

128. **TRIPOGON** Roemer & Schultes, Syst. Veg. 2: 34. 1817.

草沙蚕属 *cao sha can shu*

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Perennials, often small. Culms densely tufted, slender, unbranched. Leaf blades mainly basal, filiform to setaceous, usually involute; ligule a narrow membrane fringed with hairs. Inflorescence a solitary unilateral terminal raceme. Spikelets sessile, biserial, broadside to rachis, linear to elliptic, laterally compressed, florets 2 to several, rachilla disarticulating above glumes and between florets; glumes narrow, shorter than lemmas or upper glume exceeding lowest lemma, unequal, membranous, 1-veined or upper glume sometimes 3-veined, keeled, acute to emarginate and mucronate, lower glume often with a lobe or tooth on one side; lemmas lanceolate to ovate, membranous, 3-veined, glabrous, lightly keeled or rounded, 2-dentate, midvein produced into an awn, teeth usually also mucronate or awned; palea keels scabrid or ciliolate, often winged. Floret callus bearded. Stamens 1–3. Caryopsis narrow, trigonous to subterete.

About 30 species: Old World tropics, one species in tropical America; 11 species (five endemic) in China.

- 1a. Central awn much shorter than lemma; anthers 3.
 - 2a. Lemma midvein extended into 0.2–0.5 mm mucro; lateral veins not extended 1. *T. purpurascens*
 - 2b. Lemma midvein extended into 0.5–2 mm awn; lateral veins extended into 0.2–0.7 mm mucros.
 - 3a. Culms 5–8 cm; racemes 2–4 cm, purple-brown 2. *T. humilis*
 - 3b. Culms 10–30 cm; racemes 6–15 cm, gray-green 3. *T. chinensis*
- 1b. Central awn slightly shorter to distinctly longer than lemma; anthers 1–3.
 - 4a. Anthers 3 (rarely 2).
 - 5a. Central awn 1.8–3.3 mm; lower glume without lateral lobe.
 - 6a. Racemes erect or slightly curved; upper glume 3.5–4.3 mm, apex subacute, mucronate; awn 1.8–3.3 mm 4. *T. sichuanicus*
 - 6b. Racemes drooping; upper glume 4–5 mm, apex 2-denticulate; awn 3–4 mm 5. *T. debilis*
 - 5b. Central awn 5–11 mm; lower glume lobed on one side.
 - 7a. Plant robust, up to 50 cm; lemmas with lateral awns arising from tips of teeth; anthers 1.4–1.7 mm 6. *T. trifidus*
 - 7b. Plant slender, up to 35 cm; lemmas with apical teeth between awns; anthers 0.5–0.9 mm 7. *T. rupestris*
 - 4b. Anther 1.
 - 8a. Central awn distinctly longer than its lemma, flexuose or reflexed; lateral awns 1–2 mm.
 - 9a. Raceme with closely imbricate spikelets; central awn flexuose, at most gently reflexed 8. *T. filiformis*
 - 9b. Raceme with spaced spikelets; central awns all strongly and stiffly reflexed 9. *T. longearistatus*
 - 8b. Central awn slightly shorter to slightly longer than its lemma; lateral awns 0–1 mm.
 - 10a. Spikelets their own length apart or slightly imbricate; lemmas 3.3–4.5 mm; central awn 2.5–4 mm 10. *T. yunnanensis*
 - 10b. Spikelets closely imbricate; lemmas 2.2–2.6 mm; central awn 1.8–2.8 mm 11. *T. liouae*

1. **Tripogon purpurascens** Duthie, Ann. Roy. Bot. Gard. Calcutta 9: 74. 1901.

玫瑰紫草沙蚕 *mei gui zi cao sha can*

Tripogon jacquemontii Stapf var. *submuticus* J. D. Hooker.

