

THE CAMPANULACEAE OF TAIWAN⁽¹⁾

MUH-TSUEN KAO⁽²⁾ and CHARLES E. DEVOL⁽³⁾

Abstract: This revision is an attempt to summarize our knowledge of the Campanulaceae of Taiwan. For each genus and species found on Taiwan, a full description is given. There are altogether 8 genera and 14 species. Some species are often used locally as medicinal herbs, especially *Adenophora triphylla*, *Campanumoca lancifolia*, *Lobelia chinensis*, *Pratia nummularia*, and *Wahlenbergia marginata*.

INTRODUCTION

This revision is an attempt of summarize our knowledge of the Campanulaceae of Taiwan. For each genus and species found on Taiwan, a full description is given. There are altogether 8 genera and 14 species. Some species are often used locally as medicinal herbs, especially *Adenophora triphylla*, *Campanumoca lancifolia*, *Lobelia chinensis*, *Pratia nummularia*, and *Wahlenbergia marginata*.

All the specimens used for this study are deposited in the Herbarium of the Department of Botany, National Taiwan University (TAI) and in the Herbarium of Taiwan Forestry Research Institute (TAIF). One species, *Lobelia sessilifolia* has been reported from Taiwan but is not represented by specimens in these herbaria, and therefore is not described in the present paper.

The authors wished to thank Mr. Chin-tsu Chen for making the drawings of all the specimens included in this paper, and Dr. J. Ohwi, for his valuable suggestions.

CAMPANULACEAE Jussieu

Perennial or annual herbs, rarely woody plants, usually with milky juice; roots often thick, tuberous or fusiform; leaves alternate, opposite or whorled, exstipulate, simple, entire or serrulate to serrate, glabrous or pubescent; flowers often large, solitary or in terminal cymes, sometimes scorpioid or in racemes, perfect, rarely imperfect, actinomorphic or zygomorphic; calyx adnate to the ovary, persistent; corolla superior or inferior, gamopetalous, tubular or campanulate, often 2 lipped; stamens free from the corolla, same in number as the corolla segments and alternate with corolla tube; anthers free or connate; ovary inferior or superior, 2-10 celled; style solitary, filiform; stigmas usually equal in number to the ovary-cells; ovules numerous, axile; fruit a capsule or berry; capsule dehiscing by valves or pores; berry indehiscent; seeds usually small, numerous.

About 60 genera, with about 1,500 species in the whole world, chiefly from South America. 8 genera and 14 species in Taiwan.

KEY TO THE GENERA

1. Corolla regular; anthers free or imperfectly connate
2. Capsule dehiscent laterally, or if indehiscent, inferior to the calyx.

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(2) 高木村 Herbarium Assistant, Botany Department, National Taiwan University.

(3) 林惠基 Professor of Botany, National Taiwan University.

- 3. Flowers solitary, axillary or terminal; and in loose terminal racemes or panicles.
- 4. Disc tubular or cup-shaped.....1. *Adenophora*
- 4. Disc flat or absent.....5. *Peraerarpa*
- 3. Flowers in dense cylindric spikes7. *Sphenocleia*
- 2. Capsule dehiscent apically, or, if indehiscent, superior to the calyx.
- 3. Fruit a capsule.
- 4. Erect herbs8. *Wahlenbergia*
- 4. Vine-like herbs.....3. *Codonopsis*
- 3. Fruit a berry.....2. *Campanumoea*
- 1. Corolla 2-lipped, cleft dorsally to the base, anthers connate.
- 2. Fruit a berry, indehiscent6. *Pratia*
- 2. Fruit a capsule, 2-valved at the crown
- 4. *Lobelia*

1. *Adenophora* Fischer

Perennial herbs; main roots slender or fleshy; stem terete erect; leaves alternate or verticillate, entire or toothed, pubescent or glabrous; flowers usually large, pendulous, in loose terminal racemes or panicles; calyx-segments 5, corolla campanulate, blue, 5-lobed; stamens free from the corolla, the filaments broadened and pilose on their margins at base; disc thick, surrounding the base of the style; ovary inferior, 3-celled; stigma 3-(4)-lobed; capsules inferior, with a rather broad top, crowned with the persistent calyx-segments, dehiscent between the ribs; seeds numerous, ovate or oblong, flat.

About 50 species distributed in temperate regions of Europe and Asia, 3 species in Taiwan.

KEY TO THE SPECIES

- 1. Leaves alternate; corolla 1.5-3 cm. long.
- 2. Flowers terminal, solitary or few; stems hispid with retrorse unicellular hairs.....3. *A. schatacea*
- 2. Flowers usually many in a raceme, rarely solitary, stems sparsely pubescent when young, glabrous when old.....1. *A. morrisonensis*
- 1. Leaves 3-4 verticillate; corolla 8-13 mm. long.....2. *A. triphylla*

I(1). *Adenophora morrisonensis* Hayata, Mat. Fl. Formos. 165, 1911;

Icon. Pl. Formos. 1: 165, 1911; Icon. Pl. Formos. 2: 115, pl. 10, 1912;

T. Shimizu in Journ. Jap. Bot. 40(12): 375, 1965.....Plate 1.

Perennial herbs; main roots long, fleshy; Stems few or solitary, 25-100 cm. high, striated, erect, sparsely pubescent when young, glabrous when old. Leaves alternate, usually lanceolate, linear-lanceolate to linear, sometimes elliptic, 5-8 cm. long, 2-10 mm. wide, margins toothed, both surfaces sparsely covered with white hairs; Inflorescence usually a raceme, rarely a panicle, or solitary; bracts narrowly lanceolate or linear, 3-5 mm. long; calyx-segments lanceolate, 7 mm. long, 1.5 mm. wide, 2-3-serrate, glabrous; corolla blue-purple, campanulate, 2-2.5 cm. long, 5-lobed; stamens 5, about 11 mm. long, surrounding base of style, filaments broad and pilose at base; style filiform, about 17 cm. long, upper part with glandular hairs; stigma 3-lobed. Capsule tubular, ribbed, 6-10 mm. long. Seeds numerous, oval, flat on one side.

Distributed in Taiwan, at high altitudes of about 2500-3000 meters in the central ranges.



Plate 1. *Adenophora morrisonensis* Hayata. 1. habit; 2. flower; 3. vertical section of flower; 4. bract; 5. stamen; 6. flower with corolla removed; 7. ovary section; 8. fruit; 9. seeds; 10. sepal; 11. glandular hairs; 12. lower leaf enlarged; 13. upper leaf enlarged; 14. leaf hairs.

CHIAYI: Pai-yin-shan to Ton-pu, Huang 4591, (TAI).

Taichung: Kanko, *T. Suzuki* 13299. **Nantou:** Yinhai to Ten-tsu, *Huang Shieh & Kao* 5724. **Chiayi:** Mt. Morrison, *Chuang & Kao* s.n. July 13, 1957; *Huang* 4591; *Hsu* 6360. **Hualien:** Taroko, *S. Suzuki* 8707, *Hosokawa* 5158.

- 1(2). **Adenophora triphylla** (Thunb.) A. DC., Monogr. Campan. 365, 1830; T. Shimizu in Journ. Jap. Bot. 40(12): 375, 1965 **Plate 2.**

Campanula triphylla Thunberg, Fl. Jap. 87, 1784.

Adenophora verticillata var. *triphylla* Regel, Tent. Fl. Ussur. 108, 1861.

Adenophora verticillata form. *linearis* (Hay.) Matsum., Ind. Pl. Jap. 614, 1912.

Adenophora verticillata var. *linearis* Hay., Fl. Mont. Formos. 148, 1908.

Perennial herbs; main roots fleshy. Stems terete, erect, solitary, rarely branched, minutely covered with white-pilose hairs, 25–100 cm. high. Leaves opposite or verticillate, elliptic, 2–6 cm. long, 5–20 mm. wide, acute to acuminate at both ends, margins toothed, both surfaces covered with white-pilose hairs. Inflorescence usually a rather loose, many-flowered, erect panicle with elongate branches; peduncles long, pedicels short; calyx-segments 3–5 mm. long, linear-lanceolate; corolla pale blue, urceolate-campanulate, 8–13 mm. long; stamens 5, about 10 mm. long, surrounding the base of style, filaments broad and pilose at base; style filiform, about 20 mm. long, upper parts pilose; stigma 3-lobed; disc tubular, 2–3 mm. long, 5–7 lobed at apex. Capsule conical-clavate, 5–10 mm. long. Seeds many, oblong.

