NOTE

Emilia praetermissa Milne-Redh. (Asteraceae) – A Misidentified Alien Species in Northern Taiwan

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ABSTRACT: *Emilia praetermissa* (Asteraceae), first collected in 1997 in Keelung, has become naturalized in Taiwan and is now a frequent sight in northern part of the island. This species has often been misidentified as *Emilia fosbergii*, another alien *Emilia* species commonly seen in central and southern Taiwan. Detailed description, report of chromosome number ($2n$ = 20) and karyotype with a review of relevant cytological literature and a distribution map are provided. Line-drawings as well as color photographs of *E. praetermissa* and its congeners occurring in Taiwan are presented to aid in identification.

KEY WORDS: Compositae, *Emilia*, invasive plant, Taiwan, taxonomy.

INTRODUCTION

Biological invasion is the second major threat to the global biodiversity, rankings behind only habitat destruction (Gaskin and Schaal, 2002). To effectively control and eventually eradicate unwelcomed alien species, early report and correct taxonomic information of the newly naturalized species are essential (Pyšek et al., 2004). In Taiwan, naturalized plants account for about 8% of the local flora (Hsieh, 2002; Wu et al., 2004b; Peng and Yang, 2008). Reports on new naturalizations have increased rapidly in the past few decades, as attested by publications in recent issues of the journal Taiwania. In the past several years, the Sunflower family (Asteraceae) has become the major contributor to the invasive flora in Taiwan (Jung et al., 2005; Wu and Wang, 2005; Chen and Wu, 2006; Hsu et al., 2006; Jung et al., 2006; Wang and Chen, 2006; Chung et al., 2008; Jung et al., 2008; Tseng et al., 2008a, 2008b, 2008c), surpassing the legume family that ranked first in earlier reports (Wu et al., 2004a; Wu and Wang, 2005; Peng and Yang, 2008). In this article, we report yet another apparently invasive alien species of Asteraceae, *Emilia praetermissa*, to our naturalized flora.

TAXONOMIC TREATMENT

The genus *Emilia* (Cass.) Cass. comprises ca. 100 species distributed in the tropical and subtropical regions of the world, with the greatest species diversity in East Africa (Nordenstam, 2007). Although most of its diagnostic characters such as habit, robustness, shape of involucre, color of florets, etc. can be easily observed when plants are in living condition, these features lose their distinguishing values when dried, making taxonomy of the genus extremely challenging (Fosberg, 1972; Nicolson, 1980). Two species of *Emilia*, *E. sonchifolia* var. *javanica* (Burm. f.) Matt f. and *E. fosbergii* Nicolson, were documented in the 2nd edition of the Flora of Taiwan (Peng et al., 1998; Peng and Chung, 1999). *Emilia sonchifolia* var. *javanica*, an East Asian native weed (Nicolson, 1980) occurring throughout lowland Taiwan, is characterized by its purple to pink flowering heads (Peng et al., 1998; Peng and Chung, 1999). *Emilia fosbergii*, a naturalized species more commonly seen in the central and southern Taiwan, can be easily separated from the former by a more robust habit and scarlet or brick red capitula (Peng et al., 1998; Peng and Chung, 1999).

In January 1997, the senior author collected some unusual individuals of *Emilia* whose flowering heads are yellowish or orangey [*Peng et al. 16938* (HAST)]. When dried, however, the specimens lose the unique floret color and are nearly indistinguishable from specimens of *E. fosbergii*. Subsequently, additional collections annotated as *E. fosbergii* from the disturbed habitats in northern Taiwan were found with increasing frequencies in major herbaria (e.g., HAST, TAI, TAIF, TNS, cited below; Fig. 1) in Taiwan. A thorough study of literature and herbarium collections revealed that they are identifiable as *E. praetermissa*. A taxonomic account follows.

Emilia praetermissa Milne-Redh., Kew Bull. 5: 375. 1951. – Type: Sierra Leone, Heddle's Farm, Freetown, 8 May 1928, *F. C. Deighton 1188* (holotype: K, digital image available at www.aluka.org).

