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RESEARCH ARTICLE
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Taxonomic revision of the genus *Pedicularis* (Orobanchaceae) in China: *P. brevilabris* treated as a synonym of *P. sima*

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ABSTRACT: This study re-evaluated the taxonomic status of *Pedicularis brevilabris* and *P. sima* through a morphological comparison, type specimen examination, and literature review. The results revealed that all morphological characteristics of *P. brevilabris*, including the floral structure, corolla morphology, and calyx, fall within the range of phenotypic variation of *P. sima*. Additionally, the type localities of the two taxa are geographically adjacent, with overlapping habitats. In accordance with the International Code of Nomenclature for algae, fungi, and plants, *P. brevilabris* is herein treated as a synonym of *P. sima*. This research provides fundamental data for the taxonomic revision of the genus *Pedicularis*.

KEYWORDS: nomenclature, *Pedicularis sima*, Qinghai-Tibet Plateau, taxonomy

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INTRODUCTION

The genus *Pedicularis* L. is the one of the most species-rich genera in the family Orobanchaceae, with approximately 680 species (POWO, 2025) worldwide. It is primarily distributed in the temperate to frigid zones of the Northern Hemisphere, and the Hengduan Mountains and Qinghai-Tibet Plateau in China constitute its distribution center, where over 386 species have been recorded (Tsoong, 1963; Yang et al., 2003; Yu et al., 2010, 2015a, 2015b, 2018). Owing to the complex morphological variation of *Pedicularis* species and their susceptibility to phenotypic differentiation induced by environmental factors, there have been numerous cases of synonymy in historical taxonomic treatments. This has posed challenges to species identification and research on the genus' resources (Li, 1948, 1949; Tsoong, 1955, 1956a, 1956b, 1961).

Pedicularis brevilabris Franch. was described based on the collection collected by J. A. Soulié (Specimen No. 208) from northwestern Sichuan Province (Franchet, 1900). Its original description emphasized the characteristic that "the lower lip is distinctly shorter than the galea, with an ovate middle lobe." In contrast, *P. sima* Maxim. was named and published by Maxim. (1881), based on Specimen No. 541 collected by Przewalski from western Gansu Province. The type specimen of *P. sima* records the features: "the lower lip is ciliate and shorter than the galea, with a rounded middle lobe." For a long time, these two taxa have been recognized as distinct species, primarily due to differences in the "length of the lower lip."

In recent field surveys conducted in Gansu, Qinghai, Sichuan, and other regions, a large number of *Pedicularis* individuals were found to have lower lips measuring 3–7 mm in length. Their other morphological characteristics, including leaf shape, inflorescence arrangement, and calyx features, were highly consistent with the original type descriptions of *P. brevilabris* and *P. sima*. Meanwhile, a re-examination of type specimens and related specimens deposited in the herbaria of the Institute of Botany, Chinese Academy of Sciences (PE), the Northwest Institute of Plateau Biology, Chinese Academy of Sciences (HNWP), and the Dendrology Herbarium of Gansu Agricultural University (GAUF) revealed that the "length of the lower lip" is not a stable diagnostic character. Based on these findings, this study uses multi-dimensional evidence to demonstrate the synonymy between *P. brevilabris* and *P. sima*.

MATERIALS AND METHODS

In this study, specimens or high-resolution images of *Pedicularis* (including the type specimens of *P. brevilabris*

and *P. sima*) deposited in the herbaria PE, KUN, LZU, HNWP, GAUF, K, and LE were examined in detail. Additionally, *in-situ* observations were conducted on living individuals of these two *Pedicularis* taxa, with one population sampled from the type locality of *P. sima*—namely Gannan Tibetan Autonomous Prefecture, Gansu Province. Morphological observations focused on leaves, flowers, and fruits, with particular attention paid to corolla morphology, the sizes of the galea and lower lip, and the size of calyx teeth.

RESULTS AND DISCUSSION

The corolla lower lip length of the *P. brevilabris* type specimen ranged from 3.2–4.1 mm, while that of the *P. sima* type specimen was 5.3–6.8 mm. However, in specimens collected from the overlapping distribution area of the two taxa (Gannan Tibetan Autonomous Prefecture, Gansu Province, and Yushu Tibetan Autonomous Prefecture, Qinghai Province), the lower lip length showed continuous variation 3.0–7.2 mm. This rules out the possibility of using morphological discontinuity as a basis for species delimitation.

