NOTE

Remarks on the Species of *Gomphrena* (Amaranthaceae) of Taiwan

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ABSTRACT: *Gomphrena serrata*, an Amaranthaceous species of tropical origin, was recently found naturalized in disturbed sites of Taiwan. This species has been confused with *G. celosioides,* widespread on this island. The present study gives a key and useful characters to differentiate the present species from the latter. A taxonomic treatment of the two species in Taiwan, line drawings and other relevant information are provided.

KEY WORDS: *Gomphrena, Gomphrena celosioides, Gomphrena serrata,* naturalized plant, Taiwan, taxonomy, weed.

INTRODUCTION

Gomphrena L. (Gomphrenoideae; Amaranthaceae) is a genus of about 100 species (Townsend, 1995; Clemants, 2003), occuring throughout the warm temperate, subtropical and tropical regions of the world, with most of its species in North and South America and Pacific Islands (Bao et al., 2003). Two alien species, *G. globosa* L. and *G. celosioides* Mart. is presently known to occur in Taiwan (Huang, 1997; Yang, 1982; Boufford, et al., 2003). However, being found only in cultivation and having never been encountered wild, *G. globosa* was not included in the *Flora of Taiwan* in both the first and the second edition (Liu and Kao, 1976, 1996). *Gomphrena celosioides*, therefore, becomes the only species occurred in spontaneous flora on this island.

Recently on a field trip to the southern part of Taiwan, *Gomphrena serrata* L., a species of tropical American origin, not previously reported in literature pertaining to the flora of Taiwan was *collected*. Initially *G. serrata* was thought of as being newly introduced. An examination of the Amaranthaceous specimens deposited at TNM and PPI, however, revealed several additional collections made during the past twenty years from several central and southern counties. All specimens were erroneously annotated as *G. celosioides*. It thus becomes apparent that it represents an overlooked species on this island. *Gomphrena serrata* grows in similar locations and looks similar to *G. celosioides* in habit. It might be mistaken for that completely separate taxon in herbaria, but they are much easier to distinguish in the field.

The present study gives a taxonomical treatment of the two species, based on our collections and specimens from *herbaria* of National Museum of Natural Science (TNM) and National Pingtung University of Science and Technology (PPI). The description, illustrations, and useful diagnostic characters of the two species are given as follows. In addition, its distribution and habitat information are provided.

Key to the *Gomphrena* Species in Taiwan

1. Plant whitish green to yellowish green; leaf oblong to oblong-oblanceoate, obtuse at apex, shining, glabrous or remotely sericeous on upper surface; spike dull-white, cylindrical, elongating to a long cylinder up to 8.5 cm long; bracteole crest small, confined to upper one-third of the bracteole, with unconspicuous teeth on the uppermost margin ……..... ***G. celosioides***
1. Plant green to dark green; leaf elliptic to oblong-obovate, acute at apex, pubescent on upper surface; spike snow-white, globose, elongating to a cylinder up to 2.5 cm long; bracteole crest large, extending from the apex to or beyond the middle of the bracteole, with conspicuous teeth along the margin …….. ***G. serrata***

TAXONOMIC TREATMENT

Gomphrena celosioides Mart. in Nov. Act. Acad. Ca
Leop.-Carol. Nat. Cur. 13: 301. 1826; Backer & Bal
f., Fl. Java 1: 239. 1963; Hsu in Taiwania 18: 62. 19
Liu & Kao, Amaranthaceae in Li et al. (eds.),
Taiwan 2: 382. 1976 & in Huang et al. (eds.),
Taiwan 2nd ed. 2: 407. 1996; Townse
Amaranthaceae in Dassnayake & Fosberg (eds.), R
Handb. Fl. Ceylon 1: 53. 1980 & in Polhill (ed.),
Trop. E. Africa, Amaranthaceae 127. fig. 30. 19
Eliasson, Amaranthaceae in Harling & Anderson (ed
Fl. Ecuador No. 28. 108. figs. 35, 36 c-f. 1987; Osa
Colored Illustr. Nat. pl. Japan 325. pl. 53. 1989;