Distributed in Japan (Kyushu), Ryukyu, Taiwan and mainland China, on low to high mountains of the island.

Taipei: Kuanyingshan, *S. Suzuki* 12012. **Ilan:** Nanhutashan, *Kao* 5169; Taipingshan, *Suzuki* 5092. **Hsinchu:** Kwanwu, *Huang* 4170; Kaneyama, *Suzuki* 16428. **Taichung:** Pahsienshan, *Liu, Kuo & Kao* 314. **Nantou:** Chianchin, *Huang* 4627; Nenkaoshan, *Kao* 5728. **Chiayi:** Mt. Alishan, *T. Sata* s.n. April 1, 1932. **Taitung:** Kotobuki to Tokiwa, *Yamamoto & Mori* 308. **Hualien:** Hohuanshan, *Kao* 7016; Tsuwen, *Chuang & Kao* 4398.

- 1(3). **Adenophora uehatae** Yamamoto in Journ. Soc. Agric. 5: 484, 1932; T. Shimizu in Journ. Jap. Bot. 40(12): 373, 1965 **Plate 3.**

Adenophora coelura Diels var. *uehatae* (Yamam.) Masam., List Vasc. Taiwan 121, 1954. *nom. nud.*

Perennial herbs, main root somewhat fleshy. Stems usually solitary, 6–27 cm. high, angular, erect, densely covered with white hairs. Leaves alternate, shortly petiolate or sessile, elliptical or narrowly lanceolate, 2–5 cm. long, 5–15 mm. wide, margins toothed, both surfaces sparsely covered with white hairs. Flowers large, 1.5–3 cm. long, usually solitary, rarely two; calyx-segment lanceolate, 10–20 mm. long, serrate, aristate, outer surface pubescent, inner glabrous; corolla campanulate, sky-blue, 2.5–3 cm. long, 5-lobed; stamens 5, about 12 mm. long, surrounding the base of style; upper part of filament glabrous, filiform, the lower broadly dilated, densely ciliate on margin; style filiform 1.7 cm. long, with very short hairs; stigma 4-lobed. Capsule ellipsoidal, 5–10 mm. long. Seeds many, oblong, 2 mm. long, brown when dry.

Distributed in Taiwan, at high altitudes of about 2500–3000 meters in the central mountain range.

Ilan: Nanhutashan, *Suzuki* 17413; Yamazaki et al. 322. **Taichung:** Hsuehshan, *K. Mori* s.n. Oct. 24, 1936. **Nantou:** Wushe, *Chuang & Kao* 4238; Nenkaoshan, *Suzuki* 2200. **Chiayi:** Mt. Morrison, *Chuang* 2898. **Taitung:** Kwanshan, *Sasaki* s.n. Oct. 19, 1933. **Hualien:** Tonnenkao, *Sasaki* s.n. Aug. 22, 1929; Hohuanshan, *Kao* 7805; Chilaishan, *S. Suzuki* 2339.

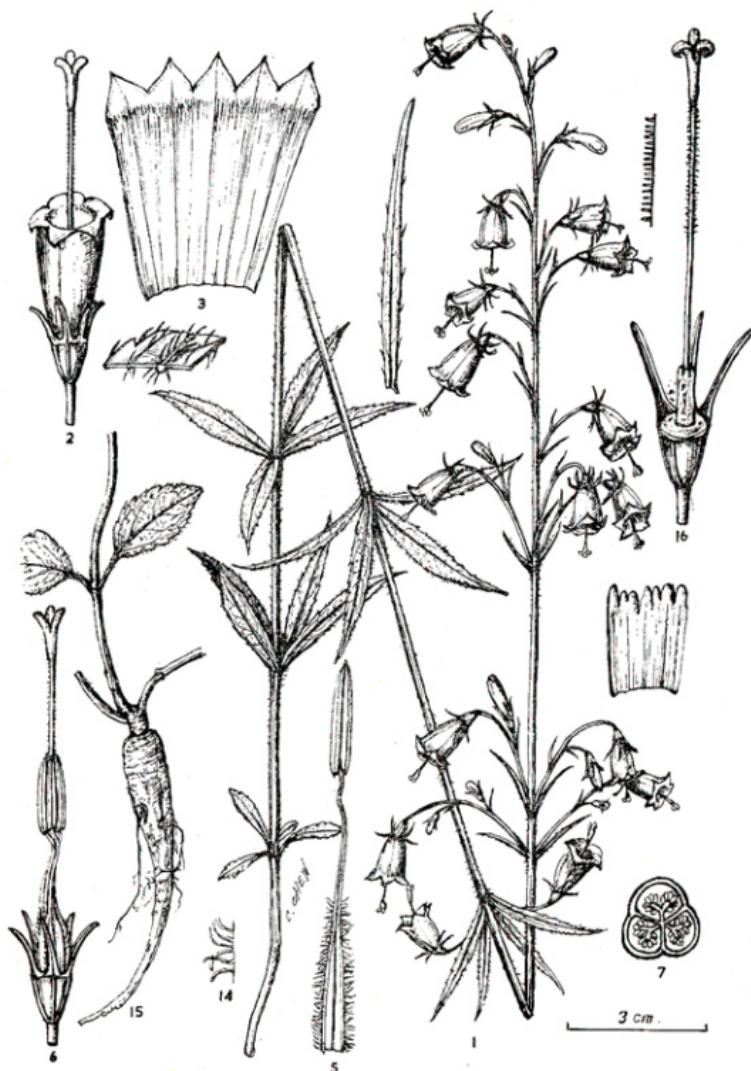


Plate 2. *Adenophora triphylla* (Thunb.) A. DC. 1. habit; 2. flower; 3. vertical section of flower; 4. stamen; 5. flower with corolla removed; 6. upper leaf enlarged; 7. ovary section; 8. leaf hairs; 9. fleshy root; 10. pistillate portion.
HSINCHU: Kwan-wu, Huang 4170, (TAI).

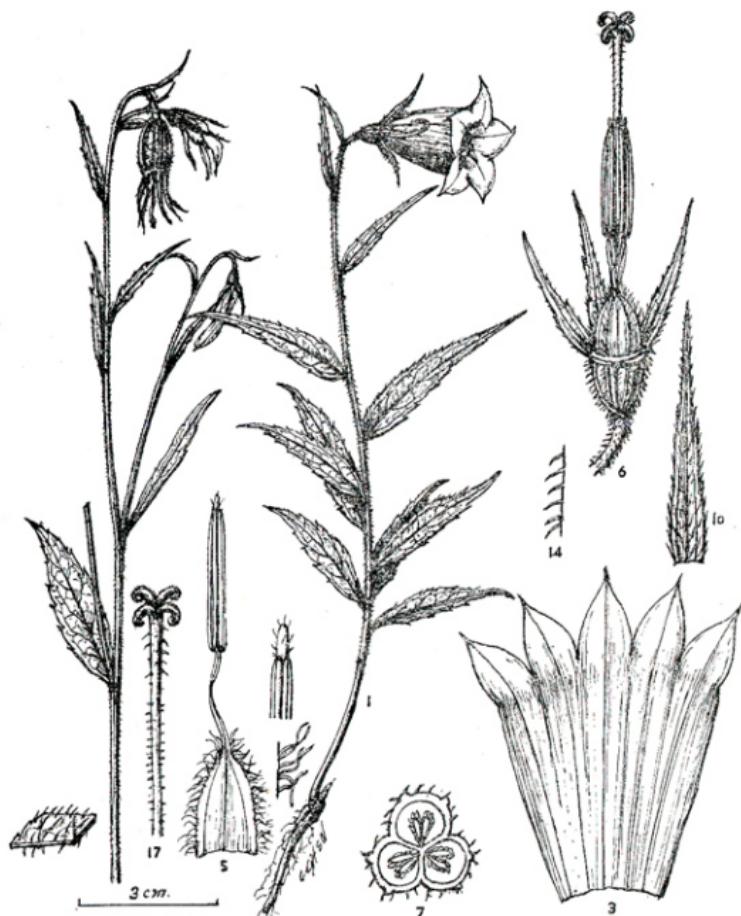


Plate 3. *Adenophora uehatae* Yamamoto. 1. habit; 3. vertical section of flower; 5. stamer
6. flower with corolla removed; 7. ovary section; 10. sepal; 14. leaf and fruit hair;
17. stigma and style.
CHIAYI: Mt. Morrison, C.C. Chuang 2898, (TAI).

