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Notes on *Eragrostis* Wolf (Poaceae) for the Flora of Taiwan

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ABSTRACT: *Eragrostis atrovirens* (Desf.) Trin. ex Steud. and *E. tenuifolia* (A. Rich.) Hochst. ex Steud. are new records for Taiwan. *Eragrostis curvula* (Schrad.) Nees has now become naturalized in low to high elevations. Descriptions, distribution maps, and line-drawings are presented.

KEY WORDS: *Eragrostis atrovirens, Eragrostis brownii, Eragrostis bulbillifera, Eragrostis curvula, Eragrostis tenuifolia,* Poaceae, Taiwan.

INTRODUCTION

The genus *Eragrostis* Wolf (Poaceae) has ca. 410 species (Clayton et al., 2002) in the tropics and subtropics of the world, and sixteen species in Taiwan (Chen and Paul, 2006; Hsu, 2000). Because of this wide distribution the identification of new records is quite difficult. *Eragrostis atrovirens* (Desf.) Trin. ex Steud. had been misidentified as *E. bulbillifera* Steud. or *E. cumingii* Steud. In our revision of the genus for Taiwan we have discovered three species new to the island.

Eragrostis atrovirens and *E. tenuifolia* (A. Rich.) Hochst. ex Steud.) occur at low elevations in northern and central Taiwan. *Eragrostis curvula* (Schrad.) Nees was introduced for slope protection and pastures (Hsu, 1975) but now has established itself in low and high elevations (Fig. 1). *Eragrostis bulbillifera* is a synonym of *E. brownii* (Kunth) Nees (Veldkamp, 2002).

TAXONOMIC TREATMENTS

1. ***Eragrostis atrovirens*** (Desf.) Trin. ex Steud. Nomencl. Bot. ed. 2 1: 562. 1840. Veldk., Blumea 47: 167. 2002. 鼠婦草 Figs. 1 & 2

Perennial, culms erect to ascending, to 50 cm long, nodes glabrous, exposed; sheath 5-10 cm long, shorter than the internode, ligule ca. 0.2 mm long, membranous, blade linear, 8-20 cm long, base adaxially pilose, hairs 4-8 mm long. Panicles 10-20 cm long, constricted to open. Spikelets disarticulating from the base upward, rachilla persistent. Glumes early deciduous, similar, 1-nerved, apex acute; lower glume ovate-lanceolate, 1-1.5 mm long; upper glume ovate. Lemma soon deciduous, ovate, 1.5-2 mm long, apex acute, 3-nerved. Palea soon deciduous, elliptic, apex acute, as long as the lemma, 2-keeled, keels scabrous. Lodicules ca. 0.2 mm long, apex truncate; anthers 3, 0.7-0.8 mm long. Caryopsis ellipsoid, surface striolate, cross section round, 0.6-1 mm long.

Specimens examined: China. Guangdong Province, Shingning City, Dutien River Preserved area, 400 m, *H.-G. Yei & U.-S. Yer* 9647 (TNM). Taiwan. Taipei City, Campus of National Taiwan University, *M.-J. Jung z020401*; Muzha Daunan Riverside Park, *M.-J. Jung x021903* (NCKU). Tauyuan Co., *Y. Simada 420* (HAST). Hsinchu Co., Jhu-Bei City, Lienhwashih, *C.-I Peng 5120*, *8594* (HAST), *M.-J. Jung z041206*, *z041207*. Miaoli Co., Miao-Li City, Fifth Public Cemetery, *M.-J. Jung y123101, z012106*; San-Yi Town, Huoyanshan Tunnel, *M.-J. Jung z032905*; Tong-Luo Town, Chu-Tzen, *M.-J. Jung z032903*, Shuang-Fong-Shan, *M.-J. Jung y122304*; Tong-Siao Town, Fifth Public Cemetery, *M.-J. Jung y122307, z070502*. Changhua Co., Chang-Pin Industrial area, near the Chung-Hua Construction Site, *T.-Y. Yang 3996* (TNM). Nantou Co., Yu-Chih Town, Lienhwachih, *M.-J. Jung z032202*; Shin-Shan Forestry Road, *M.-J. Jung z032203*.

