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NOTE

New records and keys to species of *Hemiboea* and *Loxostigma* (Gesneriaceae) for the flora of Vietnam

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ABSTRACT: We here report three species of Gesneriaceae (*Hemiboea gracilis*, *H. ovalifolia* and *Loxostigma glabrifolium*) as new records for the flora of Vietnam. These species have so far only been known to be endemic to China in previous treatments. These additional findings suggest the existence of stronger floristic links between North Vietnam and South China. We additionally provide identification keys to the species of *Hemiboea* and *Loxostigma* occurring in Vietnam.

KEY WORDS: Biodiversity, Flora of Vietnam, Gesneriaceae, New records, Taxonomy.

INTRODUCTION

Gesneriaceae plants are distributed mainly in the tropics and subtropics of both the Old and New World (Weber *et al*., 2013). Particularly, South China and North Vietnam are diversity centers of Gesneriaceae in the Old World.

Over the past ten years, more than 40 species in the recently newly defined genera of Gesneriaceae (Möller *et al*., 2016b) were discovered and published from South China especially in the border of China and Vietnam, Guangxi Zhuangzu Autonomous Region and Yunnan province, e.g. *Primulina sinovietnamica* W.H. Wu & Q. Zhang (Wu *et al*., 2012), *P. heterochroa* F. Wen & B.D. Lai (Wen *et al*., 2015), *P. petrocosmeioides* Bo Pan & Fang Wen (Wen and Pan 2014), *P. crassirhizoma* F. Wen, Bo Zhao & Xin Hong (Zhao *et al*., 2013), *Hemiboea sinovietnamica* W.B. Xu & X.Y. Zhuang (Xu *et al*., 2012), *H. malipoensis* Y.H. Tan (Zhang *et al*., 2014), *Petrocodon longgangensis* W.H. Wu & W.B. Xu (Xu *et al*., 2014). Several genera and species were also described as new to science from Vietnam or reported newly for the flora of Vietnam (Middleton and Ly 2008; Do and Vu 2011; Do *et al*., 2013; Middleton *et al*., 2014; Vu *et al*., 2015; Luu *et al*., 2015; Middleton 2015; Möller *et al*., 2016a). These new findings do not only confirm Vietnam as a diversity center for Gesneriaceae, but also highlight the potential of this area for the discovery of new taxa if more fieldwork is conducted.

While investigating the diversity of Gesneriaceae from South China and North Vietnam, we found two species of *Hemiboea* Clarke (*H. gracilis* Franch. and *H. ovalifolia* (W.T. Wang) A. Weber & Mich. Möller) and one species of *Loxostigma* Clarke (*L. glabrifolium* D. Fang & K.Y. Pan) as new records for the flora of Vietnam.

Hemiboea comprises 31 species (Möller *et al*., 2016b), including two species of the former *Metabriggsia*, *M. ovalifolia* and *M. pupureotincta* W.T. Wang, which had been merged into *Hemiboea* (Weber *et al*., 2011), and is distributed mainly in Central and South China, but some species can be found in North Vietnam and Japan. *Loxostigma* includes at least 11 species (Möller *et al*., 2014), occurring in the Himalayan and Indochina region (Bhutan, India, Myanmar, Nepal, China, Laos, and Vietnam) (Wang 1983; Wei *et al*., 2010; Möller *et al*., 2014; 2016b). Recently taxonomic treatments of Gesneriaceae for the flora of Vietnam listed four species and varieties of the former (*Hemiboea cavaleriei* Lévl. var. *cavaleriei*, *H. cavaleriei* var. *paucinervis* W.T. Wang & Z.Y. Li ex Z.Y. Li, *H. rubribracteata* Z.Y. Li & Yan Liu, *H. subcapitata* Clarke var. *subcapitata*) and three species of the latter (*Loxostigma dongxingensis* (Chun ex K.Y. Pan) Mich. Möller & Y.M. Shui, *L. fimbrisepalum* K.Y. Pan, *L. griffithii* (Wight) C.B. Clarke) occuring in Vietnam (Pham 2000; Vu 2005; Do and Vu 2011; Do *et al*., 2013; Möller *et al*., 2014). Our additional findings here raised the species and varieties number of *Hemiboea* and *Loxostigma* species occurring in Vietnam to five and four respectively.

