



# *Gardneria* (Loganiaceae) in Taiwan

Sheng-Zehn Yang<sup>1</sup> and Ching-I Peng<sup>2</sup>

<sup>1</sup>Department of Forest Resource Management and Technology, National Pingtung Polytechnic Institute, Pingtung, Taiwan, Republic of China

<sup>2</sup>Institute of Botany, Academia Sinica, Nankang, Taipei, Taiwan 115, Republic of China

(Received August 21, 1994; Accepted September 27, 1994)

**Abstract.** Based on one fruiting collection B. Hayata published *Gardneria shimadai* from Taiwan in 1916. It has since been considered a rare, endemic species on this island. Flowering specimens became available only recently in our botanical inventory of Taiwan. We are therefore able to revise the brief and incomplete taxonomic description of this species in the Flora of Taiwan. As a result, we conclude that it is synonymous with *G. multiflora* Makino, which is distributed in Japan (western Honshu and Ryukyu) and southern mainland China. We also report our discovery of a second species, *G. nutans*, heretofore thought to be endemic to Japan, in southern Taiwan. In both cases their occurrence in Taiwan marks their southeastern distribution limit in east Asia. A taxonomic treatment, line drawing, photographs, and a map showing their distribution on this island are provided.

**Keywords:** Distribution; *Gardneria*; *Gardneria shimadai*; *Gardneria multiflora*; *Gardneria liukuensis*; *Gardneria nutans*; Loganiaceae; Rare plants; Taxonomy; Taiwan.

*Gardneria* consists of 5 or 6 species of mostly climbing or creeping, glabrous shrubs in southeastern and eastern Asia, ranging from India to central Japan and Java (Leenhouts, 1962a, 1962b; Leeuwenberg, 1980; Li, 1992). Heretofore, only one species, *G. shimadai* Hayata, was reported from Taiwan (Hayata, 1916; Li, 1963; Li, 1978). It is a rare species (Hsu, 1980; Hsu and Lu, 1984; Lai, 1991) that has long been thought of as being endemic to this island. Very recently, however, it was synonymized with *G. multiflora* Makino (Li, 1992; Yamazaki, 1993). Our investigation of the genus *Gardneria* was prompted by the first author's recent discovery of a second species, *G. nutans* Sieb. & Zucc., in a floristic survey of the *Amentotaxus formosana* nature reserve at the southern end of the Central Mountain Range in Taiwan. A taxonomic treatment of the genus *Gardneria* in Taiwan follows.

## Key to species of *Gardneria* in Taiwan

- 1a. Leaves 6–12 cm long, narrowly elliptic to lanceolate; inflorescences 3–10-flowered; corolla yellow, the lobes ascending or spreading at anthesis; stamens loosely connivent, the connectives inconspicuous, glabrous; style much exerted from the anther tip, the exerted portion subequal to the anther .....  
..... 1. *G. multiflora*
- 1b. Leaves 3–7 cm long, elliptic-ovate; inflorescences 1(–3)-flowered; corolla creamy white, the lobes markedly recurved at anthesis; stamens coherent, the

connectives prominent, narrowly triangular, densely minutely appressed puberulous abaxially; style slightly exerted from the anther tip, the exerted portion much shorter than the anthers. ....

..... 2. *G. nutans*

1. ***Gardneria multiflora*** Makino, Bot. Mag. Tokyo 6: 53. 1892, nom. nud.; 15: 103. 1901.–TYPE: Japan. Honshu, *Z. Yoshino s.n.* (syntype), *T. Makino s.n.* (syntype); 'Botanical Garden,' 10 Jul 1880, *T. Makino s.n.* (paratype: TI!) 多花蓬萊葛 Figure 1A
- Gardneria shimadai* Hayata, Icon. Pl. Formos. 6:30. 1916; Li, Fl. Taiwan 4: 154, pl. 947. 1978.–TYPE: Taiwan. Taipei city: Chutsushan ('Tikushizan'), 22 Mar 1915, *Y. Shimada 1552B* (holotype: TI!; isotype: NTUF!) [Erroneously cited as *Shimada 1915* in Li (1978)]
- Gardneria honkongensis* Hayata, Icon. Pl. Formos. 9: 75. 1920. –TYPE: Hongkong. Happy Valley, Jun 1917, *B. Hayata s.n.* (holotype: TI!)