粉黃纓絨花 (新擬中名) Figs. 2 & 3

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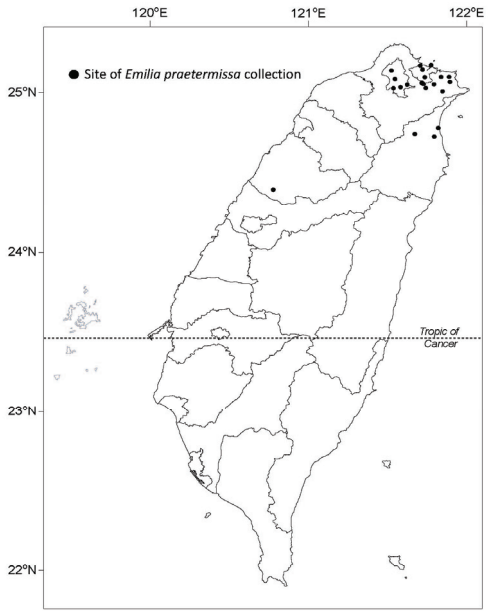


Fig. 1. Distribution of *Emilia praetermissa* (●) in Taiwan.

Annual herb, up to 140 cm tall. Stems erect or ascending, simple or branched from base, glabrous to pilose, basal internodes 0.6–2 cm long, upper internode to 9 cm long. Lowermost leaf blade broad ovate, subcordate, with attenuate petioles, margins strongly dentate, ca. 4 cm long, 4.5 cm broad, petioles 1.5–2.5 cm long, moderately pilose, wingless and not auriculate; lower (2nd and 3rd from the bottom) leaf blades broad ovate, subcordate, with attenuate petioles, leaf margin broad dentate, ca. 6 cm long, 6 cm wide, petioles 2–3 cm long, winged, not auriculate, moderately pilose; middle part leaves similar to the lower ones but strongly auriculate, auricles broadly dentate; uppermost leaves sessile, auriculate-cordate, more or less deltoid, midrib of the lower surface moderately pilose. Capitula erect, discoid, solitary to 7 in open corymbs; bracts narrowly lanceolate, apex attenuate, 8–11 mm long, pilose; capitula in anthesis ca. 20 mm long, 12 mm in diameter; involucre tubular, ca, 10 mm long, base 4 mm wide, middle part 3 mm wide, phyllaries uniseriate, 9–12, moderately pilose; florets ca. 80, tubular, 5-lobed, yellowish, orangey or cream white, corolla lobes purple or orange-tinged, corollas ca. 8 mm long, lobes 2 mm long. Anthers dark orange, 1.7 mm long, apex appendiculate. Style branches orange, ca. 1.2 mm long, recurved. Pappus ca. 7 mm long, finely barbellulate. Achenes truncate-elliptic, 3 mm long, 5-ribbed, hispid along achene midribs. Chromosome number, $2n$ = 20 (Fig. 4, here reported; Milne-Redhead, 1950; Olorode, 1973a; Olorode and Olorunfe, 1973; Nicolson, 1980). In Taiwan flowering and fruiting all year round.