Distribution and Notes: *Eragrostis atrovirens* (thalia lovegrass, wiry lovegrass) is native in tropical Africa and Asia (Chen and Paul, 2006), and has been introduced into the Pacific, North America (Clayton et al., 2002; USDA, NRCS. 2004), Mexico (Villasefior and Espinosa-Garcia, 2004), and Australia (Veldkamp, 2002). In Taiwan, *Eragrostis atrovirens* occurs in waste areas at low elevations in northern and central Taiwan (Fig. 1), and is bound to spread.

The application of this name in SE Asia is a bit confusing. Honda (1930) recorded it for Japan, the Northern Ryukyu Islands, and Taiwan with *E. bulbillifera* as a synonym. Ohwi (1965), however, considered it as misapplied to *Eragrostis bulbillifera*. Chen and Paul (2006), Hsu (1978), and Koyama (1987) regarded it as belonging to *E. cumingii*. Osada

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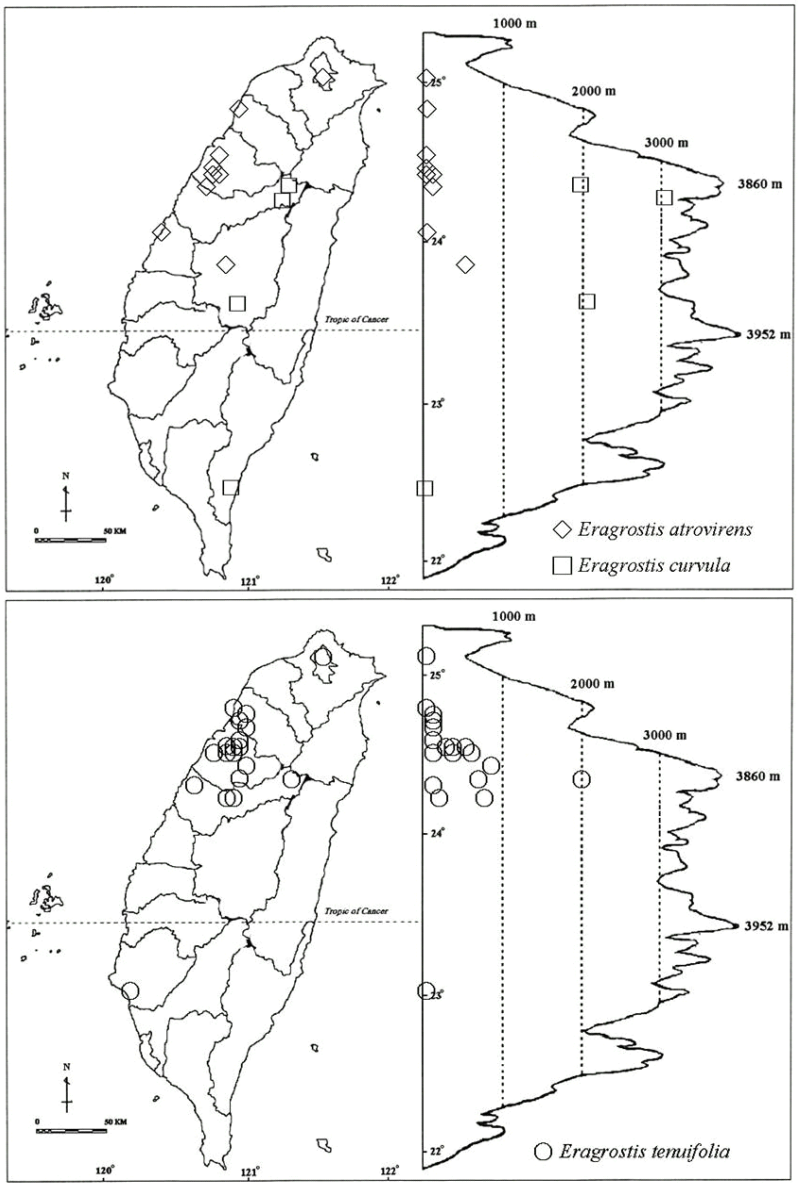

