



Original Article

*Primulina jingxiensis*, a New Record and Confirmation of *Loxostigma dongxingensis* for the Flora of Vietnam

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**Abstract:** We here report *Primulina jingxiensis* (Yan Liu, W. B. Xu, H. S. Gao) W. B. Xu, K. F. Chung as a new record and confirmed the occurrence of *Loxostigma dongxingensis* (Chun ex K. Y. Pan) Mich. Möller, H. Atkins for the flora of Vietnam which have been still known endemically to southern China from the previous treatments. Detailed morphological description as Herbs perennial, stemless. Leaves basal, carnose, blades obovate or elliptic to suborbicular, densely villous, thickened, papery when dry, base attenuate to cuneate, apex obtuse to subrounded, margin subentire, lateral veins 2 or 3, inconspicuous. Cymes lax, axillary, 2-5 cymes, 2-4-branched, each 1-3-flowered: bracts 2, opposite, margin entire, pubescent. In addition to the description as color illustrations together with information on distribution, habitat, phenology, and taxonomic notes of these two species are also given.

**Keywords:** Flora of Vietnam, Gesneriaceae, *Loxostigma*, New records, *Primulina*.

## 1. Introduction

Gesneriaceae is mainly distributed in the tropics and subtropics of both the old and new world. Particularly, South China and North

Vietnam are the diversity centers of Gesneriaceae in the old world [1]. Over past ten years, more than 40 species of Gesneriaceae were discovered and published from South China, especially in the border of China and Vietnam, Guangxi Zhuangzu Autonomous Region and Yunnan province. Numerous of genera and species were also described as new

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to science from Vietnam or reported newly for the flora of Vietnam [2-7]. These new findings did not only confirm the diversity centers of Gesneriaceae in southern China and northern Vietnam, but also highlight the potential areas for investigating the new taxa if more fieldwork is conducted.

While investigating the diversity of Gesneriaceae from southern China and northern Vietnam, we collected some interesting specimens of Gesneriaceae on limestone areas in northeastern Vietnam (Quang Ninh, Lang Son, and Cao Bang provinces) which are here identified as *Primulina jingxiensis* (Yan Liu, W. B. Xu, H. S. Gao) W. B. Xu, K. F. Chung and *Loxostigma dongxingensis* (Chun ex K. Y. Pan) Mich. Möller & H. Atkins. These two species have been known endemically to southern China in the previous studies [1, 9, 11, 18].

The genus *Primulina* (Gesneriaceae) comprises ca. 150 species and distributes mainly in various landforms of limestone karsts of the Sino-Vietnamese bordering regions [8], with the center of diversity in Guangxi, China [9-11]. While the genus *Loxostigma* (Gesneriaceae) includes 7 species occurring in Himalayan and Indochinese region (Buhtan, India, Myanmar, Nepal, Sikkim, China, northern Vietnam) [11, 12].

Pan [13] originally described *Briggsia dongxingensis* based on the flowering specimens collected from Guangxi, China. Later, it was transferred to the genus *Loxostigma* [14]. While compiling the family Gesneriaceae for Flora of China and Flora of Vietnam, Wang et al., [1] and Vu [15] listed this species also occurring in Vietnam, but none of herbarium voucher was collected and presented. Indeed, we could not trace any specimens of that species originating from Vietnam in relevant herbaria. Revising taxonomy of Gesneriaceae for Vietnam, we recently collected at least two populations of *Loxostigma dongxingensis* in Quang Ninh and Lang Son provinces, northeastern Vietnam. Therefore, we here confirmed the occurrence of *Loxostigma dongxingensis* in Vietnam.

Furthermore, we firstly described the morphological characters of capsules of *Loxostigma dongxingensis* which was not done from the previous treatments [1, 13, 14]. Our additional findings here significantly raised the number of *Primulina* and *Loxostigma* species occurring in Vietnam to 24 and 6, respectively.

## 2. Materials and Methods

The studied specimens were collected in the Dong Son-Ky Thuong Nature Reserve, Quang Ninh province, the Mau Son Nature Reserve, Lang Son province, and the Bao Lac protected limestone forest areas, Cao Bang province, northern Vietnam. They are currently deposited in the herbaria of Vietnam National Museum of Nature (VNMN), Vietnam Academy of Science and Technology and Guangxi Institute of Botany, China (IBK). The morphological characters (e.g. shape, color of the calyx and corolla) were measured and photographed using Canon (Japan) digital camera during field work. These characters were compared with description in the protologues, type materials, and additional specimens of *Primulina* and *Loxostigma* species at the following herbaria: A, E, HITBC, HN, HNU, IBK, IBSC, K, KUN, L, MO, NIMM, NY, P, PE, S, SING and VNMN. Furthermore, literatures about taxonomy and systematics involving the Gesneriads species [1, 2, 8, 9, 11, 14, 15] were reviewed as well.

