

Research note

## *Epithema benthamii* C.B. Clarke (Gesneriaceae), A Newly Naturalized Plant in Taiwan

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### 【 Summary 】

In Taiwan, only one species of the genus *Epithema*, *E. ceylanicum* Gardner, had previously been recorded. This study reports a newly naturalized species, *Epithema benthamii* C.B. Clarke, growing in Shuangxi, Meinong Dist., Kaohsiung City. These two taxa can be distinguished by the following characteristics: leaves of *E. benthamii* are oblong, with dark-green adaxial surfaces, and the corolla is light bluish-purple to white, with inconspicuous purple spots; whereas leaves of *E. ceylanicum* are elliptic to broad-elliptic, with light-green adaxial surfaces, and the corolla is bluish-purple, with conspicuous purple spots. Taxonomic descriptions and color photographs of the above two species are provided to assist in their identification.

**Key words:** *Epithema benthamii*, *Epithema*, Gesneriaceae, naturalized plant, Taiwan.

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## 研究簡報

## 臺灣新歸化植物—邊沁氏盾座苣苔(苦苣苔科)

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## 摘 要

臺灣的盾座苣苔屬僅記錄錫蘭盾座苣苔(*Epithema ceylanicum* Gardner)一種。本研究報導一新歸化種—邊沁氏盾座苣苔(*Epithema benthamii* C.B. Clarke)，生長於高雄美濃雙溪。兩者形態差異在於邊沁氏盾座苣苔的葉長橢圓形，葉正面深綠，花冠淡藍紫色至白色，具不明顯紫斑；錫蘭盾座苣苔的葉橢圓形至寬橢圓形，葉正面淡綠色，花冠藍紫色，具明顯紫斑。本文提供上述二物種的特徵描述和彩色照片，以助其鑑定。

關鍵詞：邊沁氏盾座苣苔、盾座苣苔屬、苦苣苔科、歸化植物、臺灣。

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## INTRODUCTION

The family Gesneriaceae comprises two subfamilies, the Didymocarpoideae and Gesnerioideae. The Didymocarpoideae is divided into the tribes Trichosporeae and Epithemateae, and the latter includes four subtribes: Loxotidinae, Monophyllaeinae, Loxoniinae, and Epithematinae. Only one genus (*Epithema* Blume) is present in the Epithematinae (Weber et al. 2013). The genus *Epithema* comprises approximately 20 species mainly distributed in central tropical Africa, South Asia, Southeast Asia, Malesia, and the Solomon Islands (Bransgrove and Middleton 2015). Diagnostic features of the genus *Epithema* are flowers in thyrse reduced into a cyme which is embraced by its bract, corolla lobes light-pink, blue to purple, usually with darker spots; stamens 2 fertile and 2 staminodes; fruits surrounded by a persistent calyx; and seeds straight to spiraled (Weber et al. 1988, Bransgrove and Middleton 2015). The chromosome numbers are  $2n = 16$ , 18, and 24 (Kiehn and Weber 1998).

In Taiwan, two species, *Epithema brun-*

*nis* var. *fasciculata* (Huang et al. 1989) and *Epithema taiwanensis* (Ying 1992), had been recorded to date. The former was later revised and treated as *Epithema taiwanense* var. *fasciculatum* (Li and Kao 1998). In 2015, both *E. brunonis* var. *fasciculata* and *E. taiwanense* var. *fasciculatum* were recognized as synonyms, i.e., the same taxon of *Epithema ceylanicum* Gardner (Bransgrove and Middleton 2015). Recently, we observed that the characteristics of a population, located in the Shuanghsi Tropical Botanical Garden, Meinong Dist., Kaohsiung City, differed from those of *E. ceylanicum* growing in the other areas of Taiwan. By comparing the type specimen and the morphological descriptions in the revision of the *Epithema* genus (Bransgrove and Middleton 2015), we identified this unknown species as *Epithema benthamii* C.B. Clarke.

## TAXONOMIC TREATMENT

*Epithema benthamii* C.B. Clarke in A. DC.

& C. DC., Monogr. Phan. 5(1):180 (1883).

**TYPE:** Philippines: Albay, 1841, *H. Cuming* 1265 (lectotype K [K000438696], Fig. 1, image!).

*Epithema ceylanicum* auct non Gardner, Chung, Illustr. Fl. Taiwan. 7:16. 2018.

