callus ca. 6 mm, pungent, densely brown bearded; lower glume linear-oblong, brown puberulous or pubescent, deeply grooved on either side of midvein; awn 9–16 cm, brown, column shortly pubescent. Pedicelled spikelet 15–20 mm, lower glume oblong-lanceolate, green, laterally asymmetrically winged, glabrous. Fl. and fr. Oct–Mar.

Mountain slopes. Hainan [S India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand, Vietnam; Australia].

This is a tall, robust grass with racemes of large, overlapping homogamous and pedicelled spikelets with very long awns emerging from the upper part.

215. PSEUDANTHISTIRIA (Hackel) J. D. Hooker, Fl. Brit. India 7: 219. 1896 [“1897”].

假铁秆草属 jia tie gan cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Andropogon sect. *Pseudanthistiria* Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 400. 1889.

Annuals. Culms slender, usually decumbent at base or trailing. Leaf sheaths shorter than internodes; leaf blades linear to lanceolate; ligule membranous, short, truncate. Inflorescence a leafy compound panicle, composed of several axillary fascicles of short racemes, each individual raceme subtended by a sheathing spatheole, fascicle supported by a spathe at apex of a flexuous peduncle.

Racemes fragile, comprising 1–3 spikelet pairs and a terminal triad of 1 sessile and 2 pedicelled spikelets, without homogamous spikelet pairs at base; internodes and pedicels linear, short. Sessile spikelet dorsally compressed; callus small, obtuse; lower glume papery to cartilaginous, dorsally subconvex to concave, margins rounded and inrolled, apex truncate; upper glume awnless; lower lemma reduced or absent; upper lemma stipitiform, entire, passing into a geniculate glabrous awn. Pedicelled spikelet larger than sessile, acute; callus narrowly oblong.

Three species: India to Thailand; one species (probably introduced) in China.

1. Pseudanthistiria heteroclita (Roxburgh) J. D. Hooker, Fl. Brit. India 7: 219. 1896 [“1897”].

假铁秆草 jia tie gan cao

Anthistiria heteroclita Roxburgh, Fl. Ind. 1: 253. 1820; *Andropogon heteroclitus* (Roxburgh) Nees; *Hypogynium heteroclitum* (Roxburgh) Roberty; *Pseudanthistiria hispida* J. D. Hooker; *Sorghum heteroclitum* (Roxburgh) Kuntze.

Culms slender, geniculate at base, 30–50 cm tall. Leaf sheaths glabrous or hispid near margins; leaf blades linear, 8–15 × 0.3–0.5 cm, veins distinct, hispid with tuberculate-based hairs on both surfaces, base subrounded, apex acuminate. Compound panicle 10–30 cm; spatheoles lanceolate, 7–12 mm, setose near margins, the hairs arising from conspicuous, sometimes dark-colored tubercles, apex finely acuminate. Racemes with 1–2 spikelet pairs and a terminal triad. Sessile spikelet linear-oblong, 3–4.5 mm; lower glume firmly membranous, shallowly convex, scaberulous or puberulous toward apex varying to appressed-pubescent throughout; upper lemma longer than glumes; awn 2–3 cm, column pubescent. Pedicelled spikelet lanceolate, 4.5–5.5 mm, lower glume loosely setose with tuberculate-based hairs near apex. Fl. and fr. Sep–Dec.

Open hillsides, disturbed places. Hong Kong [India].

This species has apparently been collected only once in China, by Hance in Hong Kong in 1862, and was probably a chance introduction.

216. PHACELURUS Grisebach, Spic. Fl. Rumel. 2: 423. 1846.

束尾草属 shu wei cao shu

Sun Bixing (孙必兴 Sun Bi-sin); Sylvia M. Phillips

Thyrsia Stapf.

Perennial. Culms often robust. Leaf blades linear or rarely terete; ligule membranous. Inflorescence terminal, racemes usually subdigitate, rarely spread along an elongate axis or solitary. Racemes ± flattened, bearing paired spikelets, horizontally articulated, often rather tardily disarticulating; rachis internodes inflated to clavate, glabrous, base truncate, sometimes with a central peg. Sessile spikelet flat, convex or concave across back; lower glume lanceolate to ovate, membranous to leathery, smooth, marginally 2-keeled or rounded; upper glume boat-shaped; lower floret male or barren, with or without palea; upper floret bisexual, with entire awnless lemma. Pedicelled spikelet resembling sessile but usually smaller and slightly laterally compressed; pedicel free, resembling adjacent rachis internode.

Ten species: Old World tropics, extending northward to SE Europe; three species (one endemic) in China.

Phacelurus resembles *Ischaemum* in its stout rachis internodes and pedicels and in its male lower floret, and the two genera are probably closely related. *Phacelurus* differs mainly by the absence of awns.

1a. Racemes borne on a long central axis; lower glume of sessile spikelet narrowly winged ..... 1. *P. zea*
1b. Racemes subdigitate; lower glume of sessile spikelet wingless.
2a. Sessile spikelet linear-lanceolate, concave, 8–10 mm; pedicelled spikelet well developed; pedicel cuneate, widened upward; leaves usually glabrous ..... 2. *P. latifolius*
2b. Sessile spikelet ovate-oblong, flat, 6–7 mm; pedicelled spikelet usually reduced; pedicel narrowly oblong, straight; leaves often tuberculate-hispid ..... 3. *P. trichophyllus*

1. Phacelurus zea (C. B. Clarke) Clayton, Kew Bull. 33: 177. 1978.

黍束尾草 shu shu wei cao

Rottboellia zea C. B. Clarke, J. Linn. Soc., Bot. 25: 86. 1889; *R. thyrsoidea* Hackel; *Thyrsia thyrsoidea* (Hackel) A. Camus; *Thyrsia zea* (C. B. Clarke) Stapf.

Perennial, forming large clumps. Culms stout, up to 2 m or more tall, ca. 10 mm in diam., simple or rarely branched, nodes bearded. Leaf sheaths keeled, glabrous; leaf blades linear-lanceolate, rather stiff, tough, 30–60 × 1–2 cm, hairy near ligule on adaxial surface, margins ciliate near base; ligule 1–2 mm, margin ciliate. Inflorescence a large ovate-oblong panicle, 25–40 cm, with many racemes arranged in whorls. Lower racemes pedunculate, up to 10 cm; rachis internodes broadly cuneate, angled, ribbed, finely scaberulous. Sessile spikelet 3.5–4 mm; lower glume ovate, papery, flat on back, marginally 2-keeled, keels narrowly winged, wings scabrid-hispidulous, apex obtuse; upper glume lanceolate, acute; lower floret sterile, palea absent; upper floret with palea as long as lemma, 2 styles arising separately from ovary apex, not elongate. Pedicelled spikelet similar to sessile but slightly smaller; pedicel resembling internode but shorter. Fl. and fr. autumn.

Grassy hill slopes; 300–1000 m. Guangxi, Yunnan [Bhutan, India, Myanmar, Nepal, Thailand, Vietnam].

Rottboellia zea (February 1889) has priority over *R. thyrsoidea*

(April 1889), as was acknowledged by Hackel (in A. Candolle & C. Candolle, Monogr. Phan. 6: 690. 1889).

This species is anomalous in the genus because of its elongate inflorescence of many whorled racemes.

2. Phacelurus latifolius (Steudel) Ohwi, Acta Phytotax. Geobot. 4: 59. 1935.

束尾草 shu wei cao

Rottboellia latifolia Steudel, Flora 29: 21. 1846; *Phacelurus angustifolius* (Debeaux) Nakai; *P. latifolius* var. *angustifolius* (Debeaux) Kitagawa; *P. latifolius* var. *monostachys* Keng ex S. L. Chen; *Rottboellia latifolia* var. *angustifolia* Debeaux.

Perennial, robust, with spreading, stout, scaly rhizomes. Culms tufted at nodes of rhizomes, erect, 1–2 m tall, 3–10 mm in diam., many-noded. Leaf sheaths smooth, glabrous, usually longer than internodes and overlapping; leaf blades linear-lanceolate, tough, 10–40 × 1.5–3 cm, glabrous or sparsely appressed-pilose, base rounded, margins scaberulous, apex attenuate; ligule rounded, 0.5–3 mm. Inflorescence of (1–)3–10 racemes, digitate or shortly racemose. Racemes up to 20 cm, stiffly suberect, often white-powdery; rachis internodes stoutly oblong-cuneate, sharply 3-angled, equaling or slightly shorter than pedicels. Sessile spikelet 8–10 mm, as long as internode; callus glabrous; lower glume linear-lanceolate, leathery, back concave, margins keeled, keels scabrid; upper glume spinulose on keel toward apex; lower floret staminate, palea present; upper lemma and palea subequal, styles connate, elongate, continued into a long feathery stigma 2-branched toward its apex. Pedicelled spikelet well developed, slightly laterally compressed, weakly curved; pedicel resembling internode. Fl. and fr. autumn.

Coastal salt marshes, river banks, irrigation channels on saline soils, forming colonies; below 1400 m. Anhui, Fujian, Hebei, Jiangsu, Liaoning, Shandong, Zhejiang [Japan, Korea].

3. Phacelurus trichophyllus S. L. Zhong, J. S. W. Agric. Coll. 1982(4): 78. 1982.

毛叶束尾草 mao ye shu wei cao

Phacelurus latifolius (Steudel) Ohwi var. *trichophyllus* (S. L. Zhong) B. S. Sun & Z. H. Hu; *Rhytachne anisonodis* B. S. Sun; *R. lijiangensis* B. S. Sun.

