

Triodanis Raf. ex Greene (Campanulaceae), first report for Korea

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미기록 비너스거울속(초롱꽃과)

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ABSTRACT: The genus *Triodanis* Raf. ex Greene (Campanulaceae), which is native to America, is newly reported for Korea based on the discovery of *T. perfoliata* (L.) Nieuwl in the lowlands of Donneko, Seogwipo-si, Jeju-do. The common name 'Bi-neo-seu-geo-ul-sok' is given for the genus and 'Bi-neo-seu-do-ra-ji' for the species. The morphological characters of the genus and species, and illustrations of the species are provided along with photographs of its habitat.

Keywords: *Triodanis*, *T. perfoliata*, new report, Campanulaceae

적 요: 북미에 자생하는 초롱꽃과의 비너스거울속 (*Triodanis* Raf. ex Greene) 식물이 제주도 서귀포시 상효동 돈네코 계곡 하류일대에서 처음 발견되었다. 이 속(*Triodanis* Raf. ex Greene)에 대한 국명은 '비너스거울속', 종(*Triodanis perfoliata* (L.) Nieuwl.)의 국명은 '비너스도라지'로 신칭하였다. 속과 종의 형태적 특징 및 종의 해부도와 서식지 식물사진을 제시하였다.

주요어: 비너스거울속, 비너스도라지, 미기록, 초롱꽃과

The Campanulaceae, commonly called the bellflower family, is a derived angiosperm family comprised of about 1950 species treated in 87 genera and distributed worldwide (Mabberley, 1997). Most members are herbaceous, although a number of taxa are shrubs and occasional trees. Some taxa are famous as edible, coronal, or medical plants. Nine genera with 30 taxa are indigenous plants to Korea (Lee, 2006).

In present study, the genus *Triodanis* is newly reported for Korea based on a naturalized species. *Triodanis perfoliata* (L.) Nieuwl., discovered in Sang hyo-dong, Seogwipo-si, Jeju-do, Korea, at an elevation of 150 m above sea level. The population consists of more than 300 individuals within a 300 m² area. The population occurs within a sunny meadow near the Donneko valley and contains *Pueraria thunbergiana* Benth., *Mazus pumilus* (Burm. f.) Van Steenis, *Persicaria hydropiper* (L.) Spach, and *Erigeron annuus* (L.) Pers., among other species.

The genus *Triodanis*, commonly called clasping Venus' looking-

glass, consists 6 or 7 taxa widely distributed as annual herbs in eastern North America, Central America (Lammers, 2007), and naturalized in China, Taiwan, and Japan (Satake et al., 1981; Chen et al., 1992; Peng and Lammers, 1998; Cosner et al., 2004). *Triodanis perfoliata* is a known invasive and weedy species in US (Stubbenieck et al., 1994; Uva et al., 1997). Both *T. perfoliata* and *T. biflora* are known to be invasive in China. The invasiveness of these taxa has caused obvious changes in natural ecosystem and landscape, and has caused damage to local natural and artificial ecosystem (Xie et al., 2001). Given their invasiveness, these plants may become a problem in Korea when the population expands to other regions.

The genus *Triodanis* is closely related to the genus *Legousia*, but differs in most flowers of the inflorescence are cleistogamous, calyx lobes are reduced to 3, corollas are rudimentary or lacking, and anther filaments are basally dilated. In contrast, all flowers of *Legousia* are chasmogamous, with 5 calyx lobes, well-developed corollas, and most anther filaments filiform (Sheve

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and Wiggins, 1964; Chen et al., 1992; Lammers, 2007).

Triodanis perfoliata was initially described as *Campanula perfoliata* L. in 1753 by Linnaeus. It also had been treated as *Specularia perfoliata* by A. DC in 1830. Nieuwl transferred *Campanula perfoliata* to the genus *Triodanis*, as *T. perfoliata* (L.) Nieuwl in 1914 (Peng and Lammers, 1998). The species is native to eastern North America and has become naturalized in China, Taiwan, and Japan (Satake et al., 1981; Chen et al., 1992; Peng and Lammers, 1998; Cosner et al., 2004). *Triodanis perfoliata* occurs in disturbed areas, pastures, or roadsides. The lower cleistogamous flowers are fertile but produce very little viable seed. The upper chasmogamous flowers produce abundant viable seed (Trent, 1940; Lord, 1981). Perfoliate leaves bear the deep violet or purple flowers in their axil and form a layered

arrangement at the stem.

The new local name 'Bi-neo-seu-geo-ul-sok' is chosen for the genus *Triodanis*, derived from its English common name, and 'Bi-neo-seu-do-ra-ji' for the species *T. perfoliata*, based on its neat and beautiful flowers like Venus, the Roman goddess of love. The voucher specimens are preserved in the Ewha Womans University Herbarium (EWH, Chung M. S. et al., 0906010).

