



A new species of *Viola* (Violaceae): *Viola ramiflora* K. O. Yoo

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ABSTRACT: A new taxon, *Viola ramiflora* K. O. Yoo (Violaceae), from Jeju-do is described and illustrated. *V. ramiflora* shares several characteristics (pale purple flowers; triangular-ovate, ovate, or oblong leaf blades; winged petioles) with the related species *V. hirtipes*, *V. japonica*, *V. phalacrocarpa*, and *V. seoulensis*. However, this new species has branched cleistogamous and chasmogamous peduncles and oblong-ovate cleistogamous bracteoles.

Keywords: *Viola*, *Viola ramiflora*, new species, Jeju-do

The family Violaceae Batsch is composed of approximately 25 genera, most of which are herbaceous or shrubs, with approximately 900 species distributed throughout the world. The genus *Viola* L. is the most evolved group in Violaceae (Melchior, 1925; Hekking, 1988), with about 525–600 species distributed in the temperate northern hemisphere and tropical regions (Melchior, 1925; Clausen, 1964; Ballard, 1996; Ballard et al., 1999). A study of the distribution of Korean *Viola* was initiated by Matsumura (1886), who described three species, including *Viola japonica* Langsd. ex Ging. It was also carried out by Palibin (1899), Nakai (1916), and Maekawa (1954), and it is now known that nearly 45 taxa are distributed in Korea (Lee, 1996; Lee, 2003; Lee, 2006; Lee and Yoo, 2007; Jang et al., 2009; Lee et al., 2012; Lee et al., 2014).

This study describes the morphological characteristics of *Viola ramiflora* K. O. Yoo, a new species of found in Jeju-do. The new species is similar to *Viola hirtipes* S. Moore, *Viola japonica* Langsd. ex Ging, *Viola phalacrocarpa* Maxim., and *Viola seoulensis* Nakai and of the series *Chinensis* in that the flowers are pale purple and the leaves are triangular-ovate, ovate, or oblong, and the petioles have narrow wings. However, this species is distinguished from other taxa by the branched cleistogamous and chasmogamous peduncles and oblong-ovate cleistogamous bracteoles. These morphological characters were

continuously observed when these plants are cultivated in greenhouse over many years. The same characteristics were also observed in new individuals after seeding with seeds obtained from cleistogamous and chasmogamous samples (Lee, 2014). Therefore, we named this new species *Viola ramiflora*.

Taxonomic Treatment

Viola ramiflora K. O. Yoo, sp. nov. (Figs. 1, 2).—**TYPE:** Korea. Jeju-do: Jeju-si, Ora-dong, 250 m, 4 Apr 2013, K. O. Yoo et al. KWNNU-95005 (holotype, KWNNU; isotypes: KWNNU).

Korean name: Ga-ji-je-bi-kkot 가지제비꽃.

Diagnosis: *Viola ramiflora* K. O. Yoo is distinguished from its related species *Viola hirtipes*, *Viola japonica*, *Viola phalacrocarpa*, and *Viola seoulensis* by having a peduncle form and bracteoles with a cleistogamous shape.

Herbs, perennial, acaulescent. Rhizome short. Roots white, elongated. Leaves basal, rosulate, pubescent; blade triangular-ovate, ovate, or oblong, 2.1–4.7 × 1.2–2.8 cm; petiole 3.2–10.8 cm long, narrow winged, pubescent. Flowers pale purple; peduncles 3-branched in the middle, pubescent, 6.6–13.0 cm long; bracteoles middle or above middle, oblong-ovate, 6.5–10.7 mm long, margins serrate or entire. Sepals lanceolate or

