

163. ECHINOCHLOA P. Beauvois, Ess. Agrostogr. 53. 1812, nom. cons.

稗属 bai shu

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Tema Adanson, nom. rej.

Annual or perennial. Culms often coarse and robust. Leaf blades flat, linear or broadly linear; ligule absent (ciliate in some species outside China). Inflorescence composed of racemes along a central axis; racemes simple or compound, densely spiculate, spikelets paired in 4 rows, or congested on secondary racemelets. Spikelets narrowly elliptic to subrotund, plump, plano-convex, often hispidulous or spinulose, acute to awned; lower glume triangular, 1/3–1/2(–3/5) spikelet length, sheathing; upper glume and lower lemma equaling the spikelet or upper glume somewhat shorter in cultivated forms, prominently 5–7-veined, acute to rostrate or lower lemma extended into a stout awn; upper lemma coriaceous, smooth, shining, terminating in a short, laterally compressed, incurving beak; upper palea acute, apex briefly reflexed. $x = 9$.

About 35 species: tropical and warm-temperate regions of the world; eight species (at least one introduced) in China.

The reflexed upper palea tip, although a very tiny character, is nevertheless important for distinguishing *Echinochloa* from neighboring genera, especially *Brachiaria*. The absence of a ligule is also a good spot character for recognition of the genus in China.

Species of *Echinochloa* typically grow in aquatic or moist situations. Several have become widespread weeds, especially of irrigated crops, and two are sometimes cultivated as minor cereals.

- 1a. Grain persisting at maturity; spikelets plumply ovate; branches of inflorescence incurving; cultivated plants.
 - 2a. Spikelets dark greenish when mature, awnless; racemes rather spaced, simple 1. *E. frumentacea*
 - 2b. Spikelets purplish brown when mature, acute to awned, awn 0.5–2 cm; racemes very dense, closely packed, usually branched 2. *E. esculenta*
- 1b. Grain readily deciduous at maturity; spikelets ovate, ovate-lanceolate or ovate-elliptic; branches of inflorescence not incurving; wild plants.
 - 3a. Lower lemma convex, hard and shining 6. *E. glabrescens*
 - 3b. Lower lemma flat on the back, herbaceous.
 - 4a. Spikelets ovate, 3.8–6 mm; culms erect, forming narrow tuft 3. *E. oryzoides*
 - 4b. Spikelets elliptic-ovate, mostly 2–4 mm; culms spreading, forming loose tuft.
 - 5a. Racemes neatly 4-rowed, simple, openly spaced, often erect; spikelets awnless, acute, 2–3 mm 4. *E. colona*
 - 5b. Racemes untidily 2- to several-rowed, at least the longer often with short branchlets; spikelets acuminate to shortly awned, 2–4 mm.
 - 6a. Racemes distinctly compound with many short branchlets; spikelets 2–3 mm; awn of lower lemma 1–1.5 cm 5. *E. crusgavonis*
 - 6b. Racemes simple or only inconspicuously branched; spikelets 2.5–4 mm; lower lemma acute to long-awned.
 - 7a. Inflorescence green or purple-tinged, moderately dense; spikelets 3–4 mm; lower lemma acuminate or awned 7. *E. crusgalli*
 - 7b. Inflorescence dark purple, very dense; spikelets 2.5–3 mm; lower lemma awned, awn 3–5 cm 8. *E. caudata*

1. *Echinochloa frumentacea* Link, Hort. Berol. 1: 204. 1827.

湖南稗子 hu nan bai zi

Panicum frumentaceum Roxburgh, Fl. Ind. 1: 307. 1820, not Salisbury (1796); *Echinochloa colona* (Linnaeus) Link var. *frumentacea* Ridley; *E. crusgalli* (Linnaeus) P. Beauvois var. *edulis* Hitchcock, nom. illeg. superfl.; *E. crusgalli* var. *frumentacea* (Link) W. P. Wight; *Oplismenus frumentaceus* (Link) Kunth.

Annual. Culms robust, erect, 1–1.5 m tall. Leaf sheaths smooth and glabrous; leaf blades linear, soft, 15–40 × 1–2.4 cm, glabrous, margins thickened and wavy. Inflorescence erect, lanceolate, 10–20 cm, axis robust, scabrous along edges and with tubercle-based hairs; racemes 1–3 cm, curved, simple, closely spaced and overlapping. Spikelets greenish, tardily de-

ciduous, plump, ovate-elliptic to rotund, 2.5–3.5 mm, pubescent to hispid, awnless; lower glume 1/3–2/5 as long as spikelet; upper glume slightly shorter than spikelet; lower lemma herbaceous, sterile; upper lemma 2–3 mm. Caryopsis long persistent, eventually falling. Fl. and fr. Aug–Sep. $2n = 36, 54$.

