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***Meconopsis nidongensis*, a newly recorded species of *Meconopsis* from China (Postprint)**

Authors: Zhang Xu, Zhou Haiyi, Xu Changlong, Xu Bo

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Abstract

Tibet exhibits relatively rich plant diversity. Despite numerous plant diversity surveys having been conducted, a rather serious imbalance persists, with insufficient collection, or even gaps, in certain regions and taxonomic groups. We conducted investigations in the undersurveyed areas of Shigatse, Tibet, and discovered an unrecorded species of the genus *Meconopsis* Viguiet, collecting both specimens and seeds. Through consultation of Flora of Tibet, Flora of China, Flora of China, and Flora of Nepal, it was identified as *Meconopsis dhwojii* G. Taylor ex Hay. This article reports new botanical data as follows: (1) morphological description of *Meconopsis dhwojii* and its color photographs; (2) micromorphology of the plant's seeds and morphological differences with closely related species. This new discovery enriches the diversity of *Meconopsis* plants in China and holds certain biogeographical significance and potential horticultural value for the study of *Meconopsis* in Tibet and throughout China. Classification of the genus *Meconopsis* requires enhanced field investigation and research employing multiple technical approaches.

Full Text

Preamble

***Meconopsis dhwojii* G. Taylor ex Hay (*Meconopsis* Viguiet), a New Record to China**

Xu Zhang, Haiyi Zhou, Changlong Xu, Bo Xu*

Forestry College, Southwest Forestry University, Kunming 650224, China

Abstract

Tibet is relatively rich in plant diversity, and although several plant diversity surveys have been conducted, serious imbalances persist, with some areas and

taxa remaining under-collected or even completely unsurveyed. To address these gaps, we conducted fieldwork in poorly surveyed regions of Shigatse, Tibet, where we discovered an unrecorded species of the genus *Meconopsis* and collected both specimens and seeds. After consulting *Flora Xizangica*, *Flora Reipublicae Popularis Sinicae*, *Flora of China*, and *Flora of Nepal*, the species was identified as *Meconopsis dhwojii* G. Taylor ex Hay. This new record is reported with: (1) a morphological description and color photographs of the species; and (2) seed micromorphology and morphological differences from closely related species. This discovery enriches the diversity of *Meconopsis* in China and holds biogeographical significance and potential horticultural value for studies of the genus in Tibet and throughout China. Future research on *Meconopsis* taxonomy should strengthen field investigations and employ multiple technical approaches.

Keywords: *Meconopsis*; *M. dhwojii*; new record; seed micromorphology

Introduction

The Eastern Himalaya-Hengduan Mountains region represents one of the world's biodiversity hotspots and has long attracted extensive attention from botanists conducting plant diversity surveys. However, due to harsh climate conditions, poor transportation infrastructure, and relatively short survey periods, combined with the region's vast territory, numerous blind spots in biodiversity surveys remain. In recent years, many new families, genera, and species have been reported from the region (Wang et al., 2018; Xiong et al., 2018; Xu et al., 2020; Liu et al., 2020). Studies indicate that between 2000 and 2020, newly published plant species and national records in China were concentrated in Yunnan, Tibet, Sichuan, and Guangxi, accounting for two-thirds of all new species described in China (Du et al., 2020; Du et al., 2021). Notably, Médog County in Tibet yielded the highest number of new species in 2020, with over 19 taxa described, underscoring the necessity of intensifying research efforts in these areas.

The genus *Meconopsis* Viguiet, one of the iconic taxa of the Himalaya, has garnered tremendous attention from botanists, horticulturists, and plant enthusiasts alike. Over the past two decades, numerous new species and new national records have been published for this genus (Zhang & Grey-Wilson, 2008; Grey-Wilson, 2014; Yoshida, 2021; Zhou et al., 2021). During plant diversity surveys in the Shigatse region, we encountered a distinctive *Meconopsis* species that, after consulting domestic floras (Zhuang, 1985; China Flora Editorial Board, 1999; Zhang & Grey-Wilson, 2008) and floras from neighboring countries (Taylor, 1934; Egan et al., 2012; Grey-Wilson, 2014; Yoshida, 2021), was identified as *Meconopsis dhwojii* G. Taylor ex Hay, representing a new record for China.