Specimens examined: TAIWAN. Keelung City: Hsishih Dam, ca. 50 m, 31 Jan 1997, *C.-I Peng et al. 16938* (HAST), same locality, 65 m, 4 Mar 2004, *C.-I Huang et al. 1628* (HAST); Hopingdao, 16 Dec 2003, *M.-J. Jung s.n.* (TAIF); Hsinshan Dam, 50–150 m, 16 Apr 2005, *J.-H. Lii & S.-W. Chung 1174* (TAI); Anle District, Chingjenhu, 187 m, 16 Mar 2007, *T. Y. A. Yang et al. 19245* (TNS). Ilan County: Chuangwei Township, Kuoling, 24 Apr 1999, *K.-F. Chung et al. 1153* (HAST), Yungchen village, ca. 0 m, 14 Jun 1999, *C.-I Peng et al. 17251* (HAST), near Lanyang Bridge, 5 m, 4 Aug 2004, *C.-I Huang et al. 1796* (HAST); Yuanshan Township, 300–400 m, 17 Jan 2005, *S.-W. Chung 8288* (TAIF). Taipei County: Hsichih City, ca. 230, 2 Jan 2000, *C.-I Peng 17925* (HAST), 1 Jan 2008, *M.-J. Jung 2117* (TAIF), Chiangtzu Gazebo, 530 m, 6 Mar 2000, *C.-H. Lin & K.-F. Chung 76* (HAST), same locality, 3 Aug 2001, *S.-C. Wu et al. 2449* (HAST, TAI); Juifang Township, Houtung, 150 m, 8 Sep 2001, *K.-Y. Wang & K.-H. Chen 1654* (TAIF), Shumeiping, 630 m, 15 Mar 2003, *T. Y. A. Yang et al. 15618* (TNS); Pingsi Township, 14 Nov 2007, *M.-J. Jung 1877* (TAIF), Shihfen, 3 Apr 2008, *M.-J. Jung 2649* (TAIF), Siaozihshan, 300–360 m, 2 Mar 2003, *S.-C. Liu & P.-C. Liao 990* (HAST); Shuangsi, Dapishan, 400–515 m, 23 May 2003, *S.-C. Liu et al. 1196* (HAST, TAIF, TNS), Sanchakang Village, 100 m, 4 Oct 2008, *P.-F. Lu 17002* (TAIF). Taipei City: Beitou, 160 m, Chunchienyen, 15 Mar 2007, *S.-S. Dai 1948* (TAIF); Daan, 20 m, Guting, 5 Apr 2008, *M.-J. Jung 2657* (TAIF); Nankang, Academia Sinica, 30 m, 14 Dec 2002, *S.-M. Ku 1688* (HAST); Xinyi, Hsiangshan, 200 m, 28 Mar 1999, *W. C. Leong 1148* (HAST, TNS); Zhongshan, Tachia River Park, 15 m, 21 Mar 2007, *C.-I Huang & K.-F. Chung 3096* (HAST). Miaoli County: Sanyi Township, Shengsing Railway Station, 380 m, 21 Jul 2008, *C.-Y. Lin et al. 13* (HAST).

Chromosome cytology: Our study of the somatic chromosomes of *Emilia praetermissa* revealed $2n$ = 20 (Fig. 4). A bimodal complement with ten long chromosomes (ca. 2.6 - 3.6 µm) and ten short chromosomes (ca. 1.4 - 1.9 µm) was observed. Irrespective of their length, eight chromosomes (Nos. 9 and 10, and 15-20 in Fig. 4B) are metacentric and the rest are submetacentric. Satellites were observed at the distal regions of short arms in four long submetacentric chromosomes (Fig. 4). The karyotype formula of *E. praetermissa* is $2n$ = 20 = 8m+12sm (4SAT). The karyotype we observed is somewhat different from those reported by Olorode (1973a) and Olorode and Olorunfe (1973). Nevertheless, the bimodal variation in chromosome length is consistent.

DISCUSSION

Emilia praetermissa was originally described from Sierra Leone and Nigeria (Milne-Redhead, 1950) and was subsequently found in other West Africa countries, including Cameroon, Côte d'Ivoire, Ghana, Guinea, and Liberia (Hepper, 1963; Nicolson, 1980; Lisowski, 1997). Unlike most *Emilia* species whose chromosome numbers are $2n$ = 10, *E. praetermissa* has a chromosome number of $2n$ = 20 (Milne-Redhead, 1950; Fig. 4, here reported), suggesting its polyploidy origin (Baldwin and Speese, 1949). This proposition was supported by a series of cytological studies by Olorode and his colleagues (Olorode, 1973a, b; Olorode and Olorunfe, 1973; Olorode and Olopade, 1978; Olorode and Orubo, 1978), in which *E. praetermissa* was shown to be an allotetraploid