Fig. 1. Distribution map of *Eragrostis atrovirens* (Desf.) Trin ex Steud. (◇), *E. curvula* (Schrad.) Nees (□), and *E. tenuifolia* (A. Rich.) Hochst. ex Steud. (○) in Taiwan.

(1993) treated *Eragrostis bulbillifera* and *E. cumingii* as two distinct species, and recorded *E. bulbillifera* for north-eastern Asia, Indonesia, and Taiwan. Veldkamp (2002) having seen the holotype treated it as a synonym of *Eragrostis brownii* (Kunth) Nees, and recognized *E. atrovirens*, *E. brownii*, and *E. cumingii* as three different species in Malesia. *Eragrostis bulbillifera* mentioned for Taiwan by Hsu (2000) belongs to *E. brownii*.

The paleas of *Eragrostis atrovirens* are early deciduous and the rachilla joints then become exposed. The anthers of *Eragrotis atrovirens* (0.5-1 mm) are longer than those of *E. brownii* and of *E. cumingii* (1/4-1/3 mm) and yellow, not purple.

2. ***Eragrostis brownii*** (Kunth) Nees. Cat. Indian Pl. 105. 1834. Veldk., Blumea 47: 169. 2002.

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Eragrostis bulbillifera Steud. Syn. Pl. Glumac. 1: 267. 1854; Osada T., Ill. Grasses Jap. Enlarged Ed. 482. 1993; Hsu, C.-C., Fl. Taiwan, 2nd ed. 5: 416. *pl.* 170. 2000.

3. ***Eragrostis curvula*** (Schrad.) Nees. Fl. Afr. Austral. Ill. 397. 1841. Osada, T., Ill. Grasses Jap. Enlarged Ed. 488. 1993. Illustrated Grasses of Japan 488-489. Veldk. Blumea 47: 173. 2002.

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Fig. 2. *Eragrostis atrovirens* (Desf.) Trin ex Steud. A: Habit. B: Ligule. C: Spikelet. D: Spikelet when caryopsis mature. E: Lower glume. F: Upper glume. G: Lemma. H: Palea, abaxial view. I: Palea, adaxial view. J: Lodicules. K: Anther. L: Caryopsis, lateral view. M: Caryopsis, showing the embryo.

Tufted, perennial herbs, culms erect, leaf sheath glabrous or pubescent, hairs 1-2 mm long, collar pubescent, hairs 1-2 mm long, ligule a row of c. 0.5 mm long hairs, 3-4 mm wide, leaf blade linear, 10-30 × 0.1-0.3 cm. Panicles open, to 15 cm long, nodes and branch base pilose, hairs 1.5-2.5 mm long. Spikelets disarticulating from the base upward, linear to lanceolate. Glumes 1-nerved, scabrous on the nerve, apex acute; lower glume lanceolate, ca. 1.5 mm long; upper glume ovate-lanceolate, ca. 2 mm long; rachilla persistent, 0.6-0.8 mm long, nearly 1/3 as long as the lemma. Lemma deciduous, elliptic, 3-nerved, 2-2.5 mm long, apex acute; palea persistent, oblong, keels smooth to minutely scaberulous, 2-2.5 mm long, similar to the lemma, apex acute; lodicules 2, membranous, ca. 0.3 mm long, anthers 3, 1.3-1.5 mm long. Caryopsis ellipsoid, dorso-ventrally compressed, 1.3-1.4 mm long, dorsally not grooved.

