

Zeuxine affinis (Lindl.) Benth. ex Hook.f. (Orchidaceae: Goodyerinae): A New addition to flora of Karnataka, India

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ABSTRACT

Zeuxine affinis (Lindl.) Benth. ex Hook.f. (Orchidaceae: Goodyerinae) was recorded in October 2025 from semi-evergreen forests of Mookambika Wildlife Sanctuary, Udupi District, Karnataka, at 800–850 m elevation. This constitutes the first confirmed record of the species from Karnataka, extending its distribution to the central Western Ghats. Identification was based on detailed vegetative and floral morphology, supported by scanning electron microscopic analysis of seed micromorphology, which provided diagnostic characters distinguishing it from other *Zeuxine* species reported from the state. A small population of 24 individuals was observed in a protected forest patch subjected to localized grazing and invasive species pressure, highlighting the need for monitoring and conservation.

Keywords: *Terrestrial orchids; Seed micromorphology; Scanning electron microscopy; Semi-evergreen forests; Floristic survey; Biodiversity assessment.*

Introduction

Orchidaceae is one of the largest families of flowering plants, comprising approximately 26,500 species distributed across about 695 genera worldwide [10]. The family exhibits a cosmopolitan distribution, with the highest diversity concentrated in tropical and subtropical regions. In India, the Orchidaceae family is represented by about 1,256 species under 155 genera, of which nearly 307 species are endemic [14]. The Western Ghats, a globally recognised biodiversity hotspot, support exceptionally high orchid diversity and endemism, with many taxa exhibiting narrow geographic ranges and strong habitat specialisation. Despite sustained botanical exploration, orchid diversity in several protected areas, particularly in the central Western Ghats region, remains inadequately documented. The Western Ghats harbour approximately 375 orchid species, while Karnataka State supports nearly 197 naturally occurring orchid species [11].

The genus *Zeuxine* Lindl. (Orchidaceae: Goodyerinae) comprises about 84 species distributed mainly in tropical and subtropical Asia [10]. Members of this genus are small terrestrial herbs characterised by creeping rhizomes, plicate leaves, and resupinate flowers with a distinct labellum, typically occupying shaded and moist forest understorey habitats. In India, 19 species of *Zeuxine* have been reported [5]. In Karnataka state, *Zeuxine gracilis* (Breda) Blume, *Zeuxine strateumatica* (L.) Schltr and *Zeuxine longilabris* (Lindl.) Trimen were documented [11]. Recent studies from Karnataka have expanded the known distribution of the genus, including records of. and *Z. reflexa* King & Pantl. from Peninsular India [12], additional species from Kali Tiger Reserve [2] and Sharavathi Valley Lion-tailed Macaque Sanctuary [13]. *Zeuxine flava* (Wall. ex Lindl.) Trimen was recorded from Kodagu district [6].

Only *Zeuxine longilabris* (Lindl.) Trimen was recorded before in Udupi and Dakshina Kannada [4]. These findings underscore the need for continued systematic floristic surveys to better understand the diversity and distribution of *Zeuxine* in the Western Ghats.

During a recent floristic survey in Mookambika Wildlife Sanctuary, Udupi District, Karnataka, a population of *Zeuxine* (Lindl.) was observed. The specimens closely matched the diagnostic morphological characters of *Zeuxine affinis* (Lindl.) Benth. ex Hook.f., and a critical review of relevant literature and herbarium records confirmed that *Z. affinis* has not previously been reported from Central Western Ghats region and Karnataka State. Earlier records of the species were restricted to other parts of its known distribution range, and its occurrence in the present study area represents a significant range extension. Documenting such new regional records is essential for refining species distribution patterns, reassessing conservation status, and informing habitat management priorities. This communication therefore reports the first confirmed occurrence of *Zeuxine affinis* from Mookambika Wildlife Sanctuary and provides associated information on its habitat, population size, and potential threats.