Glabrous scandent shrubs. Stems terete, green. Leaves simple, opposite, coriaceous; petioles 7–15 mm long, bases connate into a stipular ring at node; blades narrowly elliptic to lanceolate, 6–12 cm long, 1.5–3.5 cm wide, apex acuminate, base acute to round, glabrous on both surfaces, entire, green adaxially and pale green abaxially, venation pinnate, lateral veins 6–9 pairs. Inflorescences axillary, of 3–10-flowered cymes; bracts persistent, linear to triangular, 2–3 mm long; peduncles glabrous, 5–10 mm long. Flowers yellow, slightly pubescent in bud; pedicels glabrous, 5–10 mm long; calyx 5–

<sup>2</sup>Corresponding author



Figure 1. *Gardneria* from Taiwan. A) *G. multiflora* (Leu 105, HAST); B) *G. nutans* (Yang 30451, HAST).

merous, very widely ovate, ca. 1 mm long and wide, slightly imbricate, margin ciliate; corolla deeply 5-lobed, the lobes lanceolate, 5-6 mm long, 1-1.5 mm wide, ascending to spreading at anthesis; stamens 5, loosely connivent, the anther ca. 3 mm long, the filament ca. 0.5 mm long, dorsifixed; ovary glabrous, 2-locular, style filiform, ca. 6 mm long at anthesis. Fruit a 2-seeded globose berry, 6-8 mm in diameter, glabrous, blackish at maturity.

*Additional specimens examined.* TAIWAN. TAIPEI CITY: Yangmingshan National Park, Chutsuhu, elev. ca. 700 m, *Leu 105* (HAST), *Leu 117* (HAST), *Leu 1869* (HAST), *Peng 12951* (HAST); Chihsingshan, 29 Sep 1977, *Ching s.n.* (TAI, 2 sheets, both in fruit); Chihsingshan ('Hokuto Sitisei Gun'), *Murakami 286* (TAI); Wuchihshan, in forest, *Huang & Yang 1920* (TAI); Tatunshan ('Mt. Taiton'), hillside, *Chang 2* (TAI). TAIPEI HSIEN: Shuanghsi ('Shungshi'), Tsankuangliaoshan ('Tsaonkuanliaoshan'), alt. 500 m, *Chang & Chen s.n.* (NTUF); Peichatienshan ('Peichatenshan'), 600-1400m alt., in forest, *Li 3538* (TAI); Sanhsia, Wulingchienshan, *Masamune 4023* (TAI); in Trochodendro-Sakakietis montis Kabosan, ca. 1000 m alt., *Suzuki 12959* (TAI). ILAN HSIEN: Nanhutashan, Nanshan-Kiretei, alt. 1700 m, in evergreen forest, climbing liane, *Yamazaki et al. 692* (TAI, TI).

*Distribution and notes.* *Gardneria multiflora* is distributed in Japan (Western Honshu and Ryukyu), southern mainland China, and Taiwan. In Taiwan it is a rare species, restricted mainly to evergreen broadleaf forests of the Yangmingshan National Park and nearby mountainous areas in the northeastern part of the island at ca. 600-1700 m alt. (Figure 2). It is worth noting that flowering materials were rarely collected from Taiwan, *Leu 105* (HAST) and *Leu 1869* (HAST) which were

collected from the same plant on different trips, being the only such specimens. Excepting *Ching s.n.* (TAI) and the holotype of *G. shimadai* (TI), both of which are in fruit, all of the above-cited specimens are in a vegetative state. In fact, the exceedingly brief and incomplete description of *G. shimadai* in both 'Woody Flora of Taiwan' (Li, 1963) and 'Flora of Taiwan' (Li, 1978) was abstracted from the Latin diagnosis of Hayata (1916), which was based on a single fruiting type collection.