Culms 5–35 cm tall. Basal leaf sheaths finally splitting into dense clumps of fibers; leaf blades 1–10 × 0.1–0.3 cm, adaxial surface densely scabrid-hispidulous, loosely pilose with long scattered hairs, abaxial surface glabrous. Racemes 2–10 (–17) cm, stiff, straight or slightly curved, spikelets tightly appressed to concavities in rachis, imbricate by 1/4–1/3 their length. Spikelets 4–7 mm, usually purplish; florets 2–4(–6), imbricate, rachilla mostly hidden; lower glume narrowly triangular, symmetrical, 1.5–2.5 mm, acuminate; upper glume narrowly oblong, 2.5–4.5 mm, thickened along midvein, margins broad, scarious, apex scabrid-apiculate; lemmas oblong-lanceolate, 2–3.4 mm to sinus, 2-dentate, midvein produced into a 0.2–0.5 mm mucro, teeth rounded, lateral veins not extended; palea keels wingless, scabrid. Anthers 3, 1.2–2 mm. Fl. and fr. Jul–Sep.

Arid places, especially open stony mountainsides, sometimes forming a sward; 700–2400 m. Xinjiang [Afghanistan, Bhutan, NW India, Nepal, Pakistan; SW Asia (Saudi Arabia, Yemen)].

This is the only species in China with a short mucro from the lemma tip not exceeding 0.5 mm, lateral veins not at all extended from the apical teeth, and wingless, scabrid palea keels. It was misidentified as *Tripogon abyssinicus* Nees ex Steudel in Fl. Brit. India (7: 287. 1896, “1897”).

The name “*Tripogon hookerianus* Bor” (Grasses Burma, Ceylon, India, Pakistan, 522. 1960) belongs here, but was not validly published because no type was indicated.

2. **Tripogon humilis** H. L. Yang, Acta Bot. Yunnan. 5: 72. 1983.

矮草沙蚕 *ai cao sha can*

Culms 5–8 cm tall. Basal leaf sheaths persistent in tight bunches; leaf blades setaceous, 1.5–6 × ca. 0.1 cm, adaxial surface densely hirtellous and thinly pilose, abaxial surface glabrous, sometimes scabrid. Racemes 2–4 cm, slender, rachis slightly laterally compressed, margins hirtellous, spikelets appressed to rachis, not or only slightly imbricate. Spikelets 3.5–

5.5 mm, purplish brown; florets 2–4, imbricate; lower glume lanceolate, symmetrical, 2–3 mm, acuminate; upper glume lanceolate, 3–4 mm, apex acute-apiculate; lemmas oblong-ovate, 3–3.5 mm, 2-dentate, central awn 1.75–2.5 mm, erect, teeth broad, acute to truncate, lateral veins extended into 0.2–0.7 mm awns; palea keels ciliolate. Anthers 3, 0.5–0.8(–1.2) mm. Fl. Jul.

- Mountain slopes; ca. 2800 m. Xizang.

In the protologue, this small species was distinguished from *Tripogon chinensis* by its low stature and short racemes; it also has a rather longer central awn and short anthers. The type has not been seen. The awn length, anther length, and ciliolate palea keels of *T. humilis* exclude it from *T. purpurascens*.

3. *Tripogon chinensis* (Franchet) Hackel, Bull. Herb. Boissier, sér. 2, 3: 503. 1903.

中华草沙蚕 zhong hua cao sha can

Nardurus filiformis (Salzmann ex Willkomm & Lange) C. Vicioso var. *chinensis* Franchet, Nouv. Arch. Mus. Hist. Nat., sér. 2, 7: 149. 1884; *Tripogon chinensis* subsp. *coreensis* (Hackel) T. Koyama; *T. chinensis* var. *coreensis* Hackel; *T. coreensis* (Hackel) Ohwi.

