

Original Article



***Rhododendron dashanbaoense* (Ericaceae), a New Species from North-Eastern Yunnan, China**

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Abstract:

Rhododendron dashanbaoense (Ericaceae), a new species in subg. *Rhododendron* from Dashanbao Town, Zhaotong City, Yunnan Province, China, is described and illustrated. *R. dashanbaoense* resembles *R. radendum* and *R. cephalanthum*. However, the new species can be easily distinguished from *R. radendum* by its smaller plants, persistent leaf-bud scales, fewer flowers, and glabrous pedicels, and can be easily distinguished from *R. cephalanthum* by its smaller plants, fewer flowers, glabrous pedicels, and glabrous filaments.

Keywords: Ericaceae, *Pogonanthum*, new species, compare, taxonomy

1. Introduction

Linnaeus established the genus *Rhododendron* (Ericaceae) in 1753 (Linné & Salvius 1753: 392). According to the International Plant Names Index (IPNI) and World Checklist of Vascular Plants (POWO 2023), 1081 *Rhododendron* species are currently recognized. These plants are widely distributed in the Northern Hemisphere, with the Sino-Himalayan region serving as the primary center of abundance and biodiversity (Fang & Min 1995). Significantly, China harbors over 600 *Rhododendron* species, including numerous species described after the publication of *Flora of China* (Chen *et al.* 2010; Chen *et al.* 2012; Ma *et al.* 2013; Liao *et al.* 2015; Ma *et al.* 2015; Cai *et al.* 2016; Tian *et al.* 2019; Dai *et al.* 2020; Chang *et al.* 2021).

In recent years, several *Rhododendron* species have been newly discovered in Zhaotong City. For instance, *R. yaoshanense* L.M. Gao & S.D.

Zhang (Gao *et al.*, 2008) and *R. qiaojiaense* L.M. Gao & D.Z. Li (Gao *et al.*, 2009) were collected from Qiaojia County; *R. rimicola* X. L. Tian, Y. P. Ma & J. Nielsen (Tian *et al.* 2019), and *R. kuomeianum* Y.H. Chang, J. Nielsen & Y.P. Ma (Chang *et al.* 2021) were collected from Xiaocaoba Nature Reserve in Yiliang County. However, because of the intricate topography of northeastern Yunnan, botanical surveys of *Rhododendron* in this region remain relatively limited.

In April 2020, during field investigations in Dashanbao Town, an unrecognized *Rhododendron* species was observed growing on a cliff. Morphologically, this species resembles *R. radendum* (Cullen, 1980) but differs in plant stature, inflorescence structure, and pedicel characteristics. Regrettably, only photographic records were obtained at that time, without

specimen collection. To further examine the floral characteristics of this species, we conducted a field investigation in April 2023 during the flowering period. Through an extensive review of relevant literature, examination of herbarium specimens and comparative analysis of morphological characteristics against the species of section *R. sect. Pogonanthum* G. Don (1834:845), it was determined that this taxon could not be affiliated with any known species in the subgenus. Therefore, we conclude that these specimens represent a species new to science in the section *R. sect. Pogonanthum*.

Here, we describe and illustrate the new species, *R. dashanbaoense* Z. Q. Zhang & X. J. Su, and compare its diagnostic features with those of *R. radendum* (Cullen, 1980:) and *R. cephalanthum* Franch (Franch, 1885).

Materials and Methods

Morphological Description

Species characteristics and measurements were obtained from field notes and fresh specimens, respectively. The microscopic morphologies of leaves and flowers were observed using a Nikon SMZ1000 stereoscopic microscope. Subsequently, the specimens were identified by a thorough literature review (Wu *et al.* 2005) and compared with type specimens available online (JSTOR Global Plants, <http://plants.jstor.org/>). All voucher specimens of this new species were

deposited in the Herbarium of the Kunming Institute of Botany (KUN), CAS. The conservation status of *Rhododendron dashanbaoense* was assessed using IUCN Red List categories and criteria (IUCN Standards and Petitions Committee 2022; IUCN 2023).