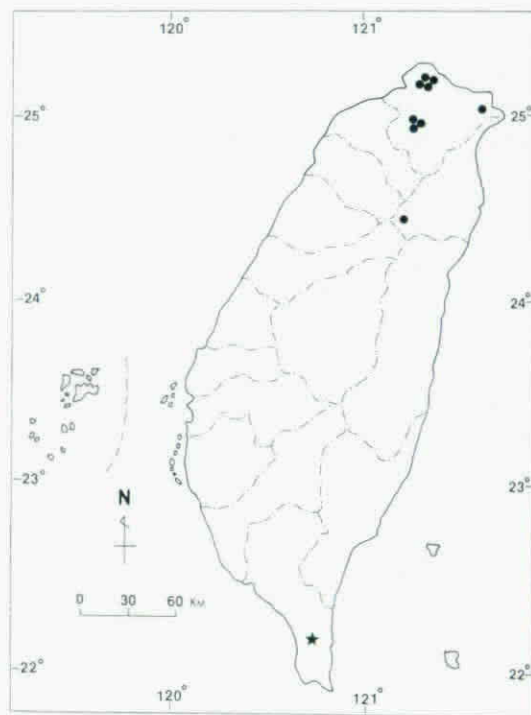
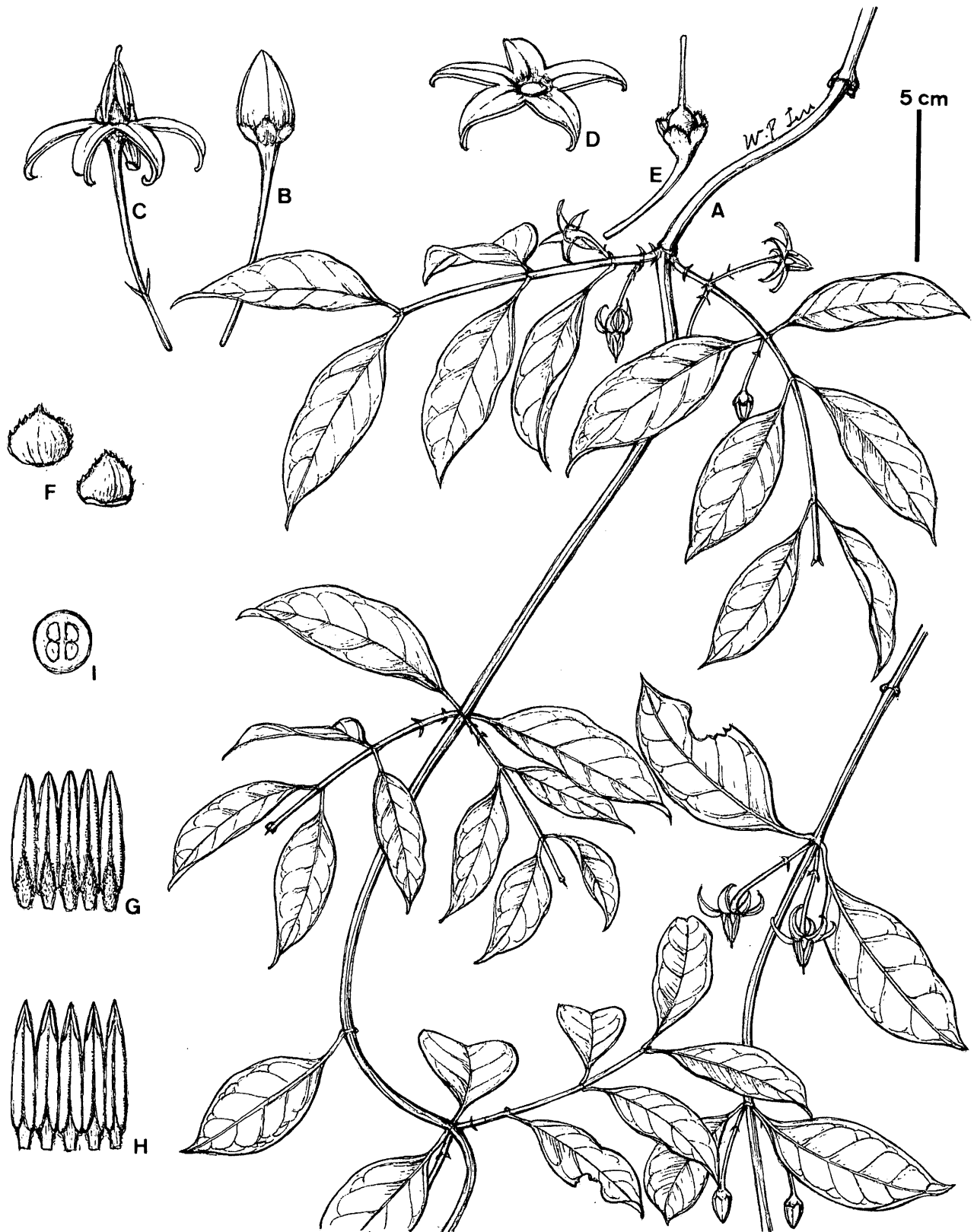


