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Geranium pusillum L. (Geraniaceae): A Newly Naturalized Plant in Taiwan

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ABSTRACT: *Geranium pusillum* L., an annual or biennial herb mainly native to Europe, northern Africa, and western Asia, has recently become naturalized in mountain regions of central Taiwan at about 1,800-2,300 m in elevation. This species is very similar to *G. molle*, which was also recently found to have become naturalized in Taiwan; however, the former has smaller flowers and scabrous fruits. In the present work, we provide a taxonomic description, an illustration, photographs, and scanning electron micrographs to facilitate identification. Furthermore, a key to the taxa of the genus *Geranium* in Taiwan is also provided.

KEY WORDS: Geraniaceae, *Geranium pusillum*, naturalized plant, Taiwan, taxonomy.

INTRODUCTION

Geranium L. is a cosmopolitan genus, with about 420 species being recognized in three subgenera and eighteen sections (Aedo et al., 1998a). Five native and one naturalized species are recorded in the Flora of Taiwan, 2nd edition (Huang, 1993; Peng, 1978), and are mainly distributed in the central mountains. Recently, *G. molle* was also found to have been naturalized in the mountain regions in Taiwan (Chen and Wang, 2005). In our botanical exploration of the Central Mountain Range, we recognized *G. pusillum* L., an unrecorded species of *Geranium* which was collected. In preparation for the forthcoming Field Guide to *Geraniums* of Taiwan, we have examined specimens from HAST, TAI, TAIF, and TNM. The earliest collection date was 10 May, 2001 by *Y. Y. Huang et al. 395* (HAST, TNM). Hence we concluded that the species has only recently become naturalized in montane regions of central Taiwan at about 1,800-2,300 m in elevation.

Geranium pusillum belongs to the section *Batrachioidea* of the subgenus *Robertium* (Yeo, 1984, 1990). This species is distributed in Europe, northern Africa, and western Asia (Aedo, 1998b), and was introduced to the Americas and East Asia where it has become a weed (Aedo et al., 1998a).

MATERIALS AND METHODS

Materials used in the studies were collected from the fields in Taiwan, and were pressed and dried as voucher specimens in the herbarium of TNM. Fruits and seeds for scanning electron microscopy (SEM) were from fresh capsules and flowers of *C. M. Wang et al. 8308* (*G. pusillum*) and *C. H. Chen et al. 7397* (*G. molle*). All materials used for SEM were coated with gold and examined under Hitachi S300N.

SYSTEMATIC TREATMENT

Geranium pusillum L., Syst. nat. ed. 10, 2:1144. 1759 May-June (Burm. f., Spec. Bot. Geran. 27. 1759 Aug). 小花牻牛兒苗 Figs. 1 & 2

Annual or biennial herb, erect, 15-35 cm tall; stem pilose, somewhat reddish with glandular hairs. Leaves round or circular with deeply palmate lobes, surface pubescent, 1.2-5.5 cm broad, petioles 2-10(12) cm long; stipules 4 at each node. Flowers 2, axillary or subterminal, actinomorphic, 5-7 mm in diameter; peduncles somewhat reddish, 0.5-1.2(1.5) cm long, pilose; pedicels 0.6-1.4 cm long, pilose; bracts 2, linear to linear-triangular, ca. 1.5 mm long; sepals 5, pilose on outside, 2.5-3.5 mm long; petals 5, bilobed, pink to magenta, 2.5-4 mm long. Stamens 10, 2-whorled, anthers ellipsoid, 0.5-0.8 mm long. Ovary 4-8 mm long; styles 5, ca. 1 mm long. Capsules light brown to brown, scabrous, 0.9-1.2 cm long. Seeds light brown, oblong, 1.4-1.8 mm long, glabrous.