Culms 10–30 cm tall. Basal leaf sheaths papery, tardily fibrous; leaf blades 5–15 × ca. 0.1 cm, adaxial surface scabrid, sometimes loosely pilose with long scattered hairs, abaxial surface glabrous. Racemes 6–15 cm, slender, spikelets appressed to rachis, slightly imbricate by up to 1/3 their length. Spikelets 4.5–8 mm, gray-green; florets 3–5, loosely imbricate, rachilla usually partially visible; lower glume lanceolate, nearly symmetrical, 1.2–3 mm, acuminate-mucronate; upper glume elliptic-oblong, 2.5–4.5 mm, thickened along midvein, margins broad, scarious, apex sharply acute or subacute and mucronate; lemmas oblong-ovate, 2–3.3 mm to sinus, 2-dentate, central awn clearly shorter than its lemma, 1–2 mm, erect, teeth broad, obliquely truncate to acute, lateral veins extended into 0.2–0.5 mm awns; palea keels very narrowly winged, ciliolate. Anthers 3, 1–1.5 mm. Fl. and fr. Jul–Sep.

Dry stony slopes, among rocks; 200–2200 m. Anhui, Gansu, Hebei, Heilongjiang, Henan, Hubei, Jiangsu, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan [Mongolia, Philippines, E Russia].

4. *Tripogon sichuanicus* S. M. Phillips & S. L. Chen, Kew Bull. 57: 916. 2002.

四川草沙蚕 si chuan cao sha can

Culms 15–30 cm tall. Basal leaf sheaths papery; leaf blades inrolled or flat, 1–10 × 0.1–0.2 cm, adaxial surface scabrid, sometimes pilose with long scattered hairs, abaxial surface glabrous. Racemes 5–13 cm, spikelets imbricate by 1/3–1/2 their length. Spikelets 5–13 mm, olive green; florets 5–10, approximate, rachilla partially visible; lower glume lanceolate, nearly symmetrical, 2.1–2.7 mm, acuminate-mucronate; upper glume lanceolate-oblong, 3.5–4.3 mm, 1–3-veined and thickened along midline, margins broad, scarious, apex subacute, mucronate; lemmas oblong-ovate, 2.8–3 mm to sinus, 2-dentate, central awn slightly shorter to slightly longer than its lem-

ma, 1.8–3.3 mm, erect, teeth rounded to truncate, lateral veins extended into 0.1–0.5 mm mucros; palea keels wingless, ciliolate. Anthers 3, 1.2–1.3 mm. Fl. and fr. Jun–Aug.

- Mountain slopes, dry valleys; 1600–3200 m. Sichuan.

Tripogon sichuanicus has been misidentified as either *T. filiformis* or the Indian species *T. bromoides* Roth ex Roemer & Schultes. It is clearly separated from *T. filiformis* by its short, blunt lemma teeth and by the presence of 3 anthers. *Tripogon bromoides* differs in having a much broader raceme, 0.8–1.5 cm wide, with spikelets diverging at an angle from the rachis, a lower glume with a lateral lobe, prominent, acute lemma teeth, and longer lateral awns. *Tripogon sichuanicus* is actually much closer to *T. chinensis*, although that species has shorter awns and a more easterly distribution.

5. *Tripogon debilis* L. B. Cai, Novon 15: 390. 2005.

柔弱草沙蚕 rou ruo cao sha can

Culms 25–34 cm tall. Leaf sheaths white-villous below blade; leaf blades inrolled, 4–11 cm, adaxial surface scabrid or sometimes pubescent toward base, abaxial surface glabrous. Racemes 8–15 cm, drooping, spikelets their own length apart or slightly imbricate. Spikelets 6–8 mm, brownish green; florets 6–8, imbricate; lower glume lanceolate, nearly symmetrical, 2.5–3.5 mm, apex entire, sharply acuminate; upper glume lanceolate, 4–5 mm, margins narrowly membranous, apex 2-denticulate; lemmas lanceolate, 3.5–4.5 mm, 2-dentate, central awn 3–4 mm, erect, teeth acute, lateral veins extended into 0.3–0.5 mm mucros from outer edge of teeth; palea ca. 1 mm shorter than lemma, keels wingless, ciliate. Anthers 3, 1.3–1.5 mm.

- Stony slopes, roadsides, wasteland; 3100–3800 m. Sichuan (Hengduan Shan).