The type specimen of *P. brevilabris* (*Soulié, J. A. 208*), collected in 1893, exhibited obvious compression deformation of the corolla lower lip during specimen pressing (Fig. 1), and the flowers were at the early opening stage with the lower lip not yet fully expanded. In contrast, the type specimen of *P. sima* (*Przewalski 541*) was collected at the full flowering stage (Fig. 2), with well-preserved floral organs. The specimen contains a detailed description of floral anatomy (Fig. 2D, E). A comparison of field photos of living individuals of the two taxa at the same flowering stage (Fig. 3), and diagnostic morphological characters (Table 1), that the lower lip length of individuals at the early flowering stage was generally shorter than that at the full flowering stage. Furthermore, external force compression during specimen pressing could further shorten the apparent length of the lower lip. Additional specimens examined findings (Appendix 1.) indicate that the "short lower lip" characteristic of *P. brevilabris* is likely an artifact caused by the combination of individual developmental stage and specimen processing, rather than a stable heritable trait.

The type locality of *P. brevilabris* (northwestern Sichuan Province) is located at the edge of the core distribution area of *P. sima* (western Gansu Province). The two taxa form a continuous distribution zone in areas such as Gannan (Gansu Province) and Aba (Sichuan Province), with no obvious geographical isolation. Both grow in alpine meadows and at the edges of thickets at an altitude of 3,200–4,500 m, with highly consistent habitat conditions. This further supports the conclusion that there is no niche differentiation between the two.

According to Article 11 of the International Code of Nomenclature for algae, fungi, and plants (Editorial Committee of the Madrid Code, 2025), when a species is proven to be the same taxon as another previously published species, the earlier-published name shall be treated as the correct name, and the later-published name becomes a synonym. *Pedicularis sima* was published in 1881, while *P. brevilabris* was published in 1900. Since the publication date of *P. sima* is earlier than that of *P. brevilabris*, and there are no special circumstances for retaining the later name with priority, *P. sima* should be the correct name. Treating *P.*

Table 1. Diagnostic morphological characters of *Pedicularis brevilabris* and *P. sima*.

Characters	*P. brevilabris*	*P. sima*
Stem	Single or in bundles, 25–50 cm tall	Branched or simple, up to 30 cm tall.
Leaf	Lower ones opposite, upper ones in whorls of 4; leaf blades oblong to elliptic-oblong, pinnately deeply lobed, with 4–8 pairs of lobes	Lower ones opposite, upper ones in whorls of 3 and 4; leaf blades oblong, pinnately deeply lobed, with 5–7 pairs of lobes
Bract	Foliate	Foliate
Inflorescence	Spicate, with lower flower whorls distinctly spaced apart	Spicate or capitate, lower part lax; 3 flowers per whorl
Calyx	Campanulate, 7–8 mm long; 5-toothed, with the posterior tooth triangular and shorter	Cylindrical, 5-irregularly toothed; the posterior tooth small, triangular and entire
Corolla	Pale red; tube curved forward at the middle; galea more or less falcately curved; lower lip subovate, margin ciliolate; middle lobe small, elliptic-ovate, overlapping the lateral lobes	Rose-colored; tube nearly straight, slightly shorter than the calyx; galea more or less falcate; lower lip ovate-orbicular, margin ciliate; middle lobe rounded, distinctly smaller than the lateral lobes; lateral lobes elliptic, overlapping the middle lobe
Fruit	Acute triangle	Triangular-lanceolate
Seed	Oblong	Long-ovate

Fig. 1. Type specimen of *Pedicularis brevilabris.* **A–C.** plant morphology. **D.** Leaf. **E.** Inflorescence. **A.** Isotype. **B, C.** Syntype. **D, E.** Leaves and inflorescences, taken from Figure A (isotype), showing the indumentum of leaves and leaf lobation.