The description of the species follows the morphological terminology used by Harris and Harris [16].

Assessment of conservation status based on field observations, applying the IUCN red list categories and criteria of threatened species (IUCN) [17].

## 3. Taxonomic Treatment

i) *Primulina jingxiensis* (Yan Liu, W. B. Xu, H. S. Gao) W. B. Xu, K. F. Chung, Phytotaxa 64: 3. 2012 (Figure 1).

Basionym: *Chiritopsis jingxiensis* Yan Liu, W. B. Xu, H. S. Gao, Novon 19: 559. 2009.

Herbs perennial, stemless. Petioles flattened, 5-18 × 1.5-2 mm, villous. Leaves

basal, carnosae, blades obovate or elliptic to suborbicular, 1-2 × 0.5-1 cm, densely villous, thickened, papery when dry, base attenuate to cuneate, apex obtuse to subrounded, margin subentire, lateral veins 2 or 3, inconspicuous. Cymes lax, axillary, 2-5 cymes, 2-4-branched, each 1-3-flowered; peduncle 3-6(-9) cm long, brown, pubescent; bracts 2, opposite, linear-lanceolate, 1-2 × 0.3-0.5 mm, margin entire, pubescent; pedicel 8-15 mm long, pubescent. Calyx 5-lobed, dissected to near base, segments narrowly linear-lanceolate, 3-3.5 × 0.5-1 mm, apex acute, externally pubescent, internally sparsely puberulent, margins entire; corolla purplish to white, 11-14 mm long, externally pubescent, internally sparsely puberulent; corolla tube 8-9 × 3-4 mm; limb distinctly 2-lipped, white, two upper lobes parted to base, lobes 2-3 × 2.5-3 mm, three lower lobes parted to near middle, lobes rounded-ovate, 3-4 × 3-3.5 mm; stamens 2, adnate to 3-3.5 mm above corolla base; filaments lanceolate-subulate, 3-4 mm long, 6 geniculate near middle, glabrous; staminodes 2, ca. 2 mm long, glabrous, linear, apex capitate, adnate to 1.5-2 mm above corolla base. Disc annular, ca. 0.8 mm in diam., glabrous. Pistil ca. 8 mm long; ovary narrowly ovoid, 2-3 × 1 mm, puberulent; style 5-6 mm long, puberulent; stigma obtrapeziform, ca. 0.5 mm diam., 2-lobed. Capsule oblong-linear, 8-10 × 2-2.5 mm, pubescent.

**Type:** CHINA. Guangxi: Jingxi County, on moist limestone rock face in karst cave, 17 August 2005, Liu et al., *L1260* (holotype IBK!, isotype PE!).

**Iconography citation:** Xu et al., [18], Figure 1.

**Ecology and phenology:** *Primulina jingxiensis* grows on moist limestone rock, at ca. 900 m. Flowering is observed from July to September and fruiting is from August to October.

**Distribution:** CHINA, New to VIETNAM.

**Conservation status:** The species is widely distributed throughout southern and southwestern China, e.g., Guizhou, Chongqing, Yunnan, Sichuan, Guangxi, Guangdong, Hubei, Hunan, Jiangxi [8]. Although only one

population with very few individuals was discovered in northeastern Vietnam, a great number of *Primulina jingxiensis* populations with many well-grown mature individuals are remaining in S and SW China. Therefore, this species should be considered as Least Concern (LC) according to the IUCN Red List categories and criteria.

**Taxonomic notes:** The species presents some variations of the inflorescence and capsule between the new population in Vietnam and the type population in China. The cymose inflorescence in Vietnamese populations have two to four branches (vs. 1-branched in the type populations). Furthermore, the capsules are oblong-linear and much longer than the calyx in Vietnamese populations (vs. ellipsoidal, twice as long as calyx in the type populations).

**Specimens examined:** VIETNAM. Cao Bang province, Bao Lac district, Xuan Truong commune, ca. 670 m, 12 October 2017, Do et al., *VMN\_CN 799* (VNMN).