Description

Triodanis Raf. ex Greene, New Fl. Bot. N. Amer. 4: 67: 1838; McVaugh in Wrightia 1: 13, 1945.

Dysmicodon (Endl.) Nutt., Trans. Amer. Philos. Soc. (n. s.)

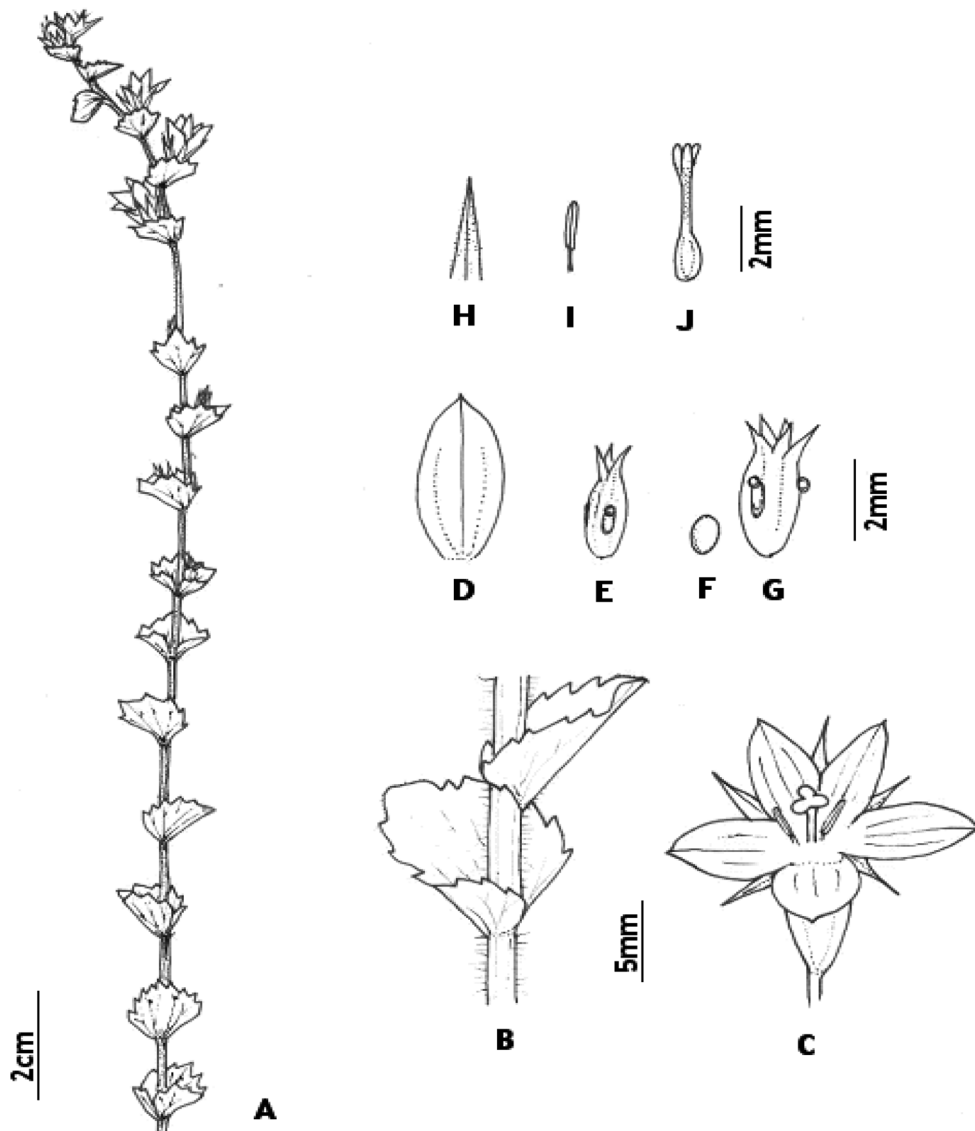


Fig. 1. *Triodanis perfoliata* (L.) Nieuwl. A. Habit; B. Stem and leaves; C. Flower; D. Petal; E. Lower fruit; F. Seed; G. Upper fruit; H. Sepal; I. Stamen; J. Pistil