MATERIALS and METHODS

In addition to the examination of previous herbarium collections from the herbaria, A, E, HITBC, HN, HNU, IBK, IBSC, K, KUN, L, MO, NIMM, NY, P, PE, SING

臺灣大學學術期刊資料庫



Fig. 1. ***Hemiboea gracilis*** Franch. **A:** Habitat; **B:** The abaxial surface of leaf blades; **C:** The lateral view of corolla and involucre; **D:** The frontal view of corolla and bud.

and VNMN, extensive fieldwork throughout protected forest areas in North Vietnam were conducted during the past five years to collect the specimens and investigate morphological characters of Gesneriaceae species which are impossible or difficult to observe in herbarium specimens. The relevant literature concerning the taxonomy and systematics of Gesneriaceae were also studied (Weber *et al*., 2011; 2013; Möller *et al*., 2014; 2016a; b).

The morphological terminology for the species description followed Wei *et al*. (2010). The characters for establishing the keys were derived from the previous treatments (Wang *et al*., 1998; Wei *et al*., 2010; Weber *et al*., 2011).

Assessment of the conservation status was based on field observations, applying the IUCN red list category criteria of threatened species (IUCN 2012).

TAXONOMIC TREATMENT

1. ***Hemiboea gracilis*** Franch. var. ***gracilis*** Franch., Bull. Mens. Soc. Linn. Paris, sér. 2. 15: 124. 1899.

Fig. 1 A–D

Local name: **Đại Thư Cuống Mảnh** (Vietnamese); **纖細半蒴苣苔**(Xián Xì Bàn Shùo Jǔ Tái) (Chinese).

Type: CHINA. Sichuan Province, in rupibus ad Mou koua keou prope Tchen keou tin, alt. 1,200 m. *Farges, R.P. 1454* (Holotype:K!; Isotype: E!).

Specimens examined: **VIETNAM**: Cao Bang Prov., Trung Khanh Distr., Trung Khanh Nature Reserve, approximately 22°54′36″N, 106°32′18″E, ca. 679 m, 22 Oct. 2013, *DVT 46* (VNMN!).

Description: Stems 4–10 cm long, sometimes rarely to 47 cm long, sparsely or densely purple-brown spotted, glabrous to sparsely pilose toward apex, usually simple, with 3–5 nodes. Petiole 2–4 cm long; leaf blade sometimes oblique, elliptic to ovate or rarely obovate, 3–15 × 1.2–5 cm, sparsely pilose, base cuneate to narrowly cuneate, margin entire to repand, apex acuminate, vermiform sclereids surrounding vascular bundles; lateral veins 4–6 on each side of midrib. Cymes 1–3-flowered, usually 1; peduncle 2–12 mm long, glabrous to sparsely white pilose; involucre to 1–1.4(–2) cm in diam., outside glabrous to white pilose. Calyx 5-sect from base; segments equal, linear to lanceolate, 5–8 × 2–4 mm, outside and margin glabrous to white pilose. Corolla outside pink to purple or bluish, inside with darker purple spots, 3–3.8 cm long, outside sparsely glandular puberulent, inside with erectly pubescent hairs at the orifice of corolla and with a ring of hairs at the bottom of corolla; tube 2.2–2.8 cm long; adaxial lip 5–8 mm long; abaxial lip 8–10 mm long. Anther (1.1–)1.7–2.5 mm long; staminodes 2, 4–5 mm long. Pistil 2–2.5 cm long, glabrous. Capsule 1.7–2.5 cm long.

