

A New Species of *Adenophora* (Campanulaceae) from Korea

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Adenophora erecta S. Lee, J. Lee et S. Kim, is described as a new species from an open north-facing mountain slope on the coast of Sukpo-Dong, Ullungdo Is., Kyungsangbukdo, Korea. This species resembles *A. remotiflora* Miq., but is well separated by having the leaves compactly arranged along the upper part of the stem, condensed raceme, distinct veins on the corolla and especially shallow dome-shaped epigynous nectar disc.

Key words: *Adenophora erecta* — Campanulaceae — Korea — Sect. *Remotiflorae* — Ullungdo Is.

Adenophora Fisch. is one of the noteworthy genera in the Korean peninsula. On the basis of earlier literature (Nakai 1911, Mori 1921, Park 1949, Lee and Ahn 1963), Oh (1981) enumerated the Korean *Adenophora* to be 18 species, 11 varieties and 9 forms. The phenetic plasticity of the species, however, often makes the taxonomic account hardly feasible. The present authors (Lee and Lee 1994) revised the Korean *Adenophora* and enumerated 9 species and 8 infraspecific taxa. After completing our study of *Adenophora*, we found a species resembling *A. remotiflora* Miq. which is distributed widely. It is different from *A. remotiflora* Miq. in several features and is described here as a new species. Since section *Remotiflorae* (Ponomarchuk 1971) is characterized by having alternately arranged, distinctly stipitate, broadly ovate leaves and a short epigynous disc, it obviously belongs to the section. This paper also deals with the position and interspecific relationship of this species within the section *Remotiflorae*.

Materials and Methods

To compare *A. erecta* from the type locality with closely related taxa, the measurements of *A. remotiflora* var. *remotiflora* form *remotiflora* were taken from the materials collected from Mts. Odae, Sorak, Halla, Daeryong, and Chiri in Korea. *A. remotiflora* var. *remotiflora* form *leucantha* was taken from those of Mt. Mani. *A. remotiflora* var. *hirticalyx* was taken from those of Mt. Chiri, whereas those of Chinese species (*A. trachelioides*, *A. petiolata*, *A. hunanensis*, *A. rupicola*, and *A. sinensis*) were adopted from the description of Hong (1983).

Acetolysis of the pollen grains followed the modified

Ertman's method (Kim and Lee 1978). Acetolyzed pollen was air-dried on specimen stubs, coated with ion sputter (JEOL JFC-1100), and examined with scanning electron microscope (JEOL EM-ASID-4D). At least twenty measurements were made from each collection with light microscope (Laborlux 12).

Description and Discussion

Adenophora erecta S. Lee, J. Lee et S. Kim, sp. nov. (Fig. 1) Herba perennis. Caules e caudice crasso erecti singuli vel complures, 30–50 cm alti, glabri. Folia alterna, inferne petiolo elongato superne brevi; lamina ovata irregulariter serrata, basi cordata apice cuspidata, 6–12 × 3–6 cm, glabra vel parce ciliata. Inflorescentia contracta racemosa, bracteis lanceolatis. Calycis lobi late lanceolati, 7–9.6 × 2.7–4.1 mm, integri, glabri. Corolla co-

