

The Genus *Trigonotis* Steven (Boraginaceae) in Taiwan

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(Manuscript received 20 October, 2001; accepted 24 November, 2001)

ABSTRACT: The genus *Trigonotis* (Boraginaceae) in Taiwan is revised. Three species and one variety, including one new record, *T. peduncularis* (Trev.) Bentham ex Baker & S. Moore, are recognized. The two closely similar taxa, *T. elevatovenosa* Hayata and *T. formosana* Hayata, were formerly treated as separate species. However, based on our critical comparison, the typical phases of them can be separated only by the leaf shape. Therefore, *T. elevatovenosa* Hayata is now reduced to the rank of variety, and a new combination *T. formosana* var. *elevatovenosa* (Hayata) S. D. Shen & J. C. Wang *stat. nov.* is proposed here. A key to the taxa of this genus in Taiwan along with description, taxonomic notes, and line drawings are provided.

KEY WORDS: Boraginaceae, New record, Nutlet, Revision, Taiwan, *Trigonotis*, *Trigonotis peduncularis*.

INTRODUCTION

The genus *Trigonotis* comprises about 60 species distributed in Asia and E. Europe (Wang, 1982; Zhu *et al.*, 1995). In Taiwan, the early Japanese botanist Hayata (1908, 1916) described two species, *T. elevatovenosa* and *T. formosana*. Later, Masamune (1930) and Sasaki (1931) described *Omphalodes formosana* and *Myosotis nankotaizanensis*, respectively. The two species were soon treated as synonymy and considered to be a member of *Trigonotis*: *T. nankotaizanensis* (Sasaki) Masamune & Ohwi (Masamune, 1933). Since then, three species (all endemic to Taiwan) were recognized by later taxonomists (Masamune, 1936; Hou, 1950; Hsiao, 1978; Wang, 1990; Zhu *et al.*, 1995; Liu, 1998a) as well as the latest edition of Flora of Taiwan (Liu, 1998b). However, based on the diagnostic characters used by previous taxonomists, the classification of Taiwanese *Trigonotis* does not always get satisfactory results, especially in *T. elevatovenosa* Hayata and *T. formosana* Hayata, two closely related species. In the present paper, we attempt to modify the classification of the Taiwanese *Trigonotis* by a more detailed morphological study. As a result, three species and one variety are recognized, including one new record, *T. peduncularis* (Trev.) Bentham ex Baker & S. Moore.

MATERIALS AND METHODS

Materials used in the present study were collected from the field throughout Taiwan. Living material for studies was cultivated in the shade house of Department of Biology, National Taiwan Normal University. In addition, specimens preserved in HAST, NTUF, PPI, TAI, TAIF, TNU were examined.

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Nutlets for scanning electronic microscopic (SEM) study were collected from mature fruits, dried in desiccators, coated with gold, and examined under scanning electron microscope. Voucher specimens for SEM observation were also deposited in the Herbarium TNU.

TAXONOMIC CHARACTERS

All the previous studies (Wang, 1990; Zhu *et al.*, 1995; Riedl, 1997) have shown that the morphology of nutlets, color of corolla, and leaf shape are important characters for the taxonomy of *Trigonotis*. The three endemic taxa formerly known to Taiwan were commonly distinguished by leaf shape and corolla color (Hsiao, 1978; Liu, 1998b). Based on detailed observation, the characters shown to be useful for the taxonomical treatment in Taiwan are concisely discussed as follows.

Habit: The plants of the genus in Taiwan are small herbs. According to our observations, the new record species *T. peduncularis* bears slender ascending stems and thin fibrous roots, and therefore is an annual herb. In contrast, all other three endemic taxa are perennials with shorter and more robust stems. Both *T. elevatovenosa* and *T. formosana* bear runners and usually grow into mat. In general, the runners of the former are more dominant. *Trigonotis nankotaizanensis* is a small herb with erect rhizome, but no runner, so usually forms a clump.

Leaf: Leaves of the Taiwanese *Trigonotis* are suborbicular, oblong or ovate. The leaves of *T. nankotaizanensis* are characterized by its obviously winged petioles, which are easily separated from the congeners in Taiwan. Leaf-shape has been used as a diagnostic character to distinguish *T. formosana* and *T. elevatovenosa* (Zhu *et al.*, 1995; Hsiao, 1978; Liu, 1998b). Both taxa bear rosette of radical leaves and runners. Typically, the basal leaves of *T. formosana* are longer than those of *T. elevatovenosa* (the length/width ratio usually > 2 in the former, while < 2 in the latter). However, this character reveals continuous variation with intermediate forms frequently found in the herbaria specimens. Therefore many specimens in the Taiwan herbaria were confusedly identified.

Leaves on the runners are even more alike between *T. formosana* and *T. elevatovenosa*, especially in the situation when the plants of the former are of small size or at the stage over winter. The character is useless in separating these two taxa.

The flatness of leaf surface is slightly different among the Taiwanese taxa. *Trigonotis nankotaizanensis* usually has folded leaf blades and petioles. The leaf surface of *T. formosana* and *T. peduncularis* are generally flat. Most leaves of *T. elevatovenosa* obviously elevate along the veins, so that the leaf surface looks uneven. Besides, the taxon sometimes bears straight hairs spreading from the leaf margin. However, these characters are not constant, and usually become inconspicuous when the plants inhabit sunny and dry areas.

Inflorescences: Inflorescences of Taiwanese *Trigonotis* are terminal scorpioid cymous. The inflorescences of *T. nankotaizanensis* and *T. peduncularis* have one to several bracts at the lower part. Their basal flowers are axillary or extra-axillary, and usually have elongated pedicels. The former has stout and shorter peduncle when compared with the latter, which has slender and longer peduncle. The former also bears much more flowers (about twice more than the latter). The inflorescences of *T. formosana* and *T. elevatovenosa* are usually branched basally and are ebracteate with evenly short pedicels. In general, the former has more branches (usually 2-5) than the latter (1-3 branches) but with overlap.