2. *Campanumoea* Blume

Perennial herbs; roots tuberous; stems vine-like or erect; leaves cauline, opposite or alternate, short or long petiolate, cordate, ovate or ovate-lanceolate, entire, crenate or serrate; flowers terminal or axillary, peduncled; calyx-tube short, 4-6-lobed, persistent; corolla broadly campanulate, inserted on upper portion of calyx-tube, 4-6-lobed; stamens 4-6, inserted around the base of the corolla-tube; ovary 4-6-celled, many ovuled; style cylindric; stigma 4-6-lobed; fruit an indehiscent berry, subglobose; seeds numerous, small, ellipsoidal.

5-6 species distributed in the Himalayas, India, Malaysia, South China, Taiwan and Japan. 2 species in Taiwan.

KEY TO THE SPECIES

- | | |
|---|----------------------|
| 1. Vine-like herbs; corolla 5-lobed | <i>C. javanica</i> |
| 1. Erect herbs; corolla 6-lobed..... | <i>C. lancifolia</i> |
- 2(1). *Campanumoea javanica* Blume, Bijdr. 726, 1826Plate 4.

Codonopsis javanica (Bl.) Hook. f. & Thoms in Illustr. Himal. Pl. t. 16, B. 1855.

Campanumoea japonica Maxim., in Bull. Acad. St. Pé. 6: 268, 1867. *non* Sieb. et Morren, 1863.

Campanumoea javanica Blume var. *japonica* (Maxim.) Makino in Bot. Mag. Tokyo, 22: 155, 1908.

Campanumoea maximowiczii Honda in Bot. Mag. Tokyo, 50: 389, 1936. *syn. nov.*, based on

Campanumoea japonica Maxim.

Vine-like scandent perennial herbs; stems long, slender, terete. Leaves thin, membranous, opposite, ovate-cordate, 3-8 cm. long, 2.5-6 cm. wide, acute, glaucous beneath, margins undulate or crenate, long petiolate. Flowers large, solitary, axillary, pendulous, pedicels 1.5-4 cm. long; calyx-segments lanceolate, 8-18 mm. long, 3-4 mm. wide, entire, recurved; corolla campanulate, 28-35 mm. long, greenish-white or yellowish-white, purplish within, 5-lobed, acute, recurved at top; stamens 5, filaments filiform, about 10 mm. long; style filiform, about 8 mm. long, upper part sparsely hairy; stigma 4-lobed. Fruits berry, depressed-globose, 1-1.2 cm. across, 5-locular. Seeds numerous, oval.

Distributed in Sikkim, Bhotan, Burma, Java, Taiwan and Japan. Growing from low to medium altitudes in the island.

Hian: Shikikun, *S. Suzuki* 4992. **Taoyuan:** Kappanzan, *Sasaki s. n.* May 1905. **Hsinchu:** Chinsan, *Suzuki* 21364. **Miaoli:** Nanchuang, *Chen* 2721. **Taichung:** Annashan, *T. S. Liu et al.* 141. **Nantou:** Chitou, *Hsu* 6132; Sun-Moon Lake, *Kudo & Sasaki* 15488. **Chiayi:** Mt. Alishan, *Sasaki s. n.* Oct. 1928. **Taitung:** Rokurio, *Kawakami s. n.* Jan. 1906.

- 2(2). *Campanumoea lancifolia* (Roxb.) Merr., Enum. Philip. Fl. Pl. 3: 587, 1923Plate 5.

Campanula lancifolia Roxb. Fl. Ind. ed. Carey, 2: 96, 1824.

Campanumoea axillaris Oliver in Hook., Icon. Pl. 8: Pl. 1775, 1888.

Codonopsis lancifolia (Roxb.) Moeliono, Fl. Malesiana Ser. 1, 6(1): 20, 1960.

Perennial herbaceous plants; stems glabrous, erect, 30-80 cm. high, often branched. Leaves opposite, broadly lanceolate, 5-13 cm. long, 1.5-5 cm. wide, apex acuminate, base rounded or cuneate, both surfaces glabrous, margins serrate;

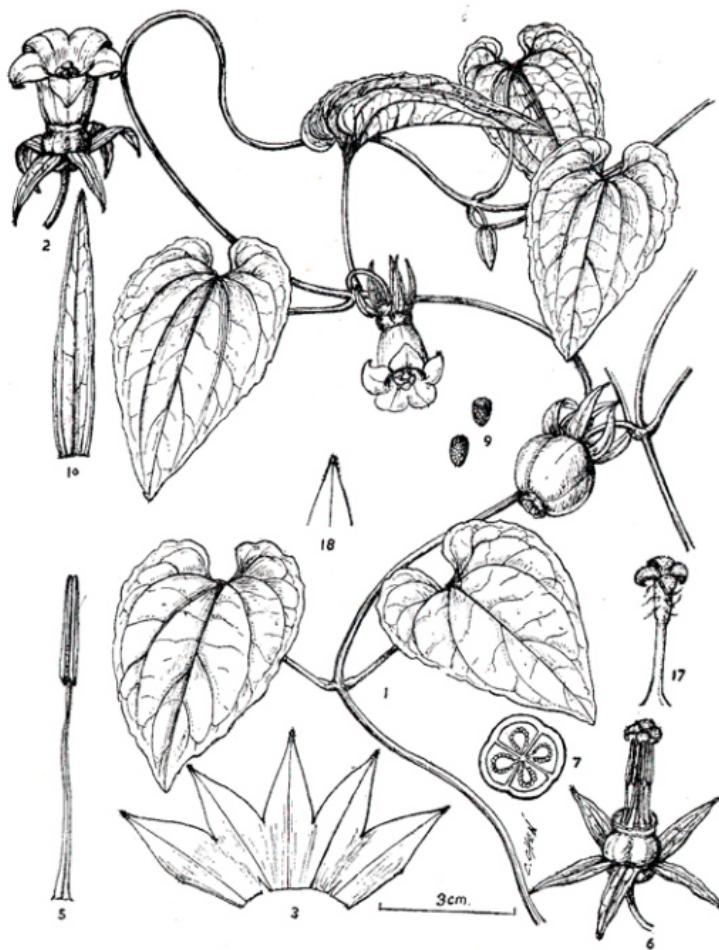


Plate 4. *Campanumoea javanica* Bl. 1. habit; 2. flower; 3. vertical section of flower; 5. stamen; 6. flower with corolla removed; 7. ovary section; 9. seeds; 10. sepal; 17. pistil; 18. petal apex.
HSINCHU: Chu-tung, Chin-shan, T. Suzuki 21364, (TAI).

