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Supplementary Morphological Description of *Indocalamus semitectus* (Bambusoideae): Post-print

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Abstract

Indocalamus semifalcatus (H. R. Zhao et Y. L. Yang) T. P. Yi was only partially described with respect to its vegetative organs in the original literature. Through field population surveys, indoor stereoscopic dissection, and scanning electron microscopy observations, this study adds descriptions of the floral organs and leaf lower epidermis micromorphological characteristics of I. semifalcatus, improves the description of its vegetative organ traits, and updates its geographical distribution. The results show that: (1) Reproductive organ characteristics: The inflorescence is paniculate; spikelets and rachilla are densely covered with white pubescence; glumes, lemmas, and paleas are smooth and glabrous; stamens number 3; anthers are purplish-red; stigmas are 2, white, and plumose; (2) Vegetative characteristics: Culms reach up to 4.5 m in height and 2 cm in diameter; culm auricles are semi-falcate or weak; culm blades are erect and closely appressed to the culm; leaf auricles are weak or absent; the ligule possesses relatively well-developed cilia; leaf blades are concolorous on both surfaces and glabrous; (3) Leaf lower epidermis micromorphological characteristics: Stomatal apparatuses are sunken and invisible; 8-10 long papillae are spread flat to cover the stomata; silica bodies are saddle-shaped; macrohairs and prickles are not observed; (4) One new distribution area, namely Guanyin Mountain in Guiyang City, Guizhou Province. This species is most similar to Indocalamus longiauritus Hand.-Mazz., with the main differences being that this species has semi-falcate auricles or lacks auricles on the culm sheaths and leaf sheaths, with culms reaching 4-5 m in height and 2 cm in diameter.

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Full Text

Supplementary Description of *Indocalamus semifalcatus* (Bambusoideae)

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Abstract

The original description of *Indocalamus semifalcatus* (H. R. Zhao et Y. L. Yang) T. P. Yi was limited to partial vegetative organs. Through field population surveys, laboratory stereoscopic anatomy, and scanning electron microscopy (SEM), this study provides the first description of its reproductive organs, characterizes the micromorphological features of the abaxial leaf epidermis, completes the description of vegetative organ traits, and updates its known geographic distribution. The key findings are: (1) **Reproductive organs:** The inflorescence is paniculate; spikelets and rachilla are densely covered with white pubescence; glumes, lemma, and palea are smooth and glabrous; there are three stamens with purple anthers; and two white, feathery stigmas. (2) **Vegetative traits:** Culms reach 4.5 m in height and 2 cm in diameter; culm sheath auricles are semifalcate or rudimentary; sheath blades are erect and appressed to the culm; leaf auricles are weakly developed or absent; the leaf ligule bears well-developed cilia; and leaf blades are concolorous and glabrous on both surfaces. (3) **Leaf micromorphology:** Stomatal apparatuses are invisible, covered by eight to ten elongated papillae; silica bodies are saddle-shaped; and neither macro-hairs nor prickles are observed. (4) **Geographic distribution:** One new distribution site is reported—Guanyin Mountain, Guiyang, Guizhou Province. This species is most similar to *Indocalamus longiauritus* Hand.-Mazz., but differs primarily in having semifalcate auricles on culm sheaths and leaf sheaths or lacking them entirely, and in its larger culm dimensions (4–5 m tall, 2 cm in diameter).

Keywords: bamboo; *Indocalamus*; description; SEM; distribution

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Introduction

The genus *Indocalamus* Nakai comprises shrub-like woody bamboos with sympodial rhizomes. Its large leaves are traditionally used for food packaging (Geng & Wang, 1996; Wang & Stapleton, 2006) and for extracting bamboo leaf flavonoids (Lai et al., 2013; Li, 2017; Zhang et al., 2022). Many species exhibit strong tolerance and resistance to heavy metal contamination (chromium, lead, cadmium,

copper) (Yang et al., 2012; Ma et al., 2019; Zhang et al., 2022), as well as notable cold and drought resistance (Li & Gao, 2016; Liu, 2021), making them suitable for remediation of heavily polluted soils in mining areas.