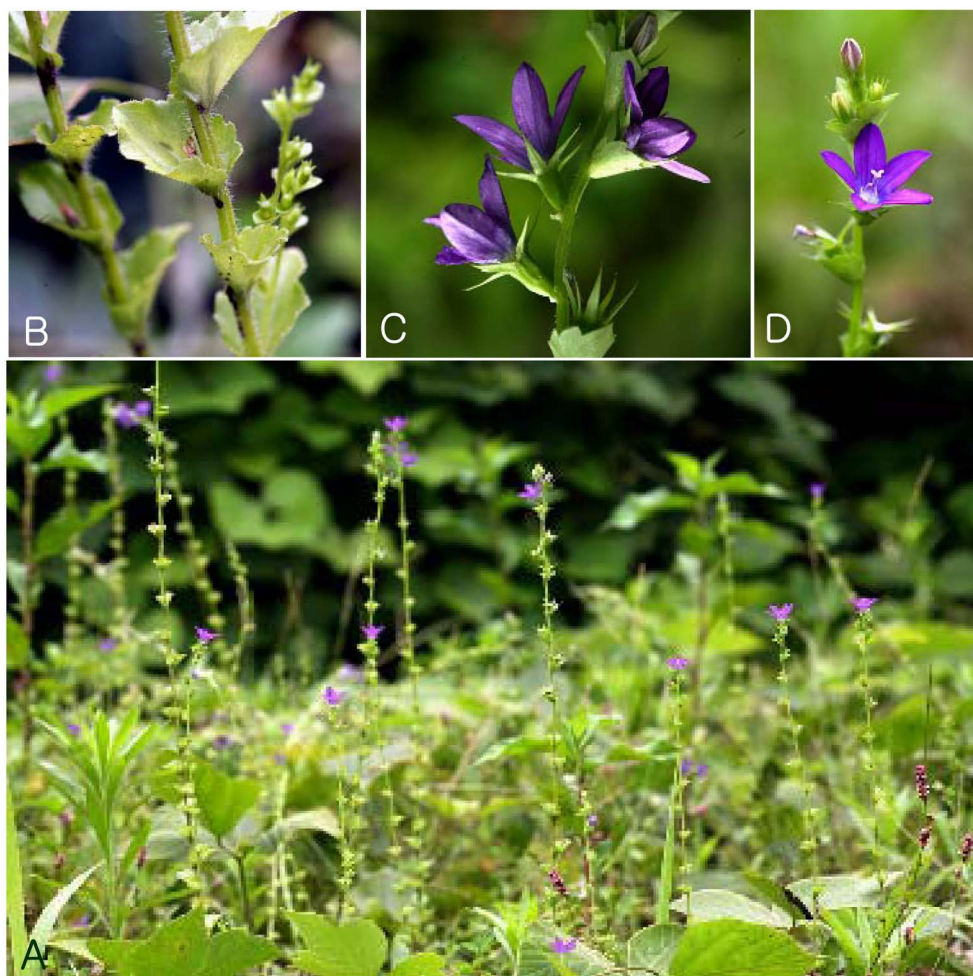


Fig. 2. Photograph of *Triodanis perfoliata* (L.) Nieuwl. taken by Mi Sook Chung in Sang hyo-dong, Seogwipo-si, Jeju-do on 5 June 2009. A. Habit; B. Leaf and stem; C. Flowers; D. Flower.

8: 255, 1842.

Campylocera Nutt., Trans. Amer. Philos. Soc. (n. s.) 8: 257, 1842.

Specularia sect. *Campylocera* (Nutt.) A. Gray, Proc. Amer. Acad. Arts 11: 82, 1876.

Korean name: Bi-neo-seu-geo-ul-sok

Herbs annual. Stems erect or reclining, unbranched or sparingly branched from lower nodes, 4-5 angled. Leaves sessile or short-petiolate, toothed, imperceptibly passing into floral bracts above. Flowers sessile; 1-3 (-8) in upper axils, forming a spikelike inflorescence, lower flowers generally smaller and cleistogamous; calyx lobes 3-5; corolla lobes 5, rotate, lobes narrowly triangular or elliptic, longer than the tube, acuminate at apex; stamens 5, distinct, free from corolla; filaments dilated basally; anthers linear, longer than filaments; ovary inferior, 3-locular with axile placenta (rarely 1-locular with parietal placenta); stigma 3-lobed. Fruits an erect linear, oblong, ellipsoid, or

clavate poricidal capsule with one pore per locule. Seeds lenticular, dark brown, small, numerous, shiny.

Triodanis perfoliata (L.) Nieuwl Amer. Midl. Naturalist 3: 192. 1914 (Figs. 1, 2)

Campanula perfoliata L. Sp. Pl. 164, 1753.

Specularia perfoliata (L.) A. DC. Monogr. Camp. 351, 1830.