Figure 2. Distributions of *Gardneria multiflora* (solid circles) and *G. nutans* (star) in Taiwan.



**Figure 3.** *Gardneria nutans*. A) habit; B) flower bud; C) flower; D) corolla; E) flower, corolla and stamens detached; F) sepal, abaxial (upper left) and adaxial (lower right) views; G) androecium, abaxial view; H) androecium, adaxial view; I) ovary, cross section. All from Yang 30451 (HAST).

Leenhouts (1962a) erroneously synonymized *G. shimadai* under *G. angustifolia* Wall. of Yunnan and the southern slopes of the Himalaya, which nearly always has 4-merous flowers borne singly in leaf axils. Li (1978) recognized *G. shimadai* Hayata while suspecting that it may be conspecific with *G. angustifolia* Wall.

Berries of *G. multiflora* are reported to be red from Japan (pl. 209: photo 3 in Yamazaki, 1989) and China (Institute of Botany, Chinese Academy of Sciences, 1980; Li, 1992), but they appear to be black at maturity in Taiwan (Figure 1A). Otherwise however plants of Taiwan described as *G. shimadai* do not seem to be distinguishable from *G. multiflora* of the other regions. It may be that the fruits are red initially, but turn blackish when fully mature.

2. ***Gardneria nutans*** Sieb. & Zucc., Abh. Mat.-Phys. Baier Akad. Wiss. 4(3): 165. 1846. —TYPE: Japan. *Siebold s.n.* (L 908.127-193 and 552, syntypes, fide Leenhouts, 1962a). 垂花蓬萊葛 Figures 1B, 3
- Gardneria liukiuensis* Hatusima, Fl. Ryukyus 485. 1971. nom. nud.; J. Geobot. 24 (4): 76. 1977. —TYPE: Japan. Ryukyus: Isl. Tonaki, on a limestone peak, *T. Amano 7604* (flowering syntype: Herb. Dept. Agric. Kagoshima Univ.; photograph, TI!; US; isosyntype, TI!); Isl. Okinawa, Nago city, Mt. Katsuu, a limestone mountain, *S. Tamaki s.n.* (fruiting syntype: Herb. Sci. & Engin., Ryukyu Univ.)