Perennial, shortly rhizomatous. Culms erect, 1–2 m tall, 3–4 mm in diam., many-noded, branching in upper part. Leaf sheaths hispid with short, tubercle-based hairs or glabrous, usually longer than internodes; leaf blades lanceolate, papery, 10–20 × 1–2.5 cm, sparsely hispid with short, scattered, tubercle-based hairs, base rounded, margins serrulate, apex acuminate; ligule 0.5–1 mm. Inflorescence of 1–6 subdigitate racemes. Racemes up to 15 cm or more, stiffly suberect, spikelets normally paired, occasionally triads of 2 sessile and 1 pedicelled present; rachis internodes columnar, laterally sharply keeled, back rounded or obtusely keeled, lowest internode elongate, much exceeding sessile spikelet, successive internodes shorter. Sessile spikelet 6–7 mm; callus shortly pilose; lower glume lanceolate to ovate, leathery, back flat or slightly convex, obscurely ribbed, margins incurved, ciliolate, keeled and scabrid below apex; upper glume scabrid on keel toward apex; lower floret staminate, palea present; upper lemma and palea subequal, 2 styles arising separately from ovary apex, not elongate. Pedicelled spikelet variable, resembling sessile spikelet but slightly smaller or much reduced; pedicel stoutly oblong, straight. Fl. and fr. Aug–Oct.

● Ditches, moist meadows, river bank thickets, on damp sandy soils; 1100–2000 m. Sichuan, Yunnan.

This grass occurs at generally higher altitudes than *Phacelurus latifolius*. The pedicelled spikelet varies from well developed to much reduced, even in adjacent spikelet pairs on the same raceme.

Two specimens with solitary racemes have been described as new species in *Rhytachne*. That genus is not known in Asia and can usually be distinguished from *Phacelurus* by a much more delicate habit, cylindrical racemes, and a frequently foliaceous pedicel. The occasional occurrence of spikelet triads in this species is reminiscent of *Mnesithea*. However, it is excluded from that genus by its well-developed male lower floret, and also from *Rottboellia* by its free pedicel.

217. HEMARTHRIA R. Brown, Prodr. 207. 1810.

牛鞭草属 niu bian cao shu

Sun Bixing (孙必兴 Sun Bi-sin); Sylvia M. Phillips

Perennial, rarely annual. Culms usually prostrate and rooting at lower nodes. Leaf blades linear, flat; ligule narrow, membranous, margin ciliate. Inflorescence composed of single axillary racemes; racemes solitary or in groups in upper leaf axils, dorsiventral, articulation line usually oblique but racemes tough, not or very tardily disarticulating; rachis internodes thickened, oblong-angular, adnate to adjacent pedicel. Sessile spikelet appressed to hollow in rachis, dorsally compressed (terete in *H. sibirica*); callus obtuse to cuneate, rarely truncate; lower glume narrowly elliptic, rigidly herbaceous to leathery, smooth, marginally 2-keeled, indistinctly winged above, obtuse to caudate or rarely 2-cleft; upper glume sometimes adnate to internode, mucronate or awned; lower floret barren, without palea; upper floret bisexual, with entire awnless lemma. Pedicelled spikelet similar to sessile, but base truncate and lacking callus; pedicel similar to adnate rachis internode, junction marked by a line. $x = 9, 10$.

Fourteen species: tropical and subtropical regions of the Old World; introduced in America; six species (one endemic) in China.

This is a genus of aquatic or semi-aquatic grasses concentrated in SE Asia. At first sight it is difficult to distinguish the sessile and pedicelled spikelets because they look very similar and, since the pedicel is fused to the rachis internode, both spikelets are in effect sessile. However, the sessile spikelet of a pair can be distinguished by its basal callus, which normally has an oblique articulation line beneath it. The strongly bilateral racemes have all the sessile spikelets on one side and all the pedicelled spikelets on the other.

1a. Sessile spikelets 8–15 mm ..... 1. *H. longiflora*
1b. Sessile spikelets less than 8 mm.
2a. Lower glume of sessile spikelet evenly narrowed to acuminate apex; upper glume of pedicelled spikelet caudate-aristate.
3a. Leaf blades 3–8 mm wide; lower glume of sessile spikelet leathery; lower glume of pedicelled spikelet distally smooth along margins ..... 2. *H. vaginata*
3b. Leaf blades 1–2 mm wide; lower glume of sessile spikelet papery; lower glume of pedicelled spikelet distally scabrid along margins ..... 3. *H. humilis*
2b. Lower glume of sessile spikelet with rounded apex, usually with subapical constriction; upper glume of pedicelled spikelet acute to acuminate.
4a. Racemes subterete; articulations of rachis transverse; callus short, truncate ..... 4. *H. sibirica*
4b. Racemes dorso-ventrally compressed; articulations of rachis oblique; callus triangular.
5a. Sessile spikelet 3–5 mm; lower glume margins distally smooth; leaf blades rounded at base ..... 5. *H. compressa*
5b. Sessile spikelet 5–7 mm; lower glume margins distally scabrid; leaf blades subcordate at base ..... 6. *H. altissima*

1. Hemarthria longiflora (J. D. Hooker) A. Camus in Lecomte, Fl. Indo-Chine 7: 380. 1922.

长花牛鞭草 chang hua niu bian cao

Rottboellia longiflora J. D. Hooker, Fl. Brit. India 7: 154. 1896 [“1897”]; *R. longiflora* var. *tonkinensis* (A. Camus) A. Camus; *R. tonkinensis* A. Camus.

Perennial. Culms loosely tufted, erect from decumbent base, 30–80 cm tall, 2–4 mm in diam., glabrous, spongy, nodes usually pubescent. Leaf sheaths loose, sub-compressed, indistinctly keeled; leaf blades linear-lanceolate, 6–15 × 0.5–0.8 cm, slightly flaccid, glabrous, base subcordate; ligule 0.8–2 mm. Racemes solitary or fascicled, 10–15 cm, stout, articulation line oblique, disarticulating tardily. Sessile spikelet twice as long as adjacent internode, 8–15 mm; callus triangular, 0.1–0.6 mm; lower glume lanceolate, back flat, margins scabrid, apex acuminate-caudate to awnlike; upper glume not adnate to rachis, 10–12 mm, acuminate-caudate; lower floret 3–7 mm; upper floret ca. 4 mm, palea very short. Pedicelled spikelet 8–20 mm, lower glume caudate-aristate, upper glume narrowly acuminate. Fl. and fr. Jul–Oct.

Ponds, ditches, other wet places; below 1000 m. Hainan, Yunnan [Bangladesh, NE India, Malaysia, Myanmar, Thailand, Vietnam].

2. Hemarthria vaginata Buse in Miquel, Pl. Jungh. 3: 14. Feb 1854 [preprint]; 3: 354. Aug 1854.

具鞘牛鞭草 ju qiao niu bian cao

Hemarthria protensa Nees ex Steudel; *Manisuris protensa* (Nees ex Steudel) Hitchcock; *Rottboellia protensa* (Nees ex Steudel) Hackel; *R. vaginata* (Buse) Backer.

Perennial. Culms loosely tufted, stout, ascending or sometimes decumbent and rooting from lower nodes, 20–80 cm tall, nodes conspicuous, dark, glabrous or pilose. Leaf sheaths rather loose, compressed, keeled, longer than internodes; leaf blades linear, 1–20 × 0.3–0.8 cm, soft, glabrous, base subcordate; ligule 0.5–2 mm. Racemes solitary or fascicled, 6–18 cm, articulation line oblique, not disarticulating. Sessile spikelet somewhat longer than adjacent internode, 6–11 mm; callus acute, 1.5–4 mm; lower glume narrowly lanceolate, leathery, flat on back, smooth, evenly tapering to an acuminate, usually minutely emarginate apex; upper glume adnate to rachis, 5–7 mm, acuminate-aristate; lower floret 3–5 mm; upper floret ca. 3 mm, palea linear, ca. 2 mm; anthers 1.2–1.3 mm. Pedicelled spikelet 7–12 mm, lower glume smooth on upper edges, long-acuminate, upper glume caudate-aristate. Fl. and fr. autumn. $2n = 54$.

Field margins, open wet places; below 500 m. Guangdong, Guangxi, S Yunnan [Bangladesh, Bhutan, NE India, Indonesia, Myanmar, Nepal, Thailand, Vietnam].

3. Hemarthria humilis Keng, Sunyatsenia 1: 128. 1933.

小牛鞭草 xiao niu bian cao

Perennial. Culms tufted, slender, erect or geniculately ascending but not rooting from lower nodes, 14–18 cm tall, nodes inconspicuous, glabrous. Leaf sheaths loose, compressed, keeled, longer than internodes; leaf blades narrowly linear, 1–6 × 0.1–0.2 cm, glabrous; ligule ca. 0.5 mm. Racemes solitary or several per node, 5–10 cm, articulation line oblique, not disarticulating. Sessile spikelet longer than adjacent internode, or lower ones shorter, 3–7.5 mm; callus obscure; lower glume lanceolate, papery, flat on back, smooth, evenly tapering to an acuminate or shortly caudate, sometimes minutely emarginate apex; upper glume adnate to rachis, 4–7.5 mm, long acuminate; lower floret 2–3 mm; upper floret 1.7–2.8 mm; anthers 0.7–0.8 mm. Pedicelled spikelet 7–12 mm, lower glume scabrid on upper edges, long-acuminate, upper glume caudate-aristate. Fl. May.