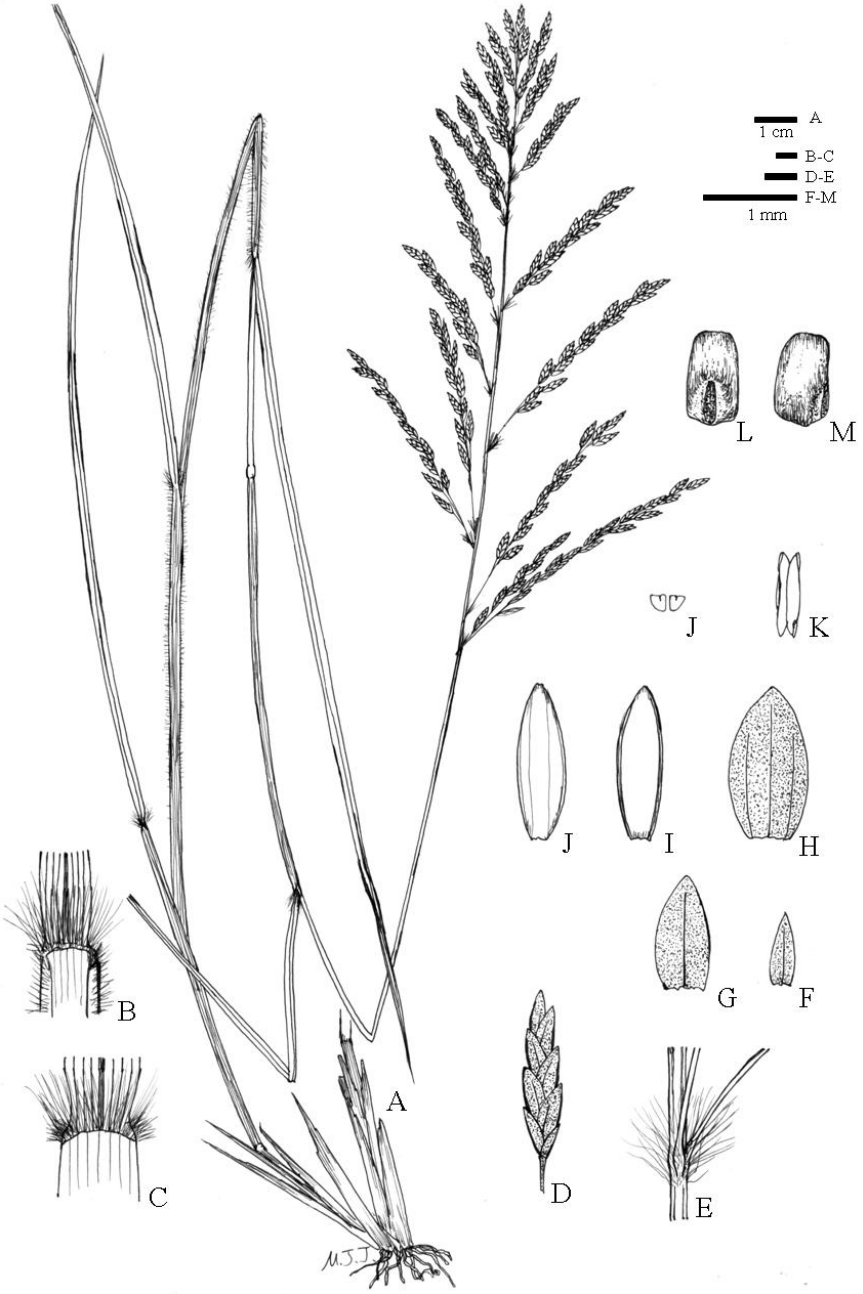

Fig. 3. *Eragrostis curvula* (Schrad.) Nees. A: Habit. B and C: Ligules. D: Inflorescence node. E: Spikelet. F: Lower glume. G: Upper glume. H: Lemma. I: Palea, abaxial view. J: Palea, adaxial view. K: Anther. L: Lodicules.