1. New Record of *Meconopsis* Species

1.1 Taxonomic Treatment

Meconopsis dhwojii G. Taylor ex Hay, New Fl. & Silva 4: 225, fig. 82 (1932) & Gard. Chron., Ser. 3, 92: 409, figs. 198-199 (1932). [Figure 1: see original paper]

Description: Herbaceous perennial, monocarpic, up to 60 cm tall. Taproot carrot-shaped. Basal stem 8-13 mm thick. Leaves gray-green, often dark purple in autumn and winter, 16-33 cm long, 4.2-10.3 cm wide, including petiole covered with straw-colored bristles, bristle bases purplish-black, 6-11 mm long; basal leaves bipinnately parted to completely divided, with 6-9(10) pairs of segments, basal segments deeply divided, apical segments shallowly lobed, apex obtuse, distance between basal segments greater than between apical segments, sparsely bristly or glabrous; cauline leaves similar to basal leaves but with smaller and fewer segments, basal segments auriculate; basal leaf petioles up to 16 cm, slender, cauline leaf petioles short to sessile. Small cymose inflorescences and solitary flowers forming a panicle exceeding two-thirds of plant height, cymose inflorescences with 2-5 flowers, apical flowers solitary, cup-shaped to dish-shaped, 40-65 mm, inflorescence axis bristly. Pedicels 5.5-13 cm long (up to 19 cm in fruit), densely bristly beneath flower, becoming sparser distally. Bracts ovate to hemispherical, bristly. Petals 4, creamy yellow, obovate to suborbicular, 25-37 mm long, 22-37 mm wide. Stamens numerous, filaments white and filiform, anthers orange-yellow. Ovary ovate, slender, 2.5-6 mm long, stigma green or yellowish-green. Capsule 20-41 mm long, 7-8 mm wide, 5-6-valved, densely bristly, bristles 8 mm long. Seeds ovoid to elliptic. Flowering June-August, fruiting August-November.

Type specimen: E Nepal, Sangmo, 12,000 ft, Lall Dhwoj 0297 (Holotype, Isotypes, BM).

Voucher specimens: Roadside grassland near Boqu, Nyalam County, Shigatse, Tibet, altitude 3,312 m, 28 August 2020, Xu Bo, Zhang Xu, Zhou Haiyi, Xu Changlong Tsui-1810, Tsui-1811 (KUN); near stream, Rongxiaqu, Rongxar Township, Tingri County, altitude 3,527 m, 1 September 2020, Xu Bo, Zhang Xu, Zhou Haiyi, Xu Changlong Tsui-1892, Tsui-1893 and Tsui-1894 (KUN); near water pipe and stream, back mountain of Chentang Village, Rongxar Township, Tingri County, altitude 4,120 m, 2 September 2020, Xu Bo, Zhang Xu, Zhou Haiyi, Xu Changlong Tsui-1923 (KUN). Examined specimens: BM 000547042, BM 000547043, BM 000547138, E 00060576, E 00622908, E 00758043.

Distribution: Central-eastern Nepal (Dolakha District, distribution center in Rolwaling Himal), growing on rocky terrain, open scrub, and stream banks at 2,950-4,755 m altitude. New distribution records for Nyalam and Tingri counties, Tibet, China.

Selection of Chinese Name: *Meconopsis dhwojii* G. Taylor ex Hay currently has three Chinese names: Ni-dong Lǚróngghāo (Wu & Chuang, 1980), Duo-ji-shi

Lùróngzhāo (Yoshida, 2021), and Rongxia Lùróngzhāo. Ni-dong Lùróngzhāo (尼东绿绒蒿) is the earliest published Chinese name, established based on the type specimen from eastern Nepal. Duo-ji-shi Lùróngzhāo is a transliteration of the scientific name, while Rongxia Lùróngzhāo is based on a single population locality and is therefore inappropriate. Considering these factors, Ni-dong Lùróngzhāo (尼东绿绒蒿) is the most suitable Chinese name.

1.2 Seed Micromorphology

Morphological variation in *Meconopsis* is substantial, making identification among similar species difficult. Seed characteristics represent important taxonomic features in *Meconopsis*, with relatively stable traits that are minimally influenced by environmental factors (Sulaiman, 1995). We examined seeds of *M. dhwojii* collected from Nyalam and Tingri counties using scanning electron microscopy to provide more detailed and comprehensive basic data for *Meconopsis* taxonomy.

SEM observation revealed that seeds from both localities are elliptic, approximately 1.10 mm long and 0.74 mm wide. However, seed coat ornamentation varied between populations. By increasing sample size and scanning 40 seeds from different individuals at both sites, we found that seed maturity affects seed plumpness and seed coat ornamentation type. Mature seeds show high plumpness with coral-like wrinkled ornamentation on the seed coat surface [FIGURE:2:A], with wrinkles standing erect; less mature seeds show low plumpness with reticulate ornamentation [FIGURE:2:B]. We hypothesize that in mature seeds of *M. dhwojii*, epidermal cells form erect coral-like wrinkles that facilitate wind dispersal.