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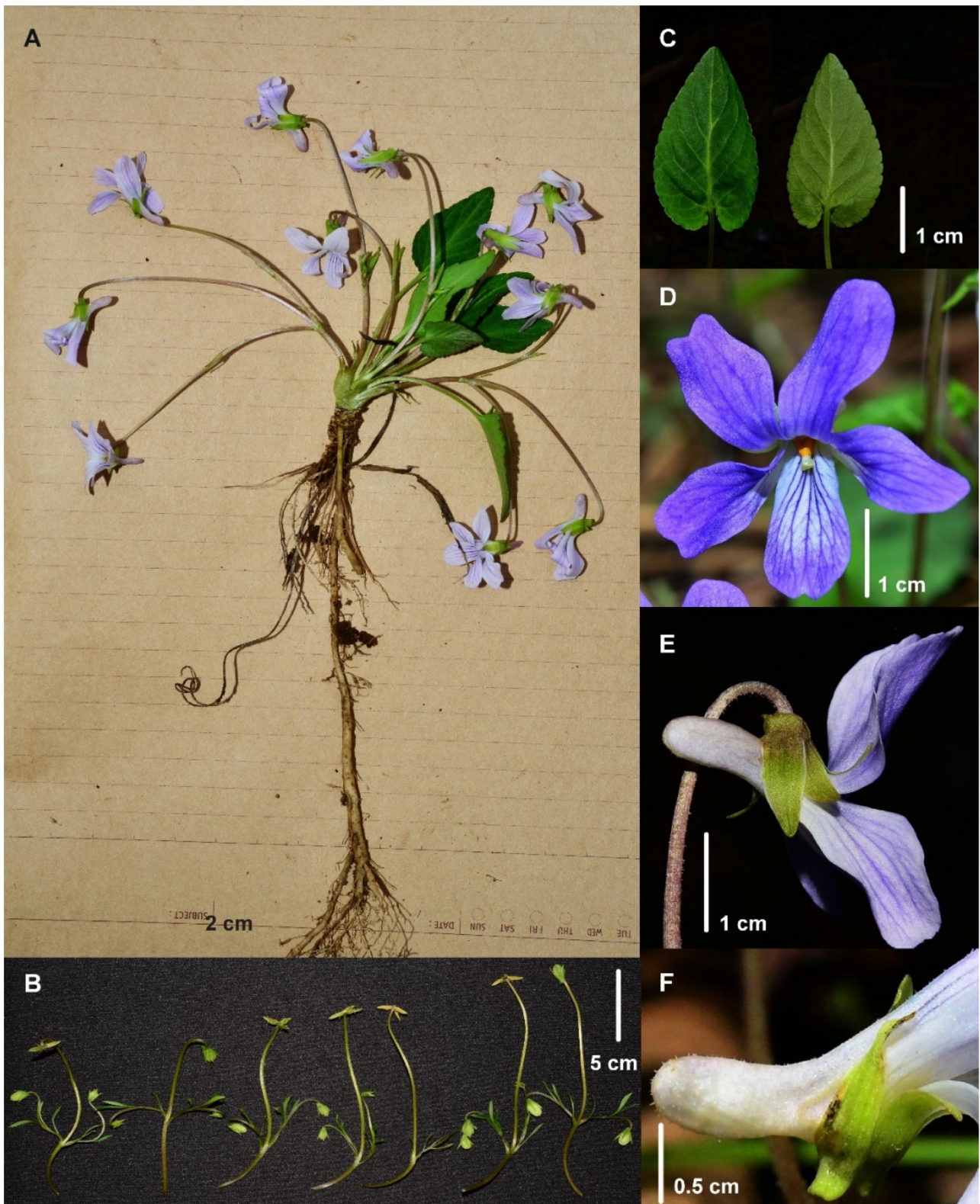


Fig. 1. Photographs of *Viola ramiflora* K. O. Yoo. **A.** Adult plant with flowers. **B.** Cleistogamous. **C.** Adaxial-abaxial of leaf. **D.** Front view of flower. **E.** Side view of flower. **F.** Spur.