Specimens examined: Nantou Co., Hsin-Yi Town, Guanshan Tunnel No. 2, *M.-J. Jung y070301* (NCKU). Taichung Co., Heping Town, Wuling Farm, *M.-J. Jung z051001*(HAST, TAIF); Shaan-shan, *T.-T. Lin and T.-H. Hsieh s.n.* (TAIF). Taitung Co., Taimali Town, Jingluen River Bridge, *M.-J. Jung x010203* (NCKU).

Distribution and notes: *Eragrostis curvula* (African or weeping lovegrass) is native in South Africa, and has been introduced widely into the tropics for ornament, fodder (but sometimes poisonous (triglochinin)), or slope protection (Chen and Paul, 2006; Fairbrothers, 1960; Hsu, 1975; Osada, 1993; USDA, NRCS., 2004; Veldkamp, 2002). This lovegrass has naturalized in low to high elevations in Taiwan (Fig. 1).

It may be confused with *Eragrostis nutans* (Retz.) Nees ex Steud. and *E. pilosa* (L.) P. Beauv. The ligule of *Eragrostis curvula* is a row of c. 0.5 mm long hairs, while that of *E. nutans* is a fringed membrane. Bearded inflorescence nodes are present in *E. curvula* and *E. pilosa*. However, *Eragrostis curvula* is a perennial, and *E. pilosa* an annual. The anthers of *E. curvula* are 1.3-1.5 mm long, much longer than those of *E. pilosa* (0.15-0.2 mm).