Korean name: Bi-neo-seu-do-ra-ji

Herbs terrestrial. Roots cylindrical tuberous, taproot. Stems erect, simple, deeply grooved, 5 angled and slightly winged (the wings to 0.5 mm broad), 20-75 cm tall (typically less), 1-2 mm wide, small whit hair line along the ridges, light green, with milky sap. Leaves alternate, light green, sessile, broadly ovate, cordate, strongly clasping and surrounding the stem (perfoliate form), but a pair of opposite leaves at the top of the stem, coarsely serrate to crenate with 3-6 teeth, to 5-30 mm long, 7-

20 mm wide, glabrous above, typically scabrous below, margins slightly ciliate, purplish. Inflorescences one, two, or three sessile flowers from leaf axils. Upper flowers chasmogamous, corolla deep violet or purple, (rarely white), 5-lobed, more than 15 mm wide; lobes to 9 mm long, with few stiff hairs on midvein below, otherwise glabrous; stamens 5, filaments flattened, base expanded, above divided, anthers yellow, 2 mm long; pistils clavate, purple at apex, pubescent, style 1, 7 mm long, stigma 3-lobed, ovary inferior. Lower flowers half of the stem cleistogamous, fertile, calyx smaller, calyx tube to 5 mm long, calyx lobes 3- or 4-lobed, to 3 mm long; ovaries separated into 2 or 3 parts to about the middle. Fruits capsule, tube to 4 mm long, lobes attenuate, 6-7 mm long, 2 mm wide at base, glabrous with strigillose margins; seeds numerous, tiny, lens-shaped, reddish brown.

Flowering: April - August.

Distribution: United States, Northern Mexico, Southern Canada. Naturalized in China, Taiwan, Japan, and Korea.

Habitat: Roadsides, prairies, upland areas of black soil prairies, sandy savanna, lake borders, abandoned fields.

Key to Genus *Triodanis* and the related genera

1. Inflorescence panicle-like, the flowers pedicellate; capsule broadly ellipsoid *Campanula*
1. Inflorescence spike-like, the flowers sessile; capsule cylindrical.
 2. All flowers chasmogamous, calyx lobes 5 and corolla well-developed; filaments filiform or nearly so *Legousia*
 2. Most flowers cleistogamous, calyx lobes reduced to 3 and corolla rudimentary or lacking; filaments basally dilated *Triodanis*

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Literature Cited

- Chen, L. J., Z.-Y. Li and D.-Y. Hong. 1992. *Triodanis* Raf. - A new recorded genus of Campanulaceae in China. *Acta Phytotax. Sin.* 30(5): 473-475.
- Cosner, M. E., L. A. Raubeson and R. K. Jansen. 2004. Chloroplast DNA rearrangements in Campanulaceae: phylogenetic utility of highly rearranged genomes. *BMC Evolutionary Biology*. 4: 27.
- Lammers, T. G. 2007. Campanulaceae. In *The Families and Genera of Vascular Plants*. Vol. VIII. Flowering Plants-Eudicots-Asterales. Kadereit, J. W. and Jeffrey, C. (eds.), Springer, Berlin.
- Lee, Y. N. 2006. New flora of Korea. Kyohaksa Publ. Co., Seoul (in Korean).
- Lord, E. M. 1981. Cleistogamy: A tool for the study of floral Morphogenesis, function and Evolution. *Bot. Rev.* 47: 421-449.
- Mabberley, D. J. 1997. *The plant-book. A portable dictionary of the vascular plants*, second edition. Cambridge University Press, UK.
- Peng, C.-I. and T. G. Lammers. 1998. *Triodanis* Raf. (Campanulaceae: Campanuloideae) a new generic record for the flora of Taiwan. *Bot. Bull. Acad. Sin.* 39: 213-216.
- Satake, Y., J. Ohwi, S. Kitamura, S. Watari and T. Tominari. 1981. *Wild Flowers of Japan*. Heibonsha Ltd., Publishers, Tokyo.
- Sheve, F. and I. L. Wiggins. 1964. *Vegetation and flora of the Sonoran Desert*. Stanford Univ. Press. Stanford, California.
- Stubbendieck, J., G. Y. Friisoe and M. R. Bolick. 1994. *Weeds of Nebraska and the Great Plains*. Nebraska Department of Agriculture, Bureau of Plant Industry. Lincoln, Nebraska.
- Trent, J. A. 1940. Floral variations in *Specularis perfoliata* (L.) A. DC. *American Midland Naturalist* 23: 448-454.
- Uva, R. H., J. C. Neal and J. M. DiTomaso. 1997. *Weeds of the Northeast*. Cornell University Press. Ithaca, New York.
- Xie, Y., Z. Li, P. G. William and D. Li. 2001. Invasive species in China-an overview. *Biodiversity and Conservation* 10: 1317-1341.