Research note

# *Chloris divaricata* (Poaceae) and Its Variety *C. divaricata cynodontoides* in Taiwan

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【Summary】

*Chloris divaricata* R. Br. and its variety *C. divaricata cynodontoides* (Bal.) Lazarides (Poaceae) have become naturalized in Taiwan. *Chloris divaricata*, which was misidentified as *Chloris divaricata* var. *cynodontoides*, was annotated. *Chloris divaricata* var. *cynodontoides* was discovered in the Penghu archipelago in a recent botanical survey. Descriptions, color photos, an illustration, and a distribution map of *Chloris divaricata* and its variety *cynodontoides* are offered.

**Key words:** *Chloris divaricata*, *Chloris divaricata* var. *cynodontoides*, naturalization, Poaceae, Taiwan.

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研究簡報

# 台灣的垂穗虎尾草(*Chloris divaricata*) (Poaceae)及其變種澳洲虎尾草(*C. divaricata* var. *cynodontoides*)

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## 摘 要

禾本科垂穗虎尾草(*Chloris divaricata* R. Br.)及其變種澳洲虎尾草(*C. divaricata* R. Br. var. *cynodontoides* (Bal.) Lazarides)歸化於台灣；以往在台灣被鑑定為澳洲虎尾草者，應為垂穗虎尾草；澳洲虎尾草則於近期的植物調查中，在澎湖群島尋獲；本文提供垂穗虎尾草及澳洲虎尾草的描述、線繪圖、彩色照片及分布圖。

**關鍵詞：**垂穗虎尾草、澳洲虎尾草、歸化、禾本科、台灣。

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The genus *Chloris* Swartz consists of several tropical to subtropical weeds in the world (Hsu 1978, 2000, Barkworth et al. 2003, Nightingale et al. 2005, Quattrocchi 2006). Five species of the genus *Chloris* were recorded in the *Flora of Taiwan* (Hsu 1975, 1978, 2000, Chen and Wu 2005, Chen 2008). *Chloris divaricata* R. Br. var. *cynodontoides* (Bal.) Lazarides was reported as a newly naturalized weed in central and eastern Taiwan (Chen and Wu 2005, Chen 2008). After examining the literature (Barkworth et al. 2003, Chen and Wu 2005, Nightingale et al. 2005, Chen 2008) and a voucher cited by Chen and Wu (2005), the grass described and illustrated with flexible digitate racemes by Chen and Wu (2005) and Chen (2008), must be annotated as *C. divaricata* R. Br. The digitate racemes of *C. divaricata* are flexible, rather than the rigid ones of *C. divaricata* var. *cynodontoides* (Barkworth et al. 2003, Nightingale et al. 2005). In our field survey, *C. divaricata* var. *cynodontoides* was found to be one of the naturalized grasses in abandoned lowlands and grasslands in the Penghu archipelago (Fig. 1). Descriptions, an illustration (Fig. 2), and a distribution map (Fig. 1) of *C. divaricata* and *C. divaricata* var. *cynodontoides* are offered. We also offer a bracket key for these *Chloris* grasses in Taiwan.

**Key to species of *Chloris* in Taiwan**

1. Spikelet outline lanceolate or oblong; apex of 2nd lemma bifid. ..... 2
1. Spikelet outline obovate; 2nd lemma apex acute, obtuse or truncate, not bifid. ..... 3
   2. Digitative racemes flexible. ..... *C. divaricata*
   2. Digitative racemes rigid. ..... *C. divaricata* var. *cynodontoides*
      3. Sterile lemma orbiculate, global. ..... *C. barbata*
      3. Sterile lemma obovate, slightly compressed. ..... 4
         4. Awn of 1st lemma shorter than 5 mm, marginal cilia of lemma shorter than 1 mm. ..... *C. gayana*
         4. Awn of 1st lemma longer than 5 mm,

