

Swertia changii (Gentianaceae), a new species from southern Taiwan

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ABSTRACT. A new species from Taiwan, *Swertia changii* S. Z. Yang, C. F. Chen & C. H. Chen (Gentianaceae), is described and illustrated. This species is so far known only from the southern part of the Central Mountain Range at elevations of ca. 800-1,300 m. The new species is most similar to *S. shintenensis* Hayata, which is endemic to northern Taiwan, but differs in having 4-merous flowers, axial corolla lobes purple, green nectaries, and smaller protrusions of the epidermal cells on the seed coat.

Keywords: Gentianaceae; New species; *Swertia*; *Swertia changii*; Taiwan; Taxonomy.

INTRODUCTION

The genus *Swertia* L. (Gentianaceae), including 16 series and 11 sections, comprises about 150 species, mainly distributed in temperate regions of the northern hemisphere (Ho and Pringle, 1995). Eighty-six species occur in the eastern Asiatic region, and the southwest China-Himalayan area is the center of species diversity of the genus, where about half of the world's species are found (Ho et al., 1994). *Swertia* exhibits strong parphyly among related taxa as revealed by DNA sequence data (Chassot et al., 2001; Struwe et al., 2001). In Taiwan, earlier taxonomists have described five endemic species (Hayata, 1908, 1911, 1916; Satake, 1941). Liu and Kuo (1970, 1974) made the first revision of the Taiwanese *Swertia*, and also published the same treatment in the *Flora of Taiwan* (Liu and Kuo, 1978). Ho et al. (1988) and Ho and Pringle's (1995) revision of the genus in China and Taiwan was similar to the treatment of Liu and Kuo (1970, 1974), but they reduced *S. randaiensis* Hayata to synonymy under *S. macrosperma* (C.B. Clarke) C.B. Clarke. More recently, Wang and Lu (1998a, b) reduced *S. matsudae* Satake to synonymy under *S. tozanensis* Hayata, and reported four species from Taiwan.

After the treatment of Gentianaceae was published in the second edition of the *Flora of Taiwan* (Wang and Lu, 1998b), three new species were recorded (Chen and Wang, 2000; Chen et al., 2006; Hsieh et al., 2007). Recently, we found an unknown species of *Swertia* during our botanical explorations in southern Taiwan. After additional field observations and comparisons with related taxa, we concluded that it is a new species not yet described.

MATERIALS AND METHODS

The plants were collected in the field and dried using standard procedures for preparing herbarium specimens. Seeds and pollen for scanning electron microscopy (SEM) were collected from fresh capsules and flowers of the holotype of *Swertia changii* (C.F. Chen 2081). For comparison, SEM photographs were also taken of the seeds of *S. shintenensis* Hayata (C.H. Chen 6216, collected from Shih-tou-shan in Taipei Hsien, deposited in TNM).

Pollen grains were treated by the acetolysis method (Erdtman, 1952) before being dried to a critical point. Seeds and pollen grains were coated with gold, examined, and photographed using a Hitachi S3000N SEM machine.

SYSTEMATIC TREATMENT

Swertia changii S. Z. Yang, C. F. Chen & C. H. Chen, sp. nov.—TYPE: TAIWAN. Pingtung County: Chunjih Township, Tahanshan elev. 1200-1,300 m, 20 Sep 2006, C.F. Chen 2081 (holotype: PPI). 大漢山當藥
Figures 1, 2

Species haec *S. shintenensi* affinis, sed flore 4-mero, corollae lobis purpureis ad medium nectario viridi instructis, testa echinata cum protuberationibus minoribus differt.