Materials and Methods

Field surveys were conducted during the post-monsoon period (October–December 2025) in the Mookambika Wildlife Sanctuary (13°51'29.75"N, 74°48'31.55"E) Udupi District, Karnataka. The region forms part of the Central Western Ghats, with an elevation range of 60-1,343 mASL. The vegetation is predominantly evergreen and semi-evergreen forests with high humidity (Image 1).

Specimens were collected and processed following standard herbarium techniques [8] and were compared with digital herbarium specimens and descriptions from *Flora of the Presidency of Madras* [7] and other regional floras. Identification of species was confirmed using standard floras, published literature, and online databases [5,14,10]. A representative voucher specimen was prepared and deposited in the Herbarium UASB, Mahatma Gandhi Botanical Garden, University of Agricultural Sciences, GKVK Campus, Bengaluru.

For seed micromorphology, mature but unopened capsules were collected from flowering individuals and air-dried at room temperature. Seeds were extracted, mounted on aluminium stubs using double-sided carbon tape, sputter-coated with gold, and examined using a JEOL scanning electron microscope at 20kV. Measurements of seed and Testa cell dimensions followed with comparative data for related *Zeuxine* species drawn from the study [3]. Using calibrated software, the length and width of the seeds were measured from SEM images. The length and width of the Testa cell were also measured. Following previous methods [1], seed volume was determined using the following formula: Seed volume = $2 \times (W/2)^2 \times (L/2)$ where L = seed length and W = seed width.

Taxonomic Treatment

Zeuxine affinis (Lindl.) Benth. ex Hook.f., Fl. Brit. India 6: 101 (1890); *Hetaeria mollis* Lindl. in J. Proc. Linn. Soc., Bot. 1: 184 (1857); *Zeuxine grandis* Seidenf. in Dansk Bot. Ark. 32: 90 (1978); *Zeuxine seidenfadenii* Deva & H. B. Naithani in Orchid Fl. N.W. Himalaya: 95 (1986); *Zeuxine sutepensis* Rolfe ex Downie in Bull. Misc. Inform. Kew 1925: 413 (1925). **Image 2**

Plants 10-15 cm tall, slender. Rhizomes elongate, thin. Stems erect, deep reddish brown to greenish brown, 4-6-leaved. Leaves sub-rosulate, ovate to ovate-lanceolate or elliptic, 2-3 × 1-2 cm; in flowering individuals, leaves are often observed to be withered and pendulous, whereas vegetative individuals bear relatively fresh and turgid leaves. Inflorescence 5-20 cm, with 1 or 2 puberulent sterile bracts, pubescent, pale brown; rachis 3-9 cm, sub-densely several to many flowered; floral bracts ovate-lanceolate, 7-8 mm, pubescent on margin and lower half of abaxial surface, apex long acuminate. Flowers resupinate or occasionally erect, 15-17 mm in size; ovary and pedicel fusiform, 5-6 mm, glabrous to puberulent. Sepals not spreading, dark brownish green at base, white toward apex, pubescent; dorsal sepal broadly ovate, 4-5 × ca. 2.5 mm, concave, 1-veined, apex obtuse or acute; lateral sepals ovate-oblong, slightly oblique, 3.5-4.5 × ca. 2.5 mm, 1-veined, apex obtuse. Petals white, elliptic to obovate, oblique, ca. as long as dorsal sepal, 1.5-2 mm wide, 1-veined, apex obtuse; lip white or pale yellow, Y-shaped, 4.5-6 mm, 3-partite; hypochile concave-saccate, containing 2 subulate, hooked calli; mesochile short, to 1 mm, tapering toward apex, margin involute; epichile dilated, 2-lobed; lobes not diverging widely, obovate-flabellate, widening toward apex, 2-2.5 × 2-2.2 mm. Column 1.5-2 mm; wings triangular; anther ovoid-lanceolate, to 2 mm; rostellum arms oblong. Pollinia 1 mm long, with many pollinia in branches, transparent tegula with obtuse round viscidium. Anther cap 1 mm long, triangular with two sacks, red colour.

Habitat: Terrestrial on moist shaded forest floors, often under tree canopy along stream edges.