This species is close to *Tripogon sichuanicus*, which also occurs in similar habitats in W Sichuan. The protologue states that there is usually only 1 anther, but the accompanying illustration shows 3. The presence of a single anther is not otherwise recorded among the species related to *T. chinensis*.

6. *Tripogon trifidus* Munro ex J. D. Hooker, Fl. Brit. India 7: 286. 1896 [“1897”].

三裂草沙蚕 san lie cao sha can

Culms up to 50 cm tall, relatively robust. Basal leaf sheaths papery, finally fibrous; leaf blades flat or inrolled, 24–30 × ca. 0.2 cm, adaxial surface scaberulous, pilose with long hairs toward ligule, abaxial surface glabrous. Racemes 10–20 cm, flexuose, fairly dense, spikelets loosely erect to slightly diverging from rachis, imbricate by 1/2–2/3 their length. Spikelets 7–14 mm, pallid to dark gray; florets 5–13, loosely to densely imbricate; lower glume lanceolate, asymmetrical, broadened on one side into a lobe or tooth, 2.4–4.2 mm, acute; upper glume narrowly oblong-elliptic, 4–6.5 mm, apex subacute and mucronate; lemmas lanceolate, 2.6–4 mm to sinus, narrowly bifid, central awn 6–11 mm, flexuose, teeth acuminate, lateral veins extended from their tips into 0.4–1.5 mm awns; palea keels winged, ciliolate. Anthers 2–3, 1.4–1.7 mm. Fl. and fr. Jul.

Stony ground, among rocks, in the open or in shade; 1300–2600 m. Xizang, Yunnan [Bhutan, India, Myanmar, Nepal, Thailand, Vietnam].

This is a relatively stout species of *Tripogon*, taller than other Chinese members of the genus, with longer, thicker leaf blades and a taller tuft of basal sheaths. Most specimens have florets with 3 anthers, but specimens from the Himalayas tend to have only 2 anthers in some or all florets.

Material of this species was misidentified in Fl. Xizang. (5: 73. 1987) as *Tripogon wardii* Bor, a little-known species from N Myanmar differing from *T. trifidus* by its much denser racemes and lemmas with a lateral tooth between the central and lateral awns. *Tripogon wardii* is similar to *T. bromoides* Roth ex Roemer & Schultes from India.

7. *Tripogon rupestris* S. M. Phillips & S. L. Chen, Kew Bull. 57: 917. 2002.

岩生草沙蚕 yan sheng cao sha can

Culms 10–35 cm tall. Basal leaf sheaths papery becoming slightly fibrous; leaf blades 4–12 × 0.08–0.12 cm, adaxial surface scabrid, sparsely pilose with long scattered hairs, abaxial surface glabrous. Racemes 5–20 cm, flexuose, spikelets loosely appressed to the slender rachis, spaced their own length apart or only slightly imbricate. Spikelets 4.3–8 mm, tinged brownish purple; florets 4–7, tightly to loosely imbricate; lower glume narrowly lanceolate, asymmetrical, broadened into a prominent lateral tooth on one side, 2.2–3 mm, acuminate; upper glume narrowly lanceolate-oblong, 3.2–5 mm, apex emarginate and mucronate; lemmas elliptic-lanceolate, 2.4–3 mm to sinus, 3-awned with 2 teeth between the awns, central awn 5–9 mm, flexuose, often recurving, teeth variable, obtuse to acuminate, lateral veins extended into (1.5–)2–3.5 mm awns; palea keels winged, shortly ciliate. Anthers 3, 0.5–0.9 mm. Fl. and fr. Aug.

Damp rocks, often among moss; 2300–3000 m. Xizang, Yunnan [N India, Nepal].

This small species, forming delicate tufts with dark, flexuose racemes, was formerly usually identified as *Tripogon filiformis*. *Tripogon rupestris* has a looser raceme of spaced spikelets with widely spreading awns. Identification can be confirmed by inspecting the number of anthers.