DNA Extraction, PCR Amplification and Sequencing

A Trelief™ Hi-Pure Plant Genomic DNA Kit (Beijing TsingKe Biotech Co., Ltd., Beijing, China) was used to extract total genomic DNA from fungal mycelia. DNA amplification was performed by a polymerase chain reaction (PCR). Sequences of *ITS*, *matK*, *psbA-trnH*, and *rbcL* were amplified using primer pairs of *ITS5/ITS4*, *390F/1326R*, *1F/724R*, and *sbaF/trnH2* (White *et al.* 1990; Fay *et al.* 1997; Sang *et al.* 1997; Cuénoud *et al.* 2002; Tate and Simpson 2003). The amplification was performed in a 25 µL reaction volume containing 9.5 µL deionized water, 12.5 µL 2 × Taq PCR Master Mix with blue dye (Sangon Biotech, China), 1 µL of DNA template and 1 µL of each primer. Adjusted thermal cycles for the amplification of each locus are given in Table 1. PCR products were checked on 1% agarose electrophoresis gels stained with Gel Red (Beijing TsingKe Biotech Co., Ltd., Beijing, China). The sequencing reactions were carried out with primers mentioned above by Tsingke Biological Engineering Technology and Services Company, Kunming, China.

Table 1. Primers, their sequences and PCR amplification conditions used in this study

Gene	Primer	Sequence 5'–3'	Thermocycling conditions	Source
ITS	ITS5	GGAAGTAAAAGTCGTAACAAGG	94 °C 3 min; [35 cycles: 94 °C 60 s; 53 °C 90 s; 72 °C 90 s]; 72 °C 10 min	White <i>et al.</i> (1990)
	ITS4	CCTTATCATTAGAGGAAGGAG		
matK	390F	CGATCTATTCAATATTTTC	94 °C 3 min; [35 cycles: 94 °C 60 s; 52 °C 60 s; 72 °C 90 s]; 72 °C 10 min	Cuénoud <i>et al.</i> (2002)
	1326R	TCTAGCACACGAAAGTCGAAGT		
rbcL	1F	ATGTCACCACAAACAGAAAC	94 °C 3 min; [35 cycles: 94 °C 60 s; 53 °C 90 s]; 72 °C 10 min	Fay <i>et al.</i> (1997)
	724R	TCGCATGTACCTGCAGTAGC		

psbA-trnH	sbAF	GTTATGCATGAACGTAATGCTC	94 °C 3 min; [35 cycles: 94 °C 30 s; 53 °C 45 s; 72 °C 60 s]; 72 °C 10 min	Sang <i>et al.</i> (1997)
	trnH2	CGCGCATGGTGGATTCAACAATCC	72 °C 10 min	Tate & Simpson (2003)

Phylogenetic Analyses

Sequences were edited and assembled using BIOEDIT 7.0.9 (Hall 1999). In addition, homologous sequences of 84 other closely related 9 species 21 specimens, and 8 sequences of *R. trichocladum* (outgroup) were obtained from the NCBI database (Table 2). Sequences were aligned using the online version of MAFFT v.7 (<http://mafft.cbrc.jp/alignment/server/>) (Kato and Standley 2013) and adjusted using BioEdit v.7.0.9 (Hall 1999) by hand to allow maximum

alignment and minimise gaps. Ambiguous regions were excluded from the analyses and gaps were treated as missing data. AliView1.19-beta was used to convert the alignment fasta file to Phylip format for phylogenetic analysis. Phylogenetic analyses were obtained from Maximum Composite Likelihood (MCL). MCL analysis was conducted MEGA12 (Tamura *et al.* 2004); all model parameters were estimated by the programme. Sequences derived in this study were deposited in GenBank (<http://www.ncbi.nlm.nih.gov>).

Table 2. Species, specimens, and GenBank accession numbers of sequences used in this study (newly-generated sequences are indicated in bold)