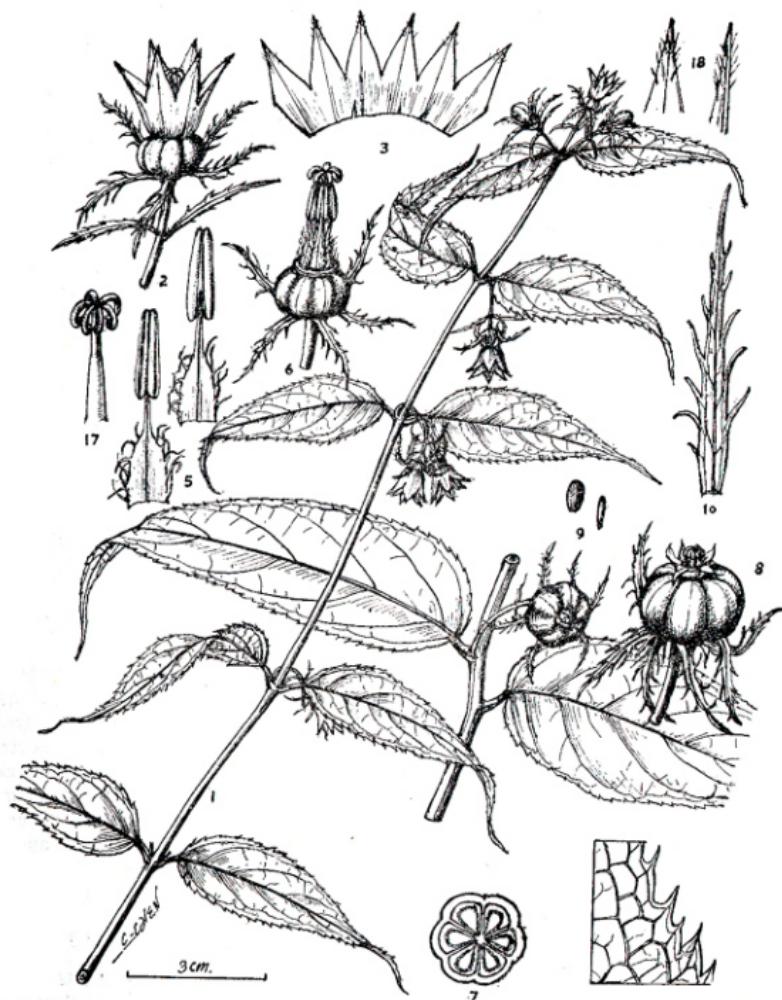


Plate 5. *Campanumoea lancifolia* (Roxb.) Merr. 1. habit; 2. flower; 3. vertical section of corolla; 4. stamens; 5. flower with corolla removed; 6. ovary section; 7. fruit; 8. seed; 9. petal apex; 10. sepal; 11. stigma and style; 12. petal apex.
ILAN: Nan-hu-ta-shan, S. Sasaki 108076, (TAI).

pedicels 3-6 mm. long. Flowers solitary, terminal or axillary; calyx-segments linear-lanceolate, 4-12 mm. long, glabrous, toothed; corolla campanulate, 8-12 mm. long, white or light-purple, 6-lobed, acute, with minute white hairs at tips; stamens 6, filament broadened and hirsute on margin at base; stigma 6-lobed, recurved. Fruits berry, globose, about 1 cm. diameter. Seeds many, elliptic, flattened.

Distributed in India, Malaya, South China, Taiwan and Ryukyus. Growing at low to medium altitudes on mountain slopes throughout the island.

Taipei: Wulai, Chuang 2299; Kwanyinshan, N. Fukuyama 175. **Ilan:** Nanhuashan, Sasaki 108076; Nanshan, Hsu 5808. **Taichung:** Pahsienshan, S. Suzuki 2875. **Nantou:** Chingshui-kou, Huang 295; Chitou, Hsu 6141. **Chiayi:** Mt. Alishan, Sasaki s.n. Dec. 1923. **Pingtung:** Kuskus, Keng 1338. **Kaohsiung:** Shaping, Huang 4924; Tenchu, Hsu 13732. **Taitung:** Chihsien, Hsu 4057. Botel Tobago, Huang & Kao 6374. **Hualien:** Tienhsiang, Shimizu & Kao 10482; Luanshan, Kao 15.

3. *Codonopsis* Wallich ex Roxburgh

Perennial herbs; with erect or vine-like scandent stems; roots tuberous or fusiform; leaves cauline, opposite, alternate, or sometimes verticillate; petiolate, margins entire, crenate or serrate; pubescent or glabrous; flowers terminal, axillary, or solitary, on short branches, usually greenish to purplish, sometimes white or blue; calyx-tube short, broad, with 4-6 segments, adnate to the ovary; corolla campanulate or broadly tubular, adnate to the ovary at base, 4-6, free from the corolla; ovary inferior or subinferior, 3-6-celled; many-ovuled; style cylindric, stigma 3-5-lobed; capsules conical, loculicidally dehiscent at the top; seeds numerous, ellipsoidal, sometimes winged.

About 40 species, distributed in India, Malaysia, South China, Taiwan and Japan, 1 species in Taiwan.

3(1). *Codonopsis kawakamii* Hayata, Mat. Fl. Formos. 165, 1911 **Plate 6.**

Bad-smelling vine-like perennial herbs; stems decumbent, terete, with many branchlets, covered with white hairs when young, glabrous when old. Leaves alternate or opposite, ovate or deltoid, 1-3 cm. long, 5-20 mm. wide, obtuse or acute, both surfaces densely covered with white hairs, short or long petiolate, margins entire, sometimes crenate. Calyx-segments elliptic-oblong, 8.5-10 mm. long, 3-4 mm. wide, entire, acute, recurved, sparsely pubescent; corolla campanulate, 1-2.2 cm. long, greenish-yellow, 5-lobed, the lobes acute, recurved, sparsely hairy at apex; stamens 5, about 10 mm. long; style about 8 mm. long, enlarged and densely pubescent at tip; stigma 3-lobed. Capsules conical, about 1 cm. long and 1 cm. across. Seeds numerous, oblong, brown when dry.

Distributed in Taiwan, at altitudes between 2500-3000 m. in the Central Range.

Nantou: Yinhai to Tentsu, Huang, Hsieh & Kao 5750; 5820; Nenkaoshan, Suzuki 2513. **Chiayi:** Lulinshan, Chuang & Kao s.n. July 13, 1957; Mt. Morrison, Hsu 6351. **Hualien:** Ho-huangshan, I. Shimozawa s.n. July 13, 1935; Chiachunanhuanshan, S. Sasaki s.n. Aug. 24, 1929.

4. *Lobelia* Linn.

Herbs or shrubs; stems erect, ascending or creeping; leaves alternate, simple, entire or serrate, pubescent or glabrous; flowers solitary, axillary or sometimes in terminal racemes, pedicelled, usually without bracteoles; calyx-tube adnate to the ovary, segments 5, sometimes unequal, persistent; corolla oblique or incurved, the

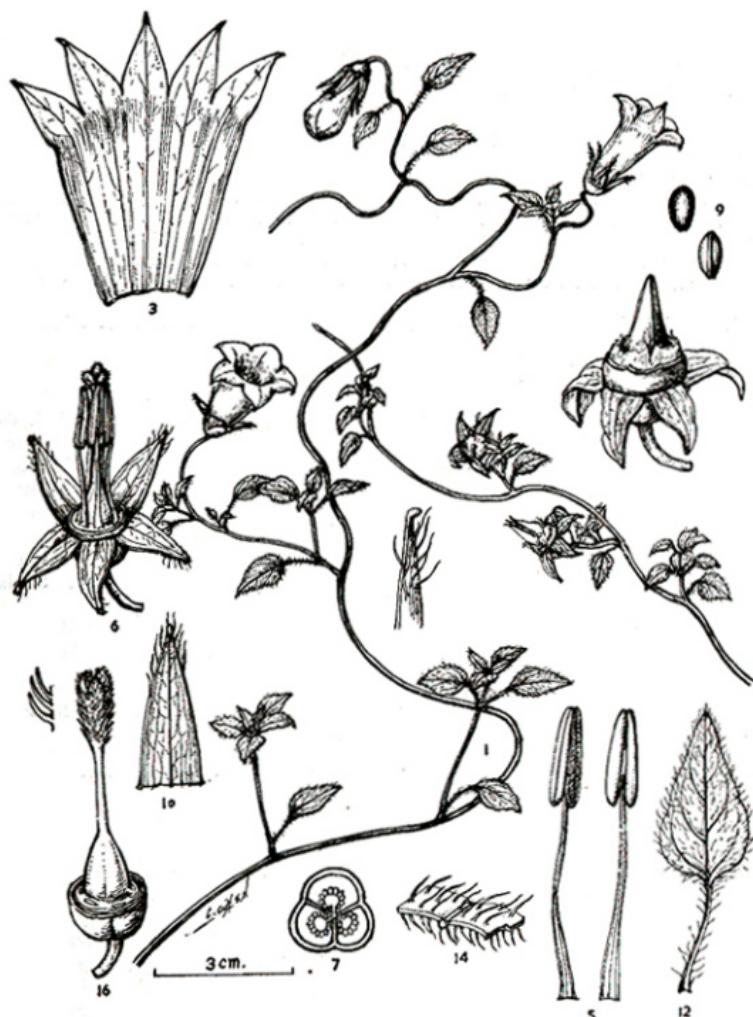


Plate 6. *Codonopsis kawakamii* Hay. 1. habit; 3. vertical section of flower; 5. stamens; 6. flower with corolla removed; 7. ovary section; 9. seeds; 10. sepal; 12. leaf enlarged; 14. leaf hairs; 16. pistil.