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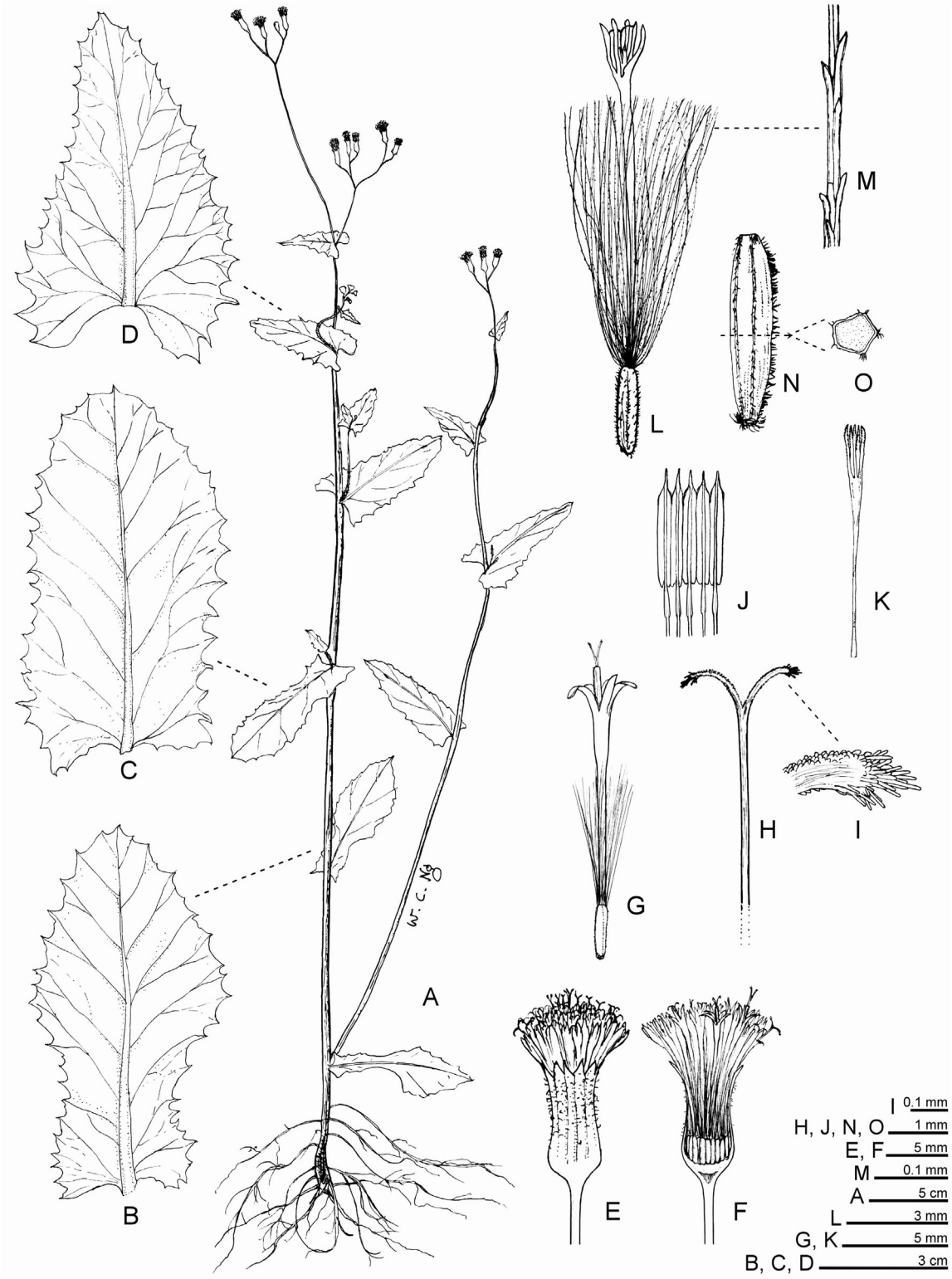


Fig. 2. *Emilia praetermissa* Milne-Redh. A: Habit. B: Lower leaf. C: Middle leaf. D: Upper leaf. E: Capitulum. F: Capitulum, longitudinal section. G: Floret. H: Style branch. I: Stigma, showing hirtellous papillate appendages. J: Stamens. K: Corolla of withered floret. L: Achene with pappus and corolla. M: Barbellate bristle of pappus. N: Achene. O: Achene, cross section.