Species	Sample ID	GenBank Accession No.			
		rbcL	matK	psbA-trnH	ITS
<i>Rhododendron anthopogon</i>	R117	KM606469	KM606188	KM605603	KM605892
<i>Rhododendron anthopogon</i>	R36	KM606530	KM606249	KM605664	KM605953
<i>Rhododendron anthopogon</i>	R38	KM606531	KM606250	KM605665	KM605954
<i>Rhododendron cephalanthum</i>	B913	KM606402	KM606121	KM605536	KM605825
<i>Rhododendron cephalanthum</i>	B914	KM606403	KM606122	KM605537	KM605826
<i>Rhododendron dashanbaoense</i>	KUN 1576216	OR576794	OR576790	OR576792	OR571860
<i>Rhododendron dashanbaoense</i>	KUN 1576217	OR576795	OR576791	OR576793	OR571861
<i>Rhododendron hypenanthum</i>	R118	KM606470	KM606189	KM605604	KM605893
<i>Rhododendron hypenanthum</i>	R156	KM606505	KM606224	KM605639	KM605928
<i>Rhododendron kongboense</i>	B480	KM606372	KM606083	KM605505	KM605792
<i>Rhododendron kongboense</i>	B941	KM606421	KM606140	KM605555	KM605844
<i>Rhododendron</i>	B942	KM606422	KM606141	KM605556	KM605845

<i>laudandum</i>					
<i>Rhododendron</i>	B943	KM606423	KM606142	KM605557	KM605846
<i>laudandum</i>					
<i>Rhododendron</i>	B951	KM606425	KM606144	KM605559	KM605848
<i>mainlingense</i>					
<i>Rhododendron</i>	B952	KM606426	KM606145	KM605560	KM605849
<i>mainlingense</i>					
<i>Rhododendron</i>	B953	KM606427	KM606146	KM605561	KM605850
<i>mainlingense</i>					
<i>Rhododendron</i>	B974	KM606435	KM606154	KM605569	KM605858
<i>mainlingense</i>					
<i>Rhododendron</i>	B983	KM606441	KM606160	KM605575	KM605864
<i>primuliflorum</i>					
<i>Rhododendron</i>	B1025	KM606335	KM606039	KM605468	KM605750
<i>trichostomum</i>					
<i>Rhododendron</i>	B1028	KM606336	KM606040	KM605469	KM605751
<i>trichostomum</i>					
<i>Rhododendron</i>	B1030	KM606337	KM606041	KM605470	KM605752
<i>trichostomum</i>					
<i>Rhododendron</i>	B1032	KM606338	KM606042	KM605471	KM605753
<i>trichostomum</i>					
<i>Rhododendron</i>	B985	KM606442	KM606161	KM605576	KM605865
<i>trichostomum</i>					
<i>Rhododendron</i>	GLM-113180	KM605749	KM606334	KM606038	KM605467
<i>trichocladum</i>					
<i>Rhododendron</i>	GLM-092549	KM605790	KM606370	KM606079	KM605503
<i>trichocladum</i>					

Taxonomic Treatment

Rhododendron dashanbaoense Z. Q. Zhang & X. J. Su, *sp. nov.*

urn:lsid:ipni.org:names:77319063-1

Fig. 1 and Fig. 2

Type: CHINA. Yunnan Province: Zhaotong City, Zhaoyang County, Dashanbao Town, 3002 m elev., 27°22'59"N, 103°16'08"E, 23 April 2023, Zhengquan Zhang and Wenpeng Wang, *FDCU-R-2023042301* (holotype KUN! 1576216); *FDCU-R-2023042302*, *FDCU-R-2023042303*, *FDCU-R-2023042304* (paratype KUN! 1576217, KUN! 1576218, KUN1576219).

Diagnosis: *Rhododendron dashanbaoense* is distinguished from *R. radendum* by several aspects: significantly smaller plant stature (5–15 cm compared to 50–100 cm), persistent leaf-bud scales (vs. deciduous bud scales in *R. radendum*), 2–3-flowered inflorescences (vs. 8–10-flowered), white corolla (vs. pink or yellowish-white), and glabrous pedicels (vs. scaly and setose). Compared with *R. cephalanthum*, it differs in smaller size (5–15 cm vs. 30–150 cm), smaller leaves (4–16 × 2–9 mm vs. 10–35 × 5–16 mm), abaxial leaf surface with dense long curved setae (vs. glabrous), 2–3-flowered inflorescences (vs. 5–10-flowered), white corolla (vs. white or pink), glabrous pedicel (vs. scaly), and glabrous filaments (vs. puberulous at base) (Table 3).