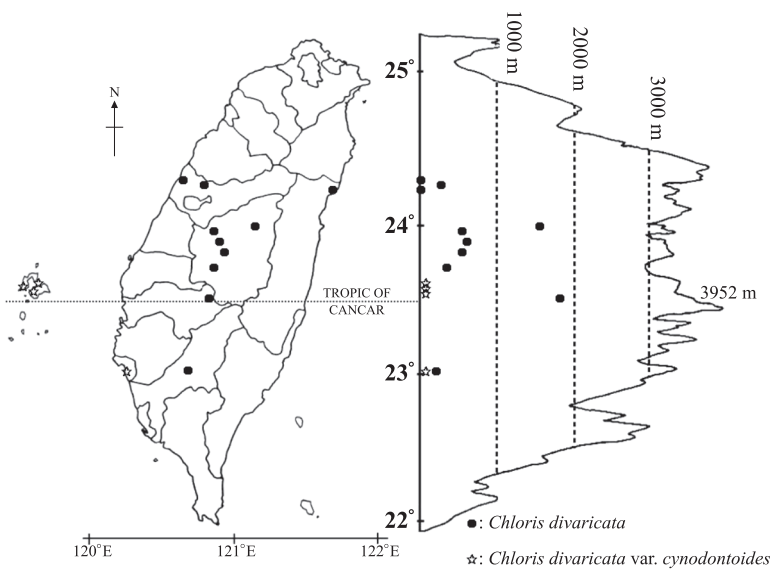


**Fig. 1. Distribution map of *Chloris divaricata* var. *divaricata* (●) and *C. divaricata* var. *cynodontoides* (☆).**

marginal cilia of lemma longer than 1 mm. ..... 5

5. Intercostal regions of 1st lemma grooved, and grooves pilose. ..... ..... *C. formosana*

5. Intercostal regions of 1st lemma not grooved. ..... *C. virgata*

## TAXONOMIC TREATMENT

1. *Chloris divaricata* R. Br., Prodr. 186. 1810. Barkworth et al., In: Fl. North Am. 25:204-218. 2003; Nightingale et al., In: Fl. Aust. 44:269-282, 2005; Quattrocchi, CRC world dictionary of grasses, p 475-488, 2006.

*Chloris divaricata* var. *cynodontoides* auct. non. Chen and Wu, 2005. Taiwania 50(1):29-39; Chen, Naturalized plants of eastern Taiwan, p 308-309, 2008..... .....垂穗虎尾草Figs. 1, 2A, C-R, 3A

Perennial, rhizome lacking, rooting at basal nodes, stem shorter than 0.5 m, culms erect, ascending, or stoloniferous; nodes as wide as culm, glabrous, intra-sheath branching, internode surface glabrous. Leaf sheath compressed, glabrous on surface, margin of leaf sheath glabrous, membranous, phyllotaxis alternate, leaf blade 2~6 cm long, linear, base cuneate, sessile, collar none, blade apex acute to obtuse, margin entire, adaxial surface glabrous, blade with unique and dominant midrib, without tessellate veinlet; ligule 0.15~0.2 mm long, membranous, abaxial surface glabrous, margin fringed, hairs 0.07~0.1 mm. Inflorescence an apical, spreading digitate raceme, 1- or 2-whorled, axis glabrous, axis to 1 cm long, branch lengths equal or nearly equal, to 7 cm long; spreading to horizontal, flexible; spikelets solitary on each raceme, bisexual, outline lanceolate or oblong, to 3.5 mm long, rachis compressed, hispidulate; glumes persistent when florets fall, lower glume lanceo-ovate, membranous, 1-nerved, glabrous or hispidulate on veins, apex acute to acuminate, margin membranous, 1.8~2 mm long; upper glume lanceolate, herbaceous, 1-nerved, glabrous or hispidulate on vein,