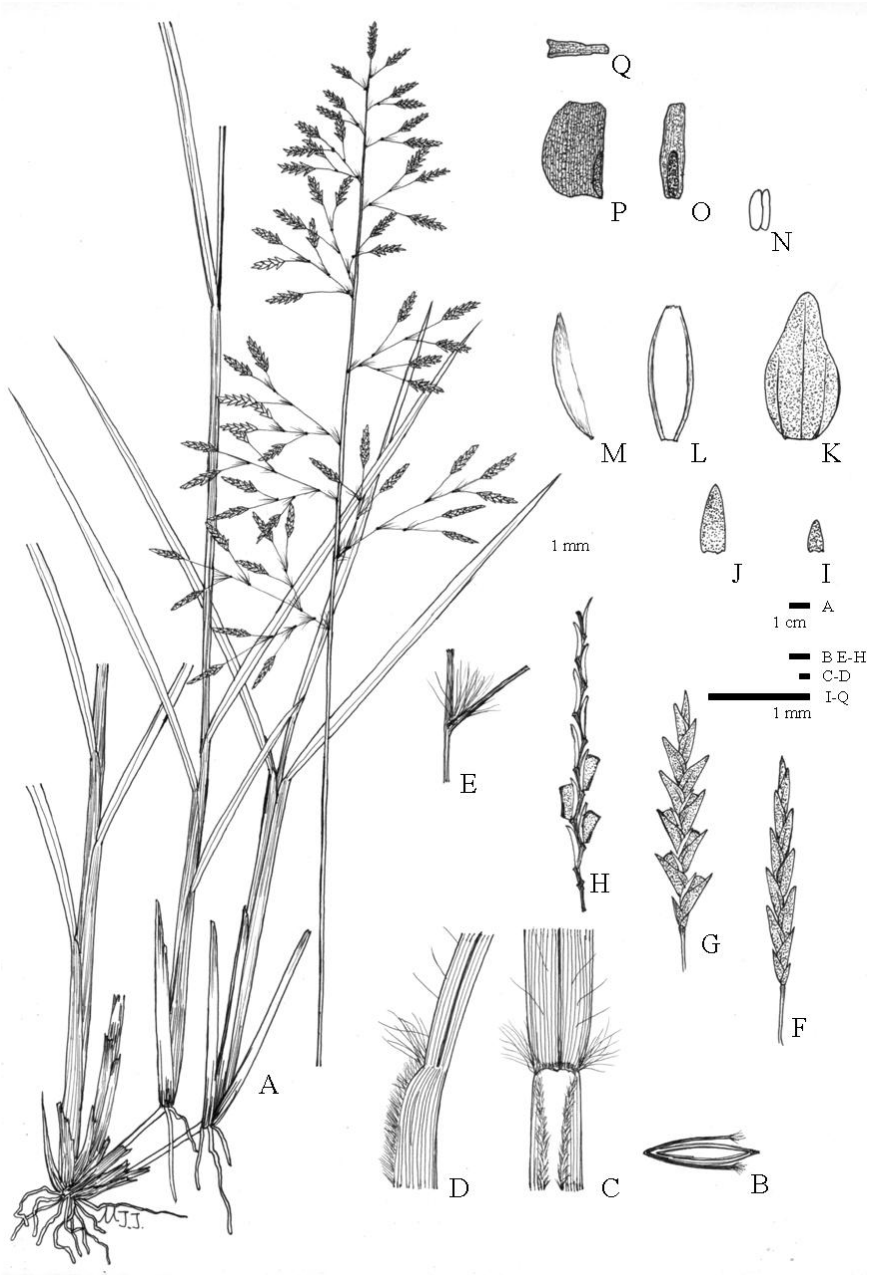

Fig. 4. *Eragrostis tenuifolia* (A. Rich.) Hochst. ex Steud. A: Habit. B: Cross section of stem. C: Ligule. D: Leaf sheath and base of blade, lateral view. E: Axial pilose hairs on inflorescence branch. F: Immature spikelet. G: Fruiting spikelet. H: Rachilla with caryopsis and persistent paleas. I: Lower glume. J: Upper glume. K: Lemma. L: Palea, abaxial view. M: Palea, lateral view. N: Anther. O: Caryopsis, showing the embryo. P: Caryopsis, lateral view. Q: Caryopsis, apical view.

4. ***Eragrostis tenuifolia*** (A. Rich.) Hochst. ex Steud. Syn. Pl. Glumac. 1: 268. 1854. Veldk., Blumea 47: 187. 2002. 薄葉畫眉草 Figs. 1 & 4

Tufted, perennial, erect or geniculate, rooting in the geniculate nodes, sheath glabrous, slightly shorter than the internode, margin ciliate, cilia ca. 1 mm long, sheath collar pilose, hairs to 2 mm long; ligule a row of hairs, ca. 0.25 mm long; leaf blade linear, adaxial surface glabrous to pubescent, abaxial surface glabrous, strongly nerved with central and/or lateral veins, 10-20 cm × 4-6 mm. Panicle open, branch axils pilose, hairs to 1.5 m long. Spikelet disarticulating from the base upward, linear, strongly laterally compressed, with a jagged outline. Lower glume ovate-lanceolate, 0-nerved, ca. 0.3 mm long, apex acuminate; upper glume lanceolate, ca. 0.7 mm long, apex acute. Rachilla as long as the palea. Lemma deciduous at maturity, lanceolate, 1-3-nerved, ca. 2 mm long, apex acuminate; palea persistent, elliptic, keels glabrous, 1.5-2 mm long, apex obtuse; anthers 3, 0.2-0.5 mm long. Caryopsis ellipsoid, strongly flattened, rectangular in cross-section, dorsally grooved, 0.8-1.2 mm long, surface reticulate, apex obtuse; embryo nearly half as long as the caryopsis.