Distribution: Native to Europe, northern Africa, Western Asia, Soviet Middle Asia, and the Caucasus. Introduced to the north-central Pacific, the Americas,

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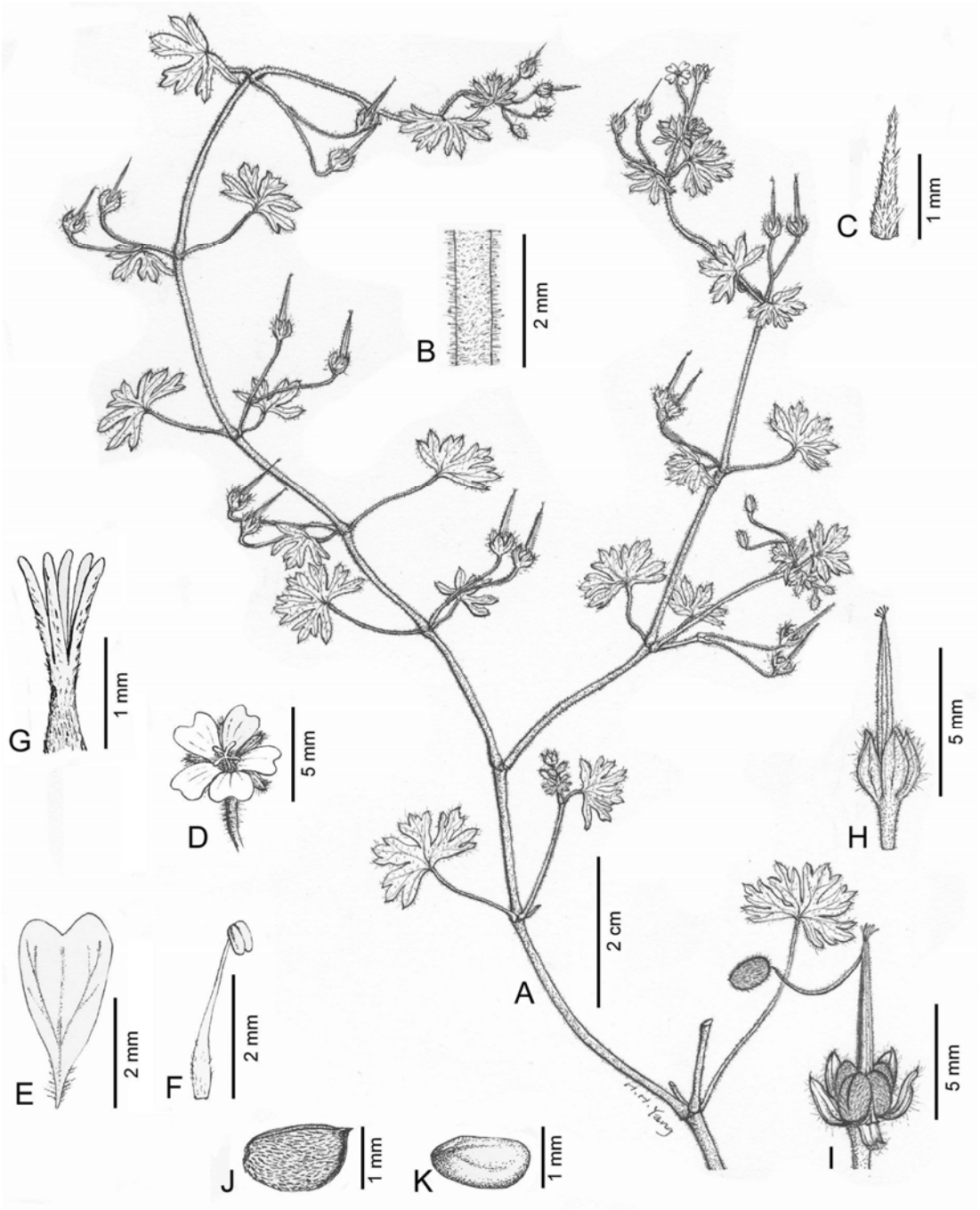


Fig. 1. *Geranium pusillum* L. A: Habit. B: Stem. C: Bract. D: Flower. E: Petal. F: Stamen. G: Style. H: Ovary with calyx. I: Dehiscing fruit. J: Capsule. K: Seed. (*C. M. Wang 8244*).

eastern Asia, and New Zealand (Aedo et al., 1998a). This species is naturalized in Japan and has been recorded as an alien species for decades (Nagata, 1972). In Taiwan, it occurs at about 1,800-2,300 m in elevation in the Central Mountain Range, and is usually found in open grasslands near roadsides or vegetable farms.