Flowering: October - November; **Fruiting:** November

Type specimen: Type: Thailand, Doi Sutep, Chiang Mai, 24 Jan 1909, Kerr 212 (K [K000596045]).

Specimen examined: India, Karnataka, Udipi District, Mookambika Wildlife Sanctuary, Kolluru wildlife range, Near Golihole village, 831 m AMSL, 30.10.2025, Omkar Nargund ON-318 (UASB 5896) (**Image 4**).

Conservation status: The presence of only 24 individuals in a restricted habitat indicates that the population is small and potentially vulnerable. Ongoing threats such as cattle grazing and invasion by *Chromolaena odorata* may adversely affect its survival. Therefore, the species may require periodic monitoring and habitat protection measures.

Distribution in India: Andaman Islands, Arunachal Pradesh, Assam, Bihar, East Himalaya, Kerala (Kollam and Wayanad districts), Meghalaya, Nagaland, Odisha, Sikkim, Tamil Nadu, and Karnataka (present record).

Distribution in World: Bangladesh, China, India, Laos, Malaya, Myanmar, Japan (Nansei-shoto), Nepal, Taiwan, Thailand, Vietnam.

Seed micromorphology

Seeds of *Zeuxine affinis* (**Image 3**) from Mookambika Wildlife Sanctuary are elongate-filiform, gently curved and Seed micromorphological analysis reveals distinct diagnostic features when compared with other congeneric species. The seeds of *Z. affinis* are markedly smaller (0.49×0.05 mm) with a comparatively lower seed volume ($0.306 \text{ mm}^3 \times 10^{-3}$) than those of *Z. gracilis*, *Z. longilabris*, and *Z. reflexa*, which exhibit significantly larger seed dimensions and volumes. Although the L/W ratio of *Z. affinis* (9.8) indicates elongation, it remains lower than that of *Z. gracilis* (16.11) and *Z. reflexa* (13.4), but higher than *Z. strateumatica* (4.4), suggesting intermediate seed elongation within the genus. The Testa cells in *Z. affinis* are smaller (0.023×0.012 mm) and arranged in regular longitudinal rows, contrasting with the larger and more variably arranged Testa cells observed in other species. *Z. strateumatica* shows relatively broader seeds with irregular Testa organization, while *Z. gracilis* and *Z. longilabris* possess more elongated seeds with higher L/W ratios. These differences in seed size, volume, and Testa cell architecture highlight the taxonomic significance of seed micromorphology in distinguishing closely related species of *Zeuxine*. The comparatively smaller seed size and uniform Testa pattern in *Z. affinis* may also reflect adaptations for effective dispersal and ecological specialisation within its restricted habitat.

Seed micromorphological characters of the Mookambika population differ distinctly (**Table 1**) from those of *Z. gracilis*, *Z. longilabris*, *Z. reflexa*, and *Z. strateumatica* reported from Karnataka [3].

Discussion

The discovery of *Zeuxine affinis* in Karnataka marks an important addition to the state's orchid flora. The species, though widespread in Southeast Asia, shows fragmented distribution in Peninsular India. Its presence in Mookambika Wildlife Sanctuary suggests a possible continuous habitat corridor between the southern and central Western Ghats.

Morphologically, the Karnataka specimens closely resemble those from Kerala and Tamil Nadu but show slightly broader leaves and a more compact inflorescence, which may be an adaptation to the moist, shaded evergreen habitats of the Mookambika Wildlife sanctuary. *Zeuxine affinis* exhibits markedly lower seed volume compared to *Z. reflexa*, along with smaller seed dimensions and more uniformly arranged Testa cells, supporting its distinct micromorphological identity.

Further molecular and ecological studies could provide insights into population structure, dispersal, and conservation needs of *Zeuxine affinis* and related taxa. Molecular studies using DNA barcoding and population genetic markers can help assess genetic diversity, gene flow, and population connectivity. Such data are crucial for understanding dispersal mechanisms and for identifying genetically distinct or vulnerable populations, thereby informing conservation strategies.