Figure 1. *Primulina jingxiensis*, A. Habitat and showing 2-4 branched cymes; B. Habit; C. Close up of cymes; D. Frontal view of opened flower. All photos by Wen Fang.

ii) *Loxostigma dongxingensis* (Chun ex K. Y. Pan) Mich. Möller, H. Atkins, Gard. Bull. Singapore 66(2): 199. 2014 (Figure 2).

Basionym: *Briggsia dongxingensis* Chun ex K. Y. Pan, Acta Phytotax. Sin. 26: 451. 1988.

Herbs perennial, stems 30-80 cm tall, densely pubescent. Petioles 1-2 cm long, densely brown-villous. Leaves unequal pairs; blades narrowly elliptic, 4-14.5 × 3-6 cm wide, apex acuminate or cuspidate, base slightly oblique, margin denticulate, adaxially puberulous, abaxially densely long pubescent, veins pinnate, 6-10 lateral pairs, impressed adaxially, prominent abaxially. Cymes terminal, axillary and on old branches, 1-5-flowered; peduncle 6-10 cm long, brownish; bracts 2, linear-oblong, 3-4 × 1-1.2 mm, brownish, pubescent; pedicel 4-6 mm long, brownish. Calyx campanulate, 5-lobed, dissected to near base, segments linear-lanceolate, unequal, 6-8 × 1.5 mm, greenish to brownish, apex acuminate, margin entire, outside pubescent, inside smooth. Corolla tubular, 3.2-4.1 × 1.3-1.8 cm, dilated at apex, much constricted at base, externally yellow and pubescent, internally with brown striation and dots, sparsely puberulent; limb distinctly 2-lipped; two upper lobes subrounded 6-7 × 4-5 cm, three lower lobes subrounded-ovate, 4-5 × 3.5-4 mm; stamens 4, ca. 1 cm long, adnate to 1.5-2 mm above corolla

base, filament sparsely glandular-pubescent, anthers 1-1.2 mm long. Staminodes 1.2-1.5 mm long, adnate to corolla base. Disc annular, 1-2 mm diam. Pistils 2.5-3 cm long; ovary linear-oblong, glabrous; style 7-11 × 1.5-2 mm long; stigma 2, glandular-pubescent. Capsules linear-oblong, 4.5-6.5 × 0.25-0.3 cm long, glabrescent, brown.

**Type:** China, Guangxi, Dongxing, Shiwandashan, X. R. Liang 70078 (holotype IBSC [0649548]!; isotype A [A00353708]!).

**Iconography citation:** Pan [13], Figure 1. 1-4.

**Ecology and phenology:** *Loxostigma dongxingensis* was found in moist and shady areas, in the forest near streams or edges of limestone forest. Flowering is observed from August to October, fruiting is from September to December.

**Distribution:** CHINA, confirmation of *Loxostigma dongxingensis* for the Flora of Vietnam (Quang Ninh & Lang Son provinces).

**Conservation status:** The species is previously known in Guangxi and Guangdong provinces, southeastern China [1, 11, 14].



Figure 2. *Loxostigma dongxingensis*, A. Habit; B. Inflorescence and lateral view of opened flower; C. Close up of inflorescence and infrutescence; D. Longitudinally dissected flower showing stamens and pistils; E. Frontal view of flower bud; F. Frontal view of open flower. All photos by Do Van Truong.

These populations are well growing. Furthermore, our recent investigation also confirmed that a great number of *Loxostigma dongxingensis* populations with many well-grown mature individuals and seedlings are remaining in protected forest areas in northeastern Vietnam. Therefore, this species should be considered as Least Concern (LC) according to the IUCN Red List categories and criteria.

**Specimens examined:** VIETNAM. Lang Son province, Loc Binh district, Mau Son Nature Reserve, 23 October 2019, Do et al., *VNMN\_CN1086* (VNMN, IBK); Quang Ninh province, Ha Long city, Dong Son-Ky Thuong Nature Reserve, 22 September 2018, Swenson et al., *US1975* (VNMN, S).