A crop plant. Anhui, Guangxi, Guizhou, Heilongjiang, Henan, Nei Mongol, Ningxia, Sichuan, Taiwan, Yunnan [cultivated in Africa and tropical Asia].

Echinochloa frumentacea is cultivated both for grain and as a forage crop. It is thought to be a cultivated derivative of *E. colona* that arose in India and perhaps Africa.

2. *Echinochloa esculenta* (A. Braun) H. Scholz, Taxon 41: 523. 1992.

紫穗稗 zi sui bai

Panicum esculentum A. Braun, Index Sem. Hort. Berol. 1861(App.): 3. 1861; *Echinochloa frumentacea* Link subsp. *utilis* (Ohwi & Yabuno) Tzvelev; *E. utilis* J. Ohwi & Yabuno.

Annual. Culms robust, erect, 1–1.5 m tall. Leaf sheaths smooth and glabrous; leaf blades linear, 20–50 × 1.2–2.5 cm, glabrous, margins thickened and wavy. Inflorescence erect, lanceolate, 10–30 cm, axis robust, scabrous along edges and with tubercle-based hairs; racemes 2–6 cm, robust, usually branched, closely spaced and overlapping. Spikelets purplish, tardily deciduous, plump, ovate or obovate-elliptic, 3.5–4 mm, hispid along veins with tubercle-based hairs; lower glume 1/3 as long as spikelet, acute; upper glume slightly shorter than spikelet; lower lemma herbaceous, sterile, acute or with a 0.5–2 cm awn; upper lemma 2.8–3.5 mm. Caryopsis long persistent, eventually falling. Fl. and fr. Aug–Oct. $2n = 54, 56, 72$.

A crop plant. Guizhou, Hubei, Yunnan [cultivated in warm-temperate regions of Asia and Africa; introduced in America].

Echinochloa esculenta is cultivated both for grain and forage, like *E. frumentacea*, and the two are most easily distinguished by the color of the seeding heads. *Echinochloa esculenta* is thought to be a cultivated derivative of *E. crusgalli* that arose in China, Japan, and Korea.

3. *Echinochloa oryzoides* (Arduino) Fritsch, Verh. Zool.-Bot. Ges. Wien 41: 742. 1891.

水田稗 shui tian bai

Panicum oryzoides Arduino, Animadv. Bot. Spec. Alt. 16, t. 5. 1764; *Echinochloa coarctata* Kossenko; *E. crusgalli* (Linnaeus) P. Beauvois subsp. *oryzicola* (Vasinger) T. Koyama; *E. crusgalli* var. *oryzicola* (Vasinger) Ohwi; *E. macrocarpa* Vasinger; *E. oryzicola* (Vasinger) Vasinger; *E. oryzoides* subsp. *phyllopogon* (Stapf) Tzvelev; *E. persistentia* Z. S. Diao; *E. phyllopogon* (Stapf) Stapf ex Kossenko; *E. phyllopogon* subsp. *oryzicola* (Vasinger) Kossenko; *Panicum oryzicola* Vasinger; *P. phyllopogon* Stapf.

Annual. Culms erect, forming a narrow tuft up to 1 m tall. Leaf sheaths and blades glabrous or rarely lower leaves with a dense tuft of hairs on abaxial side at junction of sheath and blade; leaf blades stiffly erect, linear, flat, 10–30 × 1–1.5 cm, margins thickened and scabrous. Inflorescence 8–15 × 1.5–3 cm; racemes simple. Spikelets light green, ovate, 3.8–6 mm; glumes hispid along veins, lower glume 1/2–2/3 as long as spikelet, acuminate; upper glume acuminate; lower lemma acuminate or with an awn up to 2 cm; upper lemma 3.5–5 mm. Fl. and fr. Jul–Oct. $2n = 54$.

A weed of rice fields. Anhui, Guangdong, Guizhou, Hainan, Hebei, Henan, Hunan, Jiangsu, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan [India, Indonesia, Japan, Kazakhstan, Korea, Kyrgyzstan, Pakistan, Russia, Turkmenistan, Uzbekistan; Europe, America].