Matthew, Excurs. Fl. C. Tamilnadu, India 419. 1995; Yang et al., Man. Taiwan Vasc. Pl. 2: 123. 1999; Wagner, et al., Man. Flowering Pl. Hawaii 1: 192. 1999; Bao et al., Amaranthaceae in Wu & Raven (eds.), Fl. China 5: 428. 2003; Clemants, Amaranthaceae in Iwatsuki et al. (eds.), Fl. Japan 2 (a): 229. 2006; Chen, Nat. Pl. E. Taiwan 62. 2008.

假千日紅 Figs. 1 & 3

Perennial herbs, *decumbent*, 20-50 cm tall, rooting at lower nodes and internodes, usually forming a dense mat. Stems terete, 2.5-4 mm across, striate, pilose-sericeous when young, glabrous in age, greenish yellow, usually flushed with brownish red. Leaves opposite, yellowish green, usually flushed with brownish red at margins and base, the upper sessile, the lower with a petiole 1-1.5 cm long, blade elliptic, oblong to oblong-obovate, 4-7 cm long, 1-1.5 cm wide, obtuse or mucronulate at apex, attenuate at base, pinnately veined, shining and glabrous or remotely sericeous above, sericeous beneath. Inflorescence a terminal or axillary, sessile cylindrical spike 0.8-1 cm across, 1.5 cm long, the spike with flowers falling off from bottom upwards and elongating to 8.5 cm long when fruiting, subtended by 2 leafy bracts, the bract ovate to oblong-ovate, 1.5-2 cm long, 0.8-1 cm wide, aristulate apically, glabrous above and sericeous beneath, palmately 5-7-veined. Flowers white, flushed with pale yellow, sessile, compressed lanceolate, 6 mm long, 1.5-2 mm wide, bract 1, ovate-triangular, 3 mm long, 1.5 mm wide, bracteoles 2, complicate, cymbiform, 6 mm long, 1.2mm wide, occasionally flushed with pale purple at apex, with a crest on the dorsal midrib, the crest small, 0.2-0.3 mm wide, confined to upper one-third of the bracteole, with an unconspicuously-denticulate uppermost margin; tepals 5, lanceolate, 5 mm long, 1 mm wide, acuminate at apex, the outer 2, green, fleshy, wooly on the back, the inner 3, papery, wooly on the lower half, all tepals hardened when fruiting; stamens 5, filaments connate into a tube 4 mm long, the tube 5-lobed, lobes deeply bifid, anthers yellow, oblong, 1 mm long, between incisions of the lobes; pistil 3.5 mm long, stigma 2, ovary compressed ovoid, pale green. Utricle enclosed in persistent filament-tube, 2 mm across. Seeds compressed orbicular, 1.8 mm across, reddish brown, shiny.