Corolla: Corolla color of Taiwanese taxa ranges from light blue to nearly white. The flowers of *T. peduncularis* were reported as blue (Zhu *et al.*, 1995), however, the plants

collected from Alishan show pale blue corolla. The light blue color of corolla has been considered to be an important character in separating *T. formosana* from the other Taiwanese species (white) (Zhu *et al.*, 1995; Liu, 1998b). However, based on our extensive field observations, the flower color of *T. formosana* is variable. White flowers are frequently found in this taxon, so the corolla color can not be used as a character in separating it from the other Taiwanese taxa.

Nutlet: Nutlet morphology has been considered to be very important in the classification (Wang, 1990), as well as the grouping of infrageneric taxa, of *Trigonotis* (Wang, 1982). The Taiwanese species can be easily separated using this character (see the key below). The newly recorded species *Trigonotis peduncularis* has a unique nutlet with carpophore and obvious hooked hairs (Fig. 1), while other taxa have sessile and glabrous nutlets. The nutlet of *T. nankotaizanensis* is oblique with the axis 1.5 times longer than lateral sides (Fig. 1). The nutlets of both *T. formosana* and *T. elevatovenosa* are nearly tetrahedral with equal sides. This similarity between them supports our treatment in reducing them as infraspecific taxa. A key to taxa based on the nutlet is given as follows:

- 1. nutlets with carpophore *T. peduncularis*
- 1. nutlets sessile
 - 2. nutlets oblique tetrahedral, axis ca. 1.5 mm, other sides 1 mm *T. nankotaizanensis*
 - 2. nutlets tetrahedral, each side ca. 1 mm long *T. formosana* (including infraspecific taxa)

TAXONOMIC TREATMENT

Trigonotis Steven, Bull. Soc. Imp. Naturslistes Moscou 24(1): 603. 1851. 附地草屬

Herbs annual to perennial, often hispid or pillose. Stems single or several-branched, erect to diffuse. Inflorescence scorpioid cymes, solitary or dichotomously branched, bracteate at basal part or ebracteate; calyx 5-lobed or 5-parted, persistent, not enlarged or slightly enlarged in fruit; corolla white or blue; tube shorter than calyx, with 5 lunate or trapeziform appendages (fornices) at the throat; lobes 5, spreading, overlapping; stamens 5, included; ovary 4-parted; style linear; stigma capitate or peltate, included; gynobase flat. Nutlets 4, tetrahedral or oblique tetrahedral, shiny, glabrous or pubescent, sessile or with a short stalk (carpophore), abaxial surfaces flat or convex, acute or obtuse ribbed, rarely narrow winged. About 60 species; Asia, E. Europe, the Philippines. Four taxa in Taiwan.

Key to taxa of Taiwan

- 1. Stems much branched, diffuse; nutlets with carpophore 3. *T. peduncularis*
- 1. Stems not branched; nutlets sessile
 - 2. Plant without runner; basal 1-3 flowers of inflorescence with bracts and long pedicels; corolla lobes oblong; nutlets oblique tetrahedral, axis ca. 1.5 mm, other sides 1 mm long 2. *T. nankotaizanensis*
 - 2. Plant with runner; inflorescences ebracteate, flowers with evenly short pedicels; corolla lobes round; nutlets tetrahedral, each side ca. 1 mm long
 - 3. Basal or lower leaves oblong to oblanceolate, length/width ratio usually > 2; inflorescences 2-5 cymes 1a. *T. formosana* var. *formosana*
 - 3. Basal leaves elliptic to oblong, length/width ratio usually < 2; inflorescences 1-3 cymes 1b. *T. formosana* var. *elevatovenosa*

1. *Trigonotis formosana* Hayata, J. Coll. Sci. Univ. Tokyo 25(19): 171. 1908.

Perennial herbs, usually lower than 20 cm including the inflorescence, with appressed or spreading hairs. Leaves fleshy to chartaceous, rarely coriaceous; apex mucronate as the