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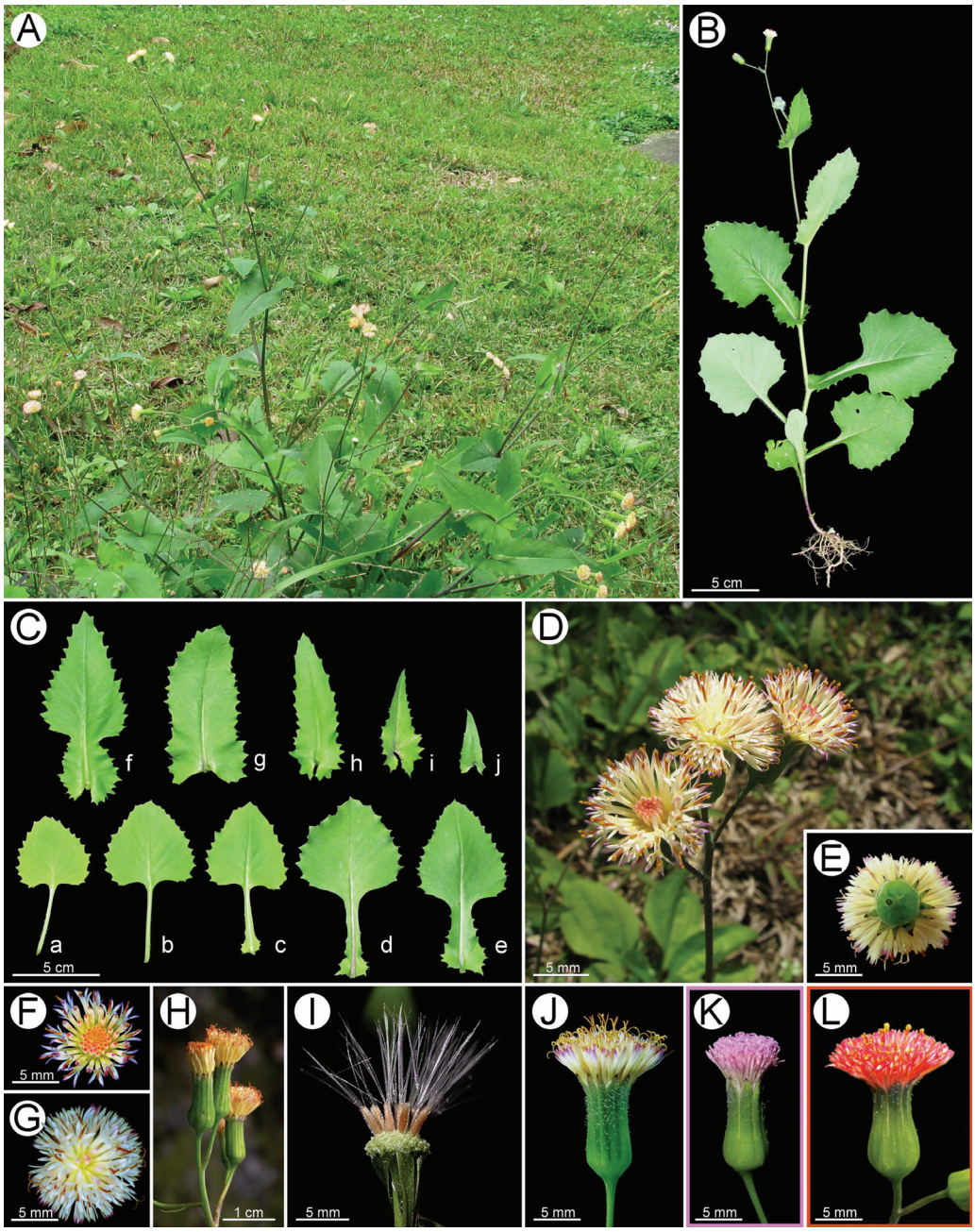


Fig. 3. Color photographs of *Emilia*. A-J: *Emilia praetermissa*. K: *E. sonchifolia* var. *javanica*. L: *E. fosbergii*. A: Habit. B: Whole plant. C: Leaf variation, a-j, from base to top. D: Flowering branch. E: Capitulum, viewed from beneath. F: Capitulum, early flowering stage. G: Capitulum, peak flowering stage. H: Flowering branch, late flowering stage. I: Achenes on receptacle. J: Capitulum, lateral view. K: Capitulum of *E. sonchifolia* var. *javanica*. L: Capitulum of *E. fosbergii*.