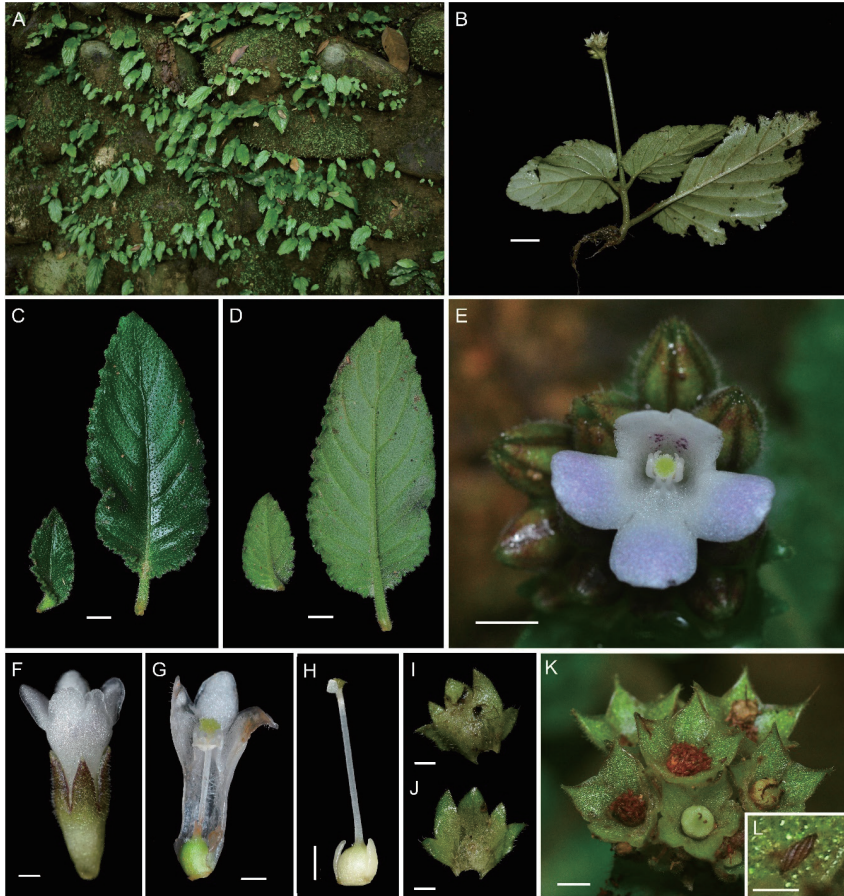
邊沁氏盾座苣苔(新擬) (Fig. 2)

Herb, 2–5 cm high, caulescent, occasionally appearing acaulescent with leaves near ground level, stem densely strigose with some hooked hairs. Leaves simple, upper leaf opposite and lower leaf alternate, ovate to oblong, usually symmetrical, upper leaves 2–6 ×

1.5–3 cm, lower leaves 4–9 × 2–6 cm, adaxial surfaces dark-green, base subcordate, rounded or truncate, margins irregularly serrate, apex acute or obtuse, veins pinnate, sparsely to densely strigose with hooked hairs, upper petioles 0.5–2 cm long, lower petioles 2–4 cm long. Inflorescences reduced, 1 or 2, larger, with cucullate bract, 7–11 × 9–13 mm, margins dentate, abaxial surfaces strigose, adaxial surfaces glabrous to pubescent; peduncles 2–8 cm long. Calyx cylindrical, 4–6 mm long; calyx tube 2.5–3.5 mm long; lobes



**Fig. 1.** Lectotype of *Epithema benthamii* C.B. Clarke (K000438696).



**Fig. 2.** *Epithema benthamii* C.B. Clarke. A. Habitat. B. Habit. C. Leaves, adaxial view. D. Leaves, abaxial view. E. Corolla, face view. F. Flower and calyx. G. Flower, opened out. H. Pistil. I. Bract, adaxial view. J. Bract, abaxial view. K. Fruits and seeds. L. Close-up of seed. Scale bars: B = 1 cm, C, D = 5 mm, E = 2 mm, F–H = 1 mm, I, J = 3 mm, K = 2 mm, L = 0.5 mm. Photographed by Po-Hao Chen.