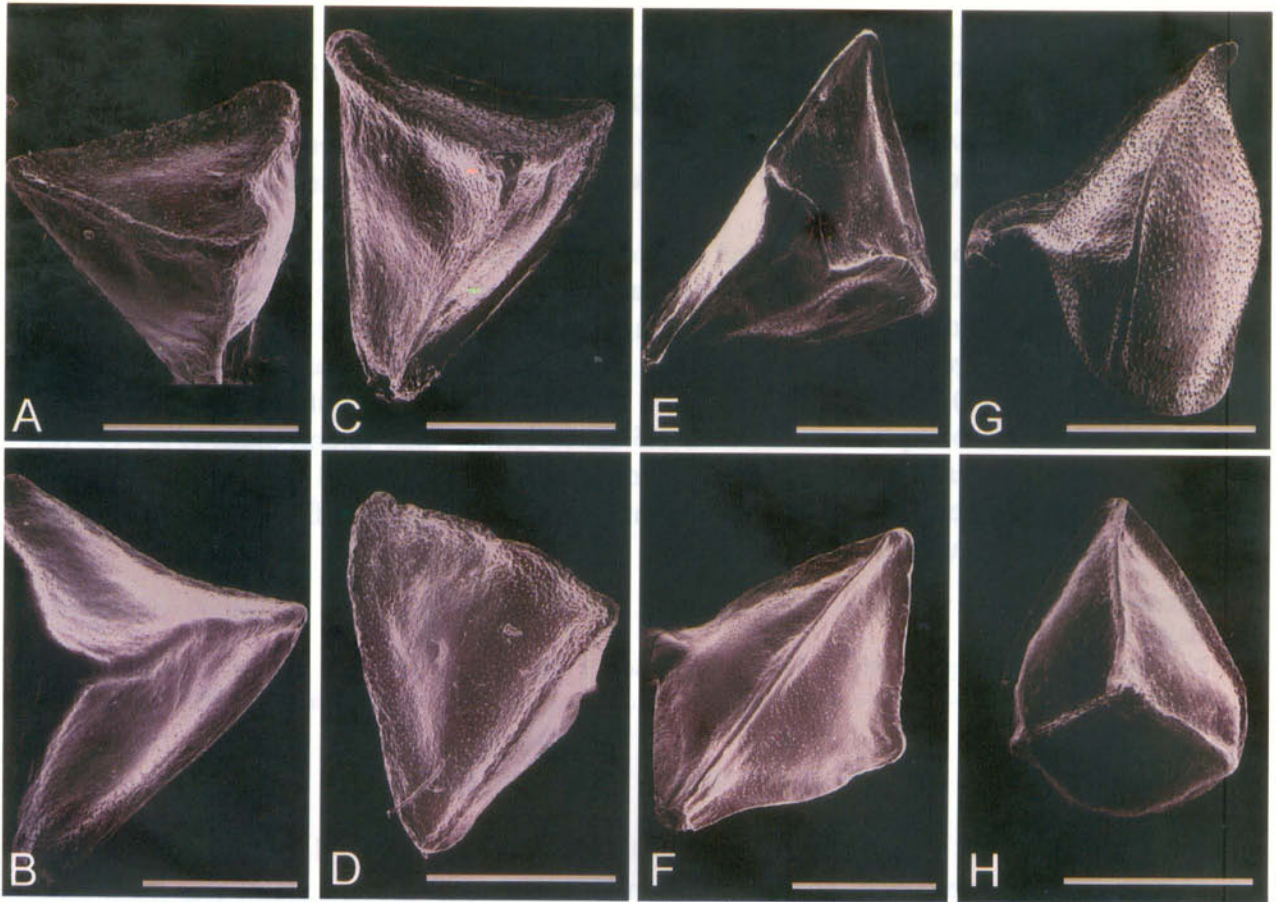


Fig. 1. Nutlets of Taiwanese *Trigonotis*. A & B, *T. formosana* var. *formosana*; C & D, *T. formosana* var. *elevatovenosa*; E & F, *T. nankotaizanensis*; G & H, *T. peduncularis*. Bar = 0.5 mm.

prolongation of midrib; basal leaves petioled; blade suborbicular, elliptic to oblong, 1-7 cm long, hairy on both surfaces, the margins entire; cauline leaves sessile, ovate to oblong; leaves on the runners smaller, short-petioled, blades orbicular to short spatulate. Inflorescences terminate, scorpioid cymes, ebracteate, simple to several, elongate after flowering; calyx-lobes ovate to lanceolate, ca. 2.5 mm long, pilose on both surfaces, scarcely enlarged in fruit; corolla rotate, 6-9 mm across; the lobes broadly orbicular; fornicies trapeziform, ca. 0.8 mm, yellow, become white quickly; stamens ca. 0.9 mm long, the filaments short, inserted at the middle of tube; ovary depressed-tetrahedral, distinctly 4-lobed; style ca. 1.3 mm; stigma capitate. Nutlets tetrahedral, ca. 1 mm long, black and shiny, sometimes with 1-3 hairs on upper surface near the style.

Endemic, at thicket of mountains, middle altitude.

The two taxa *T. elevatovenosa* Hayata and *T. formosana* Hayata are closely similar and often confuse local taxonomists. The identification of specimens in Taiwan herbaria were also often confused. Previously, the two taxa were treated as the rank of species because their typical forms are distinguishable. Hsiao (1978) separated them by the shapes of radical leaves and leaf apex. Liu (1998b) used the characters, lateral veins elevated or not and leaf apex emarginated or not, to distinguish the two species. We made a more extensive comparative study and found that the characters used by previous taxonomists were not consistent and often revealed different combinations. The gross morphology of the two taxa displays

continuous variations, and no constant characters are able to distinguish them clearly. Furthermore, their pollen morphology (Shen, 1999) and micromorphology of nutlet surfaces are almost identical. It seems reasonable to treat them as conspecifics. But judging from the feature that their typical phases are still distinguishable (see "key to taxa of Taiwan"), we reduce them as infraspecific taxa in the present paper .

1a. *Trigonotis formosana* var. *formosana*

台灣附地草 Fig. 2

Trigonotis formosana Hayata, J. Coll. Sci. Univ. Tokyo 25(19): 171. 1908 (Fl. Mont. Form.); Hou, *Taiwania* 1: 222. 1950; Hsiao in Li *et al.*, Fl. Taiwan 4: 407; Wang *et al.*, Fl. Reipubl. Popularis Sin. 64(2): 93. 1990; Zhu *et al.* in Wu & Raven, Fl. China 16: 367. 1995; Liu, *Taiwania* 43(2): 129. 1998; Liu in Huang *et al.*, Fl. Taiwan 2nd ed. 4: 400. 1998. TYPE: Taito, Daikunsha, Taiwan, *Kawakami et Mori 2230* (Iso-syntype, TAIF!); Kagi, Kishirei, Taiwan, *Kawakami et Mori 1969* (Iso-syntype, TAIF!)

Basal leaves mostly oblong to spatulate, 3-7×1-3 cm, apex truncate to acute, occasionally emarginate, adaxial veins not elevated or slightly elevated. Inflorescences branches 2-5, flowers white to light blue.

Endemic, mostly in central and southern part, under the forest, shady, moist place.