● Open marshes. Guangdong.

This species is known only from the type gathering. It has been included in *Hemarthria vaginata*, but *H. humilis* is a more slender plant and, besides the key characters, also differs in its inconspicuous culm nodes, shorter lemmas, and shorter anthers.

4. Hemarthria sibirica (Gandoger) Ohwi, Bull. Tokyo Sci. Mus. 18: 1. 1947.

牛鞭草 niu bian cao

Rottboellia sibirica Gandoger, Bull. Soc. Bot. France 66: 302. 1920 [“1919”]; *Hemarthria compressa* (Linnaeus f.) R. Brown var. *japonica* (Hackel) Y. N. Lee; *H. japonica* (Hackel) Roshevitz; *Rottboellia compressa* Linnaeus f. var. *japonica* Hackel; *R. japonica* (Hackel) Honda.

Perennial, with long creeping rhizomes. Culms usually solitary at rhizome nodes, erect, 1(–1.5) m tall, ca. 3 mm in diam., branched mainly above middle, nodes conspicuous, dark,

glabrous. Leaf sheaths loose, compressed, lightly keeled, shorter to longer than internodes; leaf blades linear, 15–30(–40) × 0.4–0.8 cm, rather stiff, glabrous, narrowed or subcordate at base, apex acuminate; ligule 0.5–1.5 mm. Racemes solitary or fascicled, subterete, 6–10 cm, fairly stout, articulation line horizontal, disarticulating at maturity. Sessile spikelet slightly longer than adjacent internode, 5–8 mm; callus truncate, 0.4–0.8 mm; lower glume narrowly lanceolate, leathery, flat to subconvex on back, subapically slightly constricted, obtuse to emarginate; upper glume adnate to rachis, 4–7 mm, acute; lower floret 3.4–5.2 mm; upper floret 3.4–4.3 mm. Pedicelled spikelet 5.3–9.4 mm, both glumes slenderly acuminate. Fl. and fr. Jul–Oct. $2n = 18$.

Damp places, sandy beaches. Anhui, Guangdong, Guangxi, Guizhou, Hebei, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Shandong, Zhejiang [Japan, Korea, Pakistan, Russia (E Siberia)].

This is the only species in China with terete racemes, a transverse articulation line, and a truncate callus beneath the sessile spikelet. The racemes disarticulate at maturity more readily than those of the other species. In spikelet characters it is similar to *Hemarthria altissima*.

5. Hemarthria compressa (Linnaeus f.) R. Brown, Prodr. 207. 1810.

扁穗牛鞭草 bian sui niu bian cao

Rottboellia compressa Linnaeus f., Suppl. Pl. 114. 1782 [“1781”]; *Hemarthria coromandelina* Steudel, nom. illeg. superfl.; *H. glabra* (Roxburgh) Blatter & McCann; *H. laxa* Nees ex Steudel; *Manisuris compressa* (Linnaeus f.) Kuntze; *Rottboellia glabra* Roxburgh.

Perennial. Culms decumbent to long-stoloniferous, rooting at lower nodes, up to 1 m or more, much branched from base, nodes conspicuous, dark, glabrous. Leaf sheaths loose, compressed, keeled, glabrous or hairy along mouth, often shorter than internodes; leaf blades linear, 2–15 × 0.2–0.5 cm, base rounded, apex subacute; ligule 0.3–1 mm. Racemes solitary or few per node, lightly compressed, 2–10 cm, articulation line oblique, tardily disarticulating. Sessile spikelet slightly longer than adjacent internode, 3–5 mm; callus broadly triangular, 0.5–1 mm; lower glume narrowly oblong, leathery, flat or subconvex on back, abruptly constricted into obtuse or emarginate apex; upper glume adnate to rachis, equaling lower glume, thin, acute; lower floret 2.4–3.3 mm; upper floret 2–3.2 mm, palea small, rarely absent. Pedicelled spikelet 2.4–5 mm, lower glume narrowly obtuse, upper glume acuminate-caudate. Fl. and fr. Jul–Sep. $2n = 18, 27, 36$.

Marshes, wet places, coasts; below 2000 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Nei Mongol, Shaanxi, Sichuan, Taiwan, Yunnan [Afghanistan, Bangladesh, Bhutan, India, Japan, Laos, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam; SW Asia (Iraq)].

Hemarthria compressa is not completely distinct from *H. altissima*, but is generally a more slender plant with smaller spikelets.

6. Hemarthria altissima (Poiret) Stapf & C. E. Hubbard, Bull. Misc. Inform. Kew 1934: 109. 1934.

大牛鞭草 da niu bian cao

Rottboellia altissima Poiret, Voy. Barbarie 2: 105. 1789; *Hemarthria compressa* (Linnaeus f.) R. Brown var. *altissima* (Poiret) Maire; *H. compressa* var. *fasciculata* (Hackel) Keng; *Rottboellia compressa* Linnaeus f. var. *fasciculata* Hackel; *R. fasciculata* Lamarck, nom. illeg. superfl.

Perennial, or sometimes annual. Culms loosely tufted to decumbent or stoloniferous, rooting at lower nodes, ascending up to 1.6 m tall, nodes glabrous. Leaf sheaths loose, compressed, keeled, usually shorter than internodes, glabrous except near mouth; leaf blades linear, 5–25 × 0.3–0.6 cm, acute; ligule ca. 0.3 mm. Racemes solitary or several per node, 5–10 cm, semicylindrical, articulation line oblique, tardily disarticulating. Sessile spikelet longer than adjacent internode, 5–7 mm; callus triangular, 0.8–2 mm; lower glume elliptic-oblong, leathery, flat on back, often with subapical constriction, apex obtuse to emarginate; upper glume papery, adnate to rachis, 4–7 mm, apex obtuse to acute; lower floret 3.5–5.2 mm; upper floret 3.2–4.6 mm. Pedicelled spikelet narrowly lanceolate, lower glume acute, upper glume acuminate. $2n = 20, 36$.

In or near water, damp places; 700–1900 m. Anhui, Beijing, Guizhou, Heilongjiang, Henan, Hubei, Shandong, Yunnan, Zhejiang [India, Indonesia, Myanmar, Thailand, Vietnam; Africa, SW Asia, Mediterranean region; introduced in America and New Zealand].

Hemarthria altissima occurs naturally mainly from the Mediterranean region through Africa, but there are scattered records from Asia and it is now widely naturalized in warm parts of America.

218. MNESITHEA Kunth, Révis. Gramin. 1: 153. 1829.

毛俭草属 mao jian cao shu

Sun Bixing (孙必兴 Sun Bi-sin); Sylvia M. Phillips

Coelorachis Brongniart.

Perennial, rarely annual. Culms robust, tufted, often branched. Leaf blades linear, flat; ligule short, membranous. Inflorescence of racemes, these usually axillary and aggregated into a spathate compound panicle, rarely terminal. Racemes cylindrical or flattened, fragile, horizontally articulated; rachis internodes clavate to pyriform, base truncate with central peg, spikelets paired, one sessile, the other pedicelled or occasionally in triplets of 2 sessile and 1 pedicelled. Sessile spikelet closely appressed or sunk in hollow in rachis, usually longer than adjacent internode; lower glume papery to leathery, ± flat, smooth or sculptured, marginally 2-keeled, keels winged at least at apex; lower floret barren, with or without a small palea; upper floret with entire awnless lemma. Pedicelled spikelet varying from well developed to rudimentary or absent; pedicel oblong, clavate or leaflike, free or partially or fully adnate to rachis internode. $x = 9$.

About 30 species: throughout the tropics; four species in China.

Mnesithea has been defined in the past by the presence of 2 sessile spikelets separated by a pedicel at each rachis node, but this character is now known to be variable. Furthermore, paired sessile spikelets also occur sporadically in the racemes of species that normally have single sessile spikelets.

Coelorachis has traditionally been separated on the basis of a free pedicel and presence of a pedicelled spikelet, but both these characters are untenable. The pedicel in *Mnesithea khasiana* is often almost completely fused to the rachis joint and may occasionally be fused in other species too. The pedicelled spikelet varies across the genus from well developed to a minute vestige, and its absence in traditional *Mnesithea* is just the final step.

The definition of the genera around *Mnesithea*, and how many species should be included within it, are still open to doubt and may change with future research.

1a. Racemes borne singly, terminal or from the upper leaf axils; sessile spikelets sometimes paired.
2a. Leaves and culms densely pubescent; sessile spikelet ornamented; base of rachis joint ciliate ..... 1. *M. mollicoma*
2b. Leaves and culms glabrous; sessile spikelet smooth (rarely pitted); base of rachis joint glabrous ..... 2. *M. laevis*
1b. Racemes several to many from the upper leaf axils; sessile spikelets always single.
3a. Pedicel free from rachis internode; racemes few, laxly spreading from leaf axils ..... 3. *M. striata*
3b. Pedicel adnate to rachis internode except toward apex; racemes many in crowded fascicles from leaf axils .... 4. *M. khasiana*

1. Mnesithea mollicoma (Hance) A. Camus, Bull. Mus. Natl. Hist. Nat. 25: 57. 1919.

毛俭草 mao jian cao

Rottboellia mollicoma Hance, J. Bot. 9: 134. 1871; *Coelorachis mollicoma* (Hance) Bor; *Mnesithea pubescens* Ridley.