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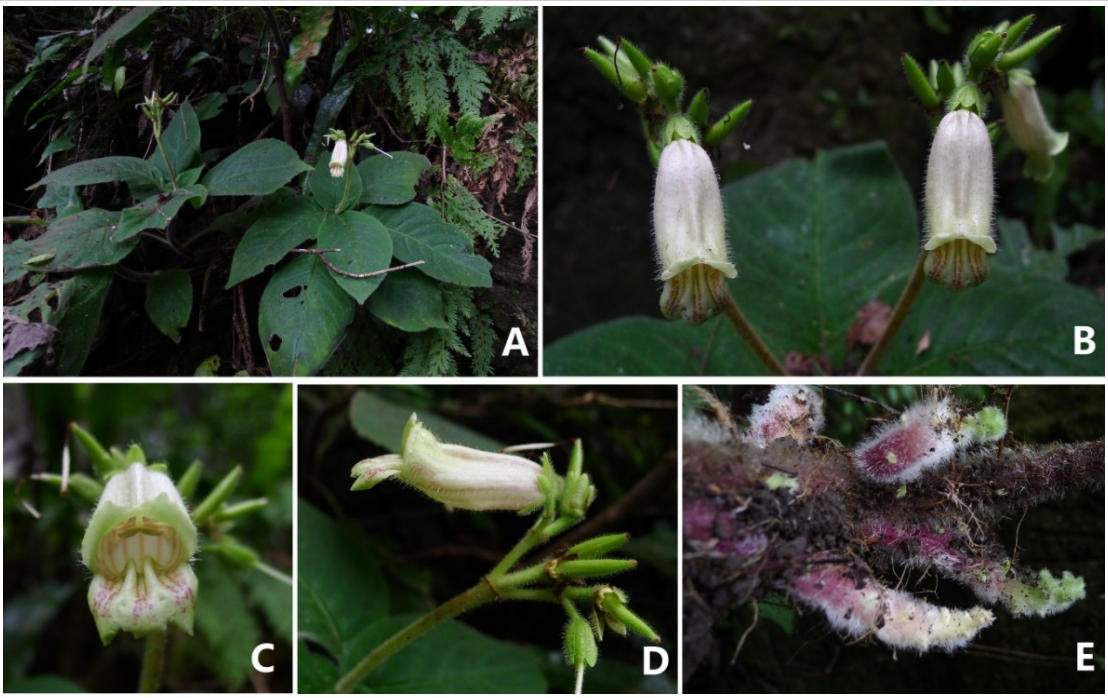


Fig. 2. ***Hemiboea ovalifolia*** (W.T. Wang) A. Weber & Mich. Möller **A:** Habitat; **B:** The top view of corolla and young capsules; **C:** The frontal view of corolla; **D:** The lateral view of corolla and young capsules; **E:** Young rhizomes.

Ecology: Grows in crevices on a limestone hill, under tropical evergreen broadleaf forest and shrubs. Flowering in August–October, fruiting in October–November.

Distribution: CHINA (Chongqing, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan), new record for VIETNAM (Cao Bang).

Conservation status in Vietnam and China: The species is of widespread distribution throughout southern and southwestern China (Chongqing, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan). Although only one population with very few individuals was discovered in North Vietnam, a great number of *Hemiboea gracilis* populations are remaining in South and Southwest China. Therefore, this species should be categorized as of Least Concern (LC) (IUCN 2012).

2. ***Hemiboea ovalifolia*** (W.T. Wang) A. Weber & Mich. Möller, Phytotaxa. 23: 43. 2011. **Fig. 2 A–E.**

Local name: **Đại Thư Lá Trái Xoan** (Vietnamese); **單座苣苔** (Dān Zuò Jǜ Tái) (Chinese).

Type: CHINA. Guangxi, Napo, Baidu, Nunghua, alt. 1100 m, in sylvis densis collium calcareorum, fl. Albi-viridulo-suffusi, 20 Oct. 1979. *D. Fang et X.P. Liao 22343* (Holotype: GXMI!; Isotype: GXMI, PE!)

Specimens examined: **VIETNAM**: Cao Bang Prov., Trung Khanh Distr., Trung Khanh Nature Reserve, approximately 22°56′42″N, 106°33′26″E, ca. 800 m, 22 Oct. 2013, *DVT 51* (VNMN!).