Additional specimens examined: TAOYUAN: Lalashan, *Matsuda s.n.* Jul. 27, 1918 (TAIF); Fuhsing Hsiang: Kaoli-Shule, elev. 600 m, *Y. K. Chen 115* (HAST). MIAOLI: Tahsuehshan 230 logging tract, elev. 2000-2300 m, *J. C. Wang et al. 4999* (TNU). TAICHUNG: Hoping Hsiang: Sanchiaoshan, en route from the hiking entrance of the mountain to the peak, elev. 1600 m and higher, *H. Y. Shen et al. 227* (HAST). NANTOU: Luku Hsiang: Chitou, elev. 1250 m, *Y. K. Chen 246* (HAST); Chitou, elev. 1100 m, *C. I Peng 5327* (HAST); Luku Hsiang: Hsitou Experiment Forest, Nat'l Taiwan Univ., elev. 1150 m, *C. I Peng 15007* (HAST); Luku Hsiang: Chito, road from Giant Tree to Fenghuangshan, elev. 1380 m, *C. C. Wang & D. H. Lin 1219* (HAST); Luku Hsiang: Hsitou, on the way from Miaopu to Shenmu, elev. 1000 m, *H. F. Yen 10265* (HAST); Hsinyi Hsiang: along Provincial Rd. #21 (New Central Cross-island Hwy) near mileage sign 128 km, elev. 1535 m, *T. Y. Liu et al. 1227* (HAST, TAIF). CHIAYI: Houtapu, *H. J. Chang 2397* (TAIF); Alishan, *Kawakami s.n.* Mar., 1911 (TAIF); Fenchihu to Dadonshan, *H. W. Lin et al. 89* (TNU); same loc., *J. C. Wang 7065* (TNU); Fenchihu-Tianchian, elev. 1300-1405 m, *J. C. Wang et al. 6228* (TNU); Meishan Hsiang: Juili Forest Recreation Area, elev. 700-800 m, *Y. C. Lu 1708* (TNU). KAOHSIUNG: Taoyuan Hsiang: Weichinhsi bridge; mileage sign 114-115 km on Provincial Road #20, elev. 1220 m, *C. C. Wang et al. 1021* (HAST); Taoyuan Hsiang: near road mileage sign 13 km on Meilan Forest Road, elev. 1540 m, *T. Y. Liu et al. 428* (HAST, TAIF). HUALIEN: Lanshan, elev. 1300 m, *C. I Peng et al. 9926* (HAST); Fuli Hsiang: Fuli, along trail from Loshan Waterfall to a rocky camping site (on the way to Fenshuilunshan), elev. 465-560 m, *C. H. Chen et al. 333* (HAST); Fuli Hsiang: Hsinkangshan (a mountain), en route from elev. ca. 1180 m to a hunting hut at mountain stream valley, elev. 1150-1180 m, *H. Y. Shen et al. 654* (HAST, TNU); Lintienshan, *C. E. Chang s. n.* May 13, 1987 (PPI); Juisui Hsiang: Juisui Forest Road, elev. 1495-1565 m, *K. Y. Wang et al. 653* (HAST, TAIF, TNU); Hualien, Tienchangshan, *Matsuda s.n.* Aug. 3, 1919 (TAIF).

1b. *Trigonotis formosana* var. *elevatovenosa* (Hayata) S. D. Shen & J. C. Wang *stat. nov.*

台北附地草 Fig. 3

Trigonotis elevatovenosa Hayata, Icon. Pl. Form. 6: 32. 1916; Hou, *Taiwania* 1: 220. 1950; Hsiao in Li *et al.*, Fl. Taiwan 4: 407. 1978; Wang *et al.*, Fl. Reipubl. Popularis Sin. 64(2): 93. 1990; Zhu *et al.* in Wu & Raven, Fl. China 16: 367. 1995; Liu, *Taiwania* 43(2): 129. 1998; Liu in Huang *et al.*, Fl. Taiwan 2nd ed. 4: 402. 1998. TYPE: Giran, Soseikyaku, Taiwan, *Hayata s.n.* May 11, 1916 (Iso-syntype, TAIF!).

Basal leaves mostly elliptic or suborbicular, 1-3.5×1-2.5 cm, apex emarginate; margin usually undulate, with spreading hairs, veins usually elevated adaxially. Inflorescences branches 1-3, flowers white, sometimes hirsute at base inside the corolla tube.