Echinochloa oryzoides is adapted as a weed of rice (*Oryza*), which it resembles in habit. A variant from ricefields in Italy has a dense band of hairs on the outer side of the leaf sheath and blade junction, particularly on the lower leaves. This is the basis of the name *E. phyllopogon*.

4. *Echinochloa colona* (Linnaeus) Link, Hort. Berol. 2: 209. 1833.

光头稗 guang tou bai

Panicum colonum Linnaeus, Syst. Nat., ed. 10, 2: 870. 1759; *Echinochloa crusgalli* (Linnaeus) P. Beauvois subsp. *colona* (Linnaeus) Honda; *Milium colonum* (Linnaeus) Moench; *Oplismenus colonus* (Linnaeus) Kunth; *P. crusgalli* subsp. *colonom* (Linnaeus) Makino & Nemoto.

Annual. Culms erect or ascending, up to 60 cm or more tall. Leaf sheaths compressed and keeled; leaf blades linear, flat, 3–20 × 0.3–0.7 cm, glabrous, sometimes with transverse purple bands, margins slightly scabrous, apex acute. Inflorescence narrow, 5–10 cm; racemes 1–2 cm, erect or sometimes stiffly diverging, simple, separated or overlapping by up to half their length or more, rachis usually without long, tubercle-based hairs, spikelets tightly congested in 4 neat rows. Spikelets plumply ovate-oblong, 2–3 mm, hirtellous, sharply acute; lower glume ca. 1/2 as long as spikelet; lower lemma staminate or sterile; upper lemma whitish at maturity, elliptic. Fl. and fr. summer and autumn. $2n = 36$.

A weed of damp places and irrigated fields. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan, Zhejiang [warm regions throughout the world].

Echinochloa colona is a widespread, weedy species, distinguished by its short, neat, usually rather openly spaced racemes of rounded, awnless spikelets.

5. *Echinochloa cruspavonis* (Kunth) Schultes, Mant. 2: 269. 1824.

孔雀稗 kong que bai

Oplismenus cruspavonis Kunth, Nov. Gen. Sp. (quarto ed.) 1: 108. 1815 [“1816”]; *Echinochloa crusgalli* (Linnaeus) P. Beauvois var. *cruspavonis* (Kunth) Hitchcock; *Panicum cruspavonis* (Kunth) Nees.

Perennial or rarely annual. Culms robust, usually decumbent at base and forming a large clump, 1.2–1.8 m tall. Leaf sheaths loose, smooth and glabrous; leaf blades linear, lush, 10–40 × 1–1.5 cm, glabrous, midrib broad and white, margins harshly scabrous. Inflorescence nodding, large, loose, 15–25 cm; branches mostly compound, spikelets many, crowded on secondary branchlets. Spikelets purple-tinged, ovate-lanceolate, 2–3 mm, hispid on veins, the hairs not tubercle-based; lower glume 1/3–2/5 as long as spikelet; upper glume rostrate; lower lemma sterile, herbaceous, 5–7-veined, with a stout, 1–1.5 cm awn; upper lemma 2–2.5 mm. Fl. and fr. summer–autumn. $2n = 36, 54$.

Streamsides and other damp places. Anhui, Fujian, Guangdong, Guizhou, Hainan, Shaanxi, Sichuan [throughout the tropics].

This is a segregate from *Echinochloa crusgalli* with a larger, more branched inflorescence and smaller spikelets.

6. *Echinochloa glabrescens* Kossenko, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR 11: 40. 1949.

硬稗稗 ying fu bai

Echinochloa crusgalli (Linnaeus) P. Beauvois var. *formosensis* Ohwi; *E. glabrescens* var. *barbata* Kossenko; *E. glabres-*

cens var. *glabra* Kossenko; *E. glabrescens* var. *pilosa* Kossenko; *E. micans* Kossenko; *E. pachychloa* Kossenko.

Culms erect or slightly decumbent at base, 50–120 cm tall. Leaf sheaths smooth and glabrous; leaf blades stiffly erect, linear, flat, 10–30 × 0.6–1.2 cm, glabrous, margins thickened, apex acuminate. Inflorescence narrow, 8–15 × 1–2(–3) cm; racemes 1–4 cm, simple. Spikelets light green, 3.5–5 mm, awnless or awned; glumes 5-veined; lower glume 1/3–1/2 as long as spikelet, acute; upper glume equal to spikelet, inconspicuously scabrous to shortly hispid along veins, cuspidate to awn-tipped; both lemmas coriaceous, hard and shining, especially down the center, the lower cuspidate to awned. Fl. and fr. summer–autumn. $2n = 54$.