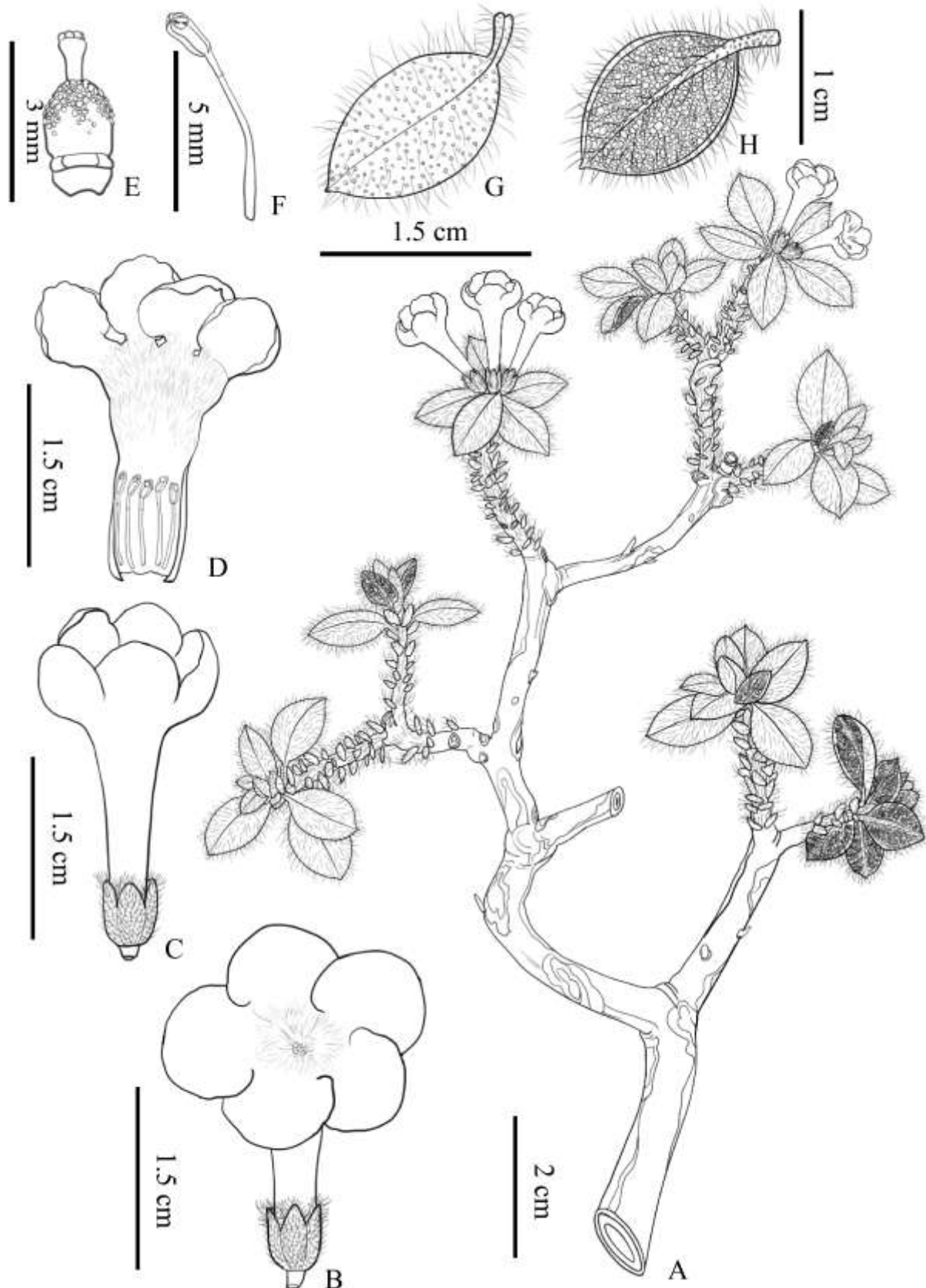


Fig. 1. *Rhododendron dashanbaoense* Z.Q. Zhang & X.J Su, *sp. nov.* A. flowering branch. B–D. flowers. E. ovary and style. F. stamen. G. leaf adaxial surface. H. leaf abaxial surface. Drawing by Mingmiao Chen (Illustrated by Mingmiao Chen)