Description: Stems 20–40 cm long, densely brownish and white villous. Petiole 0.3–7 cm long, hairs same as stem; leaf blade herbaceous, green on both surfaces, sometimes the abaxial surface purple, slightly oblique, oval to ovate, 5–25.5 × 2.5–17 cm, appressed puberulent, base usually symmetry, occasionally oblique, rounded to subcordate, margin repand-crenulate, apex abruptly acuminate. Cymes subterminal but actually axillary, 5–12-flowered, sometimes more, 2–3 branched, hairs same as stem; peduncle 7.5–12.5 cm long, brownish to white glandular-pubescent; involucre early deciduous, nearly spherical or cordate; pedicel 5–6 mm long, pubescent. Calyx segments lanceolate-linear, apex slightly obtuse, margin entire, 9–10 × 1.5–2 mm. Corolla yellowish-white, suffused yellow-green, ca. 3.6 cm long, outside sparsely glandular pubescent near apex, inside glabrous; tube ca. 2.7 cm long, ca. 1.5 cm wide. at the orifice of corolla; adaxial lip ca. 2.8 mm long, ca. 2.9 wide, 2-lobed, lobes obliquely triangle and apex obtuse to rounded; abaxial lip ca. 1 cm long, ca. 1.2 cm wide, 3-lobed, the central lobe broadly ovate, the lateral lobes obliquely triangle, apex obtuse-triangle. Stamens adnate to ca. 1.4 cm long above the corolla base, glabrous, ca. 1.7 cm long, anthers apically coherent, ca. 3.5 mm long; staminodes 3, glabrous, the central small, ca. 1.5 mm long, adnate to ca. 7 mm above the corolla base, lateral ones adnate to ca. 6 mm long above the corolla base, 9–10 mm long, slightly broaden at apex. Pistil ca. 2.5 cm long; ovary ca. 8 mm long at angle (ca. 130°) in relation to pedicel, ca. 1 mm in diam., sparsely puberulent; style ca. 16 mm long, puberulent basally; stigma small, disc-like. Capsule linear, loculicidally dehiscing, ca. 1.5 cm long at angle in relation to pedicel, 3 mm in diam., pubescent. Seeds ca. 0.4 mm long.

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Ecology: Grows on shaded rocky limestone slopes in broadleaf forests. Flowering in August–October, fruiting in October–December.

Distribution: CHINA (Guangxi: Huanjiang, Napo; Guizhou: Libo; Yunnan: Malipo), new record for VIETNAM (Cao Bang Prov.: Trung Khanh Distr.).

Conservation status in Vietnam and China: *Hemiboea ovalifolia* is rare in Vietnam. However, this species was discovered in Guangxi, Guizhou and Yunnan of China with many mature individuals in at least night known populations. Therefore, it is probably not threatened at the moment.

Identification key to species of *Hemiboea* occuring in Vietnam

1a. Stem covered densely white villous hairs.....1. ***H. ovalifolia***
1b. Stem glabrous **2**
2a. Calyx with sepals > 12 mm long; involucre outside red..... ..... 2. ***H. rubribracteata***
2b. Calyx with sepals < 12 mm long; involucre outside not red..... **3**
3a. Calyx with sepals ca. 11–12 mm long; pistil 3–4 cm long .... 3. ***H. subcapitata***
3b. Calyx with sepals 5–8 mm long; pistil 1.7–2.5 cm long 4
4a. Cyme 1–3-flowered; peduncle up to 1.2 cm long; corolla outside pink to purple ..... 4. ***H. gracilis***
4b. Cyme 3–10-flowered; peduncle up to 10 cm long; corolla outside pale yellow to white ..... 5. ***H. cavaleriei***

3. ***Loxostigma glabrifolium*** D. Fang & K.Y. Pan, Bull. Bot. Res., Harbin. 2(2): 140. 1982. **Fig. 3 A–D**.

Local name: **Xuyến Thư Lá Nhẵn** (Vietnamese); **光葉紫花苣苔**(Guāng Yè Zǐ Huā Jù Tái) (Chinese)/**光葉斜柱苣苔**(Guāng Yè Xíe Zhù Jǜ Tái) (Chinese)

Type: CHINA. Guangxi, Napo, alt. 1120 m, Oct. 1979. *D.Fang 22364* (Holotype:PE!, Isotype: GXMI!)

Specimens examined: **Vietnam**: Ha Giang Prov., Quan Ba Distr., Nghia Thuan Commune, Xin Cai Village, approximately 22°57′01″N, 105°05′28″E, ca. 650m. 1Nov. 2013, *DVT 71* (VNMN!).