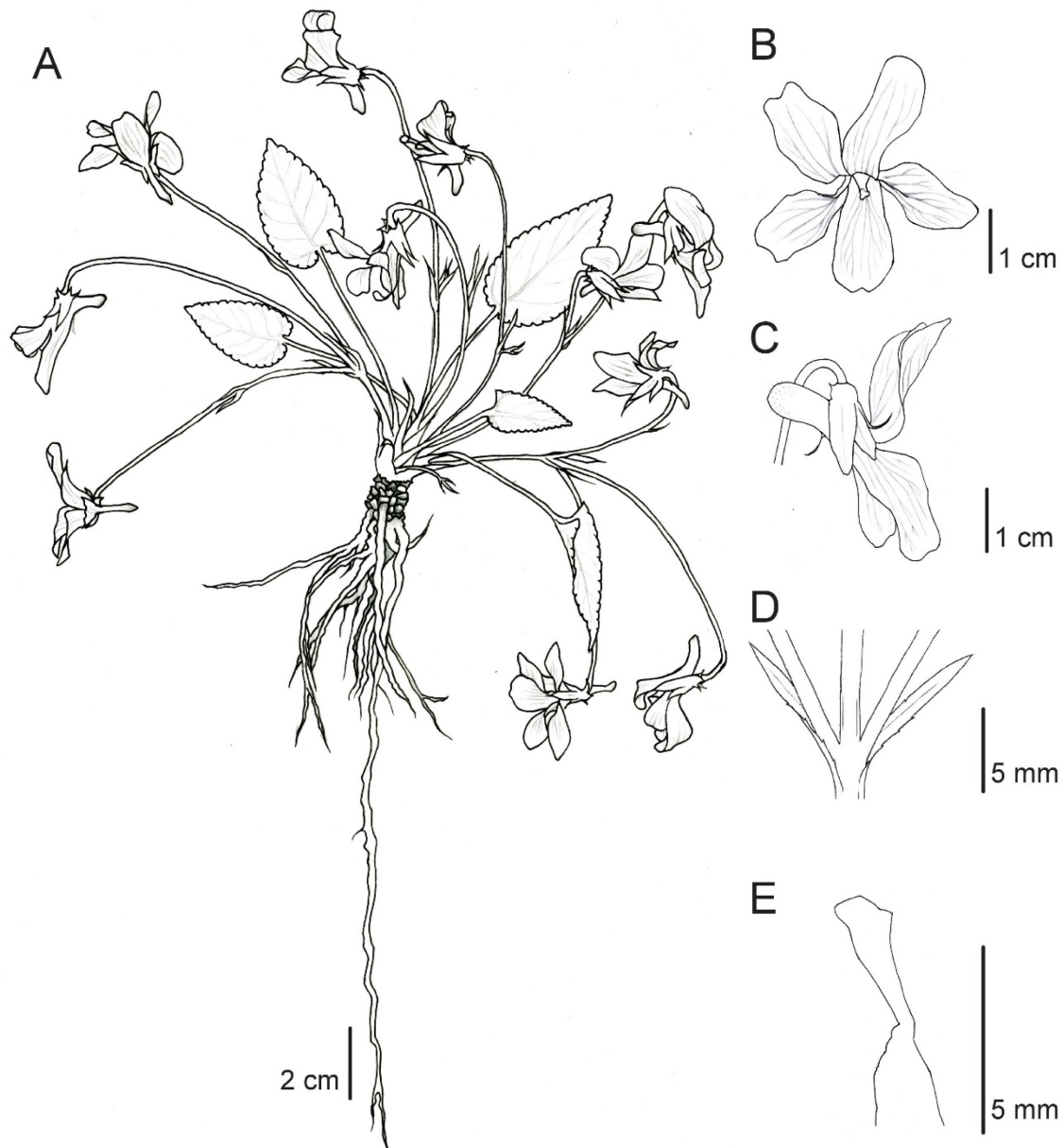


Fig. 2. *Viola ramiflora* K. O. Yoo. **A.** Adult plant with flowers. **B.** Front view of flower. **C.** Side view of flower. **D.** Bracteoles. **E.** Pistil.

ovate-lanceolate, $5.7\text{--}8.1 \times 1.5\text{--}2.6$ mm. Petals 5, glabrous; upper ones obovate, $1.2\text{--}2.3$ cm, lateral ones oblong-obovate, $0.8\text{--}1.7$ cm long, lower ones obovate, $1.3\text{--}2.4$ cm long; spur tubular, $5.6\text{--}9.6 \times 2.0\text{--}2.5$ mm, glabrous or sparsely puberulent. Stamens 5; 2 anthers extend in-to spur, secrete nectar. Styles clavate; stigmas capitate, beaked in front. Capsule obovate, glabrous. Seeds brown, pale brown, ovoid-globose, $1.9\text{--}2.2 \times 1.2\text{--}1.3$ mm (Table 1).

Flowering: April.

Distribution: Korea (Jeju-do).

Etymology: The specific epithet is derived from branched

peduncle. The Korean name, Ga-ji-je-bi-kkot, comes from the morphological characters of the branched peduncle.

Habitats: Approximately 200 individuals of *Viola ramiflora* K. O. Yoo were found at the entrance and top of the Oreum in Jeju-do. This new species occurs under trees in forests dominated by *Pinus thunbergii* Parl., but the shading rate is high due to the low coverage. This species also occurs with other herbaceous species such as *Stellaria media* (L.) Vill., *Corydalis incisa* (Thunb.) Pers., *Veronica persica* Poir., *Artemisia princeps* Pamp., and *Miscanthus sinensis* var. *purpurascens* (Andersson) Rendle.

Table 1. Comparison of morphological characters of *Viola ramiflora* K. O. Yoo and its related taxa.