Perennial. Culms erect, 60–85 cm, softly pilose. Leaf sheaths densely pilose or with caducous tubercle-based hairs; leaf blades linear-lanceolate, 10–60 × 0.5–2 cm, tapering to base and apex, softly pubescent; ligule 1–2 mm, glabrous or ciliolate. Racemes solitary in the upper leaf axils, cylindrical, ca. 12 cm × ca. 2.5 mm, sessile spikelets paired at each node and separated by a pedicel, or occasionally only one sessile spikelet present; rachis internodes strongly clavate, marked with dark lines between the veins on narrow lower portion, base shortly bearded. Sessile spikelet 3–4 mm; lower glume obliquely ovate, with 6–8, prominent, riblike veins separated by deep slits, slits interrupted by tubercle-based hairs along their length, margins narrowly winged toward apex; upper glume keeled toward apex, keel winged; lower floret reduced; upper lemma and palea subequal. Pedicel free, linear, flattened, pilose, bearing a vestigial 0.5–1 mm spikelet. Fl. and fr. Jul–Nov.

Grassy hill slopes; 100–500 m. Guangdong, Guangxi, Hainan [Indonesia, Malaysia, Thailand, Vietnam].

Mnesithea mollicoma is the only grass in China to have racemes usually with 2 sessile spikelets separated by a pedicel at each rachis node, although sometimes plants occur with some or all raceme segments bearing only 1 sessile spikelet. The species is also well marked by its softly hairy vegetative parts and ornamented sessile spikelet.

2. Mnesithea laevis (Retzius) Kunth, Révis. Gramin. 1: 154. 1829.

假蛇尾草 jia she wei cao

Perennial. Culms tufted, erect, slender, 15–70 cm tall, usually unbranched. Leaf sheaths glabrous, often keeled; leaf blades linear, 8–25 × 0.1–0.4 cm, glabrous, apex abruptly acute; ligule 0.5–1 mm, glabrous. Racemes solitary, either terminal or also axillary, cylindrical, 5–10 cm × ca. 1.5 mm, sessile spikelets paired at each joint and separated by a pedicel, or triads present only at raceme base, or whole raceme with single sessile spikelets; rachis internodes clavate, 3.5–4 mm. Sessile spikelet 3–5 mm; lower glume oblong, smooth, or slightly sunken between lower part of veins, or ribbed throughout, rarely pitted, margins not winged, apex obtuse; upper glume boat-shaped, membranous, equal to lower glume; lower lemma slightly shorter than glumes, palea absent; upper lemma ca. 2.5 mm. Pedicelled spikelet minute or absent; pedicel linear, adnate to rachis internode, when paired sessile spikelets present the pedicel between them often adnate only at apex.

Meadows, grassy hill slopes; 100–1000 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan [India, Indonesia, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam; Pacific Islands (Polynesia)].

No specimens are known from China with paired sessile spikelets. There is some geographic division between forms that regularly have only a single sessile spikelet on each raceme segment and those with a pair. Forms from India to W Indonesia usually have paired sessile spikelets, whereas those from east of this area have single sessile spikelets. However, specimens from the west occasionally have few or no paired spikelets and are then indistinguishable from the eastern form. There is also much variation in the degree of fusion of the pedicel with the rachis internode.

1a. Lower glume of sessile spikelet smooth ..... 2a. var. *laevis*
1b. Lower glume of sessile spikelet pitted between veins ..... 2b. var. *chenii*

2a. Mnesithea laevis var. **laevis**

假蛇尾草(原变种) jia she wei cao (yuan bian zhong)

Rottboellia laevis Retzius, Observ. Bot. 3: 11. 1783; *Heteropholis cochinchinensis* (Loureiro) Clayton; *Mnesithea laevis* var. *cochinchinensis* (Loureiro) de Koning & Sosef; *Ophiuros cochinchinensis* (Loureiro) Merrill; *O. laevis* (Retzius) Bentham; *O. monostachyus* J. Presl & C. Presl; *Phleum cochinchinense* Loureiro; *Thaumastochloa cochinchinensis* (Loureiro) C. E. Hubbard.

Culms 20–70 cm tall. Sessile spikelet 3–4 mm; lower glume ± smooth. Fl. and fr. autumn.

Grassy hill slopes, field margins; 100–1000 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan [India, Indonesia, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam; Pacific Islands (Polynesia)].

2b. Mnesithea laevis var. **chenii** (Hsu) de Koning & Sosef, Blumea 31: 286. 1986.

縛颖假蛇尾草 zhuan ying jia she wei cao

Thaumastochloa chenii Hsu, Taiwania 16: 216. 1971; *Heteropholis cochinchinensis* var. *chenii* (Hsu) de Koning & Sosef; *Ophiuros shimadanus* Ohwi & Odashima; *Thaumastochloa shimadana* (Ohwi & Odashima) Ohwi & Odashima.

Culms 15–30 cm tall. Sessile spikelet 3.5–5 mm; lower glume sunken and pitted between ribs. Fl. and fr. autumn.

● By the sea. S Taiwan.

This is a local variant with pitted sessile spikelets. Traces of pits also occur on some specimens of the species from Hong Kong.

3. Mnesithea striata (Nees ex Steudel) de Koning & Sosef, Blumea 31: 292. 1986.

空轴茅 kong zhou mao

Perennial, coarse. Culms robust, 1.5–3 m tall, glabrous or densely pilose. Leaf sheaths glabrous or tuberculate-hispid, upper sheaths spathiform; leaf blades linear-lanceolate, 30–60(–120) × 1–3(–5) cm, glabrous to densely pilose, margins stiffly ciliate, apex acuminate; ligule 2–3 mm, glabrous or ciliolate. Inflorescence large, loose and spreading, 2–3-noded spathate branches bearing the racemes arising from the upper leaf axils; racemes cylindrical, long pedunculate; rachis internodes strongly clavate, striate, glabrous. Sessile spikelet 4–4.2 mm; lower glume narrowly ovate, slightly asymmetrical, with 5–7 deep slits interrupted by tubercles especially in lower part, or sometimes smooth, contracted to an acute winged apex; upper glume keeled; lower floret usually barren, lemma ca. 4 mm, palea slightly shorter; upper floret as long as lower lemma. Pedicelled spikelet reduced or rudimentary, ca. 1.5 mm; pedicel flattened, narrowly oblong with 2 submarginal green veins, glabrous, free. Fl. and fr. Jul–Oct.

Hillside grasslands, thickets, forest margins; below 1300 m. S Yunnan [India, Myanmar, Thailand].

1a. Culms and leaf blades glabrous ..... 3a. var. *striata*
1b. Culms and leaf blades pilose ..... 3b. var. *pubescens*

3a. Mnesithea striata var. **striata**

空轴茅(原变种) kong zhou mao (yuan bian zhong)

Rottboellia striata Nees ex Steudel, Syn. Pl. Glumac. 1: 361. 1854; *Coelorachis striata* (Nees ex Steudel) A. Camus.

Culms and peduncles glabrous. Leaf sheaths glabrous except for ciliate margins, leaf blades glabrous.

Grassy hill slopes; 600–900 m. S Yunnan [India, Myanmar, Thailand].

3b. Mnesithea striata var. **pubescens** (Hackel) S. M. Phillips & S. L. Chen, Novon 15: 470. 2005.

毛秆空轴茅 mao gan kong zhou mao

Rottboellia striata var. *pubescens* Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 302. 1889; *Coelorachis striata* var. *pubescens* (Hackel) Bor.

Culms and peduncles pubescent above. Leaf sheaths with tubercle-based hairs; leaf blades densely pubescent.

Open forests, grassy hill slopes; 600–1200 m. SW Yunnan [NE India].

4. Mnesithea khasiana (Hackel) de Koning & Sosef, Blumea 31: 291. 1986.

密穗空轴茅 mi sui kong zhou mao

Rottboellia striata Nees ex Steudel subsp. *khasiana* Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 302. 1889; *Coelorachis khasiana* (Hackel) Stapf ex Bor.

Perennial, coarse. Culms robust, 2–3 m tall, glabrous, much branched upward. Leaf sheaths glabrous, upper sheaths with very reduced blade; leaf blades narrowly lanceolate, 40–100(–130) × 2–3(–4) cm, glabrous or scattered tuberculate-pilose on upper surface, apex setaceously acuminate; ligule 2–3 mm, glabrous. Inflorescence large, composed of fascicles of many racemes on spathate branches from the upper leaf axils; racemes cylindrical, long pedunculate; rachis internodes clavate, glabrous. Sessile spikelet 3.5–4 mm; lower glume lanceolate-oblong, smooth or with 2–5 shallow tuberculate grooves, contracted to an apiculate, broadly winged apex; upper glume ca. 3.5 mm, keeled; lower floret barren, lemma ca. 3 mm; upper floret lemma ca. 3 mm, palea shorter. Pedicelled spikelet variable, usually more than 2 mm, sometimes as long as and resembling sessile spikelet; pedicel flattened, oblong with 2 submarginal green veins, glabrous, adnate to adjacent rachis internode except toward apex. Fl. and fr. Jul–Oct.

Open woodlands, damp places; 900–1300 m. SW Yunnan [NE India, Myanmar].