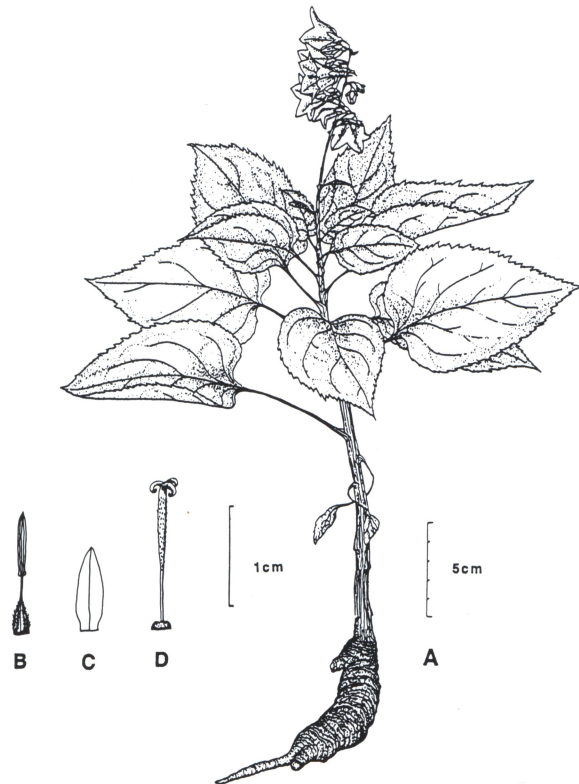


Fig. 1. *Adenophora erecta*. (24 Aug. 1992, S. Kim, SKK).
A. Habit. B. Stamen. C. Sepal. D. Pistil.

erulea vel alba glabra late companulata, 17–23×9.6–13.9 mm, lobis ±8×6 mm. Filamenta 5.4–7 mm, basi pilosa. Antherae lineares 5.3–7 mm. Discus nectarifer epigynus 0.7–1.1 mm altus, 2–2.4 mm latus, depresso tholiformis. Stylus haud exertus 13.1–16.1 mm, apice latior puberulus, basi glaber. Stigma 3- aut 4-lobum. Perennial herbs. Stem erect, solitary or sometimes clustered from a thick caudex, 30–50 cm tall, glabrous. Leaves alternate; petiole long in lower leaves, becoming shorter in upper leaves; blade ovate, 6–12 cm long, 3–6 cm wide, margin irregularly and acutely serrate, apex cuspidate, base round to cordate, glabrous or sometimes pubescent at the margin. Bracts lanceolate. Inflorescence a raceme; flowers in Aug.–Sept., somewhat compactly arranged along the upper part of peduncle. Peduncles 3.14–20.7 cm long, pedicels 0.35–1.21 cm long. Calyx limb 5-parted, the lobes broadly lanceolate, entire, 7–9.6 mm long, 2.7–4.1 mm wide. Corolla 5-lobed, light bluish to white, glabrous, widely campanulate, 17–23 mm long and 9.6–13.9 mm wide, lobes about 8 mm long and about 6 mm wide with distinct mid veins. Filaments broadened and pilose at base, 5.4–7 mm long. Anthers introrse, linear, 5.3–7 mm long. Epigynous disc surrounding base of the style, shallowly dome-shaped, 0.7–1.1 mm high. 2–2.4 mm wide. Ovary inferior, 3 or 4-locular; style included, about 13.1–16.1 mm long, thin and glabrous but thick and hairy at tip; stigma 3 or 4-lobed.

Type: Korea. Ullungdo Is.: North-facing, open slope of the mountain, at the sea coast of Sukpo-Dong, Kyung-sangbukdo, 24 Aug 1992, S. Kim s.n. (HOLOTYPE: SKK; ISOTYPE: SKK).

Additional specimens examined: Korea. Ullungdo Is., 25 Aug 1994, S. Lee et al. s.n. (SKK, SNU, Kangwon Nations1 University Herbarium); living materials cultivated in the garden of Sung Kyun Kwan University.

Korean name: Sunmosidae (nov.)

Distribution, habitat and etymology: Ullungdo Island is located at 131°52'E and 37°33'N, about 137 km east of the middle of the Korean peninsula. The plants grow on loam, approximately 10 m above sea level, where short

grasses are dominant. This species has an erect habit and compact leaves on the upper part of the stem in the natural habitat, but the compactness of leaves disappears when the plants are cultivated in fertile soil under shade. The specific epithet and the Korean name “sunmosidae” were given to describe this erect habit in its natural habitat.

Comparison to closely related taxa: Within sect. *Remotiflorae*, the flowers of *A. erecta* are distinct in the light bluish to white color and the conspicuous mid veins on the corolla lobes, whereas the color of the others are blue, dark blue or white and veins are inconspicuous. The cordate leaf base is similar to that of *A. remotiflora* and *A. trachelioides*, but the more compact arrangement of the leaves at the open site is different. The style is included in *A. erecta*, whereas it is exerted or about as long as the corolla in others. The epigynous nectary disc is shallowly dome-shaped but not highly cylindrical as in others (Table 1).