Table 1: Comparative seed Micromorphometry of selected Zeuxine species (Data for comparative species are compiled from Betageri & Kotresha. (2024))

Character	<i>Z. affinis</i> (Present study)	<i>Z. gracilis</i>	<i>Z. longilabris</i>	<i>Z. reflexa</i>	<i>Z. strateumatica</i>
Seed length (mm)	0.49 ± 0.03	1.16 ± 0.07	1.00 ± 0.09	1.34 ± 0.08	0.40 ± 0.055
Seed width (mm)	0.05 ± 0.01	0.07 ± 0.003	0.09 ± 0.007	0.10 ± 0.002	0.09 ± 0.011
L/W ratio	9.8	16.11	11.11	13.4	4.4
Seed volume (mm ³) mm ³ × 10 ⁻³	0.306	1.57	2.12	3.5	1.05
Testa cell length (mm)	0.023 ± 0.003	0.055 ± 0.004	0.035 ± 0.002	0.04 ± 0.014	0.08 ± 0.016
Testa cell width (mm)	0.012 ± 0.002	0.014 ± 0.003	0.017 ± 0.001	0.02 ± 0.012	0.02 ± 0.003
Testa L/W ratio	1.91	3.57	2.5	2.0	4.0
Testa cell arrangement	Regular, longitudinal rows	Elongate, longitudinal	Elongate, longitudinal	Moderately regular	Irregular to less organized
Seed shape	Filiform	Elongate	Elongate	Elongate	Short, broader

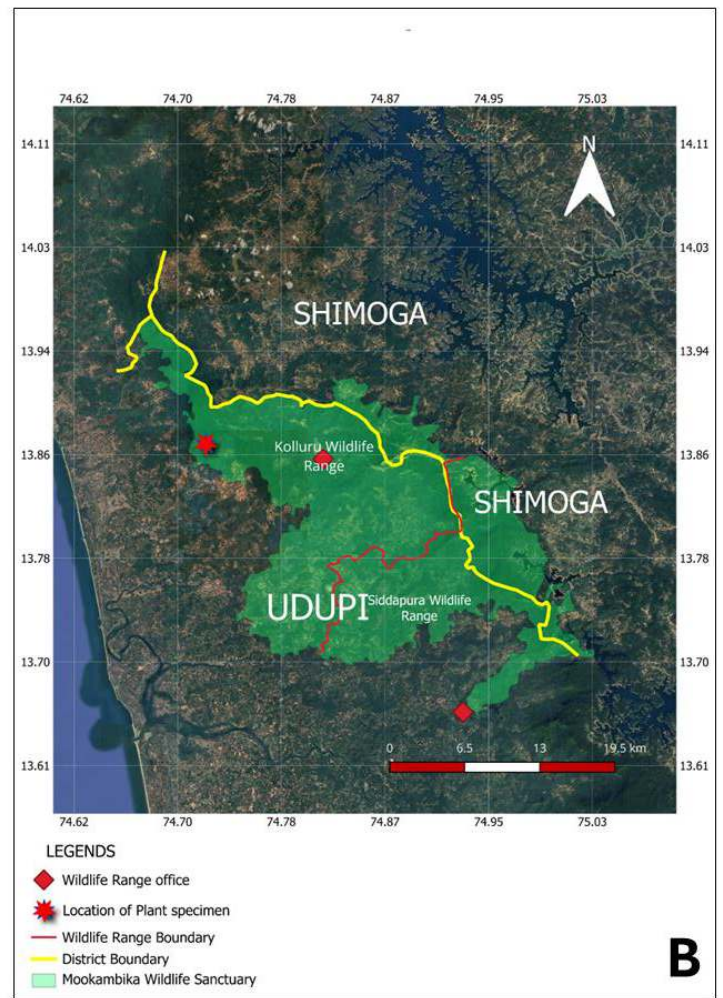
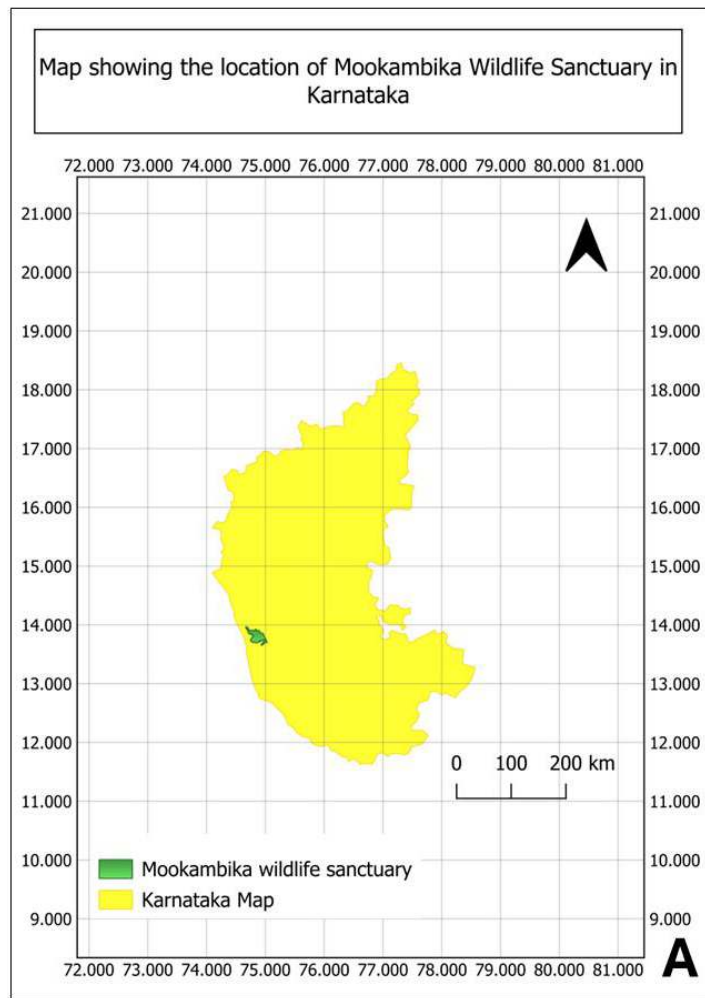