219. ROTTBOELLIA Linnaeus f., Suppl. Pl. 114. 1782 [“1781”], nom. cons., not *Rottboelia* Scopoli (1777), nom. rej.

筒轴茅属 tong zhou mao shu

Sun Bixing (孙必兴 Sun Bi-sin); Sylvia M. Phillips

Annual. Culms robust. Leaf blades linear, flat; ligule membranous. Inflorescence of single axillary racemes; racemes cylindrical, fragile, transversely articulated; rachis internodes stout, flattened or semi-cylindrical, deeply cupped at apex, truncate at base with a prominent central peg broadened into a flared elaiosome. Sessile spikelet sunk within rachis; lower glume ovate-oblong, leathery, shallowly convex, marginally 2-keeled, apex obtuse or acute, narrowly winged; upper glume boat-shaped; lower floret staminate, palea present; upper floret with entire awnless lemma. Pedicelled spikelet tightly erect, as long as or shorter than sessile spikelet, herbaceous; pedicel broad, of similar texture to, and partly or wholly adnate to adjacent rachis internode.

Five species: Old World tropics; introduced in the Caribbean region; two species (one endemic) in China.

1a. Sessile spikelet ovate, 5–6 mm, pallid; lower glume of sessile spikelet scaberulous on back; leaf sheaths hispid ..... 1. *R. cochinchinensis*
1b. Sessile spikelet oblong-lanceolate, 7–10 mm, dull green; lower glume of sessile spikelet smooth on back; leaf sheaths ± glabrous ..... 2. *R. laevispica*

1. Rottboellia cochinchinensis (Loureiro) Clayton, Kew Bull. 35: 817. 1981.

筒轴茅 tong zhou mao

Stegosia cochinchinensis Loureiro, Fl. Cochinch. 51. 1790; *Rottboellia exaltata* Linnaeus f. (1781), not (Linnaeus) Linnaeus f. (1779).

Coarse annual. Culms stout, 1–3 m tall, 5–10 mm in diam., supported below by stilt roots, branched in upper part. Leaf sheaths tuberculate-hispid with stiff irritant hairs or sometimes glabrescent; leaf blades linear-lanceolate, 20–50 × 0.5–2.5 cm, glabrous or adaxial surface hispidulous, very scabrid along margins, midrib broad, white, apex acuminate; ligule a ciliate membrane, ca. 1 mm. Racemes yellow and green, 6–15 × 0.25–0.4 cm, stiff, terminating in a green tail of reduced spikelets; rachis internodes 4–6 mm, rounded on back, slightly longer than adjacent pedicel. Sessile spikelet pale yellow, 5–6 mm; lower glume ovate, minutely scaberulous on back, keeled only toward entire or very minutely 2–3-toothed apex; lower lemma as long as upper lemma. Pedicelled spikelet green, variable, 3–5 mm, narrowly ovate, herbaceous. Fl. and fr. Jul–Oct.

Sunny or moderately shady localities, roadsides, hill thickets, dry cultivated fields, grasslands; below 1900 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Sichuan, Taiwan, Yunnan, Zhejiang [throughout the Old World tropics; introduced to the Caribbean].

2. Rottboellia laevispica Keng, J. Wash. Acad. Sci. 21: 157. 1931.

光穗筒轴茅 guang sui tong zhou mao

Mnesithea laevispica (Keng) de Koning & Sosef.

Annual. Culms slender, up to 1 m tall, 3–5 mm in diam., usually geniculate at base and rooting at lower nodes. Leaf sheaths smooth or papillate; leaf blades linear-lanceolate, flaccid, 15–40 × 0.8–1.6 cm, glabrous, midrib white, margins scabrid, apex acuminate; ligule a ciliate membrane, 0.5–1 mm. Racemes dull greenish brown, up to 20 × 0.3–0.5 cm, terminating in a tail of reduced spikelets; rachis internodes 9–10 mm, rounded on back, equaling or slightly longer than sessile spikelet and adjacent pedicel. Sessile spikelet dull green, 7–10 mm; lower glume oblong-lanceolate, smooth on back, keels scaberulous above middle and narrowly winged at apex; lower lemma as long as upper lemma. Pedicelled spikelet usually reduced to two 1–3.5 mm glumes. Fl. and fr. Jul–Oct.

● Shaded forests on mountain slopes. Anhui, Jiangsu.

220. EREMOCHLOA Buse in Miquel, Pl. Jungh. 357. 1854.

蜈蚣草属 wu gong cao shu

Sun Bixing (孙必兴 Sun Bi-sin); Sylvia M. Phillips

Perennial, tufted, stoloniferous or rhizomatous. Leaves mostly basal, leaf blades linear, flat or folded; ligule short, membranous. Inflorescence a single terminal raceme; raceme strongly flattened, spikelets overlapping along one side, disarticulating very tardily; rachis internodes narrowly clavate, nodes ciliate (in China), base truncate, sometimes with a low central peg. Sessile spikelet longer than rachis internode; lower glume elliptic-ovate to oblong, papery to leathery, 5–9-veined, marginally 2-keeled, keels pectinately spiny, often winged at apex; upper glume 3-veined, keeled along midvein, otherwise almost flat, often narrowly winged on lower keel; lower floret staminate, palea present; upper floret bisexual, upper lemma entire, awnless. Pedicelled spikelet absent or represented by a small bristle; pedicel free from and longer than adjacent internode, subulate to narrowly ovoid or leaflike.

Eleven species: India to SE Asia and Australia; five species in China.

This genus is easily recognizable by its distinctive inflorescence. The solitary, terminal, 1-sided raceme of closely overlapping spikelets does not break up readily into segments, and most species have spikelets with conspicuous, long spines along their margins.

1a. Plant with elongate stolons or rhizomes; lower glume broadly winged at apex.
2a. Keels with very short inconspicuous spines ..... 1. *E. ophiuroides*
2b. Keels with long conspicuous spines ..... 2. *E. muricata*
1b. Plant tufted; lower glume narrowly winged or wingless.
3a. Lower glume of sessile spikelet usually wingless, often pubescent on back ..... 3. *E. ciliaris*
3b. Lower glume of sessile spikelet narrowly winged toward apex, glabrous on back.
4a. Longest spines of lower glume shorter than glume width, usually ca. 1 mm; nodes of rachis obviously hairy; leaf blades hairy on basal margins, apex subacute ..... 4. *E. bimaculata*
4b. Longest spines of lower glume equaling or longer than glume width, 1.5–2.5 mm; nodes of rachis minutely hairy; leaf blades glabrous, apex cuspidate ..... 5. *E. zeylanica*

1. Eremochloa ophiuroides (Munro) Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 261. 1889.

假俭草 jia jian cao

Ischaemum ophiuroides Munro, Proc. Amer. Acad. Arts 4: 363. 1860; *Eremochloa ophiuroides* var. *longifolia* Hayata.

Perennial, stoloniferous, mat-forming. Culms decumbent,

rooting and branching, flowering shoots 15–30 cm tall. Leaf sheaths keeled, overlapping at base, hairy at mouth; leaf blades flat, (1–)3–10 × 0.2–0.4 cm, usually glabrous, apex obtuse; ligule 0.2–5 mm, margin ciliate. Raceme erect or slightly curved, 4–6 cm; rachis internodes narrowly oblong-clavate, glabrous, ca. 2.5 mm. Sessile spikelet 3.5–4 mm; lower glume oblong, ± leathery, shiny, glabrous, 5–7-veined, marginal spines very inconspicuous, short along incurving lower keels or reduced to knobs, apex acute but appearing broadly truncate because of flanking membranous wings. Pedicelled spikelet vestigial or absent; pedicel ± leaflike, ellipsoid-subulate. Fl. and fr. Jun–Oct. $2n = 18$.

Moist meadows, hillsides, especially on clay soils; 200–1200 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan, Zhejiang [Vietnam].

This species is occasionally used as a lawn grass in warm regions, especially in the SE United States (Centipede Grass).

2. Eremochloa muricata (Retzius) Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 262. 1889.

瘤糙假俭草 liu cao jia jian cao

Aegilops muricata Retzius, Observ. Bot. 2: 27. 1781; *Eremochloa truncata* W. C. Wu.

Perennial with slender spreading rhizomes. Culms decumbent, branching, up to 70 cm tall. Leaf sheaths glabrous; leaf blades flat or folded, 2–20 × 0.2–0.7 cm, glabrous or pilose, margins sometimes setose at base, apex acute or cuspidate; ligule 0.1–1 mm, margin ciliolate. Raceme straight or almost so, 5–12 cm; rachis internodes oblong-clavate, glabrous, 2.5–4 mm. Sessile spikelet 4.5–5 mm; lower glume ovate or ovate-oblong, glabrous, 5–7-veined, marginal spines straight, often flattened toward base, longest 1–1.5 mm, shorter than glume width, apex acute, flanked by large, fanlike wings. Pedicelled spikelet absent; pedicel ± leaflike, obliquely obovoid.

Damp places. Guangdong (Guangzhou) [S India, Myanmar, Sri Lanka, Thailand; N Australia].

3. Eremochloa ciliaris (Linnaeus) Merrill, Philipp. J. Sci. 1 (Suppl. 5): 331. 1906.

蜈蚣草 wu gong cao

Nardus ciliaris Linnaeus, Sp. Pl. 1: 53. 1753; *Eremochloa leersioides* (Munro) Hackel; *Ischaemum leersioides* Munro.