Glabrous woody vines without tendrils. Stems terete, green. Leaves simple, opposite, coriaceous; petioles 5-9 mm long; blades elliptic-ovate, 3-7 cm long, 2-3 cm wide, acuminate at apex, attenuate-acuminate at base, glabrous on both surfaces, entire, green above, pale green beneath, lateral veins 3-6 pairs. Flowers axillary, usually solitary, rarely in 2-3 flowered cymes, peduncles about 3-8 mm long, bracts narrowly triangular, ca. 1 mm long. Flowers creamy; pedicels 7-9 mm long; calyx 5-merous, widely depressed obovate, ca. 1 mm long and wide, glabrous, margin ciliate; corolla deeply 5-lobed, the lobes lanceolate, ca. 6 mm long, 1.5 mm wide, recurved, subglabrous, acute at apex, base united for ca. 1 mm high; stamens 5, coherent, the anther 5-6 mm long, 1.5 mm wide, fulvous, the connective white, narrowly triangular, ca. 3 mm long, 1 mm wide, the filament very short, dorsifixed; style slender, 3.5 mm long, slightly exerted above the coherent anthers. Fruits not seen.

*Additional Specimen examined.* TAIWAN. PINGTUNG HSIEN: in thickets on ridge of Mt. Chachayalaishan, on sunny slope of ca. 45°-50°, ca. 900 m alt., broadleaf forest, 23 Jul 1993, *S. Z. Yang 30451* [HAST; PPI (Herbarium, National Pingtung Polytechnic Institute)].

*Distribution and notes.* *Gardneria nutans* was heretofore known to be endemic to Japan, occurring in

lowland evergreen forests in Honshu, Shikoku, Kyushu and Ryukyu (Yamazaki, 1993). The discovery of a population in southern Taiwan (Figure 2) marks the southernmost distribution limit of this species in east Asia. Previously such plants from Ryukyu were named *G. liukiuensis* by Hatusima (1971, 1977). While acknowledging a close resemblance of *G. liukiuensis* to *G. nutans*, Hatusima (1977) distinguished the two species by a doubtful difference in characters like variegation in juvenile leaves, size of adult leaves and flowers, flower color, length of anthers, degree of elevation of lateral nerves on abaxial leaf surface, etc. The recent merging of *Gardneria liukiuensis* with *G. nutans* by Yamazaki (1993) is agreeable to us. On the other hand, Li (1992) synonymizes *G. nutans* with *G. angustifolia* Wall., which is doubtful. This study provides an additional example that demonstrate the close phylogeographic relationship between Taiwan and neighboring eastern Asiatic regions.

The discovery of *Gardneria nutans* in Taiwan adds one more species to the list of rare plants of the island. It grows at ca. 900 m alt., an elevation that is usually prone to agricultural or economic development. However the fact that it was found in the *Amentotaxus formosanus* nature reserve (Forest Compartments 28 and 29, Chauchou, Pingtung Forest District, Taiwan Forestry Bureau) assures protection to this newly discovered rare species.

**Acknowledgements.** This research was supported in part by grants from the Council of Agriculture, Taiwan, Republic of China to CIP and SZY respectively. CIP is grateful for funds from Kyoto University Foundation to support a two-month research in Japan (July 1-August 31, 1994), which made possible the consultation of relevant literature and authentic specimens. Literature kindly provided by David E. Boufford, Hongya Gu, and Peter H. Raven is appreciated. We thank the curators of the herbaria cited. We are indebted to David E. Boufford for helpful comments on the manuscript and to Wen-Pen Leu and Shu-Chuan Hsiao for line drawings and technical assistance respectively.