8. *Tripogon filiformis* Nees ex Steudel, Syn. Pl. Glumac. 1: 301. 1854.

小草沙蚕 xiao cao sha can

Tripogon filiformis var. *tenuispicus* J. D. Hooker; *T. nanus* Keng ex P. C. Keng & L. Liu; *T. unidentatus* Nees ex Steudel.

Culms 8–40 cm tall. Basal leaf sheaths papery becoming slightly fibrous; leaf blades 3–15 × 0.1–0.15 cm, adaxial surface scabrid, sparsely pilose, abaxial surface glabrous. Racemes 3–20 cm, variable, straight or flexuose, spikelets loosely erect or diverging from the slender rachis, imbricate by 1/2–3/4 their length. Spikelets 5–9 mm, pale green or tinged gray or purple; florets 4–10, tightly to loosely imbricate; lower glume narrowly lanceolate, asymmetrical, broadened into a prominent lateral tooth on one side, 1.6–2.7 mm, subacute; upper glume narrowly lanceolate-oblong, 3–4.5 mm, apex acuminate or emarginate and mucronate; lemmas elliptic-lanceolate, 2–2.7 mm to sinus, 3-awned with 2 teeth between the awns, central awn 3–8 mm, flexuose, sometimes recurving, teeth variable, acute, acuminate or awnlike, lateral veins extended into 1–3 mm awns; palea keels winged, shortly ciliate. Anther 1, 0.7–1.3 mm. Fl. and fr. Jun–Oct.

Dry grassy slopes, often among rocks; 1200–4200 m. Fujian,

Guizhou, Henan, Shaanxi, Sichuan, Xizang, Yunnan, Zhejiang [Bhutan, N India, N Myanmar, Nepal, Pakistan].

Tripogon filiformis is a Himalayan species distinguished by its slender habit with dense, feathery racemes of long-awned spikelets, lemmas with teeth between the awns, and a single anther. The racemes are variable in length and color, but are usually rather flexuose with the leaf blades extending up among them.

9. *Tripogon longearistatus* Hackel ex Honda, Bot. Mag. (Tokyo) 41: 11. 1927 [“*longe-aristatus*”].

长芒草沙蚕 chang mang cao sha can

Tripogon japonicus (Honda) Ohwi; *T. longearistatus* subsp. *japonicus* (Honda) T. Koyama; *T. longearistatus* var. *japonicus* Honda; *T. panxianensis* H. Peng.

Culms 15–30 cm tall. Basal leaf sheaths papery; leaf blades 4–13 × ca. 0.1 cm, adaxial surface glabrous or loosely pilose, abaxial surface glabrous. Racemes 8–20 cm, usually slightly flexuose, spikelets loosely erect, distant by about their own length along the slender rachis. Spikelets 4.5–9 mm, pale green to dark gray; florets 4–7(–9), loosely arranged, rachilla visible; lower glume linear-lanceolate, asymmetrical, broadened or toothed on one side, 2.5–3 mm, subacute to acuminate; upper glume narrowly lanceolate-oblong, 4–4.5 mm, apex acuminate-rostrate or emarginate and mucronate; lemmas elliptic-lanceolate, 2.5–3.3 mm to sinus, 2-dentate, central awn 3.6–8 mm, stiff, strongly reflexed, teeth acute, lateral veins extended into 0.3–2 mm awns arising free from lemma tooth or from its outer margin; palea keels very narrowly winged, ciliolate. Anther 1, 1–1.5 mm. Fl. and fr. Sep–Oct.

Rocky slopes; 300–1000 m. Fujian, Gansu, Guangdong, Guizhou, Hunan, Jiangxi, Shaanxi, Sichuan, Yunnan, Zhejiang [Japan, Korea].

Tripogon longearistatus is close to *T. filiformis*, with which it is sometimes confused. They can usually be distinguished on habit. In *T. longearistatus*, the widely spaced spikelets with stiff, strongly reflexed awns make it one of the easiest Chinese species to recognize. Moreover, there is little overlap in their geographic range: *T. filiformis* is an upland and high-altitude species, whereas *T. longearistatus* is confined to the eastern lowlands.