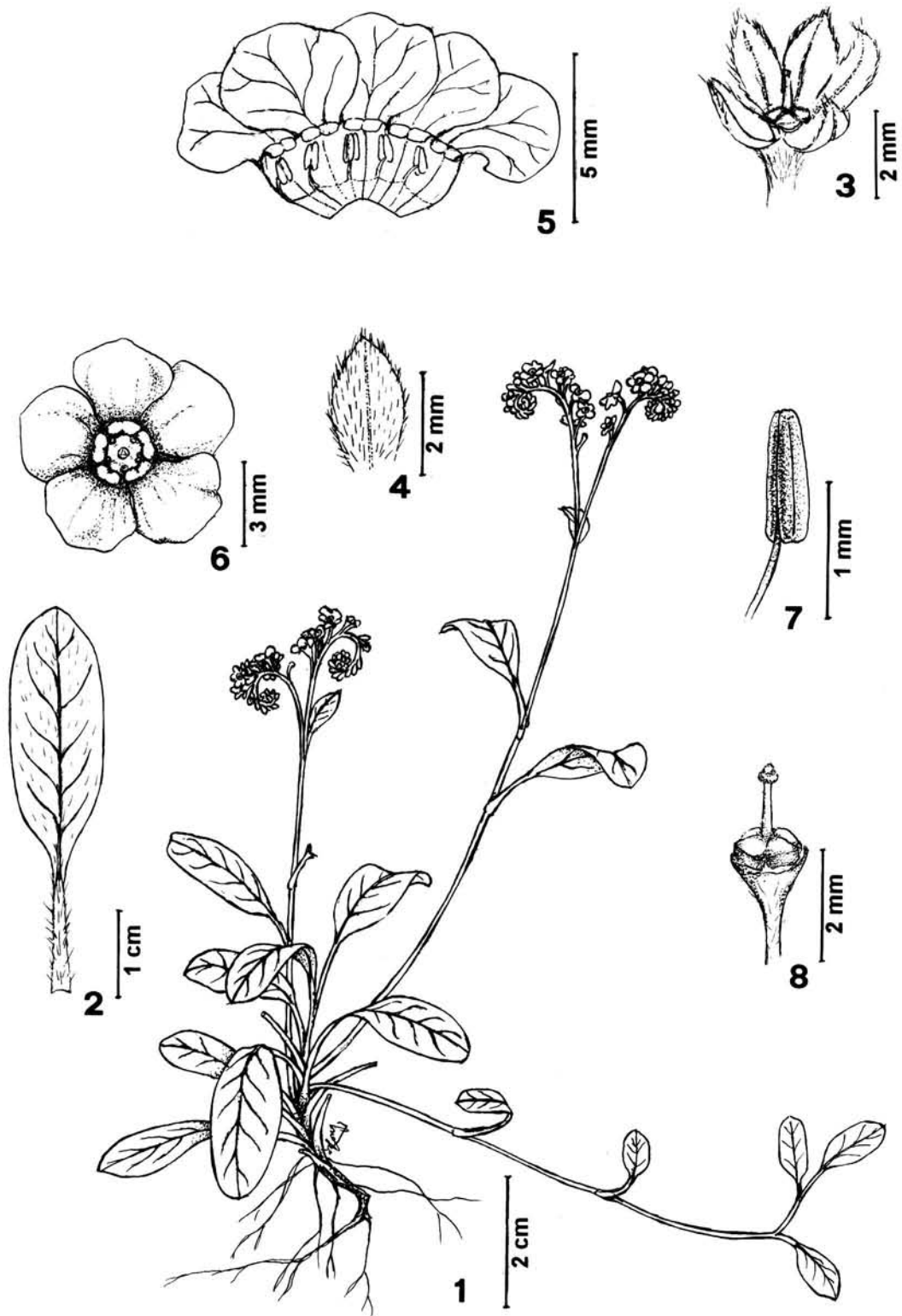


Fig. 2. *Trigonotis formosana* Hayata var. *formosana*. 1. habit; 2. leaf; 3. flower with corolla removed; 4. calyx lobe; 5, 6. corolla and stamens; 7. stamen; 8. pistil.

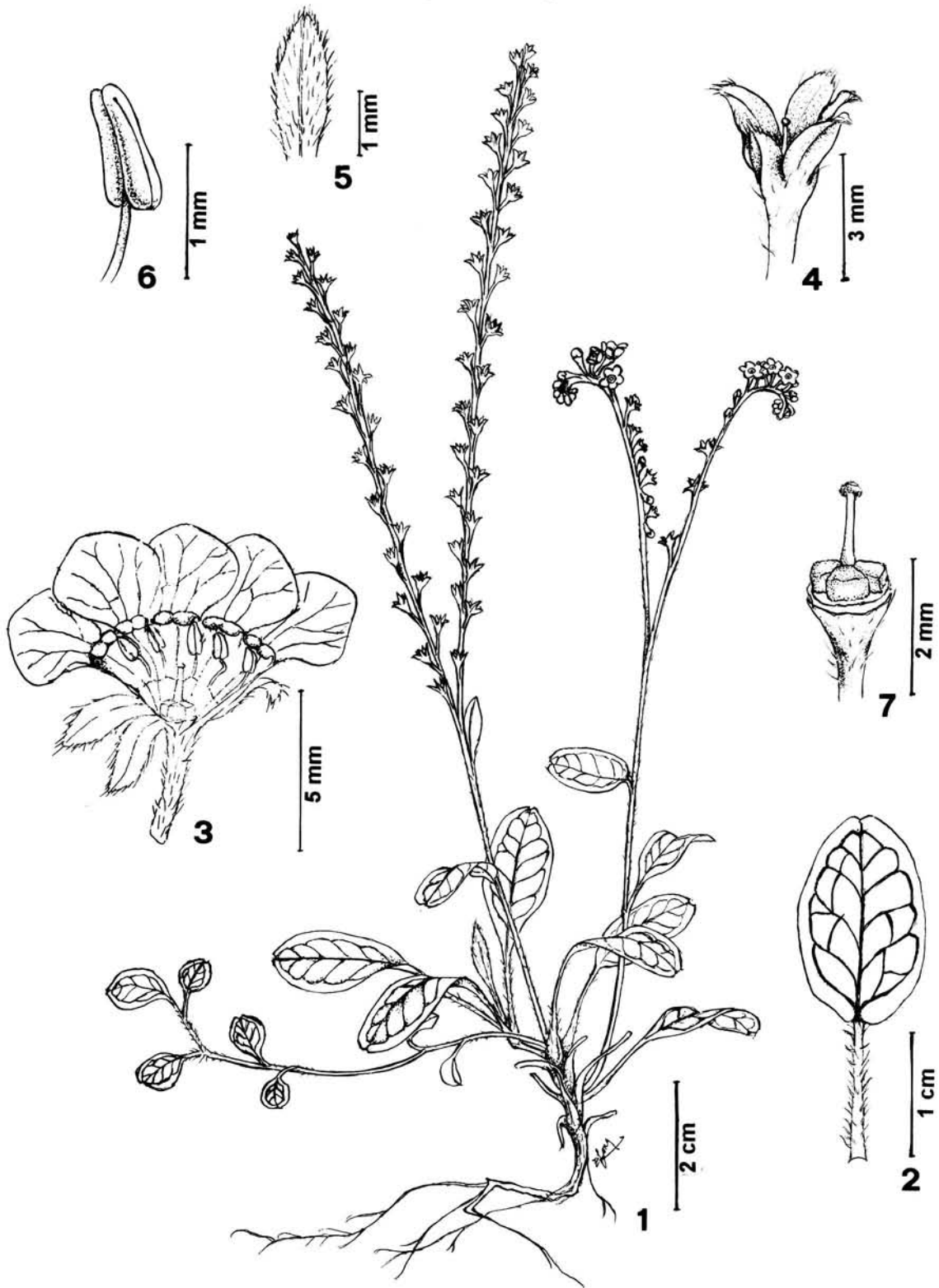


Fig. 3. *Trigonotis formosana* var. *elevatovenosa* (Hayata) S. D. Shen & J. C. Wang. 1. habit; 2. leaf; 3. dissected flower; 4. calyx; 5. calyx lobe; 6. stamens; 7. pistil.

Endemic: mostly in northern and central part, stream side or wet place.

Additional specimens examined: TAIPEI: Wulai Hsiang: On the way from Lalashan mountain entrance to Takuanshan Forest Recreation Area, elev. 1600-1800 m, K. Y. Wang *et al.* 863 (HAST, TNU); Chihsingshan,