## Literature Cited

- Hayata, B. 1916. *Icones Plantarum Formosanarum nec non et contributiones ad floram Formosanam VI.* Government of Formosa, Taihoku.
- Hayata, B. 1920. *Icones Plantarum Formosanarum nec non et contributiones ad floram Formosanam IX.* Government of Formosa, Taihoku.
- Hatusima, S. 1971. *Flora of the Ryukyus.* Okinawa Biological Education Society, Naha. (In Japanese)
- Hatusima, S. 1977. Japanese species of *Gardneria*. *J. Geobot.* 24: 76-78.
- Hsu, K. S. (ed.). 1980. *The Rare & Threatened Plants of Taiwan.* Taiwan Provincial Keelung Junior High School, Keelung. (In Chinese)
- Hsu, K. S. and S. Y. Lu. 1987. *Taiwan Rare Plants.* Vacation Press, Taipei. (In Chinese)

- Institute of Botany, Chinese Academy of Sciences. 1980. *Iconographia Cormophytorum Sinicorum*. Science Press, Beijing, p. 376.
- Lai, M. J. 1991. *Taiwan Plant Red Data Book*. Ecological Research No. 12, 1991. Council of Agriculture, Taipei, Taiwan, Republic of China. (In Chinese)
- Leenhouts, P. W. 1962a. A revision of *Gardneria* Wall. *Bull. Jard. Bot. Etat.* **32**: 431–439.
- Leenhouts, P. W. 1962b. *Loganiaceae*. *Fl. Males.* ser. 1, vol. 6, pt. 2: 293–387.
- Leeuwenberg, A. J. M. 1980. *Fam. Loganiaceae*. In A. Engler, *Pfl.-fam.*, ed. 2, **28b I**: 1–255.
- Li, H. L. 1963. *Woody Flora of Taiwan*. Livingston Publ. Co., Narberth, Pennsylvania.
- Li, H. L. 1978. *Loganiaceae*. In H. L. Li, T. S. Liu, T. C. Huang, T. Koyama, and C. E. DeVol (eds.), *Flora of Taiwan*, vol. 4. Epoch Publishing Co., Ltd., Taipei, pp. 151–160.
- Li, P. 1992. *Loganiaceae*. In M. Chang, and L. Qiu (eds.), *F1. Reip. Pop. Sin.*, vol. 61. Science Press, Beijing, pp. 223–309.
- Yamazaki, T. 1989. *Loganiaceae*. In Y. Satake, H. Hara, S. Watari, and T. Tominari (eds.), *Wild Flowers of Japan: Woody Plants*, vol. 2. Heibonsha, Tokyo, pp. 184–185. (In Japanese)
- Yamazaki, T. 1993. *Loganiaceae*. In K. Iwatsuki, T. Yamazaki, D. E. Boufford, and H. Ohba (eds.), *Flora of Japan*, vol. IIIa. *Angiospermae, Dicotyledoneae, Sympetalae (a)*. Kodansha, Japan, pp. 136–138.

## 台灣產馬錢科蓬萊葛屬(*Gardneria*)植物之分類訂正

楊勝任<sup>1</sup> 彭鏡毅<sup>2</sup>

<sup>1</sup>國立屏東技術學院森林資源系

<sup>2</sup>中央研究院植物研究所

早田文藏(B. Hayata)氏於1916年根據島田氏採自台灣的一份結果實的標本發表一新種「島田氏蓬萊葛」(*Gardneria shimadai*)，嗣後此種一直被視為特產台灣的稀有植物，直到近年中央研究院植物所標本館才首次採到此植物之開花的標本，而得以於本文將台灣植物誌第一版中過份簡單不完備的該植物描述加以增訂，並確認其為原產日本本州西部、琉球及中國大陸東南省分的「多花蓬萊葛」(*G. multiflora* Makino)之異名。本文並報導最近在台灣南部發現之本屬新記錄種「垂花蓬萊葛」(*G. nutans* Sieb. & Zucc.)，過往文獻認為此植物僅產於日本。本研究顯示這兩種植物分布之東南限均為台灣，在植物地理上饒富意義。本文就台灣產蓬萊葛屬植物進行分類訂正，提供檢索表、彩色照片、植物繪圖與其在台灣之分布圖以資辨識，並對此二種植物之稀有性加以評述。

**關鍵詞：**地理分布；蓬萊葛屬；島田氏蓬萊葛；多花蓬萊葛；琉球蓬萊葛；馬錢科；台灣；植物分類；稀有植物。