A detailed comparison to the infraspecific taxa of *A. remotiflora* which are common in the Korean peninsula and seem to be the most similar to *A. erecta*, revealed that *A. erecta* is a quite distinct species: the corolla of *A. erecta* is shorter, the calyx lobes are more broadly lan-

Table 1. Comparison of some floral and leaf characters between *A. erecta* and other species in section *Remotiflorae* (unit for disc length in mm, for other measurements in cm)

Species	leaf base	corolla length	sepal length	style length	disc length	disc shape
<i>A. erecta</i>	cordate	1.7–2.3	0.7–1.0	1.2–1.6	0.7–1.1	dome-shaped
<i>A. remotiflora</i> *	cordate	1.5–3.9	0.3–1.3	1.6–2.6	1.3–3.8	cylindrical
<i>A. trachelioides</i>	cordate	2.0–2.5	0.6–1.3	2.0–2.5	2.0–3.0	cylindrical
<i>A. petiolata</i>	cuneate	2.0–2.7	0.4–0.9	2.0–2.7	1.8–2.1	cylindrical
<i>A. hunanensis</i>	cuneate	1.5–2.0	0.4–0.7	1.5–2.0	1.0–2.5	cylindrical
<i>A. rupicola</i>	cuneate	1.7	0.5–0.8	2.0–2.2	0.5–1.5	cylindrical
<i>A. sinensis</i>	cuneate	1.3–1.5	0.5–0.8	1.5–1.9	1.0–1.5	cylindrical

* Here the species represents *A. remotiflora* v. *remotiflora* f. *remotiflora*.

Table 2. Comparison of some floral characters between *A. erecta* and *A. remotiflora* (Unit in cm, Mean±SD)

Floral characters	<i>A. erecta</i>	<i>A. remotiflora</i>		
		<i>v. remotiflora</i> f. <i>remotiflora</i>	<i>v. remotiflora</i> f. <i>leucantha</i>	<i>v. hirticalyx</i>
Corolla length	1.86±0.26	2.67±0.49	1.90±0.13	2.31±0.18
Corolla width	1.16±0.14	2.15±0.53	1.32±0.23	1.38±0.17
Calyx lobe length	0.84±0.11	0.85±0.17	0.54±0.06	0.82±0.14
Calyx lobe width	0.36±0.05	0.28±0.07	0.17±0.02	0.26±0.05
Calyx lobe L/W ratio	2.33	3.04	3.18	3.15
Style length	1.46±0.15	2.12±0.28	1.95±0.08	2.03±0.06
Anther length	0.64±0.06	0.41±0.07	0.31±0.02	0.42±0.01
Filament length	0.62±0.07	1.07±0.15	0.89±0.17	0.57±0.18
Disc length	0.09±0.02	0.35±0.50	0.22±0.05	0.29±0.05
Disc width	0.23±0.02	0.15±0.02	0.17±0.05	0.13±0.01