Herbs, robust biennial, 70-90 cm tall, leaves of first year in rosettes; producing a single flowering stem in second year, withering after seed dispersal in late winter. Root thick, fleshy. Stem erect, simple, hollow, terete, ca. 5-7 mm in diam at base, mature stem with black dots. Basal leaves persistent at anthesis, entire, glabrous, opposite, oblanceolate to spatulate, blade attenuate to winged base, apex acute, adaxial surface glossy, 20-30 cm long, 6-10

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cm wide; veins pinnate, midrib distinct, elevated on lower surface, veinlets enclosed at margin. Stem leaves entire, opposite, sessile, cordate, base cordate, apex acuminate to acute, gradually diminishing in size toward apex of stem, variable in size, to 8 cm long, 5.5 cm wide. Inflorescences verticillasters, axillary in lower node of stem; upper inflorescences, 3-flowered cymes or flowers solitary. Flowers 4-merous, pedicel 4-7 cm long. Calyx tube 1

mm long, shorter than lobes, glabrous in throat; lobes 4, entire, 6-7 mm long, 3-4 mm wide, ovate-triangular, apex acute; Corolla purple, 3-4 cm in diameter, tube 2-3 mm long, lobes narrowly elliptic to lanceolate, 20 mm long, 6-7 mm wide, apex acute; Nectary 1 per corolla lobe, at middle of corolla lobe, a naked glandular patch, sunken, green, square, apically cordate, basally sinuate. Stamens 4, alternate corolla lobes; filaments green, 9-10 mm