1.5–2.5 × 0.9–1.3 mm, densely strigose with some hooked hairs; corolla cylindrical, 6.5–8 mm long, tube 5–6 mm long, lobes 1.5–2 mm long, light bluish-purple to white, with inconspicuous dark spots on lip, abaxial surfaces of lobes and adaxial surfaces of tube with sparse straight hairs. Fertile stamens 2, 1.5 mm long; filaments 1 mm long; anthers 0.5 mm long. Staminodes 2, 1 mm long. Nectary absent or with 2 lobes, linear or lanceolate, 1–1.2 mm long. Ovary sub-spherical, 1 mm wide, with straight or hooked hairs on its top portion;

style 3.8–4.3 mm long, glabrous; stigma 0.4–0.5 mm wide, 2-lobed, papillate, glabrous; pedicels 2–3 mm long. Fruits sub-spherical, 2 mm wide; operculum 0.5 mm long, with straight or hooked hairs. Seeds oblong, 0.5 × 0.2 mm, brown, obliquely striate.

**Distribution:** *Epithema benthamii* is distributed in an elevation range of 0–1600 m from Indonesia to the Philippines, is lithophytic on both limestone and other rocks, sometimes terrestrial, and usually grows in humid and shaded environments near streams (Brans-

grove and Middleton 2015). In Taiwan, this naturalized species grows in a 20 m<sup>2</sup> habitat on a small humid dike surface which is adjacent to a stream.

**Specimens examined:** Taiwan: Kaohsiung City: Meinong, 31 Oct. 1988, *C.-F. Hsieh et al. s.n.* (E); 29 Oct. 1995, *S.-P. Teng* 12 (PPI); 6 Oct. 1996, *S.-P. Teng* 46 (PPI); 19 July 1997, *S.-C. Lin* 12 (PPI); 20 Aug. 1999, *S.-M. Ku* 19 (PPI); 3 June 2007, *T.-T. He* 188 (TAIF); 12 Sept. 2007, *S.-W. Chung* 9223 (TAIF); 10 Feb. 2008, *T.-C. Hsu* 1219 (TAIF); 20 Jan. 2010, *T.-C. Hsu* 2468 (TAIF); 21 Apr.

2016, *P.-H. Chen* 1057 (PPI); 20 Sept. 2019, *P.-H. Chen* 2425 (PPI).

***Epithema ceylanicum* Gardner**, *Calcutta J. Nat. Hist* 6:492 (1846).

**Basionym:** *Epithema carnosum* var. *ceylanicum* (Gardner) C.B. Clarke in A. DC. & C. DC. *Monogr. Phan.* 5(1):178 (1883).

**TYPE:** Sri Lanka, *G. Gardner* 606 (lectotype K [K000438690], designated by Bransgrove and Middleton (2015), Fig. 3, image!).

**Synonyms:** *Epithema brunonis* var. *fasciculatum* C.B. Clarke in A. DC. & C. DC., *Monogr.*



**Fig. 3.** Lectotype of *Epithema ceylanicum* Gardner (K000438690).

Phan. 5(1):180 (1883). — *Epithema taiwanense* var. *fasciculatum* (C.B. Clarke) Z.Y. Li & M.T. Kao, Fl. Taiwan ed. 2, 4:697 (1998). — TYPE: Philippines: Tayabas, 1841, *H. Cuming* 823 (lectotype K [K000438698], designated by Bransgrove and Middleton (2015)).

*Epithema taiwanense* S.S. Ying, Coloured Ill. Fl. Taiwan 4:795 (1992); Li & Kao, Fl. Taiwan ed. 2, 4:697 (1998); Wang et al., Fl. China 18:400 (1998); Chung, Illustr. Fl. Taiwan. 7:16, 2018. — TYPE: Taiwan: Chia-yi: Kuanyin waterfalls, Ying, S.S. s.n. (holotype NTUF

[F00000153]).

錫蘭盾座苣苔(新擬) (Fig. 4)

Herb, 2–7 cm high, caulescent, occasionally appearing acaulescent with leaves near ground level, stem densely strigose or sparsely pubescent. Leaves simple, upper leaf opposite and lower leaf alternate, ovate or broad-ovate, usually symmetrical, upper leaves 0.5–2 × 0.4–1.5 cm, lower leaves 2–6 × 1–5 cm, adaxial surfaces pale-green, base subcordate, margins serrate or obscurely serrate, apex obtuse, veins pinnate, with sparse