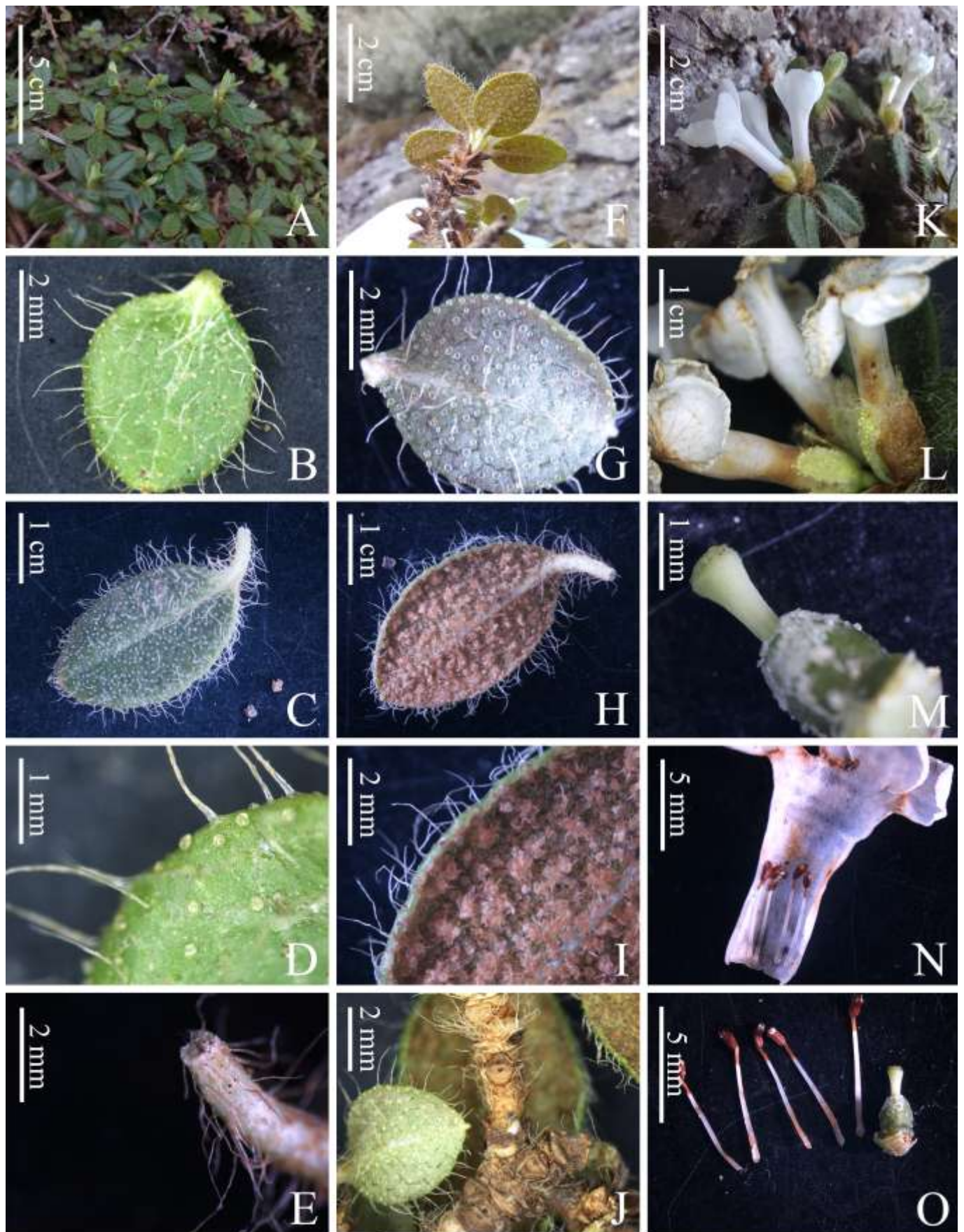


Fig. 2. Microscopic morphology features of leaves and flowers of *Rhododendron dashanbaoense* Z.Q. Zhang & X.J Su, *sp. nov.* A–D. Leaf adaxial surface. E. Petioles. F–I. Leaf abaxial surface. J. Branch. K–O. Flower.

Table 3. Main morphological comparisons among *Rhododendron dashanbaoense*, *R. radendum*, and *R. cephalanthum*.