Specimens examined: TAIWAN. New Taipei City: Auti, 25 Jun 1991, *Kao s. n.*, Linko, *Lin 202* (TNM). Miaoli Co.: Houlung Town, Chinghai Temple to Shanchiao, alt. 50 m, *Wang 01665* (TNM); Toufen Town, Hsinglung Rd. roadside, *Yang et al.* 011357 (TNM). Nantou Co.: Chito, 14 May 1991, *Kao s. n*. (TNM), Kuohsing Hsiang, Provincial Way 14, by Doushan Pending Bridge alt. 300 m, roadside, exposed site, *Wang 05507* (TNM). Taichung City: Lungching District, Sante Village, Chung-Chun Rd., by Provincial Way 1, 169 k, *Liao et al., s. n.* (TNM). Tainan City: Chungshan Park, 14 May 1987, *Chou s. n.* (TNM). Chiayi Co.: Chiayi, *Chang 15525* (PPI). Penghu Co.: Penhu, *Chen 303* (PPI). Kaohsiung City: Tsyoying District, Navy General Hospital, on roadside, 8 Oct 2011, *Chen s. n*.; Gushan District, Kaohsiung Art Museum, in lawns, 25 Dec 2010, *Chen s. n*.; Taoyuan District 23°09'12"N, 120°45'32"E, open place, *Yang 26322* (PPI). Pingtung Co.: Liuchiu Hsiang, Chungfu Village, by Fushing Bridge, alt. 30 m, open place, roadside, forest margin, *Hsieh et al. 02962*; Fangshan Hsiang, *Yen 09390* (TNM). Taitung Co.: Tungho Township, alt. 9 m, *Wu 02934* (TNM). Fujian. Kinmen Co.: Kinhu Town, *Chen 07255* (TNM), Kinmen Forestry Bureau open place, *Wang et al. 10615* (TNM). CHINA. Hainan: Wanling, Singlun to Nanwan, *Sing 6497* (TNM), Wulei Forestry Farm, *Li & Sing 4126* (TNM). Guantong: Haiko City, Singhai Forestry Farm, *Li et al. 849* (TNM); Hsuwung Hsien, Baihsa, mountain area, on roadside, *Yea 7793* (TNM).

Distribution and Notes: *Gomphrena celosioides* is a native of South America, but is now a pantropic weed widely distributed in both tropical and subtropical America, introduced and naturalized in tropical Africa and Asia (Backer and Bakhuizen, 1963; Townsend, 1985; Eliasson, 1987; Matthew, 1995). It also occurs in China (Bao et al., 2003), Japan (Osada, 1989) and the Hawaii Islands (Wagner et al., 1999).

This species was first recorded from Taiwan by Hsu in 1973, where it occurred in the central and southern coastal counties of the island, but now has become a thoroughly naturalized weed of disturbed places (Chen, 2008) and has extended from coastal areas to inland plains.

Gomphrena serrata L., Sp. Pl. 224. 1753; Eliasson, Amaranthaceae in Harling & Anderson (eds.), Fl. Ecuador No. 28. 107. fig. 36a, b. 1987; Acevedo-Rodriguez, Fl. St. John, U. S. Virgin Isl. (Memoirs) 61. fig. 13A-I. 1996; Clemants, *Gomphrena* in Fl. N. Amer. Ed. Comm., Fl. N. Amer. 4 (Part 1): 453. 2003.

短穗假千日紅 Figs. 2 & 4

Perennial herbs, decumbent, 20-50 cm tall, rooting at lower nodes and internodes, usually forming a dense mat. Stems terete, 2-2.5 mm across, striate, much-branched, green occasionally flushed with purplish red, sericeous when young and becoming subglabrate in age. Leaves opposite, the upper sessile, the lower with a short petiole up to 1 cm long, blades elliptic to oblanceolate, 2-5 cm long, 1-1.5 cm wide, acute or aristulate at apex, attenuate at base, pinnately veined, pubescent above, sericeous beneath. Inflorescence a terminal or axillary, sessile subglobose spike 1-1.2 cm across, the spike with flowers falling off from the bottom upwards and elongating to 2.5 cm long when fruiting, subtended by 2 leafy bracts, the bract ovate, 1-2.5 cm long, 0.5-1.5 cm wide, rounded at base, aristulate at apex, palmately 5-7-veined, glabrous or rarely pubescent above, sericeous below. Flowers snow-white, sessile, compressed ovate-lanceolate, 4-5