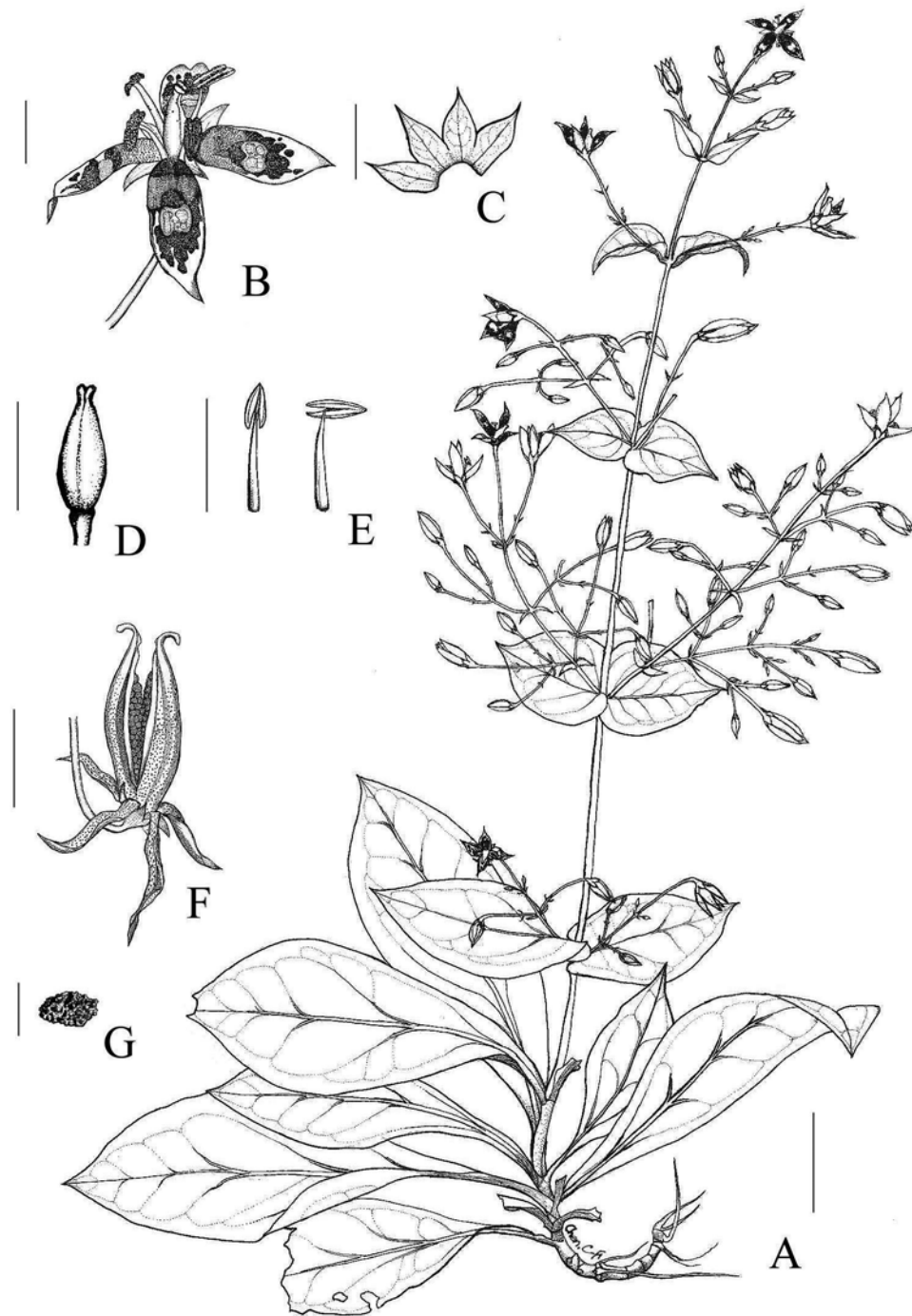


Figure 1. *Swertia changii* sp. nov. A, Habit; B, flower; C, calyx; D, pistil; E, stamens; F, fruit; G, seeds. Scale bars A = 5 cm; B, D, E, F = 1 cm; C = 5 mm; G = 1 mm. From the holotype, C.F. Chen 2081 (PPI).