Description: Perennial subshrubs with rhizomes, rhizome internodes 11–13 cm long, ca. 2 mm in diam. Stem 10–22 cm long, sparsely puberulent to glabrescent, simple, several borne from a node of rhizome. Leaves opposite, spread along stem, unequal to greatly subequal in a pair; petiole 0.5–3 cm long, sparsely pubescent; leaf blade elliptic or narrowly eplliptic, hard chartaceous when dried, 7–24.5 × 3–10.5 cm, glabrous, abaxially sparsely puberulent along veins, lateral veins 8–10 on one side, base oblique, cuneate to slightly rounded, margin entire to indistinctly denticulate, apex acuminate. Cymes axillary, subterminal, 2–5-branched, 3–10-flowered; peduncle 6–13.5 cm long, sparsely pale-brown puberulent. Bracts lanceolate to oblong, 2–5 × 0.6–1.5 mm, margin entire. Pedicel 0.5–2.5 cm long, sparsely pale-brown puberulent. Calyx 5-sect from near base; segments equal, lanceolate to triangular, 5–7 × 1–2 mm, apex acuminate, margin entire, outside sparsely puberulent, inside glabrous, veins 3. Corolla white to yellowish, inside with purple spots and stripes, ca. 4 cm long, outside with white to grey-white pubescent hairs, inside glabrous; tube 3–3.5 × 1.3–1.7 cm, tubular ventricose; limp distinctly 2-lipped, adaxial lip 5–6 mm long, lobes semiorbicular, 5–6 × ca. 10 mm; abaxial lip 3-lobed, ca. 7 mm long, lobes semiorbicular, 5–6 × ca. 7 mm. Stamens 4, adaxial stamens adnate to ca. 8 mm above corolla tube base, ca. 8 mm long, abaxial ones adnate to ca. 9 mm above corolla tube base, ca. 10 mm long; filaments linear, glabrous, curved; anther theca coherent apically in pairs. Disc ring-like, 5-lobed, 2–3 mm high. Pistil 2–2.1 cm long; ovary oblong, 7–8 × 1.5–2 mm, yellowish-brown puberulent; style linear; stigma 2, ca. 2 mm long, ovate. Capsule 7.5–8 cm long, 2–3.5 mm in diam., linear, pale brown, nearly glabrous. Seeds oblong, ca. 5 mm long, brown, appendages on both ends of the seeds, 0.4–0.5 mm long.

Ecology: Grows in the humid evergreen forest with dominant plants of Lauraceae, Fagaceae, Euphorbiaceae.

Distribution: CHINA (Guangxi: Napo; Guizhou:Malipo, Hekou; Yunnan: Zhenfeng), new record for VIETNAM (Ha Giang Prov., Quan Ba Distr.)

Conservation status in Vietnam and China: This species is found in the well-protected forest areas, with many seedlings and mature individuals. At present the species is not threatened.

Identification key to known species of *Loxostigma* occuring in Vietnam

1a. Calyx lobes narrowlly linear, lanceolate to linear-laneolate **2**
1b. Calyx lobes usually broader, ovate or broadly triangular **3**
2a. Corolla white, inside with purple spots, style glabrous ....1. ***L. fimbrisepalum***
2b. Corolla yellow, inside yellow, style glandulosa-puberulent .... 2. ***L. dongxingensis***
3a. Leaves glabrous but abaxial nervis sparsely puberulent; ovary brownish yellow puberulent ..... 3. ***L. glabrifolium***
3b. Leaves both surface pubescent; ovary glabrous ..... 4. ***L. griffithii***

DISCUSSION

The Flora of Vietnam is well known for its rich diversity, being dominated by Indo-Chinese, Indo-Malayan and Himalayan floristic elements (Phan *et al.*, 2005). This has been demonstrated in various investigations on a range of plant groups, e.g. Aristolochiaceae, Urticaceae, and Pteridophyta, some species of which have until recently been thought of to represent endemics in China, but have now also been found in North Vietnam (Wu *et al*., 2005, 2006; Wei *et al*., 2013; Lu *et al*., 2014; Do *et al*., 2015). Recent findings (Do *et al*., 2011; Phuong *et al*., 2012; Do *et al*., 2013) along with the additional report here for the flora of Vietnam does not only indicate a biodiversity hotspot and an area of high endemicity for Gesneriaceae in the Old World, but also confirms a close floristic relationship between North Vietnam and South China. It seems that more discoveries can expected from these areas if more and systematic field-work and detailed studies are conducted in the remote areas of Vietnam.