1.3 Comparison with Similar Species

Meconopsis dhwojii is generally considered most closely related to *Meconopsis gracilipes* G. Taylor (Wu & Chuang, 1980; Grey-Wilson, 2014; Yoshida, 2021). Based on relevant literature and herbarium specimens, we compiled the main differences between the two species .

TABLE:1 Differences in identifying features and ecogeography between *Meconopsis dhwojii* and *M. gracilipes*

Identification characteristics and ecogeographical differences	<i>Meconopsis dhwojii</i>	<i>M. gracilipes</i>
Basal and lower leaves	Often purplish or reddish, deeply divided, narrow; normally 6–9 pairs of segments, bristles with purplish-black bases	Segments shallow and wide, 3–5 pairs of segments, with uniform indumentum, whitish and soft
Ripe capsule	Thin, long, wide oval to oblong	Flask-shaped
Persistent style	Length 3–6 mm	Length 6–10 mm
Habitat	Open rocky terrain	Shaded areas, usually in forests or bushes or along stream banks
Distribution area	Central and eastern Nepal (Dolakha District, distribution center in Rolwaling Himal), southern Tibet (Nyalam County; Tingri County)	Central Nepal (Gorkha, Kaski & Lamjung districts; Annapurna Himal, Lamjung Himal, Gorkha Himal), southern Tibet (Nyalam County)

Discussion

The discovery of *Meconopsis dhwojii* in Tibet, China, expands the species' distribution range from its previously known endemic status in central-eastern Nepal to southwestern Tibet, enriching the diversity of *Meconopsis* in China and holding biogeographical significance and potential horticultural value for studies of the genus in Tibet and throughout China.

First, this discovery enriches the floristic data for *Meconopsis* in Tibet and China. The distribution center of *Meconopsis* lies in the Hengduan Mountains region of southwestern China extending to the Himalaya. China is the richest country in terms of *Meconopsis* resources, with preliminary statistics indicating 78 species (86.67% of the total), while Tibet, at the center of distribution, is the richest region with 31 species (34.44%) (Zhuang, 1985; Zhang & Grey-Wilson, 2008; Yoshida, 2021). The discovery of new records is significant for further research on the taxonomy and systematic evolution of *Meconopsis* in China and the Himalayan region.

Second, this finding enriches germplasm resources for *Meconopsis* horticultural breeding. *Meconopsis dhwojii* is among the lowest altitude-distributed species in the genus, with relatively tall plants and large cymose-paniculate inflorescences bearing up to a hundred flowers during peak blooming period and exhibiting a

long flowering duration, giving it exceptional horticultural value (Grey-Wilson, 2014). This new record provides germplasm resources for domestic *Meconopsis* breeding programs.

Furthermore, examination of herbarium specimens from relevant regions and taxa via the Chinese Virtual Herbarium (<https://www.cvh.ac.cn/>) revealed serious imbalances in *Meconopsis* specimen collection, with some areas and taxa under-collected or even blank. For example, Tingri County in Shigatse, Tibet, currently administers 13 townships, yet *Meconopsis* specimens from the county are concentrated primarily at Everest Base Camp in Zhaxizong Township and Qudang Township, with over 1,700 specimens collected, while fewer than five specimens have been recorded from Rongxar Township, and some townships remain completely unsampled. Searching for *Meconopsis* as a keyword reveals massive specimen holdings for *M. horridula*, *M. integrifolia*, *M. punicea*, *M. quintuplinervia*, and *M. racemosa*, whereas *M. tibetica* has only one collection (two specimens), *M. torquata* has two collections (six specimens), and *M. balangensis* has two collections (nine specimens). No specimens are housed domestically for *M. florindae*, *M. primulina*, *M. violacea*, *M. sinomaculata*, or *M. superba*.

As a highly regarded alpine plant in the Himalayan region, numerous new *Meconopsis* species have been published by domestic and international scholars in recent years (Zhang & Grey-Wilson, 2008; Grey-Wilson, 2014; Yoshida, 2021). However, these new taxa were described based solely on morphological characteristics from limited specimens, lacking molecular biological and seed micro-morphological evidence. Future research requires extensive field investigations, particularly targeting poorly collected regions and taxa within *Meconopsis*, to rectify the imbalance between over-sampled and long-neglected areas and taxa. Additionally, revisiting type localities, conducting field population observations, and acquiring molecular, palynological, and seed materials for multi-angle systematic studies are essential. Only through such comprehensive approaches can we objectively assess *Meconopsis* plant diversity, determine the exact number of *Meconopsis* species in China, evaluate the status of specific taxa in the wild, and establish a foundation for conservation and resource utilization of the genus.

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