Specimens examined: Taichung Co., Hoping Township: Huan Shan. elev. 1,850 m, May 10, 2001, *Y. Y. Huang et al. 395* (HAST, TNM); Nantou Co., Jenai Township: Central-Cross-Island Highway # 103.2 Km, elev. 2,250 m, Apr. 16, 2002, *C. M. Wang 5473* (TNM), Jenai Township: Chiyanchung. elev., 2,250 m, Sep. 15, 2005, *C. M. Wang 8244* (TNM); Oct. 12, 2005, *C. M. Wang et al., 8308* (TNM).

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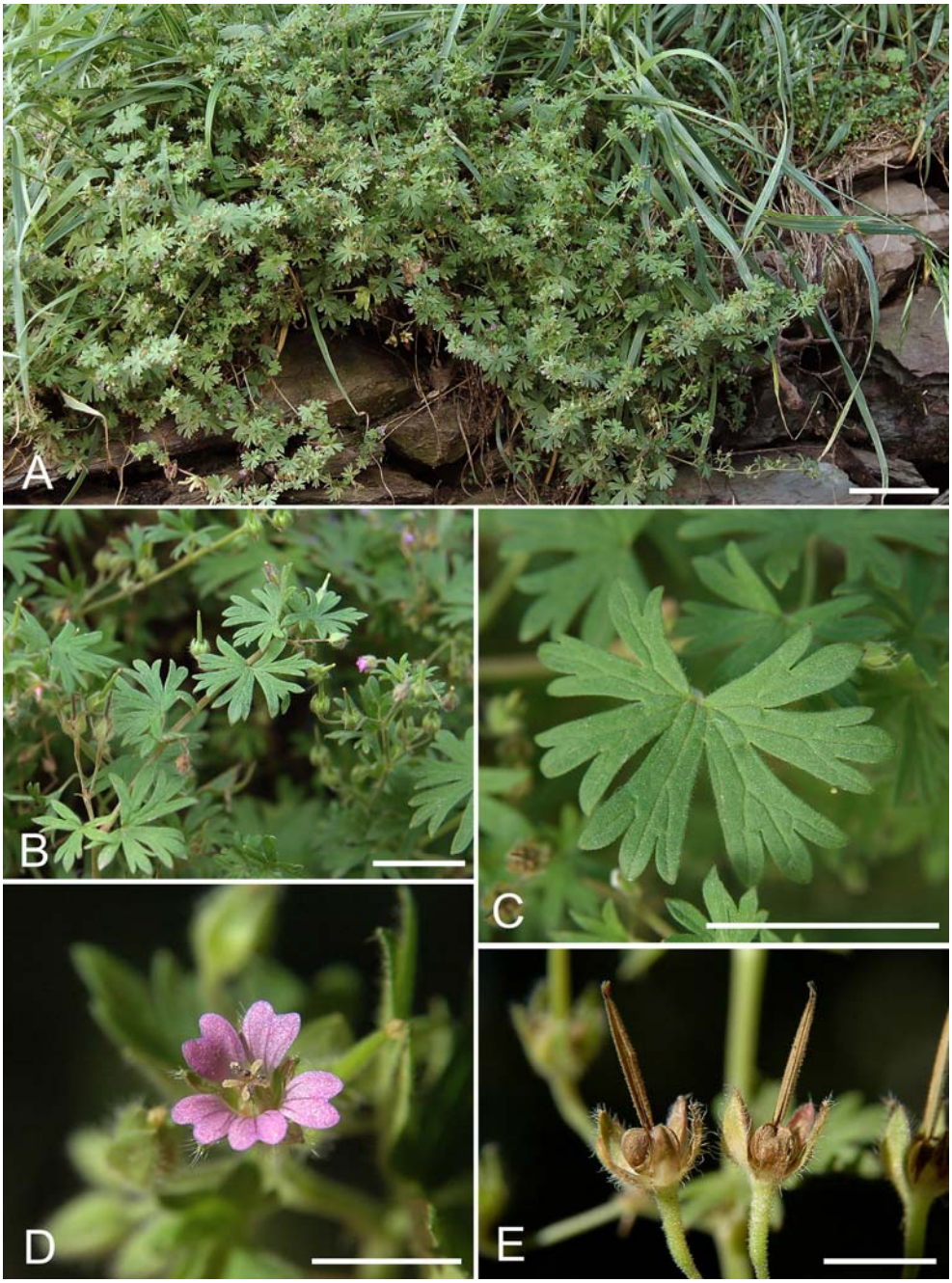