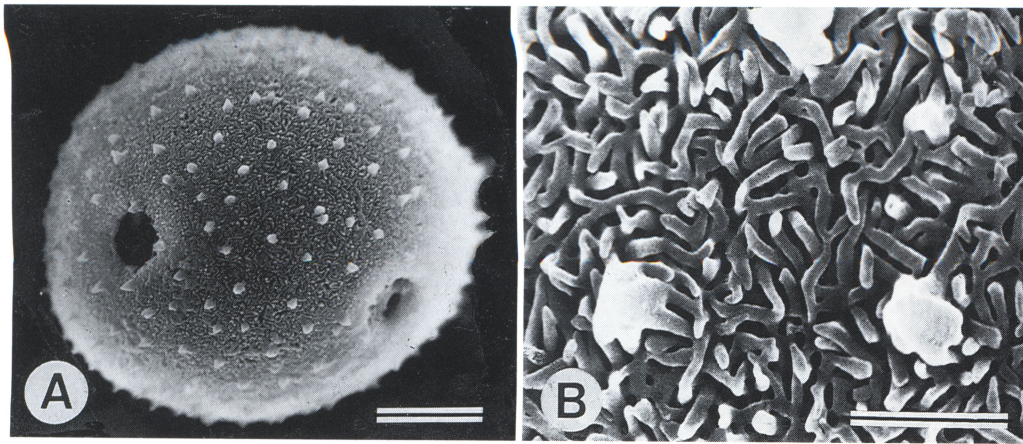


Fig. 2. SEM micrographs of pollen grain of *Adenophora erecta* (24 Aug. 1992, S. Kim, SKK).
 A. Equatorial view, scale bar=10 μm . B. Portion of surface, scale bar=2 μm .

Table 3. Comparison of pollen measurements between *A. erecta* and *A. remotiflora*

Scientific name	Polar axis* (P)	Equatorial diameter*(E)	P/E	Exine thickness*	Number or pore	Density of spinule**
<i>A. erecta</i>	40.72 \pm 1.85	44.71 \pm 1.79	0.85-0.97	2.34	3, 4, (5)	7
<i>A. remotiflora</i>						
f. <i>remotiflora</i>	36.97 \pm 0.99	40.88 \pm 1.21	0.85-0.97	2.49	3, 4, 5	8
f. <i>leucantha</i>	34.27 \pm 1.37	40.53 \pm 1.36	0.80-0.87	2.26	3, 4, 5	10
v. <i>hirticalyx</i>	37.03 \pm 0.94	40.15 \pm 1.22	0.88-0.95	2.38	3, 4	8

* unit in μm (Mean \pm SD).

** number of spinules per 100 μm^2 .

ceolate, the style is shorter, the anther is longer, the style is included, and the epigynous nectar disc is conspicuously shorter (Table 2).

Pollen morphology (Fig. 2) well supports the distinct nature of *A. erecta* from the closely related *A. remotiflora*. The grain is larger, the density of spinules is lower, the tips of the rugula are less prominently erect (Table 3).

On the basis of the present study, key of Hong (1983) and descriptions of Nakai (1909), Honda (1943), Baranov (1963), Lee *et al.* (1990) and Lee and Lee (1994), a key to the taxa in the sect. *Remotiflorae* of China and Korea was revised as follows:

1. Leaf base cordate or round.
2. Epigynous disc shallowly dome-shaped. Leaves and flowers compactly arranged; inflorescence a raceme *A. erecta*
2. Epigynous disc short- or long-cylindrical. Leaves and flowers loosely arranged; inflorescence a raceme or a panicle.
3. Epigynous disc short-cylindrical. Leaves coriaceous *A. trachelioides*
3. Epigynous disc long-cylindrical. Leaves scariosous.
4. Corolla ca. 4 cm long *A. grandiflora*

4. Corolla 1.5-3 cm long *A. remotiflora*
5. Calyx tube and lobes glabrous var. *remotiflora*
6. Flower bluish form *remotiflora*
6. Flower white form *leucantha*
5. Calyx tube and lobes hirsute var. *hirticalyx*
1. Leaf base cuneate.
7. Calyx lobes ovate or narrowly ovate. Epigynous disc hirsute *A. hunanensis*
7. Calyx lobes ovate-lanceolate to linear. Epigynous disc glabrous.
8. Corolla 2.0-2.7 cm long, somewhat deeply lobed, the lobes 8-11 mm long. Style as long as corolla. Nectar disc 1.8-2.1 mm long *A. petiolata*
8. Corolla less than 1.8 cm long, somewhat shallowly lobed, the lobes less than 5 mm long. Style exerted. Nectar disc less than 1.5 mm long.
9. Leaves glabrous, 3-8 cm long. Calyx glabrous. Corolla 1.3-1.5 cm long *A. sinensis*
9. Leaves hirsute, 7-13 cm long. Calyx pubescent. Corolla ca. 1.7 cm long *A. rupincola*

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(Received September 3, 1996: Accepted January 18, 1997)