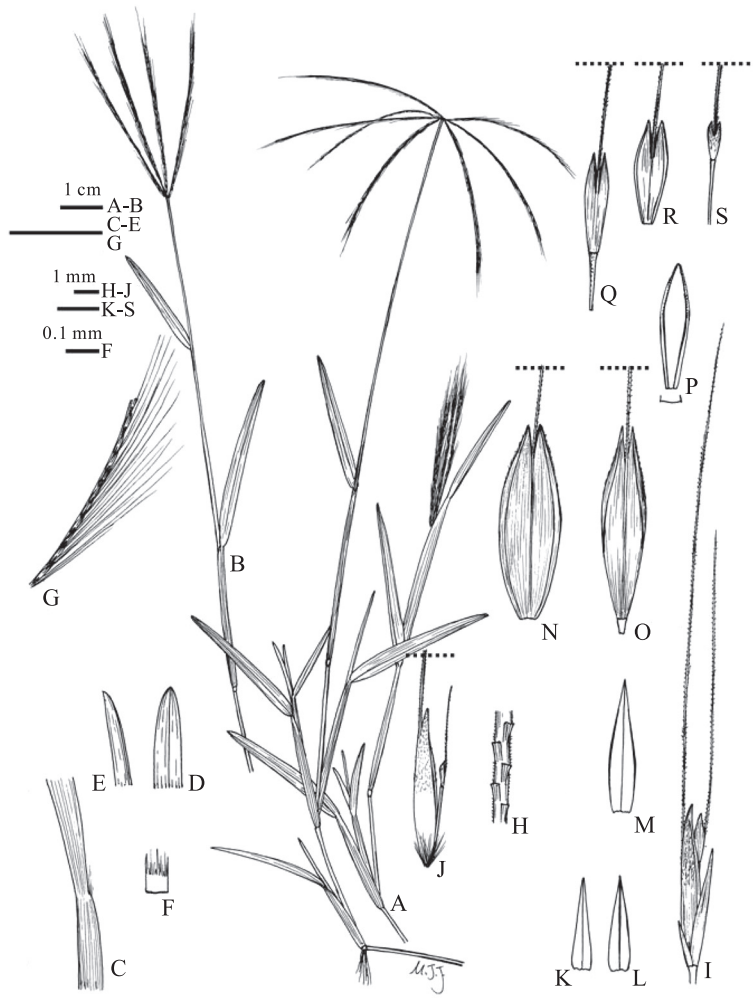


**Fig. 2.** ***Chloris divaricata*** **var.** ***divaricata*** **and var.** ***cynodontoides*****. A, B: Habit, A: var.** ***divaricata*****; B: var.** ***cynodontoides*****; C: lateral view of blade base; D, E: blade apex, E: lateral view; F: ligule; G: part of raceme, lateral view; H: part of raceme axis, glumes removed to show the rachis; I: spikelet, lateral view; J: florets, lateral view; K, L: lower glumes; M: upper glume; N, O: lemma of 1st floret, N: flattened; P: palea of first floret; Q-S: lemma of 2nd floret, R: flattened.**

margin membranous, apex acute, to 2.5 mm long; only 2 florets in each spikelet, rachilla hispidulate, articulated, falling with matured florets; 1st floret bisexual, lemma of 1st floret ellipse to obovate, 3-nerved, coriaceous, surface glabrous to sparsely hispidulate, scabrous, to 3.5 mm long, apex bifid, teeth glabrous, apical notch ca. 0.7 mm deep, lemma apex awned, awn straight, to 13 mm long, rising from notch of lemma apex, extending from spikelet, lemma margin coriaceous, reflexed or not, glabrous, hispidulate to minutely ciliate, not dominant; palea of 1st floret oblanceolate, herbaceous, shorter than lemma, apex acute, 2-keeled, upper part of keels hispidulate, glabrous at intercostal region, anthers 3; caryopsis included in floret when mature, oblong to fusiform, surface glabrous,

without persistent style, cross section of caryopsis deltoid; 2nd floret sterile, rachilla ca. 1 mm long, lemma of 2nd floret oblanceolate to obovate, coriaceous, 0- or 3-nerved, 0.5~1.5 mm long, shorter than lower glume and 1st lemma, apex bifid, apical teeth ca. 1/3 length of sterile lemma, apical teeth glabrous or hispidulate, awned, rising from notch of lemma apex, awn straight, 2~7 mm long, extending from spikelet, margin coriaceous, reflexed or not, palea lacking.

Habitats: *Chloris divaricata* R. Br. is usually found on abandoned land, in gardens, nurseries, or roadsides, in lowlands to middle elevations. *Sporobolus tenuissimus* (Mart. Ex Schrak) Kuntze), another newly naturalized grass (Jung et al. 2005), is usually found with *C. divaricata* in gardens and nurseries.

Distribution: *Chloris divaricata* is native to Australia, and naturalized in Okinawa and North America (Hatusima 1971, Shimabuku 1997, Barkworth et al. 2003, Nightingale et al. 2005, Quattrocchi 2006). In Taiwan, *C. divaricata* is naturalized in low and middle elevations in central and eastern Taiwan (Fig. 1) (Chen and Wu 2005, Chen 2008). In one of our recent botanical surveys, this grass was also found at Liouguei, at a low elevation in southern Taiwan.