Established by Japanese botanist Nakai T. in 1925, the genus was delineated from *Sasa* Makino & Shibata based on floral morphology: *Indocalamus* has three stamens and two stigmas, whereas *Sasa* has six stamens and three stigmas (Nakai, 1925). Since its establishment, 78 valid binomials have been published. Through continuous revision by bamboo taxonomists including Keng Yi-li, Zhao Qi-seng, Zhao Hui-ru, Yang Ya-ling, and Vorontsova, the genus currently comprises 33 recognized species. Except for *Indocalamus petelotii* (A. Camus) Ohrnb., which occurs in Indochina, all species are distributed in China (Keng, 1959; Chao et al., 1980; Zhao & Yang, 1985; Yang, 1987, 1990; Vorontsova et al., 2017). However, only one-quarter of these species have described floral characteristics (Wang & Stapleton, 2006), highlighting the urgent need for comprehensive morphological descriptions.

Taxonomic History

Indocalamus semifalcatus (H. R. Zhao et Y. L. Yang) T. P. Yi (2000: 26) was originally described as *Indocalamus longiauritus* var. *semifalcatus* H. R. Zhao et Y. L. Yang (1985: 464). Neither the original variety nor the elevated species description included reproductive organ characteristics, and the vegetative description remained brief. The protologue provided only a diagnostic summary: "A typo culmorum vaginarum auriculis et foliorum auriculis omnibus semifalcatis, laminis subtus secus costam utrinque glabris differt" (This variety differs from the typical variety in having all culm sheath auricles and leaf auricles semifalcate, and leaf blades glabrous on both sides of the midrib) (Zhao & Yang, 1985). The type specimen, "H. R. Zhao s. n." (N), is housed at Nanjing University and was collected near Erwangmiao, Guanxian, Sichuan Province, on October 12, 1979. In 2000, Yi Tong-pei elevated this taxon to species rank (Yi, 2000), and it has since been included in *Iconographia Bambusoidearum Sinicarum* (Yi et al., 2008) and *Claves Generum et Specierum Bambusoidearum Sinicarum* (Yi et al., 2009).

To complete the morphological description and diagnostic characteristics of this taxon, we conducted detailed field population surveys at the type locality in Guanxian, Sichuan, from 2019 to 2020. During these investigations, we unexpectedly discovered a flowering population in Sanlang Town, Chongzhou, and observed extensive wild communities on Guanyin Mountain, Guiyang, Guizhou Province. Based on laboratory dissection and SEM observation of the abaxial leaf epidermis, we herein supplement and complete the morphological description and geographic distribution of *I. semifalcatus*, and provide new micromorphological data for the leaf epidermis.

Morphological Description

Vegetative Organs *Indocalamus semifalcatus* possesses leptomorph rhizomes. Culms reach 1.2–4.5 m in height and 0.8–2.0 cm in diameter; internodes are terete, 15–76 cm long, hollow, sparsely strigose, and bear a ring of brown velvety hairs at the infranodal region. The culm wall is 1.0–3.0 mm thick; the supranodal ridge is slightly raised; intranodes measure 7–11 mm in length. Branching occurs from the third to fifth nodes at the culm base, typically with one branch per node that is nearly as thick as the main culm. Culm sheaths are purple-green, persistent, usually shorter than the internodes, and leathery; they are dark brown strigose and white tomentose, with a raised corky ring at the base and densely reddish-brown ciliate margins. The auricles are short and semifalcate, purple-green turning brown when dry, occasionally inconspicuous or absent. Oral setae are radiate, brown, approximately 0.5–1 cm long. The ligule is 0.5–1.0 mm tall, truncate, with sparsely ciliate or entire margins; the blade is purple-green, narrowly triangular to ovate-lanceolate, with an abruptly rounded base and acuminate apex.