Perennial, densely tufted. Culms erect, slender, 20–60 cm tall, usually pubescent. Leaves crowded at base of culm, overlapping; leaf sheaths keeled, glabrous or pubescent; leaf blades folded, 3–15 × 0.1–0.4 cm, glabrous or pubescent, apex acute; ligule 0.5–1 mm. Raceme falcately curved, 2–5 cm; rachis internodes narrowly oblong, slightly expanded upward, puberulous to thinly hirsute, 1.8–2.5 mm. Sessile spikelet 3.5–4 mm; lower glume oblong-ovate, firmly papery, pubescent on back or subglabrous, 7-veined, marginal spines longer than glume width, longest 1.5–5 mm, apex abruptly acute, usually wingless. Pedicelled spikelet absent; pedicel narrowly ellipsoid, ending in short point. Fl. and fr. Jul–Oct.

Dry grassy hillsides, meadows on sandy soils, roadsides; 300–2000 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Taiwan, Yunnan [Cambodia, Indonesia, Laos, Malaysia, Myanmar, New Guinea, Philippines, Thailand, Vietnam; Australia (N Queensland)].

4. Eremochloa bimaculata Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 265. 1889.

西南马陆草 xi nan ma lu cao

Perennial, compactly tufted from a tough rootstock. Culms erect, slender, unbranched, 30–60 cm tall, glabrous. Leaves crowded at base of culm, overlapping; leaf sheaths keeled, glabrous except margins near blade; leaf blades flat or folded, 3–10 × 0.2–0.3 cm, glabrous except for basal margins, abruptly narrowed to subacute apex; ligule ca. 1 mm. Raceme gently curved, 3–6 cm; rachis internodes oblong-clavate, glabrous, 2.2–2.6 mm; nodes obviously hairy, hairs ca. 0.2 mm. Sessile spikelet 4–4.6 mm; lower glume ovate-oblong, papery, shiny, glabrous, 6–7-veined, marginal spines shorter than glume width, longest 1–1.5 mm, apex acute, flanked by narrow wings. Pedicelled spikelet vestigial; pedicel narrowly leaflike, tipped by a short spine.

Grassy hill slopes, thickets; 1000–1800 m. W Guizhou, Hubei, Sichuan, Yunnan [Cambodia, Myanmar, New Guinea, Thailand, Vietnam; Australia].

Eremochloa ophiuroides (Munro) Hackel var. *longispicula* W. C. Wu (S. W. China J. Agric. Sci. 6(2): 36. 1985), described from Guangdong (Guangzhou), may belong here. The type has not been seen.

5. Eremochloa zeylanica (Hackel ex Trimen) Hackel in A. Candolle & C. Candolle, Monogr. Phan. 6: 263. 1889.

马陆草 ma lu cao

Ischaemum zeylanicum Hackel ex Trimen, Syst. Cat. Pl. Ceylon 107. 1885.

Perennial, tufted. Culms erect, slender, branching, 20–60 cm tall. Leaves mostly basal, slightly overlapping; leaf sheaths glabrous, keeled; leaf blades flat or folded, (1–)3–10 × 0.1–0.5 cm, glabrous, apex rounded, cuspidate; ligule 0.3–0.6 mm, ciliolate or glabrous. Raceme erect or curved, 3–6 cm; rachis internodes clavate, 2–3 mm; nodes minutely hairy, hairs ca. 0.1 mm. Sessile spikelet 4–5 mm; lower glume elliptic-ovate, papery, glabrous, inconspicuously veined, marginal spines terete, equaling or much longer than glume width, 1.5–2.5 mm, apex acute, flanked by narrow wings. Pedicelled spikelet a very small rudiment; pedicel subulate.

Herbage of hill slopes; 800–1500 m. W Guangxi, SE Yunnan [Sri Lanka].

A few specimens from China have the long spikelet spines of this species, which is otherwise known only from Sri Lanka.

221. HACKELOCHLOA Kuntze, Revis. Gen. Pl. 2: 776. 1891.

球穗草属 qiu sui cao shu

Sun Bixing (孙必兴 Sun Bi-sin); Sylvia M. Phillips

Annual. Leaf blades flat, linear or linear-lanceolate; ligule a short ciliate membrane. Inflorescence of single axillary racemes aggregated into a spathate compound panicle, peduncle enclosed within spatheole; racemes flattened, dorsiventral, bearing paired spikelets, fragile, obliquely articulated; rachis internodes stoutly oblong, adnate to adjacent pedicel, together forming a cavity, base obliquely truncate with central peg. Sessile spikelet much broader than internode; lower glume brittle, hemispherical, rugose, pitted to honeycombed, wingless, narrowed into a stipelike base; upper glume shorter and narrower, sunk into cavity of rachis; lower floret barren, without a palea; upper floret with entire awnless lemma. Pedicelled spikelet readily disarticulating, narrowly ovate, herbaceous, smooth, narrowly winged; pedicel oblong, adnate to adjacent rachis internode, junction with internode marked by a line. $x = 7$.

Two species: one pantropical, the other confined to Asia; two species in China.

This genus is readily recognizable by its unique, globose, reticulately wrinkled sessile spikelets. The caryopsis is unusual, as the embryo extends along its whole length. It is placed in *Mnesithea* by some authors, but differs from that genus also by its annual habit and different basic chromosome number.

1a. Sessile spikelets 1–1.5 mm, shallowly pitted, ribs between pits broad, rounded; racemes to 1.5 cm ..... 1. *H. granularis*
1b. Sessile spikelets 2–2.5 mm, deeply honeycombed, ribs between pits narrow, sharp; racemes more than 2 cm ..... 2. *H. porifera*

1. Hackelochloa granularis (Linnaeus) Kuntze, Revis. Gen. Pl. 2: 776. 1891.

球穗草 qiu sui cao

Cenchrus granularis Linnaeus, Mant. Pl. 2: 575. 1771; *Manisuris granularis* (Linnaeus) Linnaeus f.; *Mnesithea granularis* (Linnaeus) de Koning & Sosef; *Rottboellia granularis* (Linnaeus) Roberty.

Annual. Culms tufted, erect, up to 60 cm tall, branched from base. Leaf sheaths loose, slightly inflated, keeled; leaf blades linear-lanceolate, 5–20 × 0.4–1 cm, coarsely hispid, base subamplexicaul, apex subacute; ligule ca. 1 mm. Racemes 0.7–1.5(–2) cm; peduncle often pubescent; rachis internodes 1–1.5(–2) mm. Sessile spikelet 1–1.5 mm, usually cream-colored at maturity; lower glume hemispherical, coarsely reticulate-rugose, pits shallow and separated by broad rounded ribs, the whole surface finely granular; upper glume hyaline below, thickening upward toward the crested apex; lower lemma hyaline; upper lemma hyaline, ca. 1.1 mm, upper palea as long. Pedicelled spikelet 1.5–2.5 mm, glumes with prominent green veins and whitish wings. Fl. and fr. Jun–Oct. $2n = 14$.

Arable land, open grassy places; 100–1000 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Sichuan, Taiwan, Yunnan, Zhejiang [throughout the tropics].

2. Hackelochloa porifera (Hackel) D. Rhind, Grasses Burma, 77. 1945.

穿孔球穗草 chuan kong qiu sui cao

Manisuris porifera Hackel, Oesterr. Bot. Z. 41: 48. 1891.

Annual. Culms erect, 0.6–1.5 m tall, sparsely branched, often stilt-rooted. Leaf sheaths with rather rigid tubercle-based hairs; leaf blades linear-lanceolate, 5–25 × 0.5–1.5 cm, tuberculate-hispid on both surfaces; ligule 1–2 mm. Racemes 2–3 cm; peduncle glabrous or sparingly puberulent; rachis internodes ca. 2 mm. Sessile spikelets 2–2.5 mm, brown at maturity; lower glume obovate, ridged or honeycombed, upper part deeply honeycombed with sharp, narrow ribs, smooth and slightly narrowed toward base; upper glume papery. Pedicelled spikelet 3 mm or more, glumes winged. Fl. and fr. Jul–Nov.

Disturbed places; 100–800 m. S Yunnan [India, Myanmar, Vietnam].

222. OPHIUROS C. F. Gaertner, Suppl. Carp. 3. 1805.

蛇尾草属 she wei cao shu

Sun Bixing (孙必兴 Sun Bi-sin); Sylvia M. Phillips

Annual or perennial. Culms robust. Leaf blades linear, flat; ligule membranous. Inflorescence of many single racemes aggregated into a spathate compound panicle; racemes cylindrical, fragile, transversely or slightly obliquely articulated, spikelets borne alternately on opposite sides of rachis; rachis internodes stout, semi-cylindrical, base with central peg, apex hollow. Sessile spikelet sunk into hollow in rachis; lower glume oblong, leathery, broadly convex, smooth, areolate or latticelike; marginally 2-keeled, with or without narrow wings toward apex; lower floret male with a palea; upper floret hyaline with entire awnless lemma. Pedicelled spikelet absent; pedicel linear, adnate to adjacent internode, sometimes barely distinguishable from it.

Four species: NE tropical Africa, tropical Asia, Australia; one species in China.

1. Ophiuros exaltatus (Linnaeus) Kuntze, Revis. Gen. Pl. 2: 780. 1891.

蛇尾草 she wei cao

Aegilops exaltata Linnaeus, Mant. Pl. 2: 575. 1771; *Mnesithea exaltata* (Linnaeus) Skeels; *Ophiuros corymbosus* (Linnaeus f.) Gaertner; *Rottboellia corymbosa* Linnaeus f.