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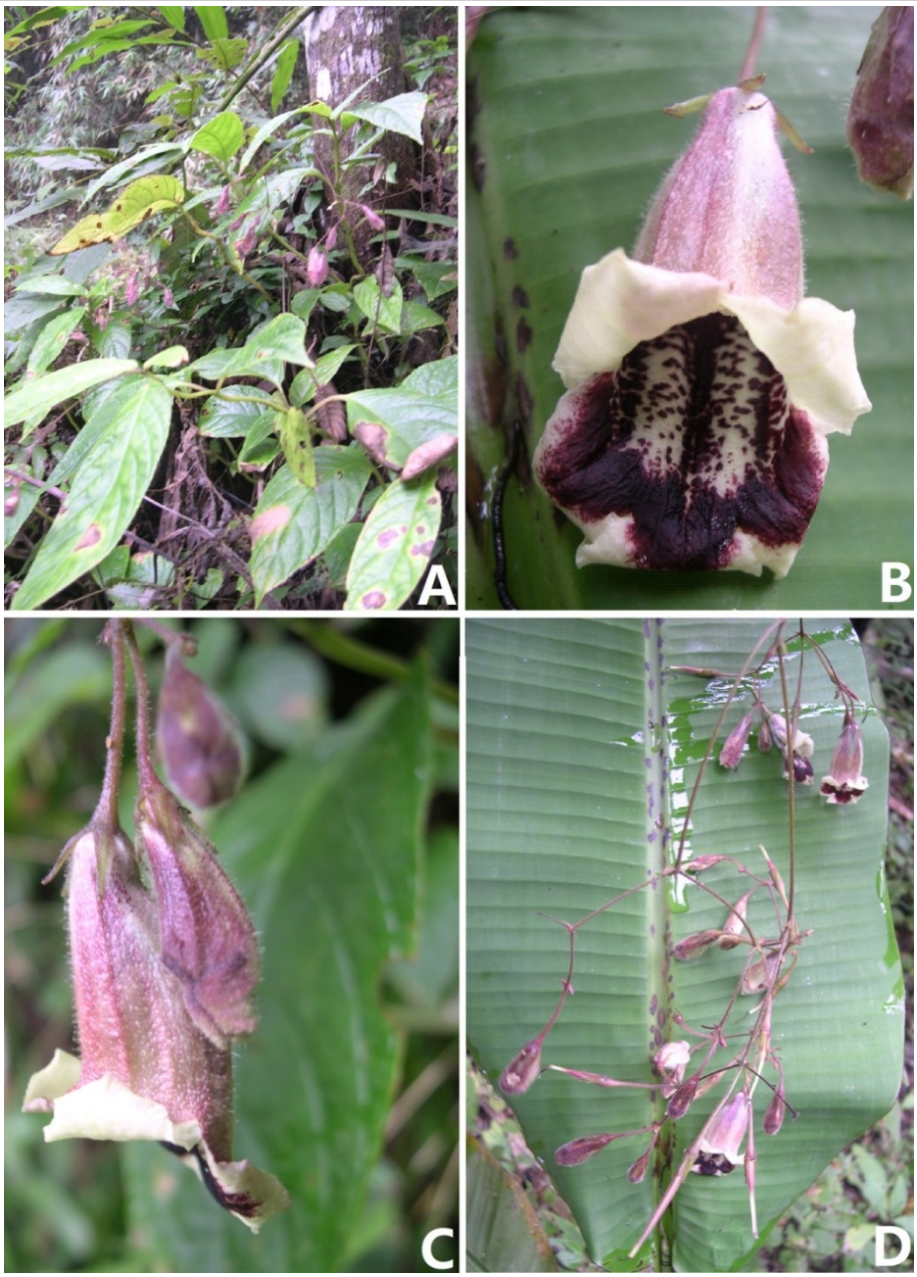


Fig. 3. ***Loxostigma glabrifolium*** D. Fang & K. Y. Pan. **A:** Habitat; **B:** The frontal view of corolla; **C:** The lateral view of corolla; **D:** The cyme and young capsule.

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