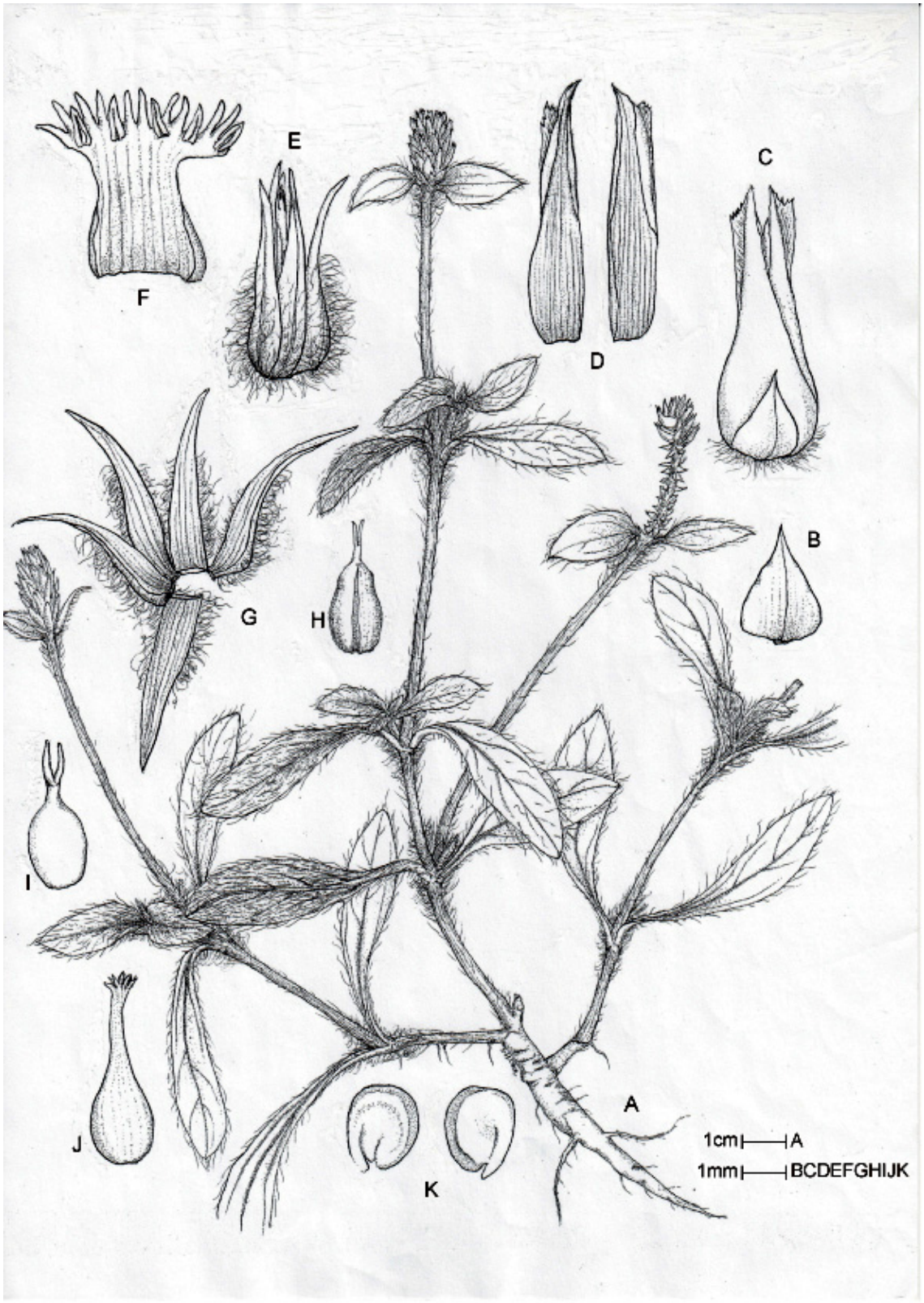

Fig. 1. *Gomphrena celosioides* Mart. A: Habit. B: Bract. C: Flower subtended by bract and bracteoles. D: Bracteoles. E: Flower. F: Filament tube with anthers. G: Tepals. H: Utricle with seed removed. I: Pistil. J: Filament tube enclosing pistil. K: Seeds.