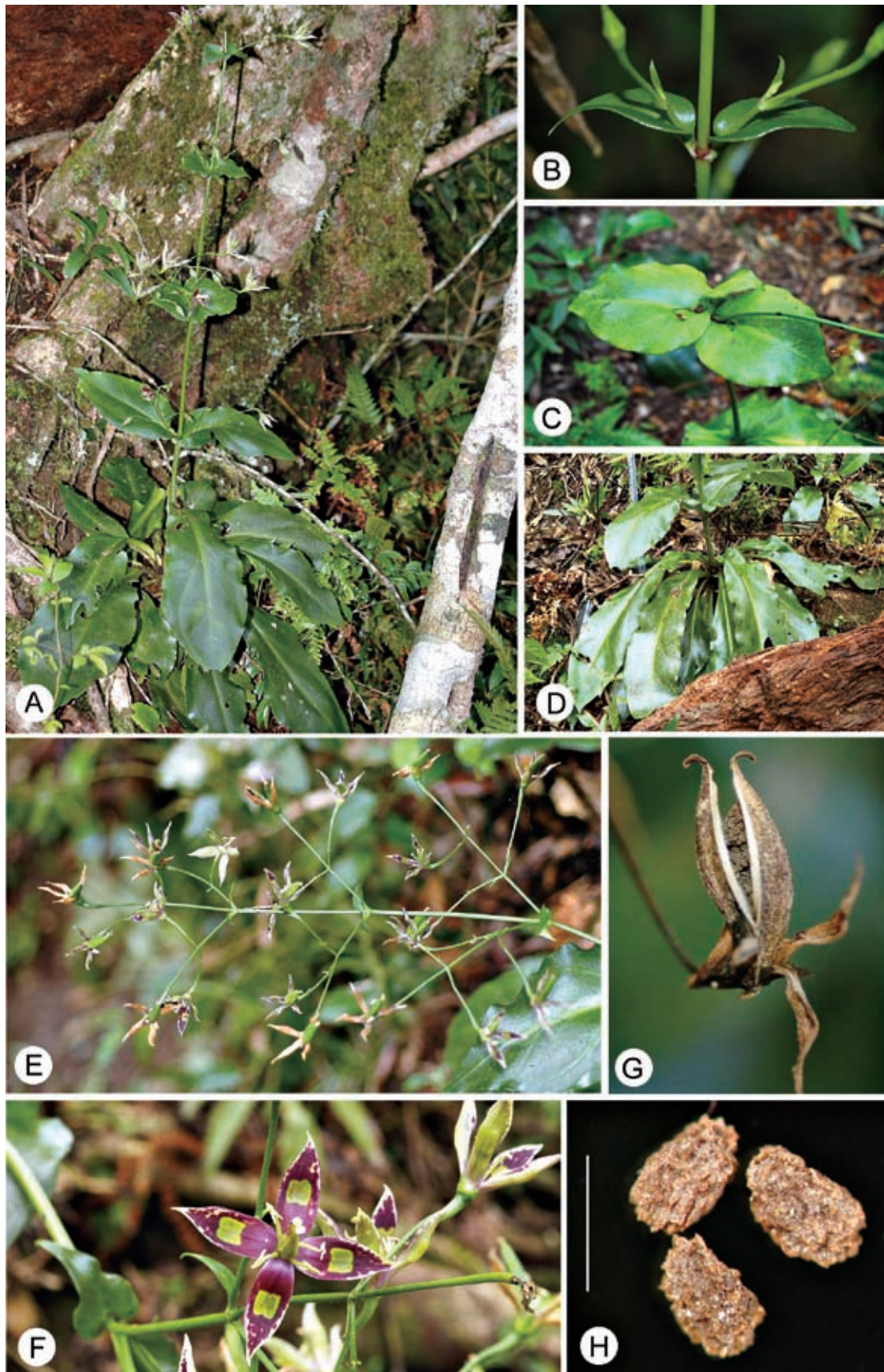


Figure 2. *Swertia changii* sp. nov. A, Habit; B, upper stem leaves; C, stem leaves; D, basal leaves; E, inflorescence; F, flower; G, fruit; H, seeds. Scale bar H = 1 mm.

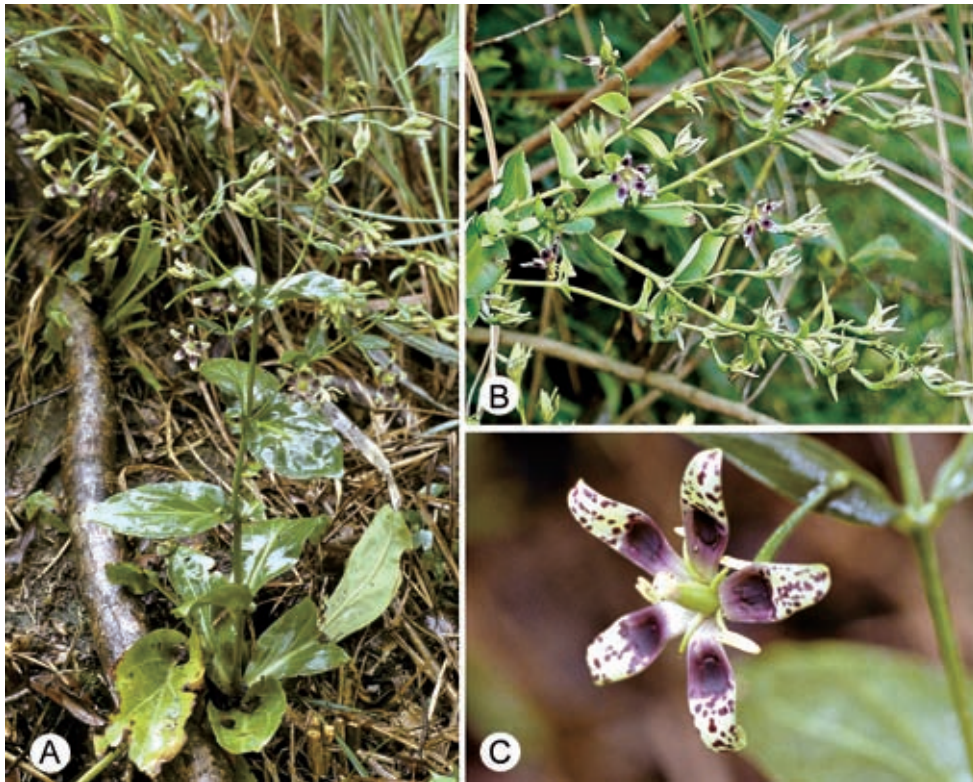


Figure 3. *Swertia shinintensis* Hayata. A, Habit; B, inflorescence; C, flower.

long; anthers yellow, ca. 4 mm long, sagittate, versatile, dehiscence longitudinal. Ovary laterally compressed, erect after flowering, style indistinct, bifid. Capsules narrowly ellipsoid to ovoid, 15-20 mm long, 7-9 mm wide. Seed coat echinate.