NANTOU: Yinhai to Tentsu, *Huang Hsieh & Kao*, 5750, (TAI).

tube dorsally split to base, the limb bilabiate or 1-labiate, the 2 upper lobes smaller, erect or spreading; stamens usually free from the corolla or only basally united with it; ovary inferior or subsuperior, 2-celled, many ovuled; stigma capitate or 2-lobed; capsules loculicidal, apically dehiscent, 2-valved.

About 200 species distributed in whole world, 3 species in Taiwan.

KEY TO THE SPECIES

1. Stems erect.
2. Stems slender, 6-25 cm. high, leaves 4-22 mm. long 1. *L. alsinoides*
2. Stems stout, 30-120 cm. high, leaves 6-23 cm. long 3. *L. pyramidalis*
1. Stems decumbent at base bearing ascending branches.
2. Leaves linear-lanceolate or elliptical 2. *L. chinensis*
2. Leaves ovate 4. *L. zeylanica*

4(1). *Lobelia alsinoides* Lamarck, Encycl. Meth. 3; 588, 1791. Plate 7.

L. trigona Roxb., Fl. Ind. 1: 506, 1824.

L. hancei Hara in Journ. Jap. Bot. 27: 23, 1941.

Glabrous herbs; stems erect, succulent, usually simple, somewhat branched, 6-25 cm. high. Leaves alternate, lower leaves elliptical or ovate, upper leaves lanceolate, 4-22 mm. long, 2-7 mm. wide, acute, margins mucronate-serrate, sessile. Flowers axillary on leaf-like bracts or in a loose terminal raceme; pedicels 10-15 mm. long; calyx-segments narrowly deltoid, entire, glabrous, 2 mm. long; corolla unequal, bright blue to white, 5-8 mm. long, 5-lobed; stamens 5, about 4.5 mm. long, surrounding style, anthers longitudinally united, each bearing a tuft of hairs at apex, filaments hairy on margins near base. Capsules obovoid, 2.5-3.5 mm. long. Seeds many, small, light brown.

Distributed in Vietnam, Malaysia, South China, Taiwan, Ryukyus and Japan (Kyushu), in marshy grasslands or rice fields, at low altitudes in the northern and central parts of the island.

Taipei: Sehpai, Suzuki 20576. Taoyuan: Taoyuan, Sasaki s.n. Nov. 16, 1923. Nantou: Sun-Moon Lake, Kudo & Sasaki 15646.

4(2). *Lobelia chinensis* Loureiro, Fl. Cochinch. 2; 514, 1790. Plate 8.

L. radicans Thunb. in Trans. Linn. Soc. 2: 330, 1794.

Pratia radicans G. Don. Gen. Syst 3: 700, 1834.

Glabrous, perennial herbs; stems slender, decumbent, long-creeping, bearing upright simple branches, 5-20 cm. long. Leaves alternate, narrowly elliptical or lanceolate, 1-2 cm. long, 2-5 mm. wide, obtuse or acute, entire or minutely denticulate. Flowers usually solitary in upper axillary branches; pedicels 1.5-3 cm. long; calyx-segments narrowly deltoid, margins minutely toothed, 3-4 mm. long; corolla white to rose-purple, 5-12 mm. long, covered with white woolly hairs inside of the tube, 5-lobed, the lobes unequal, pointed; stamens 5, about 7.5 mm. long, surrounding the style, filaments forming a tube uniting near top, densely tomentose below; 2 anthers bearing a tuft of hairs at apex, the other 3 being glabrous; style 8 mm. long, densely tomentose; stigma 2-lobed. Capsules conical, 5-7 mm. long. Seeds many, ovate, smooth, reddish-brown.

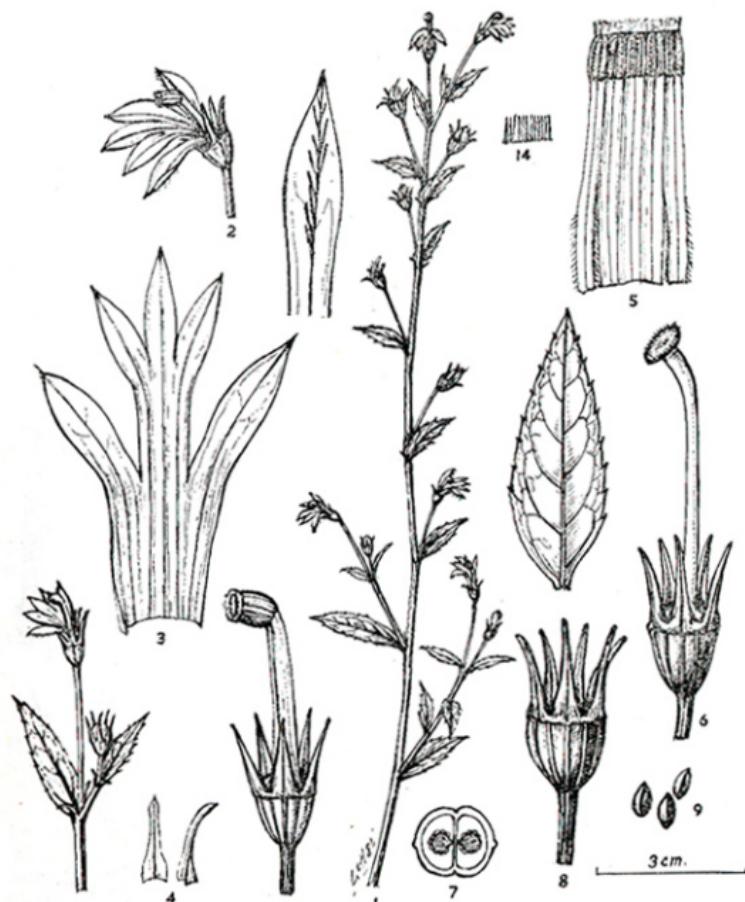


Plate 7. *Lobelia alsinoides* Lam. 1. habit; 2. flower; 3. vertical section of corolla; 4. bracts; 5. stamens; 6. pistillate part of flower; 7. c.s. ovary; 8. fruit; 9. seeds; 14. anther hairs.

TAOYUAN: S. Sasaki s.n. Nov. 16, 1923, (TAI).



Plate 8. *Lobelia chinensis* Lour. 1. habit; 2. flower; 3. vertical section of flower; 4. stamens; 5. pistillate part of flower; 7. c.s. ovary; 10. sepal.
TAIPEI: Taipei, S. Sasaki s.n. VIII. 10, 1927. (TAI).

Distributed in Nepal, Khasia, Thailand, Vietnam, Malaysia, mainland China, Taiwan, the Ryukyus, Korea and Japan, common in grasslands throughout the island.

Taipei: Taipei, *Sasaki s.n.* Aug. 10, 1927; *Chuang 3058*; Yangmingshan, *Matuda 1756*.
Miaoli: Tongshiau, *Kao 5686*. **Taichung:** Taichung Park, *Morimoto 462*; Houli, *Hsu 4709*.
Yulin: Huwei, *Ashiri 2498*. **Nantou:** Sun-Moon Lake, *S. Sasaki s.n.* Sept. 12, 1929; Lienhua-chih, *Yamamoto & Mori s.n.* Nov. 2, 1932. **Taitung:** Pinan, *Suzuki 5496*. **Hualien:** Mataian, *Suzuki 5282*. **Ilan:** Sanshin, *Yamamoto 3755*.

- 4(3). *Lobelia pyramidalis* Wallich, in Asiat. Research. 13: 376, 1820;**
Curtis's Bot. Mag. Pl. No. 2387, 1823.....Plate 9.