originating from chromosome doubling of the hybrid between two West African species, *E. sonchifolia* (L.) DC. and *E. coccinea* (Sims) G. Don, both diploid with 2*n* = 10. Based on the karyotype we observed, *E. praetermissa* does not contain a set of four chromosomes in the complement, and may well represent an allotetraploid species. Morphologically, most quantitative and qualitative traits of *Emilia praetermissa* are intermediate between *E. sonchifolia* var. *sonchifolia* and *E. coccinea* (Isawumi, 1992). In West Africa, *E. praetermissa* is sympatrically distributed with its putative diploid progenitors but natural hybrids among the three

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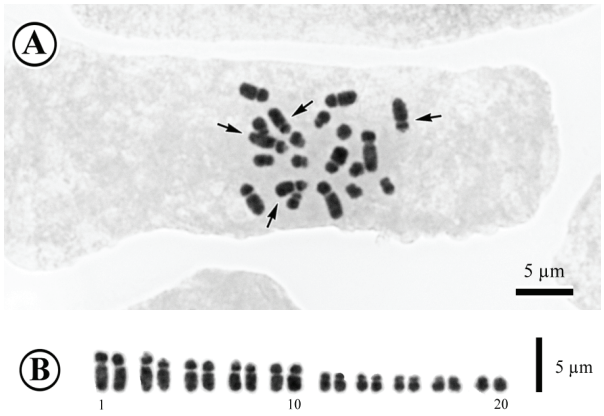


Fig. 4. Mitotic chromosome spread of *Emilia praetermissa* at metaphase (2*n* = 20, from *Lin et al. 1*, HAST). A; Microphotograph. B; Somatic chromosomes serially arranged by their length and the position of centromeres. Arrows indicate chromosomes with satellites.

species were not reported (Isawumi, 1992). In Taiwan, however, we have found some unusual individuals presumably resulted from natural hybridization between co-occurring *Emilia sonchifolia* var. *javanica* (2*n* = 20; Nicolson, 1980) and *E. praetermissa* (2*n* = 20). Cytological and molecular studies to ascertain the interesting case of natural hybridization between a native and an alien plant species in Taiwan are in progress.

Emilia praetermissa is morphologically very similar to *E. fosbergii*, a weed widely naturalized in the Neotropic and Pacific regions (Nicolson, 1980) and commonly seen in central and southern Taiwan (Peng et al., 1998; Peng and Chung, 1999), differing mainly by the brick-colored capitula in the latter species (Nicolson, 1980; Fig. 3). Nicolson (1980) commented that the line drawing *E. praetermissa* in Hepper (1963) is indistinguishable from *E. fosbergii* and specimens of the two species are very difficult to separate from each other. Presumably, resemblance between the two species is resulted from their co-ancestry. The tetraploid *Emilia fosbergii* (2*n* = 20; Nicolson, 1980) has been hypothesized as a hybrid sibling of *E. praetermissa*, originated from the same parental species *E. sonchifolia* var. *sonchifolia* and *E. coccinea* that gave rise to *E. praetermissa* (Nicolson, 1980).

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臺灣北部一種經常錯誤鑑定的外來種菊科植物－粉黃纓絨花

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摘要：本文提供臺灣北部新歸化植物「粉黃纓絨花」之形態描述、線繪圖、彩色照片與其分布圖，並報導其染色體數與核型分析。粉黃纓絨花的最早採集記錄是 1997 年於基隆市，目前已廣泛歸化於宜蘭縣與臺北縣市。臺灣各主要標本館典藏之粉黃纓絨花標本常被錯誤鑑定為中南部常見之紫背草屬另一種植物「纓絨花」。粉黃纓絨花之頭花花冠為極特別之淡黃色或淺橘色，易於與纓絨花之深橘紅色頭花區別之。本文並報導粉黃纓絨花的染色體數（$2n = 20$）及核型，且回顧相關之染色體細胞學資料。

關鍵詞：菊科、紫背草屬、入侵植物、臺灣、分類學。

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