Foliage leaves number 3–7 per ultimate branch. The leaf sheath is rigid, glabrous or initially finely strigose abaxially, with a smooth outer margin. Leaf auricles are developed or inconspicuous, with short radiate oral setae. The ligule is truncate, 2–3 mm tall, with a densely ciliate margin. Leaf blades are oblong-lanceolate, 30.0–50.0 × 5.0–9.0 cm, glabrous on both surfaces, with 10–15 pairs of longitudinal veins; the base is cuneate, the apex long-acuminate, and the margin entire.

Reproductive Organs The panicle is 8–25 cm long, loose and spreading, with a densely white tomentose axis. Spikelets are greenish or straw-colored at maturity, 2–6 cm long, bearing 3–5 florets. Rachilla internodes are compressed-clavate, 4–5.5 mm long, angular, and densely white tomentose. Glumes are two, lanceolate; the first glume measures 3–5 mm, the second 8–12 mm. The lemma is oblong-lanceolate with an awnlike apex, smooth and hairless; the first lemma is subequal to the second, 1–1.2 cm long. Lodicules are three, oblong-lanceolate, ciliate, distally sparsely pilose. Anthers are purple, 8–9 mm long; filaments are white, 8–12 mm long. Stigmas are two, white, feathery, approximately 5–7 mm long. The caryopsis remains unknown.

Leaf Micromorphology SEM observation reveals that one to two rows of stomatal apparatuses are typically distributed between veins. Stomatal apparatuses are sub-orbicular and covered by eight to ten elongated papillae that overarch and obscure them; short papillae are rare. Micro-hairs are distributed in the intercostal region, and saddle-shaped silica bodies occur in both costal and intercostal regions. Neither macro-hairs nor prickles are observed.

Phenology and Distribution

New shoots emerge from April to May, and flowering occurs from July to August. *Indocalamus semifalcatus* is endemic to China, naturally distributed in Guangxi, Sichuan, Fujian, and Guizhou provinces, and cultivated in Zhejiang. It typically inhabits mountain slopes, hillsides, or roadsides at elevations of 600–1100 m.

Comparison with Related Species

This species is most similar to *Indocalamus longiauritus* Hand.-Mazz., but differs primarily in having semifalcate auricles on culm sheaths and leaf sheaths (or lacking them entirely), and in its significantly larger culm dimensions (4–5 m tall, 2 cm in diameter). The typical shrubby bamboos of *Indocalamus* are characterized by culm heights of approximately 2 m and diameters not exceeding 1.0 cm (e.g., *I. tessellatus* and *I. longiauritus*) (Geng & Wang, 1996; Wang & Stapleton, 2006). The discovery of *I. semifalcatus* populations with culms reaching 4.5 m in height and 1.8–2 cm in diameter represents a notable exception within the genus, updating our traditional understanding of size ranges in *Indocalamus*.

The paniculate, loose inflorescences of *I. semifalcatus* are borne on main or lateral branches, with densely white tomentose axes and rachillae. Spikelets contain 3–5 florets, with two glumes, three lodicules, three stamens, and bifid, feathery stigmas—features that do not differ significantly from *I. longiauritus*. Additionally, the sub-orbicular stomatal apparatuses surrounded by eight to ten elongated papillae that overarch and cover the stomata are remarkably similar to those of *I. longiauritus*, consistent with findings by Zhang et al. (2014) and Ji (2019).

Conclusion

Morphological research forms the foundation of classical plant taxonomy. Based on the original description of *Indocalamus semifalcatus*, this study has refined and supplemented vegetative and floral morphological data and illustrations through detailed measurements, SEM analysis of leaf epidermal micromorphology, and verification of geographic distribution points. The addition of leaf micromorphological characters and updated distribution records provides more accurate research materials for species identification, infrageneric classification revision, and systematic evolution studies within *Indocalamus*.

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