Fig. 2. Type specimen of *Pedicularis sima*. **A–C.** Plant morphology. **D, E.** Line drawings and anatomical drawings. **A.** Holotype. **B.** Isotype. **C.** Non-type specimen. **D, E.** Line drawings and anatomical drawings attached to the holotype specimen.

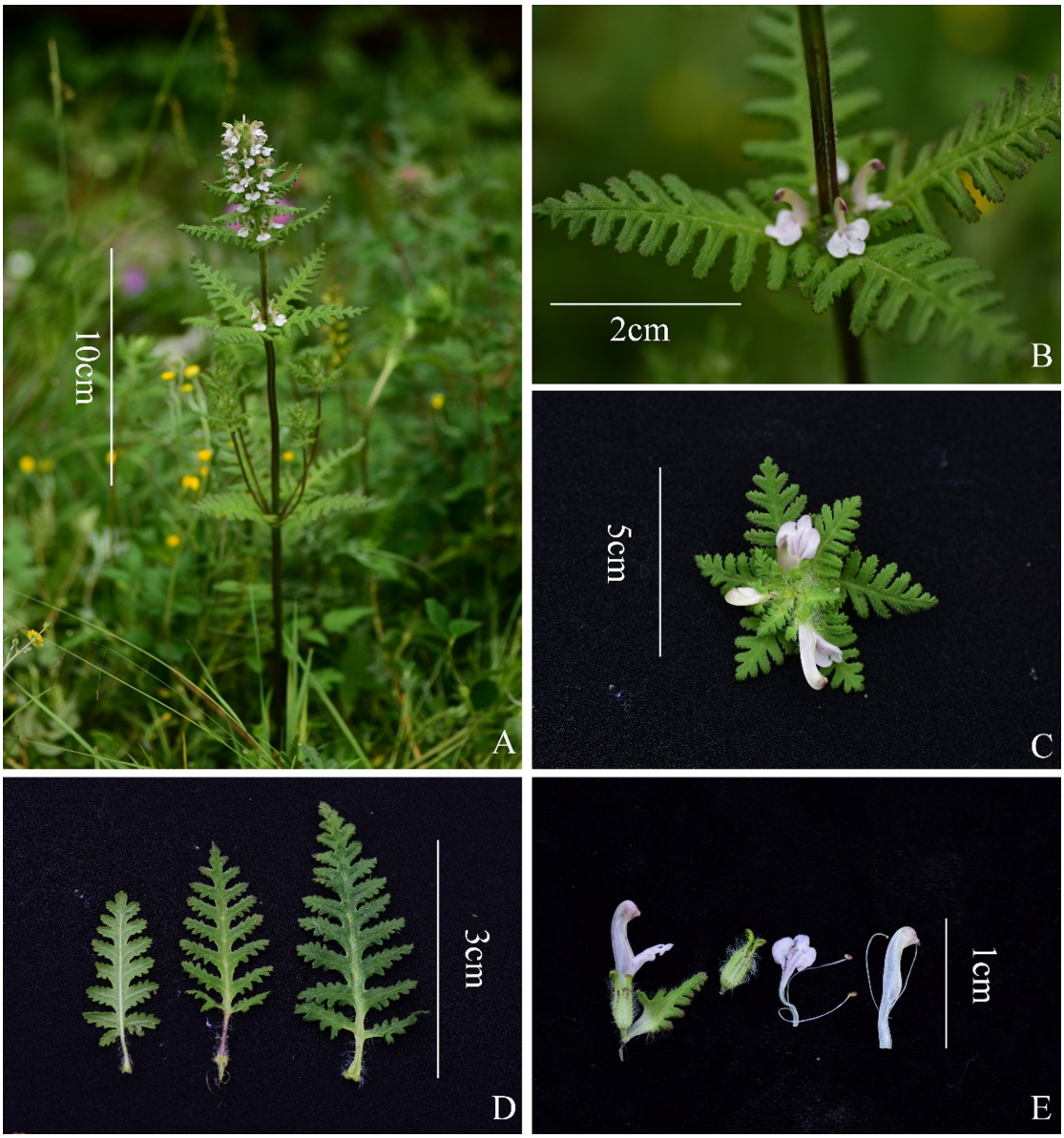

Fig. 3. Ecological illustration of *Pedicularis sima*. **A.** Habit. **B, C.** Inflorescence. **D.** Leaf. **E.** Anatomical drawings.

brevilabris as its synonym is consistent with the ICN provisions.