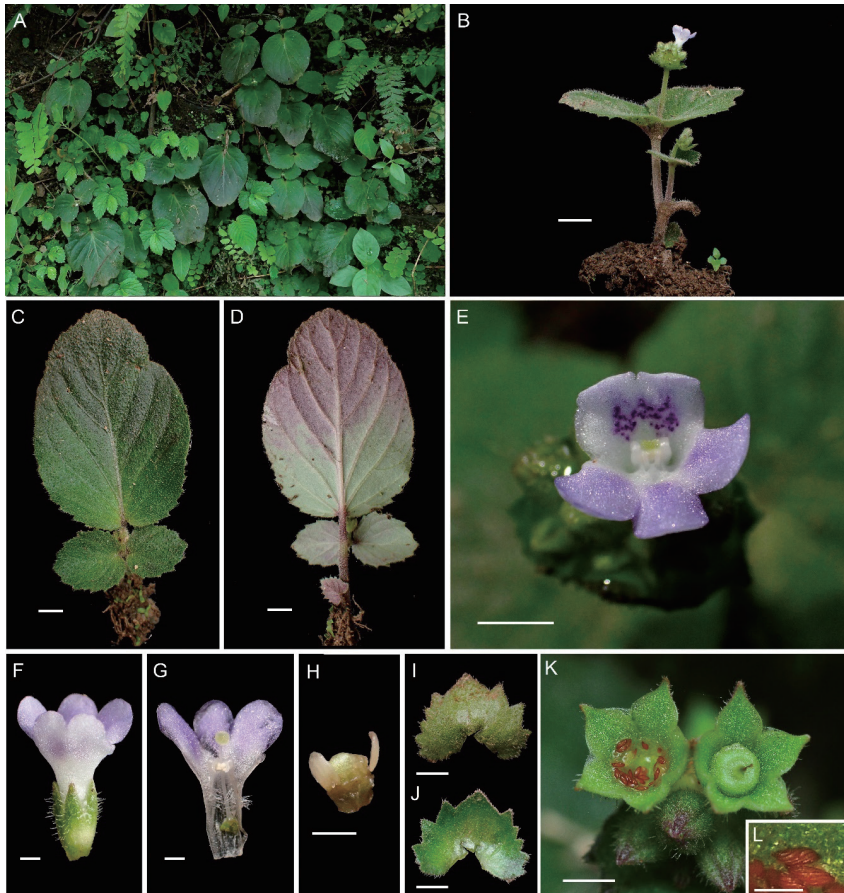


Fig. 4. *Epithema ceylanicum* Gardner. A. Habitat. B. Habit. C. Leaves, adaxial view. D. Leaves, abaxial view. E. Corolla, face view. F. Flower and calyx. G. Flower, opened out. H. Ovary and nectaries. I. Bract, adaxial view. J. Bract, abaxial view. K. Fruits and seeds. L. Close-up of seeds. Scale bars: B = 1 cm, C, D = 5 mm, E = 2 mm, F–H = 1 mm, I, J = 3 mm, K = 2 mm, L = 0.5 mm. Photographed by Po-Hao Chen.

straight and hooked hairs and sparsely to densely strigose, upper petioles 0.5–1 cm long, lower petioles 2–3 cm long. Inflorescences reduced, 1 to many, smaller, bract cucullate, 7–9 × 10–12 mm, margins serrate, abaxial surfaces strigose and pubescent, adaxial surfaces glabrous to sparsely strigose; peduncles 1–6 cm long. Calyx cylindrical, 4–5 mm long; calyx tube 2.2–3 mm long; lobes 1.8–2 × 0.8–1 mm, densely strigose with some straight and hooked hairs; corolla cylindrical, 7–8 mm long, tube 5–6 mm long, lobes 1.5–2 mm long, bluish-purple, with conspicuous darker spots on lip, abaxial surfaces of lobes and adaxial surfaces of tube with straight hairs. Fertile stamens 2, 1.5–2 mm long; filaments 1–1.5 mm long; anthers 0.5 mm long. Staminodes 2, 1–1.5 mm long. Nectary absent or with 2 lobes, linear or lanceolate, 0.8–1 mm long. Ovary sub-spherical, 1 mm wide, subglabrous or with straight or hooked hairs on top portion of ovary; style 3.7–3.9 mm long, glabrous; stigma 0.6–0.7 mm wide, 2-lobed, papillate, glabrous; pedicels 1 mm long. Fruits sub-spherical, 1.5–2 mm wide; operculum 0.5–0.6 mm long, with straight or hooked hairs. Seeds oblong, 0.5 × 0.2 mm, brown, obliquely striate.