Image 01: A. Map showing the location of Mookambika wildlife sanctuary in Karnataka state B. Map showing new record locality. (Mookambika WLS, Karnataka)

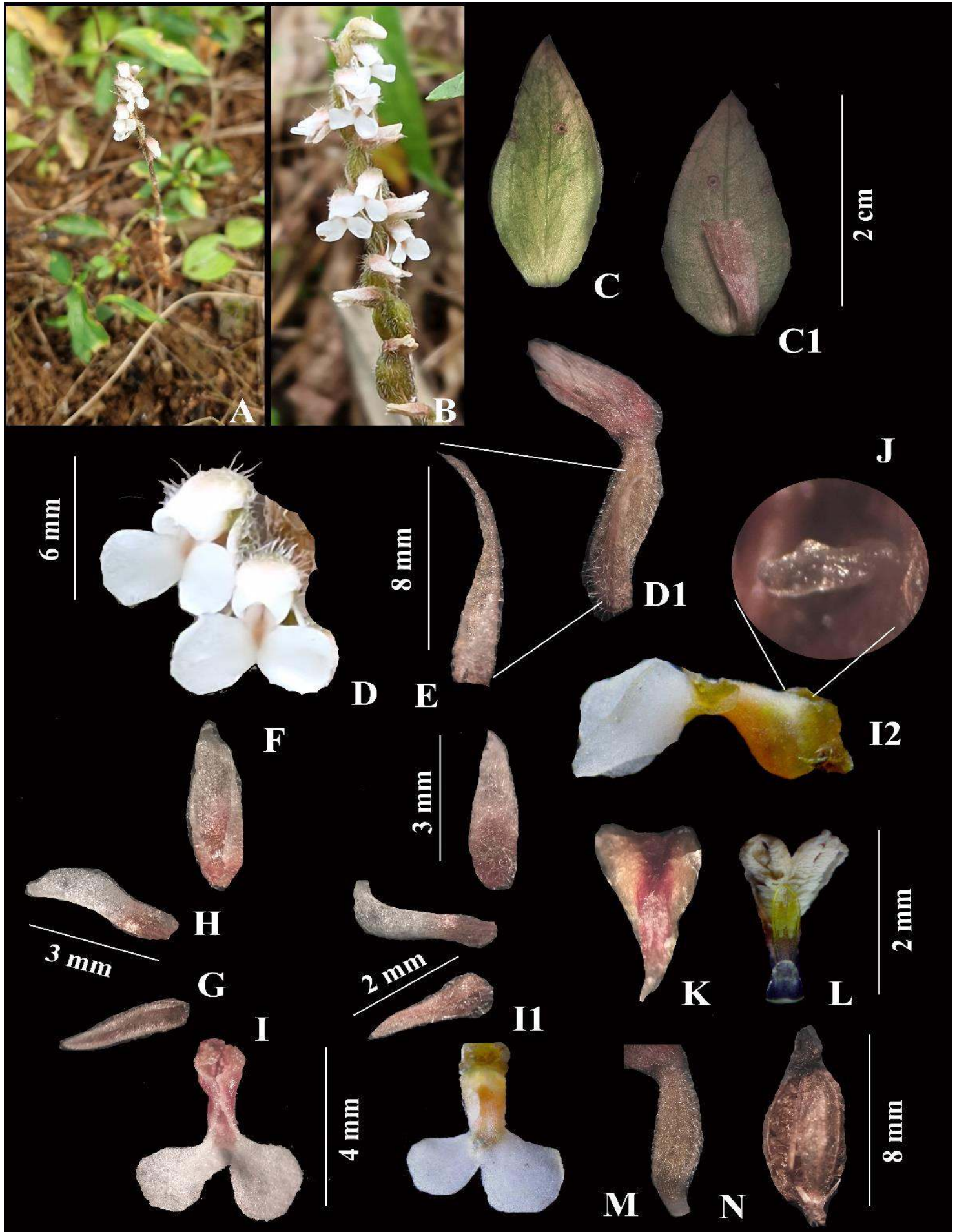


Image 2: *Zeuxine affinis* – Morphological characters : A. Habit; B. Inflorescence; C. & C1. Dorsal and ventral leaf; D. & D1. Front and side view of flower; E. Bract; F. Dorsal sepal; G. Lateral sepal; H. Petal; I., I1. & I3. Labellum dorsal and ventral with side views; J. Gland from the labellum; K. Anther cap; L. Pollinarium; M. Ovary; N. Mature capsule. (© Omkar Nargund)