800m. *S. Y. Lu 25219* (TAIF). **HSINCHU:** 14 km N of Kuanwu, elev. 1400 m, *C. I Peng et al. 14941* (HAST, TAIF); Chienshih Hsiang: Yuanyanghu, Mileage sign 13-17 km on Forest Road #100, elev. 1600 m, *C. C. Wang & D. S. Hsu 1347* (HAST); Chienshih Hsiang: Yuanyanghu Natural Preserved Area, along the trail of the lake, elev. 1670 m, *H. Y. Shen et al. 738* (HAST); same loc., *H. Y. Shen et al. 782* (HAST); Wufeng District: en route from Tuchang to Kuanwu, ca. 16.5 km S of Tuchang, elev. 1520 m, *C. I Peng 9365* (HAST); Kuanwu to Kwaishan, elev. 1800-2100 m, *J. C. Wang & K. C. Yang 4780* (TNU). **MIAOLI:** Nanchuang Hsiang: on the way to Hakannishan, between Luchang and Mountain-hiking entrance, elev. 1200-1500 m, *C. H. Chen et al. 629* (HAST, TNU); Kuanwu: Tunghsien forest road, *C. H. Chen 830* (HAST, TAIF, TNU); Kuanwu Da-lu logging tract, elev. ca. 2000 m, *J. C. Wang et al. 8265* (TNU). **TAICHUNG:** 710 logging tract, elev. 1700 m, *Y. C. Lu 104* (TNU). **NANTOU:** Puli to Meifeng, elev. 2100 m, *Y. K. Chen & Suzuki 45* (HAST). **HUALIEN:** Hoping logging tract, 41K-46K, elev. 1900-2000 m, *J. C. Wang et al. 8542* (TNU); Hsiulin Hsiang: Hsinpaiyang, at mileage signs ca. 144K of Central Cross-island Hway, elev. ca. 1700 m, *S. D. Shen et al. 310* (TNU). **ILAN:** Tatung Hsiang: Yuanyanghu Nature Preserve Area, elev. 1650 m, *W. P. Leu 2017* (HAST, TNU); Tatung Hsiang: Taipingshan Forest Recreation Area, along the railroad, elev. 1950-2000 m, *H. Y. Shen et al. 810* (HAST); Taipingshan, Chienchaiping, *Suzuki 4098* (TAI); Tatung Hsiang: Along the Forest Road #100 between the mileage signs 16 km and 24 km, elev. 1600-1860 m, *T. Y. Liu et al. 934* (HAST); Taitung Hsiang: Nanhutashan, on the way from mountain entrance to Yunlengshanchuang, elev. 2600-2800 m, *C. H. Chen 988* (TNU); Ssuyuan - Nanshan, *J. C. Wang 8146* (HAST, TAIF, TNU); Ilan, Tsao-pei, *Y. P. Yang s.n. Apr. 9, 1977* (TAIF); Fushan Botanical Garden, elev. ca. 800 m, *S. D. Shen et al. 298* (TNU).

- 2. *Trigonotis nankotaizanensis*** (Sasaki) Masamune & Ohwi, *Trans. Nat. Hist. Soc. Form.* 23: 210. 1933; Hou, *Taiwania* 1: 221. 1950; Hsiao in *Li et al.*, *Fl. Taiwan* 4: 409. 1978; Wang *et al.*, *Fl. Reipubl. Popularis Sin.* 64(2): 94. 1990; Zhu *et al.* in Wu & Raven, *Fl. China* 16: 368. 1995; Liu, *Taiwania* 43(2): 130; Liu in Huang *et al.*, *Fl. Taiwan* 2nd ed. 4: 402. 1998. TYPE: Monte Tsugitaka elev. ca. 4000 m, *Masamune 1234* (holotype, TAI!)

南湖附地草 Fig. 4

Myosotis nankotaizanensis Sasaki, *Trans. Nat. Hist. Soc. Formos.* 21: 155. 1931.

Omphalodes formosana Masamune, *J. Trop. Agric.* 2: 240. 1930.

Perennial herbs, strigose to pubescent throughout. Stems several, erect and slender, 6-20 cm high, rising from obliquely spreading rhizomes. Basal leaves ovate to oblanceolate, mucronate (prolongation of midrib) at apex, attenuate at base; petioles winged especially widened at base, each covered by the lower one, persistent; stem leaves gradually sessile, spatulate to ovate, apex acute. Inflorescences simple to 2-cymes, 3-7 cm long, 7-15 flowered, slender but erect in fruit; pedicels straight, slender; basal 1-3 flowers with bracts and loosely set, pedicels to 1(or more) cm long; bracts lanceolate; calyx lobes lanceolate, almost divided to the base, 2-4 mm long, ca. 1 mm wide; corolla white, ca. 8 mm across; lobes elliptic to oblong; tube 1.4-2 mm across, 2.2-2.5 mm high; fornicies yellow, ca. 1 mm wide, 0.5 mm high; stamens inserted on upper half of corolla tube, anthers long elliptic, ca. 1 mm, apex obtuse. Nutlets black and shiny when mature, oblique trigonous-tetrahedral, axis ca. 1.5 mm long, other sides 1 mm.

Endemic, a small alpine herb, confined on gravelly field of Nanhutashan, Hsuehshan, and Tapachienshan above alt. 3300 m.

Additional specimens examined: **HSINCHU:** Wufeng Hsiang: Hsuehpa National Park: Tapachienshan, elev. 3400 m, *C. L. Huang et al. 113* (HAST); Tapachienshan, *Sasaki s.n.* Jul. 19, 1932 (TAI); same loc., *C. Y. Li 17* (PPI); *C. F. Hsieh 1338* (TAI); same loc., *Shimada SH567* (TAI). **MIAOLI:** Tapachienshan, elev. 2000-3500 m, *J. C. Wang 1296* (TNU). **TAICHUNG:** en route from '369 Lodge' to Hsuehshan main peak, elev. 3400-3500 m, *C. I Peng 7969* (HAST); Wuling: en route from 369 Lodge to Hsuehshan peak, elev. 3884 m, *D. S. Hsu & Moore 722* (HAST); Hsuehshan: cirque to Shengling, elev. 3500-3884 m, *K. C. Yang s.n.* Aug. 23, 1995 (TAIF); Shan-cha shelter to Hsieh-shan-pei-feng, elev. 3100-3700 m, *J. C. Wang et al. 4588* (TAI, TNU); Hsuehshan Cirque, elev. ca. 3700 m, *S. D. Shen & G. L. Chen 330* (TNU); Nanhutashan, on the way from Nanhupeishan to summit of Nanhutashan, elev. 3300-3740 m, *C. I Peng 5774* (HAST); Nanhutashan, elev. 3600 m, *Yamazaki et al.*