Damp places, streams. Guangdong, Guangxi, Guizhou, Jiangsu, Sichuan, Taiwan, Yunnan, Zhejiang [Bhutan, NE India, Japan, Korea, Nepal; Africa].

This is an extreme variant from the *Echinochloa crusgalli* gene pool distinguished by the hard, glossy lower floret.

7. *Echinochloa crusgalli* (Linnaeus) P. Beauvois, Ess. Agrostogr. 53. 1812.

稗 bai

Annual. Culms coarse, erect or geniculate ascending, 20–150 cm tall. Leaf blades linear, 5–40 × 0.2–1.2 cm, usually glabrous, smooth except for scabrous margins, apex acute. Inflorescence erect, lanceolate to ovate or pyramidal, 6–22 cm; racemes 2–10 cm, usually ascending, simple or the longest with inconspicuous branchlets near the base, rachis usually with tubercle-based setae, spikelets loosely to densely crowded. Spikelets green or purplish, ovate, 2.5–4 mm, spinulose along veins; lower glume ca. 1/3 as long as spikelet, acute; lower lemma sterile, herbaceous, acuminate or extended into an awn to 3 cm; upper lemma pale brownish at maturity, elliptic, 2–3 mm. Fl. and fr. summer and autumn. $2n = 36, 48, 54, 72$.

Damp weedy places, streamsides, rice fields. Throughout China [warm-temperate and subtropical regions of the world].

Echinochloa crusgalli is a widespread, polymorphic weed with many intergrading variants. The following varieties may be recognized in China:

- 1a. Racemes with some secondary branching.
 - 2a. Racemes soft; awn of lower lemma 5–15(–30) mm 7a. var. *crusgalli*
 - 2b. Racemes stiff; awn of lower lemma absent or less than 5 mm 7b. var. *mitis*
- 1b. Racemes all simple.
 - 3a. Spikelets 3–4 mm, awnless 7c. var. *zelayensis*
 - 3b. Spikelets 2.5–3 mm, awnless or with awn less than 5 mm.
 - 4a. Leaf blades 2–5 mm broad; racemes erect, appressed to axis 7d. var. *austrojaponensis*
 - 4b. Leaf blades 4–10 mm broad; racemes ascending.
 - 5a. Spikelets green 7e. var. *brevisetata*
 - 5b. Spikelets purplish 7f. var. *praticola*

7a. *Echinochloa crusgalli* var. *crusgalli*

稗(原变种) bai (yuan bian zhong)

Panicum crusgalli Linnaeus, Sp. Pl. 1: 56. 1753; *Echinochloa hispidula* (Retzius) Nees; *Milium crusgalli* (Linnaeus) Moench; *Panicum hispidulum* Retzius; *Pennisetum crusgalli* (Linnaeus) Baumgarten.

Culms 50–150 cm tall. Leaf blades 10–40 × 0.5–2 cm. Inflorescence pyramidal, 6–20 cm; axis scabrous or with tubercle-based setae; racemes ascending, soft. Spikelets 3–4 mm, veins with tubercle-based setae; lower lemma with 5–15(–30) mm awn.

Damp weedy places, streamsides, rice fields. Throughout China [warm-temperate and subtropical regions of the world].

7b. *Echinochloa crusgalli* var. *mitis* (Pursh) Petermann, Fl. Lips. Excurs. 82. 1838.

无芒稗 wu mang bai

Panicum crusgalli var. *mite* Pursh, Fl. Amer. Sept. 66. 1813 [“1814”]; *Echinochloa crusgalli* subsp. *spiralis* (Vasinger) Tzvelev; *E. spiralis* Vasinger.

Culms robust, erect, 50–120 cm tall. Leaf blades 20–30 × 0.6–1.2 cm. Inflorescence 10–20 cm; racemes ascending or spreading, stiff, usually branched. Spikelets ca. 3 mm, awnless or with an awn less than 5 mm.

Roadsides, streamsides. Throughout China [warm-temperate and subtropical regions of the world].