Fig. 2. *Geranium pusillum* L. A: Habit. B: Branch and inflorescence. C: Leaf. D: Flower. E: Fruits. Scale bar A = 5 cm; bars B and C = 1 cm; bars D and E = 5 mm.

Notes: This species was found in exposed area, and is sometimes distributed near the similar species *G. molle* in Taiwan. Both species are in the subgenus *Robertium*, which is characterized by the "carpel-projection" type fruit discharge (other congeners in Taiwan also have fruit of the "seed-ejection" type), and are also in the same section *Batrachioidea* by the shallowly divided leaves and blue pollens.

Geranium pusillum and *G. molle* are very similar and easy misidentificatied if only the vegetative body is examined. The former species differs from the latter in having smaller flowers (5-7 vs. 8-10 mm in diameter). From examination of scanning electron-micrographs, the capsule surface of *G. pusillum* is scabrous, but that of *G. molle* is rugose (Figs. 3A, B, E & F). The seed shape of the former is narrower than the latter (long-ovoid vs. subglobose),

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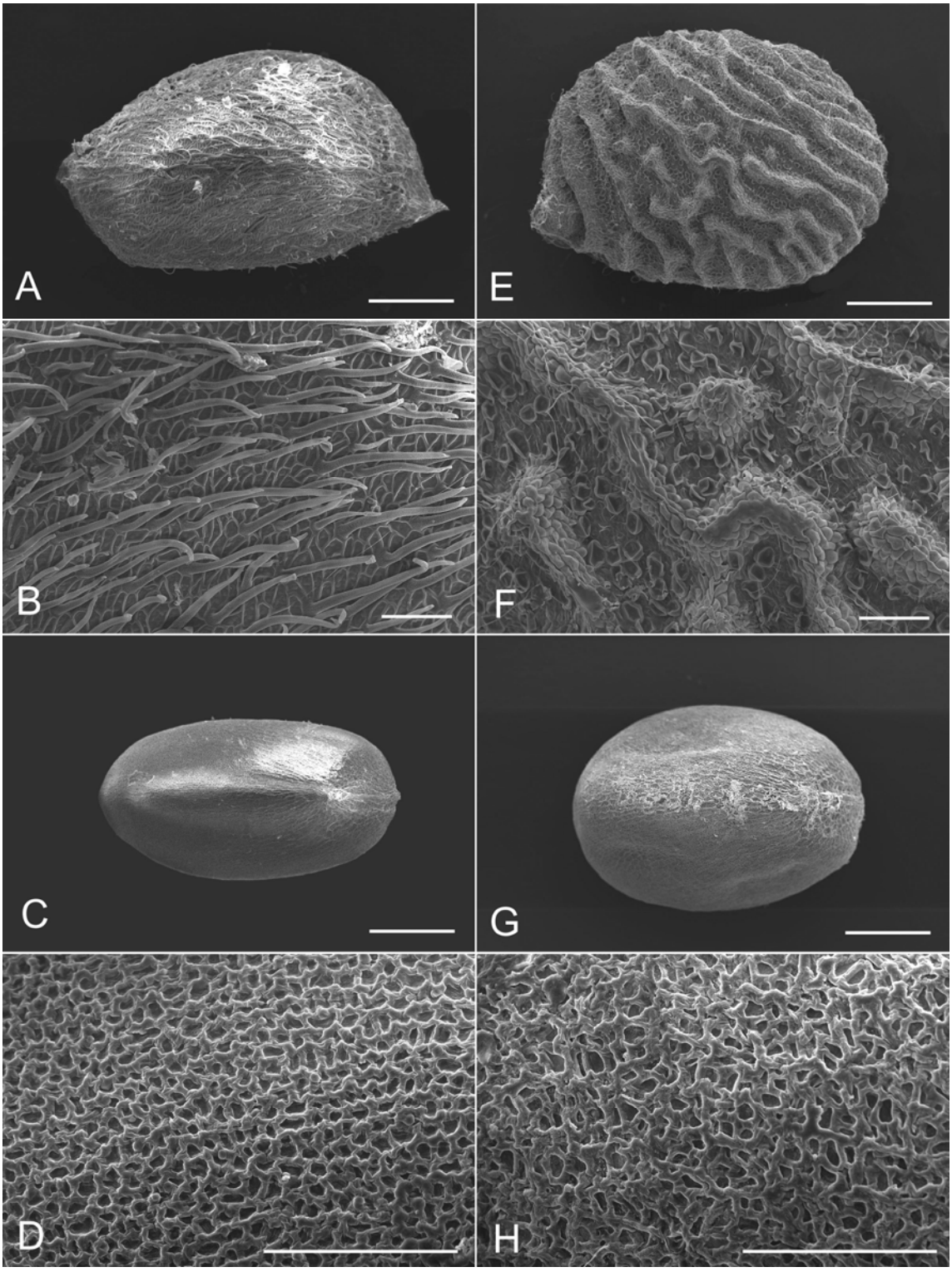