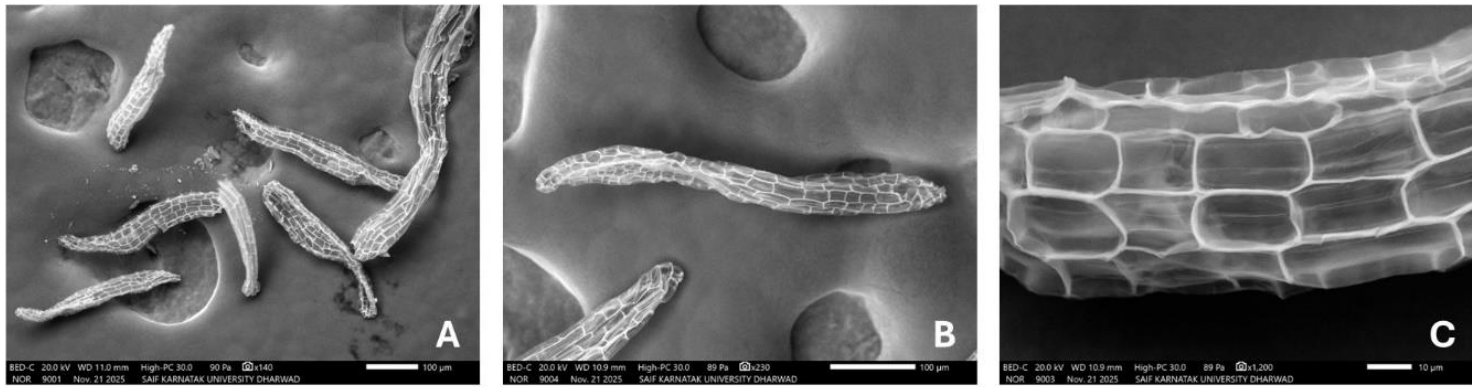


Image 3: Seed morphometric images of *Zeuxine affinis*: A. Clump of seeds; B. Single seed enlarged; C. Enlarged Testa cell.

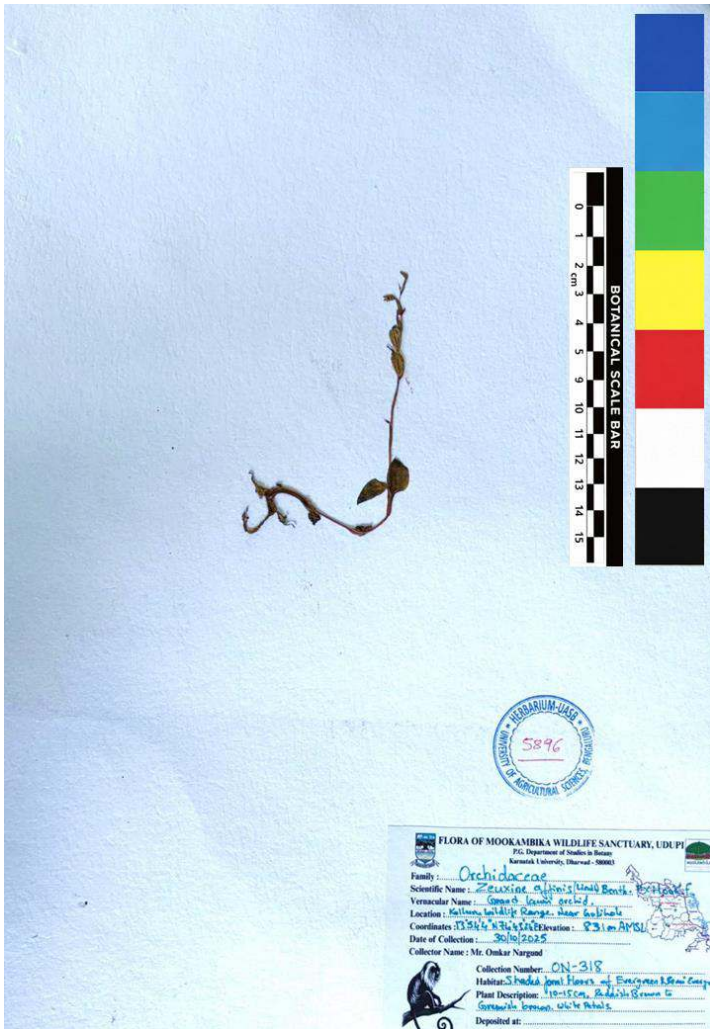


Image 4: Herbarium submitted to Herbarium UASB, GVKV Bengaluru

Conclusion

The present study reports *Zeuxine affinis* (Lindl.) Benth. ex Hook.f as a new state record for Karnataka, thereby extending its known distribution to the central Western Ghats. The identification is supported by detailed morphological characters and seed micromorphological evidence obtained through scanning electron microscopy. The occurrence of a small and localised population (24 individuals) within a restricted habitat highlights its potential vulnerability and the need for periodic monitoring. This finding emphasises the importance of continued floristic exploration in the Western Ghats, which continues to reveal undocumented orchid diversity. Further studies integrating ecological and molecular approaches may provide deeper insights into the species population dynamics, dispersal, and conservation status.

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