Characters	<i>V. ramiflora</i>	<i>V. hirtipes</i>	<i>V. japonica</i>	<i>V. phalacrocarpa</i>	<i>V. seoulensis</i>
Leaf length (cm)	2.1 – 3.2 – 4.7	4.3 – 5.5 – 8.1	2.4 – 4.1 – 7.6	1.6 – 2.5 – 4.0	2.1 – 2.7 – 3.8
Leaf width (cm)	1.2 – 1.8 – 2.8	2.0 – 2.9 – 4.5	1.6 – 2.6 – 4.8	1.1 – 1.8 – 2.7	0.8 – 1.1 – 1.6
Petiole length (cm)	3.2 – 6.8 – 10.8	4.2 – 9.3 – 13.5	1.9 – 9.8 – 20.2	3.0 – 5.2 – 7.4	1.4 – 2.6 – 4.9
Petiole hairs	Pubescent	Pubescent	Glabrous	Pubescent	Pubescent
Flower color	Pale purple	Purple	Pale purple, purple	Pale purple, purple, dark purple	Pale purple
Peduncle branch	3-branched	Not branched	Not branched	Not branched	Not branched
Peduncle length (cm)	6.6 – 10.3 – 13.0	5.0 – 10.6 – 14.8	5.5 – 13.1 – 19.8	6.7 – 8.7 – 12.3	4.3 – 6.2 – 7.7
Bract shape	Oblong-ovate	Lanceolate	Lanceolate	Lanceolate	Lanceolate
Bract length (mm)	6.5 – 8.0 – 10.7	4.3 – 6.3 – 7.9	5.6 – 8.5 – 11.3	3.7 – 5.7 – 6.8	5.5 – 8.3 – 9.9
Bract tooth	Serrate or entire	Entire	Entire	Entire	Entire
Sepal length (mm)	5.7 – 7.1 – 8.1	5.8 – 7.7 – 9.2	5.4 – 7.8 – 8.6	4.6 – 6.2 – 7.8	5.5 – 7.6 – 10.3
Sepal width (mm)	1.5 – 2.0 – 2.6	1.7 – 2.3 – 3.2	1.6 – 2.2 – 2.8	1.5 – 1.7 – 2.0	1.9 – 2.4 – 3.1
Spur hairs	Glabrous or sparsely puberulent	Glabrous	Glabrous	Pubescent	Glabrous
Capsule hairs	Glabrous	Glabrous	Glabrous	Pubescent	Glabrous
Seed color	Pale brown	Pale brown	Dark brown	Dark brown	Dark brown
Seed length (mm)	1.9 – 2.0 – 2.2	1.7 – 1.9 – 2.1	1.9 – 2.1 – 2.3	1.4 – 1.5 – 1.6	1.8 – 1.9 – 2.1
Seed width (mm)	1.2 – 1.2 – 1.3	1.1 – 1.2 – 1.3	1.1 – 1.3 – 1.4	0.9 – 1.1 – 1.2	1.0 – 1.1 – 1.3

Additional specimens examined (paratypes): Korea. Jeju-do: Min Oreum, 4 Apr 2014, *KWNU-93601*, *93602* (KWNU); 11 Apr 2014, *KWNU-93567*, *93600*, *93603*, *93604* (KWNU); 15 Apr 2017, *KWNU-93704*, *93705*, *93718* (KWNU).

A Key to *Viola ramiflora* and its related taxa

1. Leaves ovate, ovate-ellipsoid, triangular-ovate, oblong, orbicular.
 2. Flowers white.
 3. Leaf blade entire, margin regularly dentate
..... *V. albida* 태백제비꽃
 3. Leaf blade divided, margin irregularly dentate
..... *V. albida* var. *takahashii* 단풍제비꽃
 2. Flowers purple, pale purple.
 3. Ovary and capsule pubescent
..... *V. phalacrocarpa* 털제비꽃
 3. Ovary and capsule glabrous.
 4. Petiole pubescent.
 5. Leaves both surface, petiole, peduncles pubescent.
 6. Peduncles 3-branched
..... *V. ramiflora* 가지제비꽃
 6. Peduncles not branched.....
1. Leaves narrowly ovate, triangular-lanceolate, broadly triangular.
 7. Flowers purple.
 8. Petiole glabrous; lateral petals pubescent.....
..... *V. mandshurica* 제비꽃
 8. Petiole pubescent; lateral petals glabrous.....
..... *V. yedoensis* 호제비꽃
 7. Flowers white.
 9. Leaves narrowly triangular-lanceolate, petiole conspicuously winged from base; lateral petals with purple stripes
..... *V. patrinii* 흰제비꽃
 9. Leaves broadly triangular-lanceolate, petiole narrowly winged on upper part; lateral petals, stripes absent
..... *V. lactiflora* 흰젓제비꽃

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Conflict of Interest

The authors declare that there are no conflicts of interest.