Perennial. Culms often bulbously swollen at base, erect, 1–2 m tall, 4–6 mm in diam., simple or branched. Leaf sheaths with tubercle-based hairs or glabrous, margins densely ciliate with rather rigid tubercle-based hairs; leaf blades broadly linear, 30–60 × 0.5–2.5 cm, midrib broad and white, margins pectinate, base rounded or subcordate, apex long-acuminate; ligule 1–2 mm, glabrous. Racemes often fastigiately clustered, slender, 0.5–1.5 cm, base enclosed by a spatheole; rachis very fragile, internodes ca. 3 mm, obliquely articulated. Sessile spikelet 2–3 mm; lower glume ovate-oblong, smooth or areolate on back, sometimes also tuberculate, wingless, apex subacute; up-

per glume equal to lower glume, boat-shaped. Pedicelled spikelet completely absent; pedicel obscure, free at extreme apex. Fl. and fr. Jun–Oct.

Grassy hillsides; below 900 m. Fujian, Guangdong, Guangxi, Hainan, Yunnan [India, Laos, Malaysia, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; Australia].

223. COIX Linnaeus, Sp. Pl. 2: 972. 1753.

薏苡属 yi yi shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Annual or perennial. Culms robust, erect or decumbent, sometimes floating, usually solid. Leaves cauline; leaf blades large, usually broad, flat; ligule membranous. Inflorescences many, fascicled in the upper leaf axils, each subtended by a globose or elongated, bony or sometimes softer modified involucral spatheole ("utricle"); each inflorescence comprising 2 racemes, a female sessile raceme enclosed within the utricle, and a pedunculate male raceme subtended by a prophyll and exserted from the apical pore of the utricle. Female raceme of 1 sessile fertile spikelet accompanied by 2 free stout pedicels, sometimes bearing vestigial spikelets. Female spikelet: lower glume broad, infolding spikelet, membranous with cartilaginous beak; upper glume narrower, keeled; lower floret reduced to a broad hyaline lemma; upper floret with hyaline lemma and palea; lodicules absent; stigmas 2, elongate, exserted from utricle. Male raceme deciduous at maturity, composed of imbricate spikelets borne in pairs or triads, 1(–2) sessile and 1 pedicelled, pedicelled spikelet often reduced in triads. Male spikelets: glumes subequal, herbaceous; lower glume flat on back, margins keeled, keels winged upward, wings with obvious branching veins; upper glume boat-shaped; both florets staminate, lemma and palea hyaline. Caryopsis orbicular, ventrally furrowed, enclosed in utricle.

Four species: tropical Asia; two species in China.

1a. Annual, culms tufted; leaf blades 1.5–7 cm wide, acute; male spikelets mostly paired (except terminal triad) ..... 1. *C. lacryma-jobi*
1b. Perennial, culms often decumbent and rooting at base; leaf blades 0.3–2.5 cm wide, slenderly acuminate; male spikelets in triads ..... 2. *C. aquatica*

1. Coix lacryma-jobi Linnaeus, Sp. Pl. 2: 972. 1753.

薏苡 yi yi

Annual. Culms erect, robust, 1–3 m tall, more than 10-noded, branched. Leaves cauline; leaf sheaths shorter than internodes, glabrous; leaf blades linear-lanceolate, usually glabrous, 10–40 × 1.5–7 cm, midvein stout, base subrounded or cordate, margins scabrous, apex acute; ligule 0.6–1.2 mm. Male raceme 1.5–4 cm, spikelets in pairs with terminal triad; utricle ovoid to cylindrical, usually bony, shiny, 7–11 × 6–10 mm, white, bluish or gray-brown, sometimes with apical beak. Male spikelets oblong-ovate, 6–9 mm; glumes many-veined, lower glume winged on keels, wings 0.4–0.8 mm wide, wing margin ciliolate; anthers 4–5 mm. Fl. and fr. Jun–Dec. $2n = 20$.

Streams, marshy valleys, moist fields, by houses, often cultivated. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xinjiang, Yunnan, Zhejiang [Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam].

This species is now widely cultivated in tropical and subtropical regions of the world (Job's Tears). There are many variants, of which the following are the most distinct.

1a. Utricle cylindrical or bottle-shaped, much longer than broad ..... 1b. var. *stenocarpa*
1b. Utricle spherical to ovoid.
  2a. Utricle soft, striate ..... 1d. var. *ma-yuen*
  2b. Utricle bony, polished.
    3a. Utricle ovoid, 7–11 mm long ..... 1a. var. *lacryma-jobi*
    3b. Utricle globose, 4–5 mm in diam. ..... 1c. var. *puellarum*

1a. Coix lacryma-jobi var. lacryma-jobi

薏苡(原变种) yi yi (yuan bian zhong)

Coix arundinacea Lamarck; *C. lacryma* Linnaeus, nom. illeg. superfl.; *C. lacryma-jobi* var. *maxima* Makino; *Lithagrostis lacryma-jobi* (Linnaeus) Gaertner.

Utricle beadlike, ovoid, bony, glossy, not beaked, 7–11 × 6–10 mm. Fl. and fr. Jun–Oct.

Streams, marshy valleys, moist fields, by houses. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xinjiang, Yunnan, Zhejiang [India, Indonesia, Laos, Myanmar, Nepal, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam].

This is widely cultivated in tropical regions for the hard, beadlike utricles. There are many races with utricles in different shapes and colors, used for necklaces and other decorative purposes.

1b. Coix lacryma-jobi var. stenocarpa (Oliver) Stapf in J. D. Hooker, Fl. Brit. India 7: 100. 1896 ["1897"].

窄果薏苡 zhai guo yi yi

Coix lacryma var. *stenocarpa* Oliver, Hooker's Icon. Pl. 18: t. 1764. 1888; *C. lacryma-jobi* var. *tubulosa* K. Schumann & Lauterbach; *C. stenocarpa* (Oliver) Balansa; *C. tubulosa* Hackel.

Utricle narrowly cylindrical, bony, glossy, white, bluish or brown, 7–15 × 2–3 mm. Fl. and fr. Oct–Dec.

Cultivated. Yunnan [NE India, Indonesia, Myanmar, New Guinea, Philippines, Vietnam].

This variety is grown in gardens for the ornamental, elongate utricles, which are used for beads.

1c. Coix lacryma-jobi var. **puellarum** (Balansa) A. Camus in Lecomte, Fl. Indo-Chine 7(5): 220. 1922.

小珠薏苡 xiao zhu yi yi

Coix puellarum Balansa, J. Bot. (Morot) 4: 77. 1890.

Utricle globose, very hard, bony, white or bluish, 4–5 mm in diam., not beaked.

Moist valley forests; ca. 1400 m. Hainan, Xizang, Yunnan [NE India, Myanmar, Thailand, Vietnam].

This is a form distinguished by its small, globose utricles.

1d. Coix lacryma-jobi var. **ma-yuen** (Romanet du Caillaud) Stapf in J. D. Hooker, Fl. Brit. India 7: 100. 1896 [“1897”].

薏米 yi mi

Coix ma-yuen Romanet du Caillaud, Bull. Soc. Natl. Acclim. France, Sér. 2, 8: 442. 1881; *Coix chinensis* Todaro ex Balansa; *C. chinensis* var. *formosana* (Ohwi) L. Liu; *C. lacryma-jobi* subsp. *ma-yuen* (Romanet du Caillaud) T. Koyama; *C. lacryma-jobi* var. *formosana* Ohwi; *C. lacryma-jobi* var. *frumentacea* Makino.

Utricle thin, longitudinally striate, pale or dark brown, elliptical to subglobose, constricted to an apical beak, 8–12 × 4–9 mm, brittle and easily broken. Caryopsis white or yellow, oblong, 5–8 × 4–6 mm, rich in starch. Fl. and fr. Jul–Dec.

Roadsides, valleys, often cultivated; below 2000 m. Anhui, Fujian, Guangdong, Guangxi, Hebei, Henan, Hubei, Jiangsu, Jiangxi, Liaoning, Shaanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam].

This form with softer utricles is used as a food grain and for medicine. It also provides good forage.

2. Coix aquatica Roxburgh, Fl. Ind., 3: 571. 1832.

水生薏苡 shui sheng yi yi

Coix gigantea Roxburgh (1832), not Koenig (1788); *C. gigantea* subsp. *aquatica* (Roxburgh) Bhattacharya; *C. gigantea* var. *aquatica* (Roxburgh) Watt; *C. lingulata* Hackel.

Perennial, aquatic. Culms creeping and rooting from nodes at base, sometimes floating, up to 30 m long, ca. 1 cm in diam., flowering stems up to 2 m tall, more than 10-noded. Leaf sheaths smooth, glabrous or upper sheaths tuberculate-hispid; leaf blades narrowly to broadly linear, up to 100 × (0.3–)1–2.5 cm, hispid with tubercle-based hairs on both surfaces or almost glabrous, midvein stout, base rounded, margins scabrous, apex slenderly acuminate; ligule ca. 1 mm, margin ciliate. Male raceme 2.5–7 cm, drooping, spikelets mostly in triads, closely imbricate; utricle ovoid, longer than broad, bony, shiny, 10–14 × 5–7 mm, white or pale brown, sometimes with a median transverse line, apex occasionally extended into a green blade. Male spikelets broadly elliptic, 8–12 mm; glumes many-veined, lower glume winged on keels, wing (0.4–)0.7–1.2(–1.5) mm wide, margin ciliolate; anthers 4–5.5 mm. Fl. and fr. Aug–Nov. $2n = 10, 20, 40$.