Notes: The vernacular name of *C. divaricata* is spreading windmill-grass. The description of *C. divaricata* var. *cynodontoides* in Taiwan (Chen and Wu 2005, Chen 2008) exactly fits the characters of *C. divaricata* (Barkworth et al. 2003, Nightingale et al. 2005, Quattrocchi 2006). Flexible digitate racemes are given on illustrations and color photos offered by Chen and Wu (2005), Chen (2008), and here (Fig. 3A). The sterile lemma of *C. divaricata* is obovate or oblanceolate (Fig. 2Q-S). The apical teeth of the sterile lemma are about 1/3 the length of the obovate sterile lemma (Fig. 2Q, R), or are not present in the oblanceolate sterile lemma.

Specimens examined: Taiwan. Chiayi Co., Alishan Township, Alishan Youth Activity Center, 14 Feb 2006, *M.-J. Jung x021404* (TAIF); Hualien Co., Sioulin Township, Chingshui, 14 Dec 2007, *M.-J. Jung 2060* (TAIF); Kaohsiung Co., Liouguei Township,


**Fig. 3. Digitate racemes of *Chloris divaricata* var. *divaricata* (A) and *Chloris divaricata* var. *cynodontoides* (B).**

nursery of Liouguei Branch, Taiwan Forestry Research Institute, 15 Apr 2009, *M.-J. Jung 3932* (TAIF); Nantou Co., Guosing Township, Changliu Village, 22 Mar 2007, *M.-J. Jung z032208* (TAIF), Jenai Township, Lushan, 4 Mar 2009, *M.-J. Jung 3765* (TAIF), Luku Township, Luku, 21 Oct 2007, *M.-J. Jung 1714* (TAIF), Puli Township, Liyutan, 26 Mar 2004, *M.-J. Jung w032602* (NCKU), Yuchi Township, Jihyehtan (Sun-Moon Lake), 7 Nov 2007, *M.-J. Jung 1799* (TAIF), at the same site, 28 Apr 2008, *M.-J. Jung 2751* (TAIF), Lianhuachih Research Center, 25 Nov 2007, *M.-J. Jung 1987* (TAIF), Wucheng, 19 Feb 2008, *M.-J. Jung 2343* (TAIF); Taichung Co., Chingshui Township, Chingshui, 14 Dec 2008, *M.-J. Jung 2060* (TAIF), Tungshih Township, Lanshih Bridge, 7 Oct 2008, *M.-J. Jung 3529* (TAIF).

2. *Chloris divaricata* R. Br. var. *cynodontoides* (Balansa) Lazarides. Aust. J. Bot., Suppl. Ser. 5:18. 1972. Nightingale et al., In: Fl. Aust. 44:269-282, 2005; Quattrocchi, CRC world dictionary of grasses, p 475-488, 2006. —*Chloris cynodontoides* Balansa. Bull. Soc. Bot. Fr. 19:318. 1872. .. .....澳洲虎尾草Figs. 1, 2B-R, 3B

Digitate racemes spreading to horizontal, rigid.

Habitats: *Chloris divaricata* var. *cynodontoides* is distributed in unshaded grasslands and roadsides of low elevation in the Penghu archipelago (Fig. 1).

Distribution: *Chloris divaricata* var. *cynodontoides* is native to Australia (Nightingale et al. 2005, Quattrocchi 2006).

Notes: Two vouchers of *C. divaricata* var. *cynodontoides* were collected from southern Taiwan and the Penghu archipelago around 100 yr ago. This grass was neglected in the *Flora of Taiwan* (Hsu 1978, 2000).

Specimens examined: Taiwan. Tainan, 19 Aug 1908, *T. Kawakami & Y. Shimada s. n.* (TAIF); Penghu Co., Hushi Township, Chinluo, 28 Aug 2008, *M.-J. Jung 3335* (TAIF); Magong City, Guanyingting, 25 Aug 2008, *M.-J. Jung 3267* (TAIF), Penghu, 1 July 1919, *Hayata s. n.* (TAIF), South Sea Recreation Service Center, 25 Aug 2008, *M.-J. Jung 3249* (TAIF); Fongguei, 24 Aug 2008, *M.-J. Jung 3244* (TAIF); Siyu Township, 27 Aug 2008, *M.-J. Jung 3300* (TAIF), Nai-an, 27 Aug 2008, *M.-J. Jung 3318* (TAIF); Yuwong Lighthouse, 27 Aug 2008, *M.-J. Jung 3312* (TAIF).

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