L. wallichiana Hook. f. & Thoms in Journ. Linn. Soc. 2: 29, 1794.

Tall perennial herbs, woody at base, 30–120 cm. high; stems terete, erect, solitary, widely branched upwards, robust, glabrous. Leaves alternate, linear-lanceolate or narrowly elliptical, 6–23 cm. long, 0.5–4.5 cm. wide, acuminate at apex, attenuate at base, glabrous or puberulous, margins finely serrulate. Flowers axillary or in terminal racemes, peduncle 5–10 mm. long, glabrous or minutely pubescent; calyx-segments linear, 1–2 cm. long, margins toothed; corolla lobes unequal, purple-rose to white, 2.5–3 cm. long, the tube covered inside with white woolly hairs; stamens 5, 1.5–2 cm. long, surrounding style, upper region of filaments united, lower portion free and tomentose on margins at base; 2 anthers bearing a tuft of hairs at apex, others glabrous; style 1.5–2 cm. long; stigma 2-lobed, sparsely covered with hairs on back side. Capsule ovoid, ribbed, glabrous or puberulent. Seeds minute yellow, numerous, ellipsoid, flattened on one side, 0.5 mm. long.

Distributed in Nepal, Khasia, North Burma, Vietnam, South China and Taiwan, at medium altitudes throughout the island.

Hsinchu: Tapachienshan, *Sasaki s.n.* July 7, 1920. **Taichung:** Pahsienshan, *S. Suzuki s.n.* Oct. 22, 1929; Mt. Anma, *Liu et al. 122*. **Nantou:** Shantsalun, *Hsu 5118*. **Kaohsiung:** Teng-chu, *Huang 6469*; *Hsu 13775*. **Hualien:** Warabi, *Yasukawa s.n.* Feb. 5, 1923.

- 4(4). *Lobelia zeylanica* Linn. Sp. Pl. 932, 1753.....Plate 10.**

L. affinis Wall. Cat. n. 1311, 1829.*nom. nud.*; in DC., Prodr. 7: 360, 1839.

Perennial herbs; stems prostrate or erect, terete, slender, rooting at base. Leaves alternate, thinly membranous, ovate, 2–3.5 cm. long, 1–2.2 cm. wide, mucronate at apex, obtuse at base, both surfaces sparsely pilose, margin serrulate, petiole 3–10 mm. long. Flowers solitary, axillary, pedicels 10–15 mm. long, calyx-segments linear, 3–3.5 mm. long, margins hirsute; corolla 6–7 mm. long, 5-lobed, lobes unequal, yellow or white with short violet streaks, upper lobes with marginal hairs, otherwise glabrous; stamens 5, 4.5–5 mm. long, surrounding style, filaments united along upper parts, tomentose towards base on margin; each anther bearing a tuft of apical hairs; style 5 mm. long, glabrous; stigma 2-lobed. Capsule conical, covered with multicellular hairs. Seeds numerous, small, ovoid, yellow, 4–5 mm. long.

Distributed in Sikkim, Bengal, Assam, Malacca, Ceylon, Malaya, South China and Taiwan, at low altitudes in northern and central parts of the island.

Taipei: Wantan, *Shimizu 2320*; Wulai, *E. Matuda 281*. **Taoyuan:** Kappanzan, *Sasaki s.n.* Oct. 10, 1915. **Nantou:** Suisya Lake, *S. Sasaki s.n.* Sept. 12, 1929; Sun-Moon Lake, *Kudo & Sasaki 15489*.



Plate 9. *Lobelia pyramidalis* Wall. 1. habit; 2. vertical section of corolla; 3. stamens; 4. pistillate part of flower; 5. c.s. ovary; 6. seeds; 7. sepal; 8. fruit; 9. stigma. KAOHSIUNG: Ten-chi, T. C. Huang 6469 (TAI).

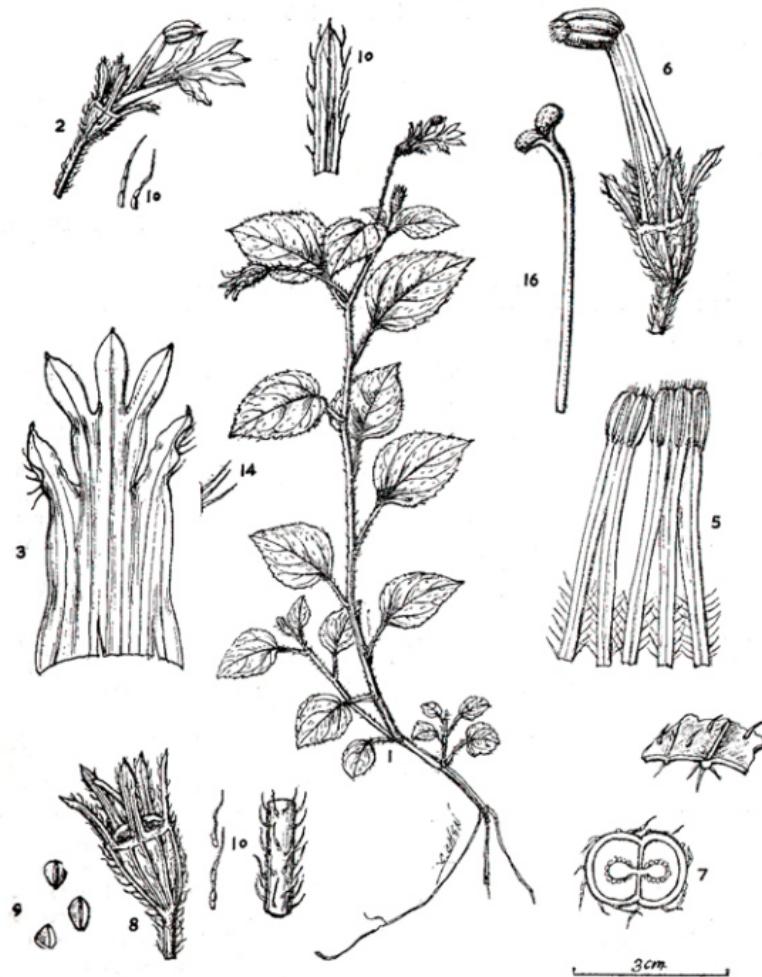


Plate 10. *Lobelia zeylanica* Linn. 1. habit; 2. flower; 3. vertical section of corolla; 5. stamens; 6. pistillate part of flower; 7. c.s. ovary; 8. fruit and persistent calyx; 9. seeds; 10. sepal; 11. multicellular hairs; 14. corolla hairs; 16. stigma and style.
NANTOU: Sui-sya Lake, S. Sasaki s.n. IX. 12, 1927 (TAI).

5. *Peracarpa* Hook. f. & Thoms.

Perennial herbs; stolon slender, creeping, much branched; leaves small, alternate, deltoid to broadly ovate, red-purple, toothed, petiolate, upper surface sparsely pilose, lower surface glabrous; flowers small, solitary, long pedicellate, axillary; calyx-tube adnate to the ovary, 5-parted, the segments acute; corolla campanulate, 5-cleft; stamens 5, free, surrounding style; ovary inferior, 3-celled, placentation central with many ovules in each cell; stigma 3-lobed; fruits ovoid, indehiscent, crowned with persistent calyx-segments; seeds many, ovoid.

A single species distributed in the Himalayas, Taiwan, Japan, Korea, Southern Kuriles, Sakhalin, and Kamchatka.

5(1). *Peracarpa carnosa* (Wall.) Hook. f. & Thoms. in Journ. Soc.

2: 26, 1858 Plate 11.

Campanula carnosa Wallich in Roxb., Fl. Ind. Carey, 2: 102. 1824.

Perennial herbs; stolon slender, creeping, much branched, 5-15 cm. long. Leaves alternate, deltoid to broadly ovate, 7-22 mm. long, 6-10 mm. wide, reddish-purple, toothed, upper surface sparsely pilose, lower surface glabrous, mucronate at apex, rounded at base; pedicels 3-10 cm. long. Flowers small, solitary, axillary; petioles 5-20 mm. long; calyx-segments acute, about 1 mm. long; corolla campanulate, white or purplish, 3-8 mm. long, 5-cleft; stamens 5, free, surrounding style, 3-4 mm. long; filament linear-lanceolate, margins pubescent; style filiform, slightly pilose on upper parts; stigma 3-lobed. Fruits 4-5 mm. long, ovoid, indehiscent, crowned with persistent calyx-segments. Seeds numerous, ovoid.