Characters	<i>R. dashanbaoense</i>	<i>R. radendum</i>	<i>R. cephalanthum</i>
plant stature	5–15 cm	50–100 cm	30–150 cm
Leaf bud scale	persistent	deciduous	persistent
Leaf	papery	leathery	leathery
Leaf size	4–16 × 2–9 mm	10–18 × 3–6 mm	10–35 × 5–16 mm
Leaf adaxial surface	scaly, long-setose	scaly, setae along midrib	glabrous
Leaf abaxial surface	scales overlapping, long-setose	scales overlapping	scales overlapping
Petiole	sparsely scaly, long-setose	scaly, setose	scaly
Inflorescence	2–3	8–10	5–10
Corolla	white	pink to pale rose-purple	white or pink
Corolla length	15–18 mm	8–12 mm	12–15 mm
Tube length	11–13 mm	6–10 mm	6.5–13 mm
Pedicel	glabrous	scaly, setose	scaly
Stamens	5	5	5–8
Filaments	glabrous	glabrous	puberulous towards base

Description: Shrubs, semi-deciduous, 5–15 cm tall; young branches scaly, densely long-setose; leaf-bud scales persistent. Petiole 1–4 mm, scaly, long-setose; leaves papery, aromatic, obovate, oblong-obovate to ovate, 4–16 × 2–9 mm; base obtuse or cuneate, long-setose; apex rounded, mucronate; abaxial surface scales overlapping, red-brown to cinnamon; scales 1–8 times diameter apart, usually unequal, transparent to brown, vesicular, mid-rib setose; adaxial surface dark lime-green, glossy, with nearly transparent sparse lepidote scales and dense, long, curved setae. Inflorescence terminal, 2–3-flowered. Pedicel 1–2 mm, scaly, long-setose; calyx lobes ca. 2 mm, lanceolate to ovate, long-setose; corolla

5-lobed, narrowly tubular, white with orange spots, 16–18 mm; tube 11–13 mm, glabrous externally, densely pilose inside throat; stamens 5, 6–8 mm long, filaments glabrous; ovary scaly, glabrous; style slender, ca. 1 mm, apex swollen, always shorter than corolla; capsule and seeds unknown. Flowering: April–May.

Distribution and Ecology: *Rhododendron dashanbaoense* Z.Q. Zhang & X.J Su, *sp. nov.* is currently endemic to the type locality, a single population growing in cliff crevices at ca. 3000 m elevation in Dashanbao Town, Zhaotong City, Yunnan Province, China. The habitat of *R. dashanbaoense* presents shallow soil in limestone cliff fissures (Fig. 3).