Lakes, streams, marshy borders, open water; 500–1800 m. Guangdong, Guangxi, Yunnan [Bangladesh, Bhutan, India, Malaysia, Myanmar, Sri Lanka, Thailand, Vietnam].

All forms of the variable, perennial, aquatic *Coix* are included here in a single species. Some forms with a supposedly non-creeping habit have been separated as *C. gigantea* Roxburgh (1832), but this name is a later homonym of *C. gigantea* Koenig (1788), a different grass now placed in *Chionachne*. It is, in any case, very uncertain whether this difference in habit, which is usually impossible to determine in herbarium specimens often lacking the basal parts, is real or simply a response to the environment.

This species covers a range of chromosome levels. A form with very narrow leaf blades is the basis of *Coix lingulata*. Similar narrow-leaved specimens have been shown to have a chromosome number of $2n = 10$. The utricle apex is sometimes extended into a leaflike, green blade. The occurrence of this feature is sporadic, and it can vary from a minute vestige to a blade ca. 3 cm or more long, even on the same plant. The leaf blades are often spotted with tubercles, which appear to be glandular and carry a short bristle-hair. These tubercle-hairs vary from dense to very sparse. The male spikelets are tightly packed into a cone-like raceme, and are on average broader with broader marginal wings than in *C. lacryma-jobi*, but there is much variation.

224. CHIONACHNE R. Brown in J. J. Bennett & R. Brown, Pl. Jav. Rar. 15, 18. 1838.

葫芦草属 hu lu cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Sclerachne R. Brown.

Perennial or annual. Leaf blades linear; ligule membranous. Inflorescences axillary, of single racemes, each usually supported by a spatheole, often gathered into a spathate compound panicle; racemes bearing pairs of unisexual awnless spikelets, female and male spikelets separated into different zones, female pairs below male pairs, axis fragile between female pairs. Rachis internode and pedicel fused along one margin; callus truncate with central knob. Female zone: sessile spikelet dorsally compressed; lower glume leathery to bony, enveloping spikelet, body smooth or transversely constricted, flanks usually winged above; lower floret sterile, palea usually absent; upper floret pistillate, palea present; pedicelled spikelet reduced to vestigial. Male zone: spikelet pair similar, both or only sessile staminate; lower glume herbaceous, elliptic-oblong.

Nine species: India and Sri Lanka through SE Asia to the Philippines and Australia; one species in China.

1. Chionachne massiei Balansa, J. Bot. (Morot) 4: 78. 1890 [*“massii”*].

葫芦草 hu lu cao

Polytoca massiei (Balansa) Schenck ex Henrard [*“massii”*].

Annual. Culms loosely tufted, up to 50 cm tall, much branched, nodes bearded. Leaf sheaths papery, keeled, loose,

slightly inflated, sparsely hairy; leaf blades narrowly lanceolate, flat or folded, thin, ca. 9–30 × 0.8–1.4 cm, glabrous or sparsely hairy with tubercle-based hairs, margins smooth or scaberulous, apex acuminate; ligule 0.5–1.5 mm. Racemes in spathate clusters of 2–4, each 2–8 cm; peduncles funnel-shaped with deep cupular apex straight across rim. Female sessile spikelets 1–3, 7–10 mm; lower glume hard, rounded, with 2 conspicuous transverse constrictions, lower margins abutting internode, abruptly contracted above into keeled, broadly winged beak; pedicelled spikelet rudimentary, comprising only a 1.5–4 mm lower glume. Male spikelet pairs 1–2 on short internodes, encircled by uppermost female spikelet; male sessile and pedicelled spikelets 2.5–5 mm.

Meadows. Hainan [Laos, Thailand, N Vietnam].

This species is very similar to *Chionachne punctata* (R. Brown) Jannink (*Sclerachne punctata* R. Brown), from Indonesia, and the two have been confused. *Chionachne punctata* is a taller plant with longer leaf blades and also differs in having peduncles with an oblique, apical rim and an asperulous sessile lower glume with more broadly overlapping margins.

225. POLYTOCA R. Brown in J. J. Bennett & R. Brown, Pl. Jav. Rar. 20. 1838.

多裔草属 duo yi cao shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Perennial. Leaf blades broadly linear; ligule membranous. Inflorescences terminal and axillary, racemes subdigitate or axillary racemes sometimes solitary, spathate; racemes bearing pairs of unisexual awnless spikelets, female and male spikelets separated into different zones, axis fragile, especially in female zone; lateral racemes of digitate cluster entirely staminate, terminal raceme and solitary axillary racemes mixed, usually sterile spikelet pairs at base, then a zone with female sessile and sterile pedicelled spikelets, distally both spikelets of a pair staminate, uppermost spikelet pairs sterile. Rachis internode and pedicel fused along one margin, flat, ciliate; callus truncate with central knob. Female zone: spikelet pair dissimilar; sessile spikelet dorsally compressed; lower glume leathery, enveloping whole spikelet, glume body oblong, flanks rounded, abruptly contracted into keeled winged apical beak; lower floret sterile, reduced to a lemma; upper floret pistillate, palea present, stigma single, elongate; pedicelled spikelet much longer than sessile, sterile, comprising only a herbaceous, many-veined lower glume. Male zone: spikelet pair similar, both staminate; lower glume lanceolate, papery, winged above middle; both florets male with paleas.

One species: NE India to Indonesia, New Guinea, and the Philippines, including S China.

1. Polytoca digitata (Linnaeus f.) Druce, Rep. Bot. Exch. Club. 4: 641. 1917.

多裔草 duo yi cao

Apluda digitata Linnaeus f., Suppl. Pl. 434. 1782 ["1781"]; *Coix heteroclita* Roxburgh; *Polytoca bracteata* R. Brown; *P. heteroclita* (Roxburgh) Koorders.

Perennial from short stout rhizome. Culms erect, up to 3 m tall, 4–8 mm in diam., branched, 6–10-noded, nodes densely bearded with upwardly pointing hairs. Leaf sheaths glabrous or setose with tubercle-based hairs; leaf blades cauline, up to 80 × 1–4 cm, abaxial surface glaucous, glabrous or setulose, margins serrate, apex acuminate; ligule 2–5 mm. Racemes 2–4, 4–12 cm. Female zone: sessile spikelet 8–11 mm; lower glume shortly hairy on back, longer hair tufts laterally at base of beak, beak ca. 3 mm, wings ca. 1 mm wide; lodicules absent; pedicelled spikelet 15–20 mm, asymmetrical, broadly winged on one side. Male zone: spikelets oblong-lanceolate, 8–10 mm; lower glume symmetrically winged on margins above middle, wing 0.5–1 mm wide. Fl. and fr. Jul–Sep.

Hill slopes, grasslands, roadsides. Guangdong, Guangxi, Hainan, Yunnan [Cambodia, NE India, Indonesia, Malaysia, Myanmar, New Guinea, Philippines, Thailand, Vietnam].

The zonation of the mixed-sex racemes is obvious, with the tough, yellowish female spikelets, which often have the long stigmas exserted, located below the more slender, green male portion.

226. ZEA Linnaeus, Sp. Pl. 2: 971. 1753.

玉蜀黍属 yu shu shu shu

Chen Shouliang (陈守良); Sylvia M. Phillips

Annual. Culms robust, often tall with stilt roots, solid. Leaf blades large, broadly linear; ligule membranous. Inflorescences terminal and axillary, spikelets unisexual, separated into male and female inflorescences, not disarticulating at maturity, spikelets of a pair alike. Female inflorescence axillary, enclosed in enveloping foliaceous sheaths; spikelets all sessile in many longitudinal rows, partially sunk in the thickened, almost woody axis, glumes and lemmas chaffy, awnless, lower floret sterile; styles single, very long, silky, pendulous from inflorescence apex. Male inflorescence terminal, of many digitate or paniculate racemes; one spikelet of a pair subsessile, the other on a slender pedicel, papery, awnless, both florets staminate. Mature caryopses plump, much larger than spikelet scales, very variable in shape and color. $x = 5$.

Five species: four wild species in Central America; one species cultivated in all warm parts of the world, including China.

1. Zea mays Linnaeus, Sp. Pl. 2: 971. 1753.

玉蜀黍 yu shu shu

Culms erect, 1–4 m tall. Leaf sheaths with transverse veinlets; leaf blades 50–90 × 3–12 cm, glabrous or with tubercle-based hairs, margins scabrid, midvein stout; ligule ca. 2 mm. Female inflorescence a cylindrical "cob," with 16–30 rows of spikelets; glumes equal, veinless, margins ciliate; florets hya-

line. Male inflorescence a “tassel” of many digitate racemes; spikelets 9–14 mm, unequally pedicellate, one pedicel 1–2 mm, the other 2–4 mm; glumes subequal, membranous, lower ca. 10-veined, margins ciliate, upper 7-veined; lower lemma and palea hyaline, subequal; upper lemma smaller than lower. Anthers orange, ca. 5 mm. Fl. and fr. summer–autumn. $2n$ = 20, 40, 80.

Widely cultivated in China [originating in America; widely cultivated elsewhere].

This plant (maize, corn) was first domesticated in Central America about 7000 years ago and is now the third most important crop in the world. The many cultivars are grown for cereal or forage, and it is also an important source of oil, syrup, and alcohol.