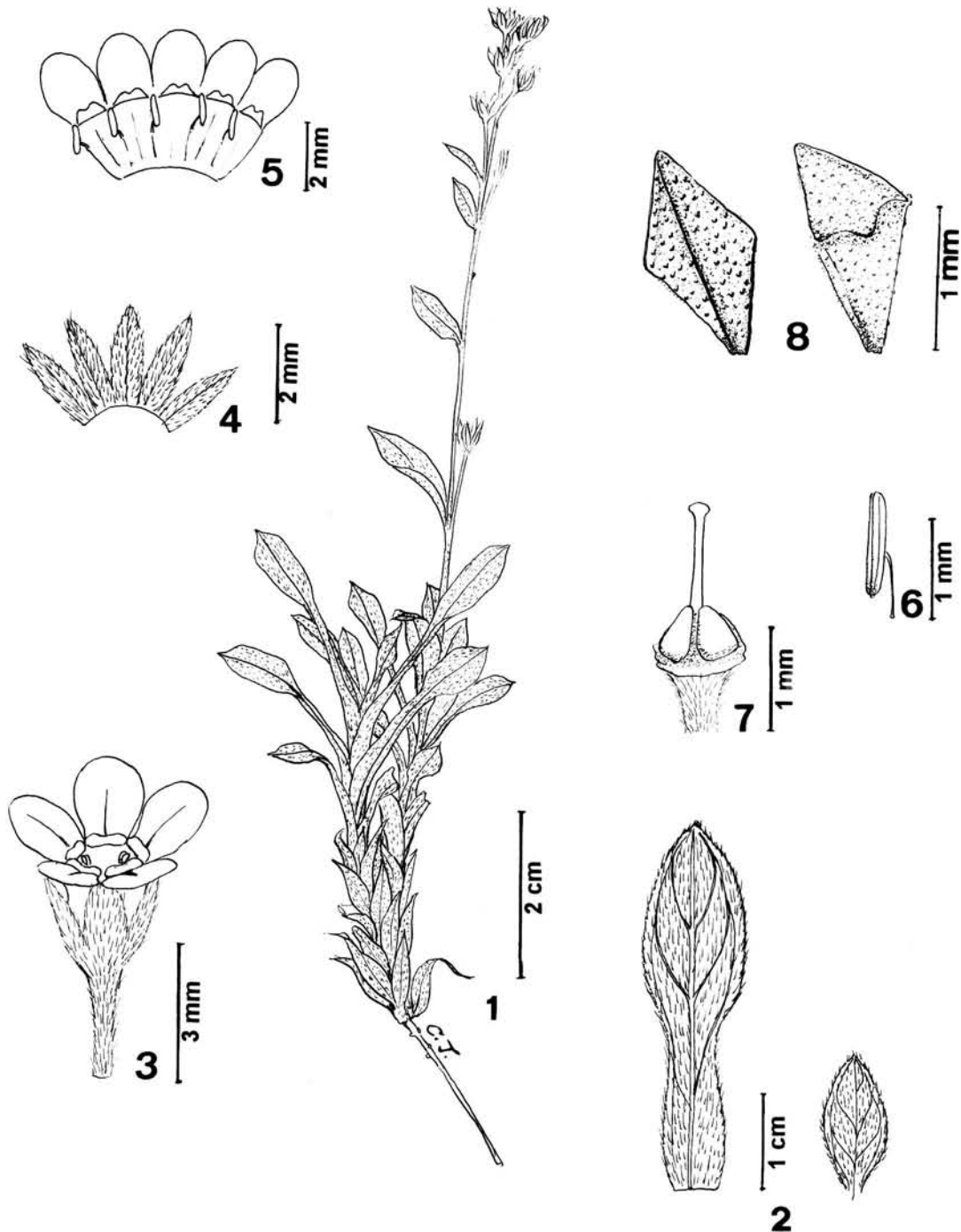


Fig. 4. *Trigonotis nankotaizanensis* (Sasaki) Masamune & Ohwi. 1. habit; 2. leaves; 3. flower; 4. calyx; 5. corolla and stamens; 6. stamen; 7. pistil; 8. nutlets, adaxial view (left) and abaxial view (right).

s.n. Aug. 22, 1969 (TAI); same loc., *S. F. Huang* 792 (TAI); same loc., *Suzuki et al.* ST17376 (TAI); same loc., *Hashioka s.n.* Jul. 28, 1934 (TAI). **KAOHSIUNG:** 3026 cottage-Kuanshan, elev. 3026-3600 m, *S. F. Huang & M. J. Wu* 5404 (TAI). **ILAN:** Nanhutashan Cirque, elev. ca. 3500 m, *S. D. Shen et al.* 476 (TNU). **HUALIEN:** Hsiulin Hsiang: Taroko National Park: Chilaishan, en route from the fork of the trails between Chilai N Peak and Chilaishan to Chilai Youth Hostel, elev. 3035-3387 m, *S. Y. Shen & T. Y. Liu* 75 (HAST).

This taxon inhabits alpine gravelly fields by streams. It usually grows in clumps because of short rhizomes. The winged petioles are persistent even though the leaf blades wilted



Fig. 5. *Trigonotis peduncularis* (Trev.) Bentham ex Baker & S. Moore. 1. habit; 2. calyx; 3. nutlet, lateral view.

entirely, so that the small crop seems tightened at the base. In a sunny place, the crops are more tightened and obviously covered with white hairs; in shady and moist areas, crops become enlarged and become slender.

3. *Trigonotis peduncularis* (Trev.) Bentham ex Baker & S. Moore, J. Linn. Soc. Bot. 17: 384. 1879; Wang *et al.*, Fl. Reipubl. Popularis Sin. 64(2): 104. 1990; Zhu *et al.* in Wu & Raven, Fl. China 16: 372. 1995.

附地菜 Figs. 5 & 6

Myosotis peduncularis Trev., Ges. Naturf. Fr. Berl. Mag. 7: 147. 1813.