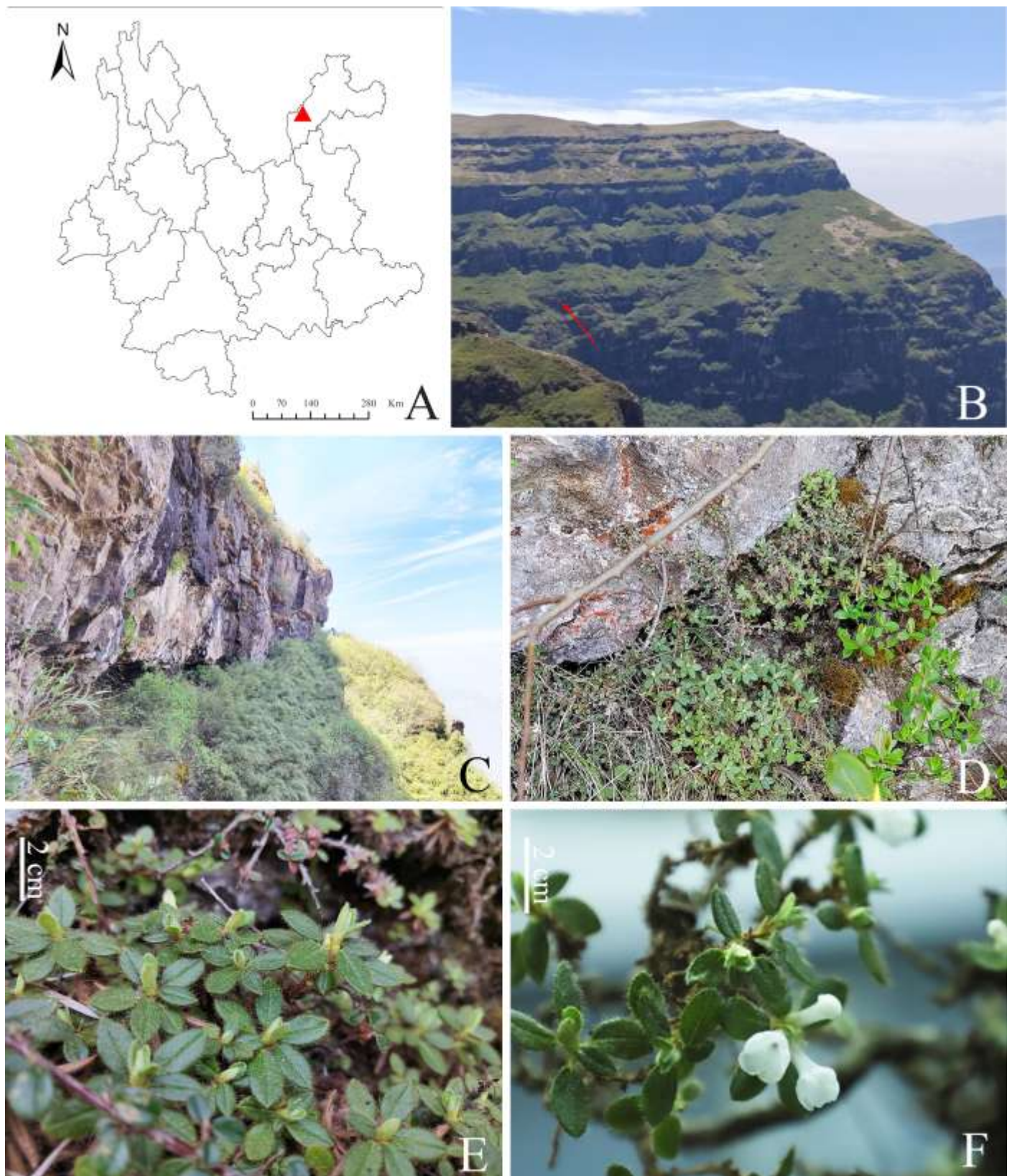


Fig. 3. Habitat of *Rhododendron dashanbaoense* Z.Q. Zhang & X.J Su, sp. nov.

Phylogenetic Analysis

The phylogenetic tree was constructed using 25 specimens from 11 species, a total of 100 sequences. Ten species of the *R.* Sect.

Pogonanthum clustered together in a single clade, distinct from the outgroup. The two specimens collected in this study formed a separate subclade with a bootstrap support of 91%, suggesting that the genes of *R. dashanbaoense* collected in this

study are significantly different from those of other conserved species (Fig. 4).

In previous studies on the phylogenetic analysis of *Rhododendron* species, methods such as Maximum Likelihood (ML) and Neighbor-Joining (NJ) were predominantly used. However, these models were unable to distinguish species

within *sect. Pogonanthum* using genes such as ITS, *matK*, *psbA-trnH*, and *rbcL*. In this study, the Maximum Composite Likelihood (MCL) method not only maintained the stability of different clades within the subg. *Rhododendron* (Fig. S1), but also effectively distinguished the species within the *sect. Pogonanthum*.