Specimens examined: Taiwan. Taipei City, Da-Jia Riverside Park, *M.-J. Jung z050502*. Hsinchu City, Nan-Liao Old Port, *M.-J. Jung z041208*; Shih-Pa-Chien-Shan, *M.-J. Jung z050201*; Qing-Cao-Hu, *M.-J. Jung z050205*. Hsinchu Co., Bao-Shan Town, Bao-Shan Reservoir, *M.-J. Jung z050206*. Miaoli Co., Da-Hu Town, Da-Ging-Fuo Temple, *G.-I. Liao et al. s.n.* (NCKU); Nan-Hu, *M.-J. Jung z043001*; Wen-Shuei, *M.-J. Jung z043002*; Gong-Guan Town, Fu-Ji, *M.-J. Jung z043003*; Nan-Juang Town, Nanjuang, *M.-J. Jung z062104*; Tai-An Town, Hushan, *M.-J. Jung z062105*; Meiyuan, *M.-J. Jung z063004*; Shihlin, *M.-J. Jung z063005*; Tong-Luo Town, Chu-Tzen, *M.-J. Jung z070103*; Jiuhuashan, *M.-J. Jung z012804*; Tong-Siao Town, Wu-Mei, *M.-J. Jung z071009*. Taichung Co., Chin-Shui Town, Ao-Feng Park, *M.-J. Jung z041303*; Heping Town, Wuling Farm, *M.-J. Jung z051005*; Tung-Shih Town, Dong-Ken, along the Dasyueshan Forestry Road, *M.-J. Jung z052901*; Tungshih Riverside Park, *M.-J. Jung z052905*. Tainan City, Tzu-chiang Campus in NCKU, *M.-J. Jung 357* (NCKU).

Distribution and notes: *Eragrostis tenuifolia* (elastic grass) is native to Indochina, southern Asia, Madagascar, and Tropical Africa, and was introduced elsewhere, e.g. in Mexico (Villasefior and Espinosa-Garcia, 2004), Australia, Malesia, New Guinea, Philippines, and Southern America (Veldkamp, 2002), and Hawaii (USDA, NRCS., 2004). Since the early 1990s, elastic grass is rapidly spreading in Indonesia: in 2006 the second author saw it everywhere in N. Sumatra and Central and East Java, but none when in Java in 1992. This grass is eaten by cattle, but resistant to trampling, mowing, fire, and difficult to pull up by hand. In 2007 it was a weed along roadsides, in wastelands, and park lawns of western Taiwan (Fig. 1), and is bound to spread.

It is similar to *Eragrostis curvula*, *E. pilosa*, and *E. pilosiuscula* Ohwi by its open panicle and long pilose hairs in the axils of its branches but it is immediately distinct by the jagged outline of the spikelets (Fig. 4G). The back of the strongly flattened caryopsis is grooved (Fig. 4O), while the grains of *Eragrostis pilosa* are not. *Eragrostis curvula* has somewhat dorso-ventrally compressed caryopses and longer anthers (0.9-1.25 mm long). The nerveless glumes are also diagnostic, that they are 1-nerved in *Eragrostis curvula*, *E. pilosa*, *E. pilosissima*, and *E. pilosiuscula*. *Eragrostis ferruginea* (Thunb.) P. Beauv. is similar to *E. tenuifolia* in its caryopses, however, the axils of the inflorescence branches and the margins of the sheath are glabrous, rather than pilose (Figs. 4B, C and D).

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臺灣產畫眉草屬(*Eragrostis* Wolf, Poaceae)補註

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摘　　要

本文報導最近於臺灣發現的禾草：鼠婦草(*Eragrostis atrovirens* (Desf.) Trin. ex Steud.)、及薄葉畫眉草(*E. tenuifolia* (A. Rich.) Hochst. ex Steud.)，本文除提供描述、分布圖及線繪圖外，並一併描述歸化於低至高海拔的垂愛草(*E. curvula* (Schrad.) Nees)。

關鍵詞：鼠婦草、長畫眉草、肯氏畫眉草、垂愛草、薄葉畫眉草、禾本科、臺灣。

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