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### References

- [1] W. T. Wang, K. Y. Pan, Z. Y. Li, A. L. Weitzman, L. E. Skog, Flora of China, Volume 18, Gesneriaceae, Science Press, Beijing and Missouri Bot Garden, St. Louis, 1998 (in Chinese).
- [2] W. T. Wang, K. Y. Pan, Notulae de Gesneriaceis Sinensibus III, Bulletin of Botanical Research, Vol. 2, 1982, pp. 121-124.
- [3] T. H. Nguyen, R. Kiew, New and Interesting Plants from Ha Long Bay, Vietnam, Garden's Bulletin (Singapore), Vol. 52, 2000, pp. 185-202.
- [4] D. J. Middleton, N. S. Ly, A New Species of *Ornithoboea* (Gesneriaceae) from Vietnam, Edinburgh Journal of Botany, Vol. 65, 2008, pp. 353-357, <https://doi.org/10.1017/S0960428608005039>.
- [5] X. T. Do, P. X. Vu, A New Record of Species *Loxostigma fimbrisepalum* K. Y. Pan (Gesneriaceae Dumort) for the Flora of Vietnam, Academia Journal of Biology, Vol. 33, No. 4, 2011, pp. 45-47 (in Vietnamese), <https://doi.org/10.15625/0866-7160/v33n4.779>.
- [6] T. V. Do, S. Y. Liu, Y. G. Wei, F. Wen, Four Newly Recorded Gesneraceous Species from Vietnam, Guihaia, Vol. 33, 2013, pp. 395-400, <https://doi.org/10.3969/j.issn.1000-3142.2013.03.019>.
- [7] T. H. Luu, N. H. Pham, G. Tran, D. T. T. Ngo, L. N. Dinh, M. T. Ton, *Billolivia kyi* (Gesneriaceae), a New Species from Vietnam, Annales Botanici Fennici, Vol. 52, 2015, pp. 362-364, <https://doi.org/10.5735/085.052.0515>.
- [8] W. B. Xu, Q. Zhang, F. Wen, W. B. Liao, B. Pan, H. Chang, K. F. Chung, Nine New Combinations and One New Name of *Primulina* (Gesneriaceae) from South China, Phytotaxa, Vol. 64, 2012, pp. 1-8, <https://doi.org/10.11646/phytotaxa.64.1.1>.
- [9] Z. Y. Li, Y. Z. Wang, Plants of Gesneriaceae in China, Henan Science and Technology Publishing House, Zhengzhou, Henan, 2004.
- [10] M. F. Hou, J. L. Pujol, H. N. Qin, L. S. Wang, Y. Liu, Distribution Pattern and Conservation Priorities for Vascular Plants in Southern China: Guangxi Province as a Case Study, Botanical Studies, Vol. 51, 2010, pp. 377-386.
- [11] Y. G. Wei, F. Wen, M. Möller, A. Monro, Q. Zhang, Q. Gao, H. F. Mou, S. H. Zhong, C. Cui, Gesneriaceae of South China, Guangxi Science and Technology Publishing House, Nanning, Guangxi, 2010.
- [12] W. T. Wang, Genus Novum Gesneriacearum E Guangxi, Guihaia, Vol. 3, No. 1, 1983, pp. 1-6.
- [13] K. Y. Pan, New Taxa of *Briggsia* Craib (Gesneriaceae) from China, Acta Phytotaxonomica Sinica, Vol. 26, 1988, pp. 450-457.
- [14] M. Möller, W. H. Chen, Y. M. Shui, H. Atkins, D. J. Middleton, A New Genus of Gesneriaceae in China and the Transfer of *Briggsia* Species to Other Genera, Gardens' Bulletin Singapore, Vol. 66, 2014, pp. 195-205.

- [15] P. X. Vu, Flora of Vietnam, Volume 18, Gesneriaceae, Publishing House for Technology and Science, Hanoi, 2017 (in Vietnamese).
- [16] J. G. Harris, M. W. Harris, Plant Identification Terminology: An Illustrated Glossary (2<sup>nd</sup>). Spring Lake Pub., Spring Lake, Utah, 2001.
- [17] IUCN Standards and Petitions Subcommittee, Guidelines for Using the IUCN Red List Categories and Criteria, Version 14, Prepared by the Standards and Petitions Subcommittee, <https://www.iucnredlist.org/resources/redlistguidelines/>, 2019 (accessed on: December 28<sup>th</sup>, 2020).
- [18] W. B. Xu, Y. Liu, H. S. Gao, *Chiritopsis jingxiensis*, a New Species of Gesneriaceae from a Karst Cave in Guangxi, China, Novon, Vol. 19, 2009, pp. 559-561, <https://doi.org/10.3417/2008014>.