Paratypes. PINGTUNG HSIEN: Chunjih Township, Chinshuiying, elev. 1,200-1,300 m, *C.F. Chen 2034* (PPI); same loc., *C.H. Chen 7963* (TNM); Kuzulunshan, *S.Z. Yang 24493* (PPI); Shihtzu Township, Chachayalaishan, elev. 1,100-1,200 m, *C.F. Chen 1166* (PPI); TAITUNG HSIEN: Tajen Township, Xiewushan, *K.P. Lo 846* (PPI); Tajen Township, Tajen Experimental Forest, elev. 800-900 m, *T.Y. Cheng 1* (PPI).

Notes. *Swertia changii* is a member of the section *Ophelia*. It is most similar to *S. shintenensis* (Figure 3), which is endemic to northern Taiwan, but differs in having 4-merous flowers, purple corolla lobes, green nectaries, and smaller protrusions of epidermal cells on the seed coat (Figures 2, 5A-D).

Of the Taiwanese species, *Swertia changii* and *S. shintenensis* are biennial (monocarpic) while all the other species are annuals (Wang and Lu, 1998). The flowers of *S. shintenensis* are 5-merous, but a few may be 4-merous, even on the same individual; 4-merous flowers usually occur on smaller plants. According to our observations of *S. changii* in the field, only 4-merous flowers are produced.

Distribution. Endemic to Taiwan, southern part of the Central Mountain Range (Figure 4), on steep slopes in an undisturbed evergreen forests with slight gaps, in elevations of 800-1,300 m. Flowers Aug.-Oct.; fruits Oct.-Nov.

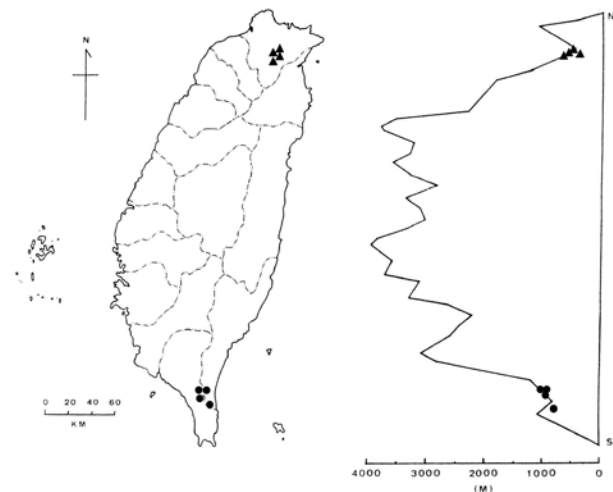


Figure 4. Latitudinal and elevational distribution of *Swertia changii* (circle) and similar species *S. shintenensis* (triangle) in Taiwan.

Palynology. Pollen grains (Figure 5E-H) tricolporate, isopolar, spheroidal to prolate spheroidal in equatorial view, $26-31 \times 25-31 \mu\text{m}$ (P \times E); semiangular in polar view, with long colpi, ends acuminate, exine regulate, with 1-2 μm striae. The pollen morphology of *S. changii* by SEM appears similar to light microscopic photos of the pollen of *S. shintenensis* taken by Nilsson (1967), who described the exine as bearing spinules.

Etymology. The species is named in honor of Dr. Cheng-En Chang (1920-2005), of the Department of Forestry, National Pingtung University of Science and