Fig. 2. *Gomphrena serrata* L. A: Habit. B: Tepals. C: Flower subtended by bract and bracteoles. D: Bracteoles. E: Bract. F: Filament-tube with anthers. G: Filament-tube enclosing pistil. H: Flower. I: Pistil. J: Utricle with seed removed. K: Seeds.

Fig. 3. Habitat of *Gomphrena celosioides* Mart.

Fig. 4. Habitat of *Gomphrena serrata* L.

mm long, 2 mm wide, bract 1, ovate-triangular, 2 mm long, 1 mm wide, acuminate at apex, bracteoles 2, complicate, cymbiform, 4-5 mm long, 1-1.2 mm wide, with an irregularly dentate crest on the dorsal midrib, the crest broad, 0.5-0.6 mm wide, extending from the apex to the middle or nearly to the base; tepals 5, lanceolate, 4-5 mm long, 1-1.2 mm wide, long-acuminate at apex, the outer 2, green, fleshy, woolly on the back, the inner 3, papery, woolly at base, all tepals hardened when fruiting; stamens 5, filaments connate into a tube 3.5 mm long, the tube 5-lobed, lobes deeply bifid, anthers yellow, oblong, 0.8 mm long, between incisions of the lobes; pistil 3 mm long, stigma 2, ovary compressed orbicular. Utricle 1.8 mm across, enclosed in persistent filament-tube. Seeds compressed orbicular, 1.5 mm across, reddish brown, shiny.

Specimens examined: TAIWAN. Taichung City: Dadu District, Dadushan, 24°08'31"N, 120°34'0"E, in park, *Ku 699* (PPI); Tachiah District, Tachiahsikou, 9 Sep 1992, *Hwang s. n.* (TNM), Tachiahsi, *Chiu 04866* (TNM); Chingshui District, Tourist Fishmarket, alt. 3m, roadside, *Wang et al. 09035* (TNM), Nankao Li, open place, roadside, *Wang 12918* (TNM), Kaomei Damp Place, roadside, seashore, *Hsieh 02811* (TNM); Peitun District, Huanchung Rd., on roadside, open place, *Wang 04255* (TNM); Lungching District, Nanliao Li, alt. 200 m, *Wang et al. 09673* (TNM). Kaohsiung City: Neimen District, *Yen 0477* (TNM); Tsoying District, on lawns, 16 Oct 2011, *Chen s. n.*; Gushan District, Kaohsiung Art Museum, on lawns, 25 Dec 2010, *Chen s. n*. Pingtung Co.: Fangshan Township, Chiahou, alt. 3m, on roadside of secondary forest, *Wang 11617* (TNM). Taitung Co.: Tawu, on seashore, 11 Sep 1970, *Hwang et al. s. n.* (TNM), Hsiaoyehliu ,*Wu 02391* (TNM).

Distribution and Notes: *Gomphrena serrata*, native to tropical America, has been grown as an ornamental and escaped as a weed throughout the tropics (Eliasson, 1987; Acevedo-Rodriguez, 1996). It also occurs in southeastern United States (Clemants, 2003).

In Taiwan, *Gomphrena serrata* occurs mainly in the central and southern coastal counties as a weed of similar situations to *G. celosioides.* It is found on lawns, at disturbed places such as roadsides, parking lots, playing fields and other waste ground, and in open sunny sandy or clay soils, often co-occurs with other common weeds such as *Eragrostis amabilis* (L.) Wight & Arn. *ex* Nees, *Desmodium triflorum* (L.) DC., *Hedyotis corymbosa* (L.) Lam., *Tridax procumbens* L., and *Vernonia cinerea* (L.) Lees. var. *cinerea*. Flowering is all year round. *G. serrata* is most easily confused vegetatively with *Alternanthera ficoides* (L.) R. Br. *ex* Griseb. var. *bettzickiana* (Nicholson) Backer in the field, but bear little resemblance to that species when flowering.