Distributed in the Himalayas, Taiwan, Japan, Korea, Southern Kuriles, Sakhalin and Kamchatka, at medium to high mountain regions of the island.

Taipei: Babo, Suzuki 18347. **Ilan:** Taipingshan, S. Suzuki 3970. **Hsinchu:** Chutung, Liu, Kuo & Chuang 1407. **Taichung:** Anmashan, T.S. Liu et al. 217. **Nantou:** Mt. Luanta, Mori s.n. July 5, 1908. **Chiayi:** Mt. Alishan, Chao & Kao 6165; Mt. Morrison, Wakotsuki 1454. **Kaohsiung:** Sehsuan, Huang 6516; Peinanchushan, Yamazaki 677. **Taitung:** Hsinkan, Kwan-shan, Huang & Kao 6591. **Hualien:** Tailukotashan, Sasaki s.n. Nov. 2, 1933.

6. *Pratia* Gaudich.

Perennial herbs; stems stoloniferous, widely creeping, rooting at intervals. Leaves alternate, simple, petiolate, cordate, broadly ovate, pubescent. Flowers solitary, axillary, pedunculate; calyx segment 5-cleft linear-lanceolate, persistent corolla zygomorphic, 2-lipped, upper lip 2-lobed, lower lip 3-lobed; stamens 5, free from the corolla; filaments united forming a tube around style, 2 anthers with 1 or more terminal bristles, 3 anthers without bristles; ovary inferior, 2-celled; placenta hemispherical central; stigma 2-lobed or emarginate, fruits a berry, ellipsoidal, crowned with persistent calyx-teeth; seeds numerous, oval, minute.

About 25 species, distributed in East India, Malaya, Central and South China, the Philippines and Taiwan, only one species in Taiwan.

6(1). *Pratia nummularia* (Lam.) A. Br. et Ascherson, Ind. Sem. Hort.

Berol. app. 6, 1861 Plate 12.

Lobelia nummularia Lamarck, Encycl. Méth. 3: 589. 1791.

L. begonifolia Wallich in Asiatic Research. 13: 377. 1820.

Pratia begonifolia (Wall.) Lindley in Bot. Reg. Pl. 1373, 1830.

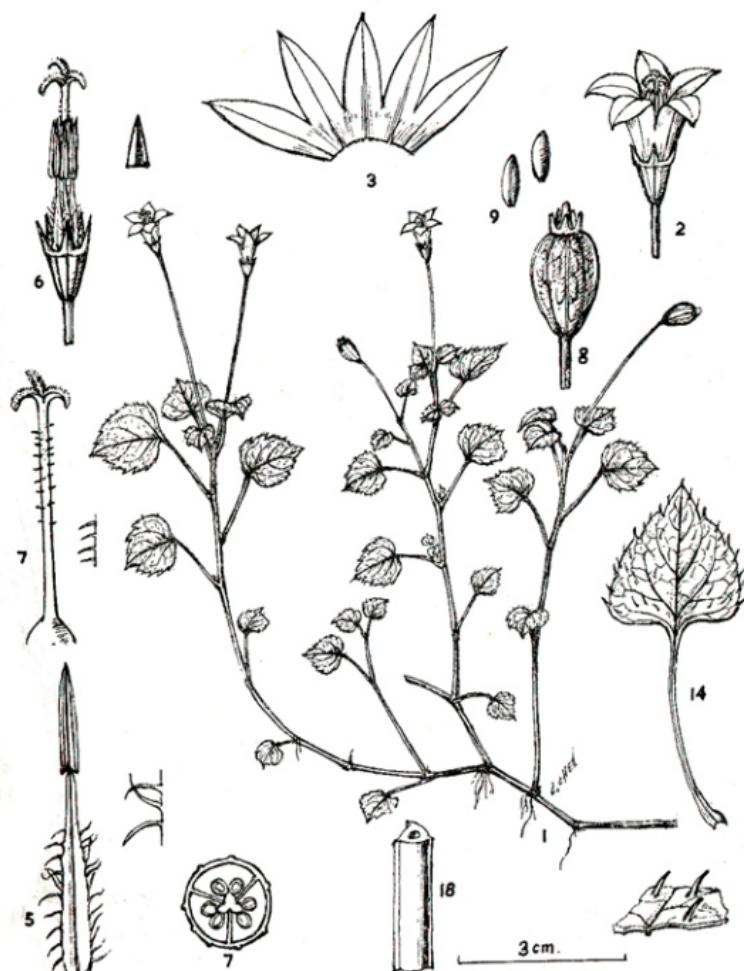


Plate 11. *Peracarpa carnosa* (Wall.) Hook. f. & Thoms. 1. habit; 2. flower; 3. section of corolla; 4. stamen; 5. flower with corolla removed; 6. ovary section; 7. fruit; 8. enlarged leaf; 9. seeds; 10. stigma; 11. stem section.
TAITUNG: Kwanshan, Huang & Kao 6591 (TAI).

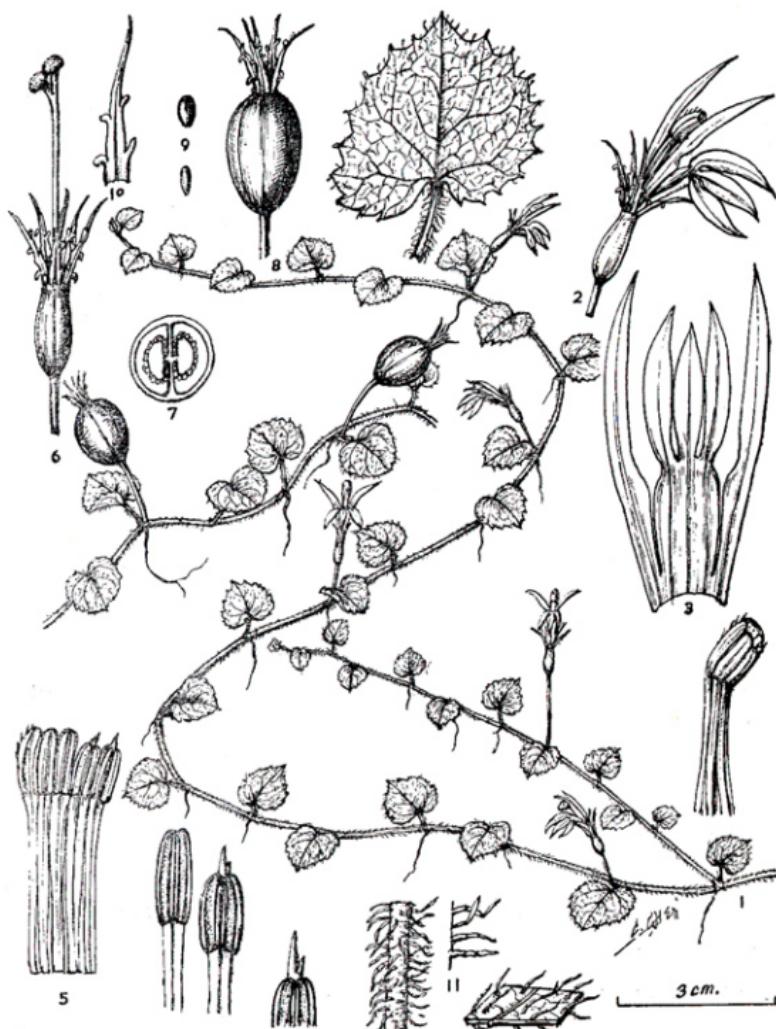


Plate 12. *Pratia nummularia* (Lam.) A. Br. 1. habit; 2. flower; 3. vertical section of flower; 4. flower with corolla removed; 5. stamens; 6. fruit; 7. ovary section; 8. seeds; 9. multicellular hairs; 10. multicellular hairs.

ILAN: Mt. Taiping, S. Sasaki s.n. April 25, 1930 (TAI).