Fig. 3. Comparison of scanning electron micrographs between *Geranium pusillum* (left panels) and *G. molle* (right panels). A & E: Fruits. B & F: Enlarged fruit-coat. C & G: Seed. D & H: Sculpturing of seed-coat. Scale bars A, E, C & G = 0.5 mm; bars B, F, D & H = 0.1 mm.

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and *G. pusillum* has a more-obvious ridge near the hilum (Figs. 3C & G). Both of these species have similar reticular sculpturing on seed-surface (Figs. 3D & H).

Key to the taxa of Taiwanese *Geranium*

1. Capsules with seed discharged from stalk when mature 2
1. Seeds directly ejected from capsules when mature 4
2. Leaves ternately divided …… *G. robertianum*
2. Leaves simple, 5~7 divided 3
3. Capsule surface scabrous, flowers less than 7 mm in diameter .... …..... *G. pusillum*
3. Capsule surface rugose, flowers more than 8 mm in diameter ..... …..... *G. molle*
4. Flower solitary; bracts 2 5
4. Flowers 2; bracts 4 6
5. Stipules 4 at each node; flowers yellow ….....……. *G. suzukii*
5. Stipules 2 at each node; flowers pink to purple …. *G. hayatanum*
6. Pedicels less than 1 cm long; flowers in a compact cluster ....….. *G. carolinianum*
6. Pedicels longer than 1 cm long; flowers in a loose cluster 7
7. Stem hairy with glandular hairs; flowers purple ……..... ……..... *G. nepalense* ssp. *thunbergii*
7. Stem glabrous or tomentose on the upper portion; flowers white ..... *G. wilfordii*

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臺灣新歸化牻牛兒苗科植物－小花牻牛兒苗

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摘　　要

主要原產於歐洲、北非、西亞的牻牛兒苗科植物－小花牻牛兒苗（*Geranium pusillum* L.），新歸化於台灣中部山區，為一年或二年生草本。小花牻牛兒苗與最近歸化於臺灣山區的柔毛牻牛兒苗形態相似，但是花較小，且果實表面粗糙具短毛而可區分。本文提供分類特徵描述，手繪圖，照片與檢索表以供區分鑑定。

關鍵詞：牻牛兒苗科、小花牻牛兒苗、歸化植物、臺灣、分類。

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