Annual or biennial herbs. Stems usually much branched, rarely single, diffuse, 5-30 cm high, short strigose throughout. Basal leaves rosulate, spatulate, 2-5 cm long including petioles, strigose, apex rounded to obtuse, mucronate; upper stem leaves sessile or short petioled, oblong to elliptic, apex mucronate to acute. Inflorescences 5-20 cm; basal 2 or 3 flowers with leaflike bracts, axillary or extra-axillary; ebracteate upward. Pedicels 3-5 mm after anthesis, apex thickened, clavate in fruit; calyx lobes narrowly triangular in fruit, 1-3 mm long; corolla pale blue, 1.5-2.5 mm across; lobes obovate; anthers ovate, ca. 0.3 mm, apex mucronate. Nutlets with carpophore, oblique trigonous-tetrahedral, 0.8-1 mm, short pubescent or glabrous, adaxial 2 lateral surfaces subequal, bottom surface smaller and convex; abaxial surfaces triangular-ovate, margins ribbed; carpophore ca. 0.5 mm long, curved.

Widely distributed in temperate Asia, E. Europe. In Taiwan, so far only known from Alishan.

Specimens examined: Chiayi Co: Alishan, on the way from Tsao-ping Station to the hiking entrance of Datashan, *S. M. Kuo et al. 126b* (TNU); same loc., *S. M. Kuo 320* (TNU); Alishan, the 3rd branch to the first branch, *C. C. Hsu 6839* (TAI).

This taxon is a new record for Taiwan, although the first collection can be traced back to 1970, where it was misidentified as *Bothriospermum tenellum*. The species is easily distinguished from other Taiwanese taxa in having long ebracteate inflorescences and pyramidal nutlet with carpophore.

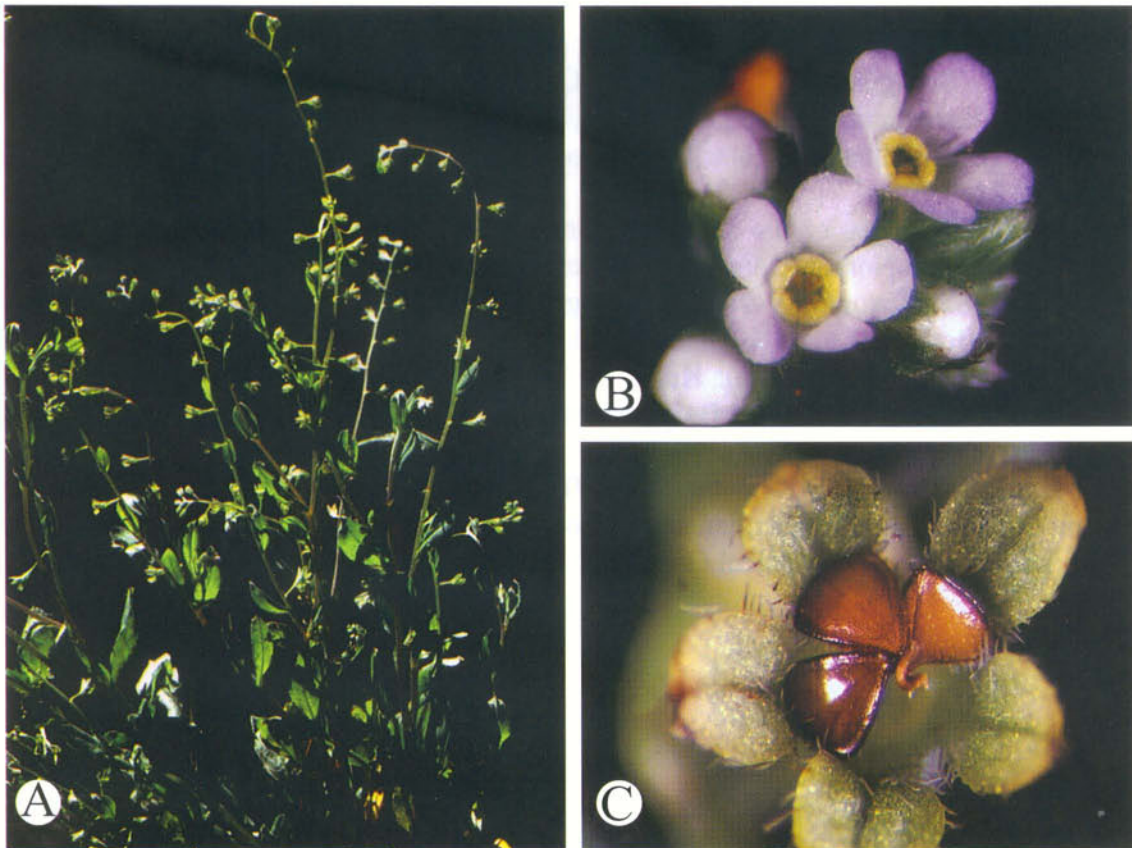


Fig. 6. *Trigonotis peduncularis* (Trev.) Bentham ex Baker & S. Moore. A. habit; B. flowers; C. nutlets.

ACKNOWLEDGEMENTS

We thank Mr. Chang-Tze Lu for technical assistance in the line drawings, Mr. Tsai-Wen Hsu for providing collection information. This study was supported by a research grant from the National Science Council (NSC88-2311-B-003-004).

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台灣產附地草屬（紫草科）植物之訂正

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(收稿日期：2001年10月20日；接受日期：2001年11月24日)

摘 要

本文依據詳細之外部形態研究結果將台灣產附地草屬植物(*Trigonotis* Steven)處理為三種一變種：台灣附地草(*T. formosana* var. *formosana*)，台北附地草(*T. formosana* var. *elevatovenosa*)，南湖附地草(*T. nankotaizanensis*)以及附地菜(*T. peduncularis*)，其中附地菜為新紀錄種。根據詳細之形態研究，發現台北附地草與台灣附地草之形態呈現連續性變異，僅有葉形一項特徵可區分典型之類型，故將前者處理為台灣附地草之一變種(*T. formosana* var. *elevatovenosa* S. D. Shen & J. C. Wang *stat. nov.*)。台灣產本屬植物在外部形態方面，以葉片形態、花序類型、小堅果形態等為分類的重要特徵。以掃瞄式電子顯微鏡觀察台灣產本屬植物小堅果細部形態，發現各分類群有種間差異存在。本文提供檢索表、描述及各分類群之手繪圖。

關鍵詞：紫草科、新紀錄種、小堅果、分類訂正、台灣、附地草屬、附地菜。

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