Perennial herbs; stems creeping, rooting, pubescent, 10–50 cm. long. Leaves alternate, cordate-ovate or orbicular, 10–25 mm. long, 10–20 mm. wide, both surfaces sparsely covered with multicellular white hairs, margins toothed; petioles 3–10 mm. long. Flowers small, solitary, axillary, pedicels 10–20 mm. long; calyx-segments linear, 2–4 mm. long, margins 2–3 toothed; corolla zygomorphic, white with pale purple 5–6 mm. long; stamens 5, 3–4 mm. long, surrounding style, filaments united; 2-anthers with a tuft of bristle-like hairs at apex; style 3–4 mm. long; stigmas 2, capitate. Fruit a berry, globose, purple, 1–2 cm. long. Seeds small, many, ovoid.

Distributed in the Himalayas, Eastern India, Burma, Thailand, Vietnam, Central and Southern China, the Philippines and Taiwan, at low to medium altitudes throughout the island.

Taipei: Kankou, *Hsu* 5259; Masha, *Cheng* 705. **Ilan:** Taipingshan, *Suzuki* 239; Tayenshan, *Kao* 3171. **Hsinchu:** Huang 4165. **Miaoli:** Taran, *Sasaki* s.n. May 4, 1909. **Taichung:** *Seki* 107. **Nantou:** Chitou, *Chuang* 4011. **Chiayi:** Mt. Alishan, *Yamamoto* 4138; Kwantsulin, *Morimoto* 463. **Kaohsiung:** Shapning, *Chuang* 3202; Peinanchushan, *Yamazaki* 886. **Pingtung:** Paiwan, *Matuda* 1757; Kuskus, *Kudo & Susuki* 16090. **Taitung:** Tapalan, *Yamamoto* 1254; Chyunshan, *Yamamoto & Mori* 504. **Hualien:** Luanshan, *Kao* 6950; Tongli, S. *Suzuki* 1618.

7. *Sphenoclea* Gaerth.

Annual herbs; stems erect, glabrous, grooved on upper side, with a hollow center; leaves alternate, petiolate, simple, oblong or lanceolate, entire, glabrous; inflorescence spicate, terminal and opposite to upper leaves; long peduncled, erect, densely many flowered; each flower subtended by a bract and 2 lateral bracteoles; calyx-tube short, calyx 5-lobed, segments broad, slightly imbricate; corolla campanulate, 5-lobed, the lobes imbricate in bud; stamens 5, inserted on the corolla-tube near base, filaments short, broadened at base, anthers free; ovary 2–3-celled; many-ovuled; style short; stigma capitate; capsule semi-inferior round, flattened on top and bottom; seeds many, minute.

Two species distributed in Tropical Africa, India, Malaysia, Central China and Taiwan, one species in Taiwan.

7(1). *Sphenoclea zeylanica* Gaertner, Fruct. et Sem. 1: 113. pl. 24. f. 5.

1788; Yamamoto in Journ. Soc. Trop. Agr. 8: 149, 1936.....**Plate 13.**

Annual herbs; stems erect, glabrous, grooved on upper side, with a hollow center, 20–60 cm. high. Leaves alternate, oblong or lanceolate, 3.5–9 cm. long, 5–20 mm. wide, glabrous, entire; petiolate or subsessile. Inflorescence a spike, terminal and opposite to upper leaves; peduncles 1–3 cm. long, erect, densely flowered; each flower subtended by a bract and 2 lateral bracteoles; calyx-tube short, 5-lobed, the lobes broad, 1–2 mm. long, imbricate in bud; stamens 5, about 1 mm. long, inserted near base of the corolla tube; filaments very short, broadened at base; anthers pale yellow; ovary 3-celled; style short; stigma capitate. Capsule broadly rounded, 3 mm. broad. Seeds small, many, oblong, brown.

Distributed in Tropical Africa, Central Asia, India, Malaysia, mainland China and Taiwan, in grasslands at low altitudes throughout the island.

Taipei: Peitou, *DeVol* 7679; Shulin, *Chuang* 3115. **Chiayi:** Chiayi *Yamashita*, 317. **Tai-nan:** Chungchou, *Morimoto* 460. **Kaohsiung:** Kaohsiung, *Sasaki* s.n. Aug. 10, 1918. **Pingtung:** Hengchun, *Suzuki* 4993.



Plate 13. *Sphenoclea zeylanica* Gaertn. 1. habit; 2. flower; 3. vertical section of flower; 4. bracteoles; 5. stamen; 6. flower with corolla removed; 7. ovary section; 8. fruit; 10. calyx; 11. c.s. portion of stem.
TAIPEI City: Shih-lin, Kao 3115 (TAI).

8. *Wahlenbergia* Schrader ex A. DC.

Annual or perennial herbs; main roots thick or slender; leaves alternate; rarely opposite, entire or serrate, pubescent or glabrous; inflorescence a centrifugal panicle or sometimes one flowered; flowers usually bluish-purple; calyx-tube campanulate or obconical; the segment 5; corolla campanulate, tubular or rotate, 5-lobed; stamens free from the corolla, filaments often with a broadened base; ovary inferior or subsuperior, 2-5-celled, many-ovuled; style well-developed; stigma 2-5-lobed; capsule erect, 2-5-valved; seeds many, small.

About 100 species distributed in the Southern Hemisphere, a few in tropical America and Eurasia, one species in Taiwan.

8(1). *Wahlenbergia marginata* (Thunb.) A. de Candolle, Monogr. Campan. 143. 1830 **Plate 14.**

Campanula marginata Thunberg, Fl. Jap. 89. 1784.

Lobelia campanuloides Thunberg in Trans. Linn. Soc. 2: 330. 1794.

Wahlenbergia gracilis Schrader: Forbes et Hemsley, Enum. Pl. Chin. 2: 4. 1889.

Pubescent or glabrous perennial herbs; main roots fleshy. Stems erect, decumbent at base, often branched, slender 20-45 cm. long. Radical and lower caudine leaves spatulate, 2-8 cm. long, 3-8 mm. wide, margins somewhat undulate, remotely serrate, acute or apiculate; upper leaves small, linear-lanceolate. Flowers terminal or axillary, solitary, long pedicellate; calyx-segments narrowly triangular, 3-4 mm. long, glabrous; corolla infundibular-campanulate, violet-blue, rarely white, 5-10 mm. long, 5-lobed, segments elliptic-oblong; stamens 5, surrounding style, 2-3 mm. long; filaments 3-lobed at base, margins ciliate; anthers yellow; style 3-5 mm. long, stigma 3-lobed. Capsules erect, obconical, 6-8 mm. long. Seeds small, many, oblong, brown.

Distributed in Java, mainland China, Taiwan, Ryukyus, Japan and Korea, growing on grasslands at low to high altitudes throughout the island.

Taipei: University Campus, Kao 7936; Shihting, Huang 4192. **Ilan:** Nanhuashan, Hsu 6077; Sikikun, Suzuki 4975. **Taoyuan:** Fushin, Chuang & Kao 3135. **Hsinchu:** Mogili, N. Fukuyama 3542; Kueishan, Simada 1375. **Miaoli:** Neima, Yamamoto 193; Tawu, Cheng 81. **Taichung:** Houli, Suzuki 6324; Sungmao, Kuoh 8747. **Nantou:** Lushan, Kao 7947; Wushe, Masamune et al. 2062. **Changhua:** Pankwashan, Morimoto 461. **Chiayi:** Mt. Morrison, Hsu 3964. **Pingtung:** Hengchun, Suzuki 6176; Kuskus, Kudo & Suzuki 16091. **Taitung:** Hsinkan, Y. Yamamoto 1256. **Hualien:** Tienhsian, Shimizu & Kao 10629; Tayilin, Kao 7063.

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Plate 14. *Wahlenbergia marginata* (Thunb.) DC. 1. habit; 2. flower; 3. vertical section of flower and ovary; 4. stamens; 5. flower with corolla removed; 6. fruit; 7. ovary section; 8. seeds; 9. individual seeds; 10. petal; 11. hairs; 12. fleshy root.

TAIPEI City: University Campus, Kao 8624 (TAI).