TAXONOMIC TREATMENT

Pedicularis sima Maxim., Bull. Acad. Imp. Sci. Saint-Pétersbourg 27: 514, 1881 (Fig. 3).—TYPE: CHINA. Gansu province, Western, 1880, *N. M. Przewalski* 541 (holotype: LE01034781!; isotype: PE00033024!).

Pedicularis brevilabris Franch. syn. nov., Bull. Soc. Bot. France 47: 33, 1900.—TYPE: CHINA. Sichuan province, Dajianlu, 1893, *J.-A. Soulié 208* (lectotype!; isolectotypes with the numbers 226! and 236!).

Herbs, annual, 25–50 cm tall, not blackening when dried, with a slender root. **Stem** branched at the base or simple, bearing 4 lines of woolly hairs. **Leaves** lower ones opposite, upper ones in whorls of 3 and 4, densely curly-hairy on both surfaces; petioles up to 15 mm long; blades oblong, pinnately deeply lobed, with 5–7 pairs of lobes, lobes ovate to oblong and serrate margins. **Inflorescence** spicate or capitate, with 3 flowers per whorl; the lower whorls are lax and densely covered with long hairs; calyx short-cylindrical, 7–8 mm long, with 5 irregular teeth; the posterior calyx teeth smaller than others, triangular, entire; the other calyx teeth enlarged, serrate, often revolute; abaxial veins are densely long-hairy; corolla rose-colored or pale fuchsia; collora tube nearly straight,

shorter than both calyx tube and galea; galea is slightly falcate-curved, with a rounded forehead, abruptly narrows apically into a short but distinct beak; lower lip ciliate, 6–8 mm long, 6–9 mm wide, slightly shorter than galea; middle lobe rhombic, smaller than lateral lobes; stamens glabrous. **Fruits** capsules, triangular-lanceolate. **Seeds** elongate ovoid.

Phenology: Flowering period: July–August; Fruiting period: August.

Distribution and habitat: Qinghai, Sichuan, eastern Tibet; in Gansu Province: Diebu, Zhuoni, Hezuo, Xiahe, Yongdeng (Liancheng), Tianzhu. Grows in alpine meadows or alpine thickets, at an altitude of 3,000–3,800 m.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

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Appendix 1. Additional specimens examined.

CHINA. Gansu: Liancheng, elev. 2,300 m, 23 Jul 1959, *Y. Q. He. 5162* (PE); La buleng, elev. 3,100 m, 19 Jul 1937, *K. T. Fu. 1294* (PE); Da yugou, elev. 3,191 m, 27 Aug 2008, *Q. Wei. LJQ-2008-GN-398* (KUN); Hezuo shenshan, elev. 3,040 m, 2 Sep 2011, *K. Liu. JQ-GN-2011-549* (KUN); Tu lugou, elev. 2,300 m, 15 Jul 1985, *Huangtu Plateau Team. 4812* (WUK). Qinghai: Guang huisi, elev. 1,980 m, 26 Jul 1936, *K. M. Liou. 6163* (PE); Maduo, elev. 4,250 m, 12 Aug 2009, *S. L Chen et al. ChenSL0533* (KUN); Maixiu, elev. 2,870 m, 13 Aug 1982, *B. Z. Guo. 26070* (HNWP); Makehe, elev. 3,200 m, 5 Aug 1983, *W. Y. Wang et al. 27407* (HNWP). Sichuan: yulinkong, elev, 3,500 m, 22 Jul 1934, *H. Smith. 10670* (PE); Xiaojianxian, elev. 3,730 m, 28 Aug 2000, *F. S. Yang. 2128* (PE); Rangtanxian, elev. 3,465 m, 13 Jul 2019, *Eaton et al. DE624* (KUN). Tibet: Gongjuexian, elev. 3,600 m, 31 Jul 2009, *D. E. Boufford et al. 41493* (PE); Ranwuxian, elev. 3,800 m, 18 Aug 1976, *Qinghai-Tibet Scientific Expedition Team. 12890* (HNWP).