**Distribution:** *Epithema ceylanicum* is also lithophytic and grows in humid, shaded environments distributed in an elevation range of 0–2000 m in India, Sri Lanka, Taiwan, Myanmar, Thailand, Cambodia, Vietnam, and the Philippines (Bransgrove and Middleton 2015), as well as on humid rocks at low elevations in southern Taiwan.

**Specimens examined:** Taiwan: Nantou County: Chingshuihu, 6 June 2018, *T.-C. Hsu 10643* (TAIF). Chiayi County: Zhuqi Township, 22 Sept. 1992, *W.-P. Leu 1621* (HAST); Kuanyin Waterfall, 20 Aug. 2008, *T.-C. Hsu 1565* (TAIF). Tainan City: Nansi District, 10 Aug. 1990, *C.-I Peng 13421* (HAST); Shui-huo-tun-

yuan, 29 May 2001, *C.-I Peng 18400* (HAST); same location, 15 Nov. 2002, *S.-M. Ku 1667* (HAST). Kaohsiung City: Shoushan, 10 Oct. 2002, *S.-M. Ku 1664* (HAST); Takangshan, 10 Aug. 1988, *T.-C. Huang et al. 13750* (TAI), 14 Nov. 1988, *K.-C. Yang 3465* (E); same location, 5 Sept. 2001, *M.-J. Jung 299* (TAIF); Dashe, 16 Aug. 2011, *M.-J. Jung 5590* (TAIF). Pingtung County: Woilososhan, 27 Aug. 2004, *H.-L. Chiang 3750* (TAIF); Laiyi, 13 Oct. 2019, *T.-C. Hsu 12157* (TAIF).

## DISCUSSION

Bransgrove and Middleton (2015) cited two specimens of *E. ceylanicum* also collected in the Shuanghsi area of Taiwan (E00622084, *C.F. Hsieh et al. s.n.*). However, after checking the voucher specimens of *E. ceylanicum* preserved in Taiwan herbaria including duplicates of *C.F. Hsieh et al.* specimens, we found that characteristics of a population located in Shuanghsi Botanical Garden were in fact different from those of *E. ceylanicum* growing in other areas of Taiwan. Characteristics of *E. benthamii* and *E. ceylanicum* are listed in Table 1.

Specifically, the two taxa can be distinguished by the following characteristics: in *E. benthamii*, leaves are oblong, with dark-green adaxial surfaces (Fig. 2C), the corolla is light bluish-purple to white, with inconspicuous purple spots (Fig. 2E), and the bract margins are dentate (Fig. 2I, J); on the other hand, in *E. ceylanicum*, leaves are elliptic to broad-elliptic, with light-green adaxial surfaces (Fig. 4C), the corolla is bluish-purple with conspicuous purple spots (Fig. 4E), and the bract margins are serrate (Fig. 4I, J). Both *E. benthamii* and *E. ceylanicum* blossom and bear fruit from April to October, are dormant in the dry season (around December), and sprout again in the rainy season, around March of the following year. These two species exhibit two life forms, the first leaf

**Table 1. Diagnostic features of *Epithema benthamii* and *E. ceylanicum***

Characteristic	<i>E. benthamii</i>	<i>E. ceylanicum</i>
Leaf shape	oblong	elliptic to broad-elliptic
Leaf adaxial surface	dark-green	light-green
Upper leaves	petiolate	sessile
Bract margin	dentate	serrate
Corolla color	light bluish-purple to white	bluish-purple
Purple spots on corolla	inconspicuous	conspicuous
Hairs on ovary/operculum, primarily	straight	hooked
Inflorescence and size	1 or 2, larger	1 to many, small

arising more or less at ground level or from a very short stem, or arising above a definite stem (Bransgrove and Middleton 2015). In this study, we only found a very short stem; continuing investigations to obtain more evidence for comparison are still needed.

In Taiwan, *E. benthamii* was only found in one population in the Shuanghsi Tropical Botanical Garden, where diverse tree species native to the Malay Archipelago, Indochinese Peninsula, Australia, Africa, and South America were planted for a tree progeny test (Chang 1970). We suggest that *E. benthamii* was naturalized here as a consequence of its cultivation, as it has never been found in other areas of Taiwan to date. Perhaps this is due to the narrow niche of this species, as this may have influenced its abundance or distribution. Regardless, the data presented here provide new information on the genus *Epithema*, which improves understanding of its morphology and aids in identification.

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