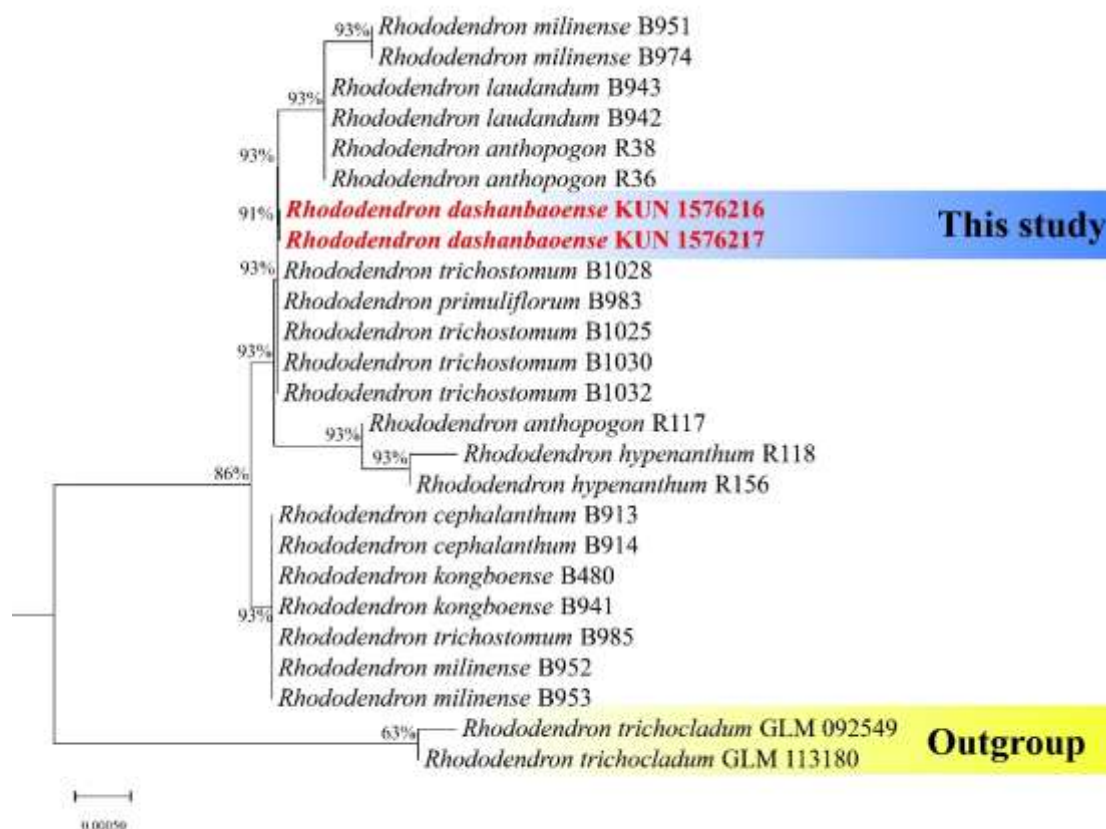


Fig. 4. Phylogenetic tree of the new species and related taxa which belong to *sect. Pogonanthum*, based on *ITS*, *matK*, *psbA-trnH*, and *rbcL* sequence data.

Note: Section *Pogonanthum* currently comprises 22 recognized species, exhibiting distinct geographic endemism. These species are primarily distributed in the Himalayan region, with a specific concentration in the high-altitude areas (3000–5000 m) of the southern Himalayas, western Sichuan, and northwestern Yunnan (Wu *et al.* 2005). The nearest documented locality for *Pogonanthum* species to the present collection site are the Daguniu Mountains in Qujing (*R. cephalanthum* and *R. primuliflorum* are recorded), and the Cangshan Mountains in Dali (*R. cephalanthum*, *R. platyphyllum*, and *R. primuliflorum* are recorded). The straight-line distance from Daguniu Mountains to the specimen collection site exceeds 150

kilometers, while the straight-line distance from Cangshan Mountains to the specimen collection site exceeds 350 kilometers. Moreover, no other members of *sect. Pogonanthum* were observed within a 20-kilometer radius of the current collection site. This absence strongly supports the hypothesis that the collected specimens represent a new species within this section.

Etymology: The specific epithet refers to the site (Dashanbao Town) where the new species was discovered and collected.

Vernacular Name: Chinese Mandarin: dà shān bāo dù juān (大山包杜鹃)

Phenology: This new species flowers from the end of April to early May.

Conservation Status: During our field investigations since 2020, we identified this species only in the type locality. The population consists of approximately 20 mature individuals; however, the rugged terrain precludes a comprehensive survey of all potential cliff habitats in the vicinity. Given the current limited distribution data and inability to assess total population size, this species is tentatively assigned to the IUCN Red List category of Data Deficient (DD) (IUCN, 2022), pending further ecological and demographic studies.

Acknowledgments

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Conflict of Interest Statement

The authors declare no conflict of interest.

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Note: [\(Fig. S1\)](#)