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LITERATURE CITED

Acevedo-Rodriguez, P. 1996. Flora of St. John, U. S. Virgin Islands. New York Bot. Gard., Bronx, New York, USA. 581 pp.

Backer, C. A. and R. C. Bakhuizen Van Den Brink. 1963. Flora of Java. 1: 239. Noordhoff, The Netherlands.

Bao, B., S. E. Clemants, and T. Borsch. 2003. Amaranthaceae. In: Wu, Z.-Y. and P. H. Raven (eds.), Flora of China, 5: 415-429. Science Press, Beijing, China and MBG, St. Louis, Missouri, USA.

Boufford, D. E., H. Ohashi, T.-C. Huang, C.-F. Hsieh, J.-L. Tsai, K.-C. Yang, C.-I Peng, C.-S. Kuoh and H. Hsiao. 2003. A checklist of the vascular plants of Taiwan. In: Huang, T.-C. et al. (eds.), Flora of Taiwan, 2nd ed. 6: 15-139. Editorial Committee, Dept. Bot., NTU, Taipei, Taiwan.

Chen, S.-H. 2008. Naturalized Plants of Eastern Taiwan. National Hualien University of Education, Hualien, Taiwan. 422 pp.

Clemants, S. E. 2003. *Gomphrena*. In: Flora of North America Editorial Committee (ed.), Flora of North America 4 (Part 1): 451-454. Oxford Univ. Press. New York, USA.

Eliasson, U. H. 1987. Amaranthaceae. In: Harling, G. & L. Anderson (eds.), Flora of Ecuador, No. 28: 1-137. Gothenburg: Department of Systematic Botany, University of Gothenburg; and Stockholm: The Section for Botany, Museum of Natural History, Berlings, Arlov.

Hsu, C.-C. 1973. Some noteworthy plants found in Taiwan. Taiwania 18: 62-72.

Huang, T.-C. 1979. A checklist of the vascular plants of Taiwan. Spermatopyta. In: Li, H.-L. et al. (eds.), Flora of Taiwan, 1st ed. 6: 22-188. Epoch Publ. Co., Ltd., Taipei, Taiwan.

Liu, T.-S. and M.-T. Kao. 1976. Amaranthaceae. In: Li, H.-L. et al. (eds.), Flora of Taiwan, 1st ed. 2: 382. Epoch Publ. Co., Ltd., Taipei, Taiwan.

Liu, T.-S. and M.-T. Kao. 1996. Amaranthaceae. In: Huang, T.-C. et al. (eds.), Flora of Taiwan, 2nd ed. 2: 407. Editorial Committee, Dept. Bot., NTU, Taipei, Taiwan.

Matthew, K. M. 1995. An Excursion Flora of Central Tamilnadu, India. A. A. Balkema, Rotterdam, The Netherlands. 682 pp.

Osada, T. 1989. Colored Illustrations of Naturalized Plants of Japan. Published by Hoikusha Publishing Co., Ltd. Japan. 425 pp.

Townsend, C. C. 1985. Amaranthaceae. In: Polhill, R. M. (ed.), Flora of Tropical East Africa. Crown Agents for Oversea Governments and Administrations, London, UK. 136 pp.

Wagner. W. L., D. R. Herbst and S. H. Sohmer. 1999. Mannual of the Flowering Plants of Hawaii, rev. ed. 1: 192, Bishop Museum, USA.

Yang, T.-I. 1982. A List of Plants in Taiwan. Natural Publish Co., LTD. Taipei, Taiwan. p.573.

台灣千日紅屬植物之分類

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摘要：短穗假千日紅（*Gomphrena serrata* L.）（新擬中名）為新歸化台灣的莧科植物，本種常與假千日紅（*G. celosioides* Mart.）混淆。本文描述兩種之分類性狀、分佈與生長環境，並提供外形解剖圖幅及檢索表以做比較。

關鍵詞：千日紅屬、假千日紅、短穗假千日紅、莧科、雜草、分類學、台灣。