Literature Cited

- Ballard, H. E. Jr. 1996. Phylogenetic relationships and infrageneric groups in *Viola* (Violaceae) based on morphology, chromosome number, natural hybridization and internal transcribed spacer (ITS) sequences. Ph.D. dissertation, Univ. of Wisconsin, Madison, WI, USA. 344pp.
- Ballard, H. E. Jr., K. J. Sytsma and R. R. Kowal. 1999. Shrinking the violets: phylogenetic relationships of infrageneric groups in *Viola* (Violaceae) based on internal transcribed spacer DNA sequences. *Systematic Botany* 23: 439–458.
- Clausen, J. 1964. Cytotaxonomy and distributional ecology of western North American violets. *Mandrono* 17: 173–197.
- Hekking, W. H. A. 1988. *Violaceae Part I: Rinorea and Rinoreocarpus*. *Flora Neotropica* 46: 1–207.
- Jang, S. K., W. T. Lee and K. O. Yoo. 2009. New record of genus *Viola*: *Viola grypoceras* A. Gray var. *pubescens* Nakai in Korea. *Korean Journal of Plant Taxonomy* 39: 299–303. (in Korean)
- Lee, H. 2014. Taxonomic studies on the *Viola seoulensis* Nakai and related taxa. Master's thesis, Kangwon National University, Chuncheon, Korea, 60 pp.
- Lee, J. S., C. H. Choi, K. S. Han, S. K. So, Y. Hwang and M. Y. Kim. 2012. A new species of *Viola* (Violaceae): *V. ulleungdoensis* M. Kim & J. Lee. *Korean Journal of Plant Taxonomy* 42: 202–206.
- Lee, J. S., Y. Hwang and M. Y. Kim. 2014. A new species of *Viola* (Violaceae): *V. breviflora* J. Lee & M. Kim. *Korean Journal of Plant Taxonomy* 44: 84–87.
- Lee, T. B. 2003. *Coloured Flora of Korea*. Hyangmunsa, Seoul, 2096 pp. (in Korean)
- Lee, W. T. 1996. *Standard Illustrations of Korean Plants*. Academy Publishing Co., Seoul, 624 pp. (in Korean)
- Lee, W. T. and K. O. Yoo. 2007. *Violaceae*. In *The Genera of Vascular Plants of Korea*. Park, C.-W. (ed.), Academy Publishing Co., Seoul. Pp. 393–402.
- Lee, Y. N. 2006. *New Flora of Korea*. Kyohaksa, Seoul, Vol. 1, 975 pp, Vol. 2, 885 pp. (in Korean)
- Maekawa, F. 1954. *Violaceae*. In *Enumeratio Spermatophytarum Japonicum III*. Hara, H. (ed.), Iwanami, Tokyo. Pp. 194–227.
- Matsumura, J. 1886. *Catalogue of plants in the herbarium of the College of Science, Imperial University*. Tokyo, 287 pp.
- Melchior, H. 1925. *Die phylogenetische entwicklung der Violaecen und die natürlichen verwandtschaftsverhältnisse ihrer gattungen*. *Repertorium Specierum Novarum Regni Vegetabilis* 36: 83–125.
- Nakai, T. 1916. *Viola coreanae*. *The Botanical Magazine*, Tokyo 30: 276–289.
- Palibin, J. 1899. *Conspectus Florae Koreae I*. *Acta Horti Petropolitani* 17: 30–36.

제비꽃속(제비꽃과)의 신종: 가지제비꽃(*Viola ramiflora* K. O. Yoo)

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적 요: 제주도에서 제비꽃속의 신종인 가지제비꽃(*Viola ramiflora* K. O. Yoo)을 새로이 발견하여 기재 및 도해하였다. 가지제비꽃은 꽃이 연한 자색이고 잎이 삼각상 난형, 난형 또는 장타원형으로 엽병에 얽은 날개가 발달한다는 점에서 제비꽃계열의 털제비꽃, 서울제비꽃, 흰털제비꽃, 그리고 왜제비꽃과 비슷하나 폐쇄화와 개방화의 환경이 뚜렷하게 분지하며, 폐쇄화의 포엽이 장란형으로 신장하는 특징을 가져 신종으로 명명하였다.

주요어: 제비꽃속, 가지제비꽃, 신종, 제주도