7c. *Echinochloa crusgalli* var. *zelayensis* (Kunth) Hitchcock, Bull. U.S.D.A. 772: 238. 1920.

西来稗 xi lai bai

Oplismenus zelayensis Kunth, Nov. Gen. Sp. (quarto ed.) 1: 108. 1816 [“1815”]; *Echinochloa zelayensis* (Kunth) Schultes; *Panicum zelayense* (Kunth) Steudel.

Culms 50–75 cm tall. Leaf blades 5–20 × 0.4–1.2 cm. Inflorescence 11–19 cm. Spikelets 3–4 mm, hispid along veins but without tubercle-based setae; lower lemma usually awnless.

Streams, rice fields. Throughout China [America].

7d. *Echinochloa crusgalli* var. *austrojaponensis* Ohwi, Acta Phytotax. Geobot. 11: 38. 1942 [“*austrojaponensis*”].

小旱稗 xiao han bai

Culms 20–40 cm tall. Leaf blades often involute, 0.2–0.5 cm broad. Inflorescence narrow; racemes short, erect, appressed to axis. Spikelets purplish, 2.5–3 mm, hispid along veins; lower lemma awnless or with a short awn.

Streams, damp grasslands. Guangdong, Guangxi, Guizhou, Hunan, Jiangsu, Jiangxi, Taiwan, Yunnan, Zhejiang [Japan (Ryukyu Islands), Philippines].

7e. *Echinochloa crusgalli* var. *brevisetata* (Döll) Podpéra, Kvetena Moravy 6: 475. 1926.

短芒稗 duan mang bai

Panicum crusgalli var. *brevisetum* Döll, Fl. Bad. 1: 232. 1857.

Culms 30–70 cm tall. Leaf blades 8–15 × 0.4–0.6 cm. Inflorescence narrow, 8–10 cm. Spikelets green, ca. 3 mm, hispid along veins; lower lemma awnless or with a short awn less than 5 mm.

Grasslands. Guangdong, Taiwan [India, Malaysia, Sri Lanka; Africa].

7f. *Echinochloa crusgalli* var. *praticola* Ohwi, Acta Phytotax. Geobot. 11: 37. 1942.

细叶旱稗 xi ye han bai

Echinochloa crusgalli subsp. *submutica* (Meyer) Honda; *Panicum crusgalli* var. *submuticum* Meyer.

Culms usually purplish at base, 20–70 cm tall. Leaf blades 0.4–1 cm broad. Racemes simple, short, loose. Spikelets purplish, 2.5–3 mm, hispid along veins or with tubercle-based setae; lower lemma awnless.

Roadsides and other disturbed places. Anhui, Guangxi, Guizhou, Hebei, Hubei, Jiangsu, Taiwan, Yunnan [Japan].

This variety grows in rather drier conditions than the other varieties.

8. *Echinochloa caudata* Roshevitz in Komarov, Trudy Bot. Inst. Akad. Nauk SSSR, Ser. 1, Fl. Sist. Vyssh. Rast. 2: 91. 1936.

长芒稗 chang mang bai

Echinochloa crusgalli (Linnaeus) P. Beauvois subsp. *caudata* (Roshevitz) Tzvelev; *E. crusgalli* var. *caudata* (Roshevitz) Kitagawa.

Annual. Culms forming small dense tufts, 1–2 m tall. Leaf sheaths glabrous to tuberculate-hairy; leaf blades broadly linear, 10–40 × 1–2 cm, glabrous, margins thickened and scabrous. Inflorescence slightly nodding, spikelets dense, 10–25 × 1.5–4 cm, axis scabrous and bearing long tubercle-based setae. Spikelets purplish, ovate-elliptic, 2.5–4 mm; lower glume 1/3–2/5 as long as spikelet, acuminate; upper glume equaling spikelet, 5-veined, with a stout 0.1–0.2 mm mucro; lower lemma herbaceous, loosely hispid along veins, awn 3–5 cm; upper lemma coriaceous. Fl. and fr. summer–autumn.

Streams, fields, roadsides. Anhui, Guizhou, Hebei, Heilongjiang, Henan, Hunan, Jiangsu, Jiangxi, Jilin, Nei Mongol, Shanxi, Sichuan, Xinjiang, Yunnan, Zhejiang [Japan, Korea, Mongolia, Russia (Far East)].

This is a segregate from *Echinochloa crusgalli* with a very dense, purple inflorescence and long awns.

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