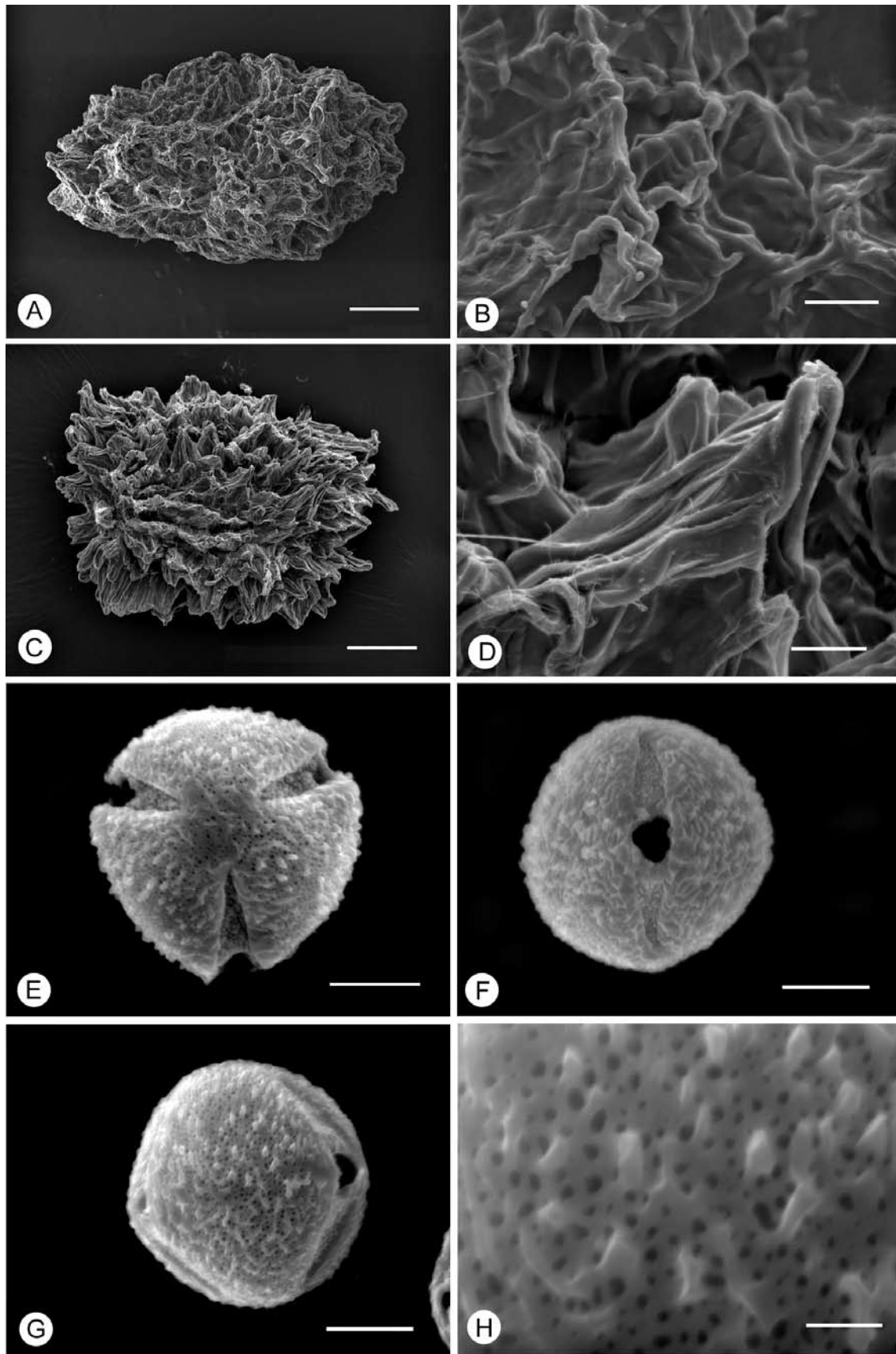


Figure 5. SEM photographs of seeds and pollen grains of *Swertia changii* (A, B, E-H), and seeds of *S. shintenensis* (C, D). A, C, Seed morphology; B, D, seed surface; E-H, pollen grains; E, polar view; F, aperture; G, equatorial view; H, exine. Scale bars A, C = 200 μm ; B, D = 20 μm ; E, F, G = 10 μm ; F = 2 μm .

Technology, who devoted over 50 years to the study of the Elaeocarpaceae, Eriocaulaceae, Lauraceae, Malvaceae, Meliaceae, Myrtaceae, Olacaceae, and Rutaceae in Taiwan and the flora of Lanyu (Orchid) Island.

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台灣產龍膽科新種：大漢山當藥

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本文發表台灣的當藥屬（龍膽科）新種—大漢山當藥（*Swertia changii*），提供分類的描述及繪圖以供辨識；本種類目前僅發現於中央山脈南端的中海拔山區（分布海拔約從 800 至 1,300 m）。此新種與新店當藥（*Swertia shintenensis*）較相似，但大漢山當藥的花數為四，花瓣內側顏色主要為紫色，花瓣上的腺斑為綠色，種子表面突起較小而與之不同。

關鍵詞：龍膽科；新種；當藥屬；大漢山當藥；台灣；分類。