The name “*Tripogon corensis* var. *longearistatus* Hackel ex T. Mori” (Enum. Pl. Corea, 56. 1922) is a *nomen nudum* and was therefore not validly published; “*T. chinensis* var. *longearistatus* Hackel ex Honda” was not validly published because it was merely cited as a synonym in the protologue of *T. longearistatus*; and the same combination published by I. C. Chung (J. Wash. Acad. Sci. 45: 216. 1955) was not validly published because a full and direct reference to the basionym was not provided.

10. *Tripogon yunnanensis* J. L. Yang ex S. M. Phillips & S. L. Chen, Kew Bull. 57: 921. 2002.

云南草沙蚕 yun nan cao sha can

Culms 25–33 cm tall. Basal leaf sheaths finally forming dense fibrous clumps; leaf blades 2.5–10 × ca. 0.1 cm, adaxial surface pilose with long scattered hairs or subglabrous, abaxial surface glabrous. Racemes 9–15 cm, spikelets distant by about their own length on lower part of rachis, imbricate above. Spikelets (8.5–)10–22 mm, dark gray or gray-green; florets (4–)6–17, loosely imbricate, rachilla visible; lower glume lanceolate, asymmetrical, broadened on one side into a lateral lobe, 1.5–3.5 mm, acuminate; upper glume narrowly lanceolate-ob-

long, 4–5.5 mm, apex emarginate and mucronate; lemmas lanceolate-oblong, 3.3–4.5 mm to sinus, 2-dentate, central awn a little shorter or about equaling its lemma, 2.5–4 mm, slightly flexuose, teeth acute to truncate, lateral veins extended into 0.4–1 mm mucros; palea keels very narrowly winged, ciliolate. Anther 1, 1.4–2 mm. Fl. and fr. Jul–Aug.

• Dry mountain slopes, among rocks; 2800–4500 m. Sichuan, Xizang, Yunnan.

The name *Tripogon yunnanensis* was not previously validly published by J. L. Yang (Acta Bot. Yunnan. 5: 51. 1981) because two types were indicated. Consequently the intended new combination "*T. bromoides* var. *yunnanensis* (Keng ex J. L. Yang) S. L. Chen & X. L. Yang" (FRPS 10(1): 59. 1990) was also not validly published.

11. *Tripogon liouae* S. M. Phillips & S. L. Chen, Kew Bull. 57: 922. 2002.

丽藕草沙蚕 li ou cao sha can

Culms 10–30 cm tall. Basal leaf sheaths finally splitting

into dense clumps of fibers; leaf blades 1.5–6 × ca. 0.1 cm, much shorter than the culms, adaxial surface pilose with long scattered hairs, abaxial surface glabrous. Racemes 2–8 cm, slightly flexuose, very dense, spikelets diverging from rachis, imbricate by 1/2 their length or more. Spikelets 6–15 mm, blackish; florets 7–15, loosely imbricate, rachilla visible; lower glume lanceolate, asymmetrical, broadened on one side below middle, sometimes lobed, subacute and mucronate; upper glume narrowly lanceolate-oblong, 2.7–4 mm, apex emarginate and mucronate; lemmas lanceolate-oblong, 2.2–2.6 mm to sinus, 2-dentate, central awn a little shorter or about equaling its lemma, 1.8–2.8 mm, teeth acute to truncate, lateral veins extended into 0–0.5 mm mucros; palea keels narrowly winged, ciliolate. Anther 1, 1.3–1.8 mm. Fl. and fr. Jul–Sep.

• Dry open spaces, sometimes forming a turf; 3000–4600 m. Xizang.

Tripogon liouae has a distinctive habit, with a basal tuft of short leaves and dense, blackish racemes on culms that are conspicuously taller than the basal tuft.

Flora of China 22: 466–469. 2006.