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Species

To Cite:
Mathew MJ, Mathew J, Pichan SM, Szlachetko DL. Reinstatement of the genus *Xenikophyton* Garay (Orchidaceae - Aeridinae), endemic to Peninsular India. *Species* 2026; 27: e12s3273
doi:

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Peer-Review History
Received: 18 December 2025
Reviewed & Revised: 06/January/2026 to 23/April/2026
Accepted: 09 May 2026
Published: 18 May 2026

Peer-Review Model
External peer-review was done through double-blind method.

Species
pISSN 2319–5746; eISSN 2319–5754

DISCOVERY SCIENTIFIC SOCIETY

Reinstatement of the genus *Xenikophyton* Garay (Orchidaceae - Aeridinae), endemic to Peninsular India

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ABSTRACT

In 1974, Leslie Andrew Garay introduced the peninsular Indian genus *Xenikophyton* (Orchidaceae - Aeridinae) by placing *X. smeeanum* (Rchb.f.) Garay, based on the material in K, *A.M. Smee* s.n. (basionym: *Saccolabium smeeanum* Rchb.f.). The second element of the genus, *X. seidenfadenianum* M. Kumar, S. Seq. & J. Wood was published in 2002. In 2014, Jalal et al., subsumed the genus into *Schoenorchis* Reinw. ex Blume. But, considering the detailed morphological studies, revision of type material, herbarium specimens, along with genetic analyses, has revealed that *Xenikophyton* is morphologically and genetically distinct from *Schoenorchis*. Phylogenetic analyses strongly support that *Xenikophyton* is monophyletic, sister to *Seidenfadenia mitrata* and not to *Schoenorchis*. In this paper, we reinstate the genus *Xenikophyton*, with a comprehensive taxonomic discussion to substantiate it, along with the proposal to reject the misapplied name *Schoenorchis smeeana* (Rchb. f.) Jalal, Jayanthi & Schuit.

Keywords: *Schoenorchis*, South Western Ghats, Taxonomy, *Xenikophyton*

1. INTRODUCTION

The South Indian endemic orchid genus *Xenikophyton* proposed by L.A. Garay (1974). The generic name is derived from the Greek words *Xenikos* - strange, and *phyton* - plant, referring to the strange admixture of characters of the genus *Cleisomeria* Lindl. ex G.Don and *Sarcophyton* Garay. Garay (1974) pointed out that, "Vegetatively the plants of this genus resemble those of the genus *Cleisomeria*, but the pollinia are very different. It is perhaps closest to the genus *Sarcophyton*, but the lack of a backwall callus immediately separates the two. The erect large, and prominently bifurcate rostellum and the vertical stigma, resembling the structure found in *Eparmatostigma*, easily identify this genus."

The only species of the genus at the time, *Xenikophyton smeeanum*, was based on Reichenbach's *Saccolabium smeeanum* Rchb.f., described based on *A.M. Smee* s.n. collection stored now at K. This collection's precise origin is unknown. Unaware of Reichenbach's publication, Fischer (1927) reported Barber's 6093 collection (K) from Cardamonai in Mysore as a new species of *Rhynchostylis* and proposed the name *R.*

latifolia C.E.C.Fisch. Saldanha (1973) later transferred it to *Schoenorchis* as *S. latifolia* (C.E.C.Fisch.) C.J.Saldanha. However, all these names were summoned under the combination, *X. smeeanum* (Rchb.f.) Garay. Later, in 2002, the second species in the genus *X. seidenfadenianum* M.Kumar, S.Seq. & J.J.Wood was introduced based on the specimen, *Stephen 0020621* (holotype KFRI; isotype K). The main differences between them are: Inflorescence simple (vs. branched in *X. smeeanum*), leaves greenish beneath (vs. purple beneath), flowers greenish-white with a brownish tinge (vs. white with a violet tinge).

Jalal et al., (2014) reduced *X. seidenfadenianum* as a synonym of *X. smeeanum* (Rchb.f.) Garay and incorporated both into the genus *Schoenorchis* Reinw. ex Blume by creating a new combination, *Schoenorchis smeeana* (Rchb. f.) Jalal, Jayanthi & Schuit. And, it has been followed in the subsequent checklists (GBIF 2025; POWO 2025 and online database such as https://www.eflorakerala.com/; https://efloraofindia.com/ etc.). To validate the proposal, Jalal et al., (2014) state that "A detailed comparison of the protologues of these species (*X. smeeanum* & *X. seidenfadenianum*), most of the type material and a study of our fresh specimens showed that the characters by which they were distinguished integrate to such an extent that we consider the two to be conspecific". Even if it is acceptable, the dissolving of the genus status of *Xenikophyton* is not justifiable.

The descriptions of *Xenikophyton* species contain limited morphological details, especially regarding the reproductive parts, which are crucial in understanding species and generic boundaries within the tribe Vandeae and subtribe Aeridinae. Also, delimitations of the genus within Aeridinae are presently based on overlapping characters. For example, pollinium character is considered as a key factor for the classification of Aeridinae (Seidenfaden 1988, Senghas 1988-1990). Five series were proposed in the system of classification viz., Series 1 (Pollinia 2, solid); Series II (Pollinia 2, porate); Series III (Pollinia 2, cleft); Series IV (Pollinia 4, unequal) and Series V ((Pollinia 4, equal). In this classification, *Schoenorchis* comes under Series IV (with unequal 4 pollinia) and *Xenikophyton* is placed under Series V (with equal 4 pollinia). At the same time, Jalal et al., (2014) reduced *Xenikophyton* to *Schoenorchis* based only on the number of pollinia (4). Beyond the number 4, it was not observed whether they were of equal size, appeared in pairs or differed in other characteristics such as presence of column foot, and the papillose labellum etc.

If another criterion is considered, genus *Xenikophyton* was usually treated separately from other genera of Vandeae by all subsequent researchers who classified it in the subtribe Aerangidinae (Dressler 1981, Dressler 1993, Senghas 1996). Szlachetko (1995) proposed a completely new system of classification for monopodial orchids from the tribe Vandeae. He added *Xenikophyton* and *Schoenorchis* in the newly established subtribe Deceptorinae Szlach, along with genera such as *Abdominea* J.J. Sm., *Deceptor* Seidenf., *Lesliea* Seidenf. and *Seidenfadeniella* C.S. Kumar. The subtribe embraced usually small plants with small flowers, with relatively large, erect to subincumbent rostellum, which is deeply furcate after removing pollinarium, with tegula usually shorter than viscidium, usually U- or S-curved in natural position (Szlachetko 2003).

Here, we use a combination of morphological and genetic analyses of live and herbarium material to conclude that *Xenikophyton* should not be included in *Schoenorchis.* We also attempt to determine that *Xenikophyton* species that were previously included in *Schoenorchis* (*S. smeeana*) should be recognized as a separate taxon under *Xenikophyton*, specifically *X. smeeanum*. Besides, an updated description of *Xenikophyton,* along with details about its ecology, distribution, and molecular affinities are presented.

2. MATERIALS AND METHODS

Botanical explorations in the Tamil Nadu forests of southern India during 2015–2020 have yielded some specimens of the genus *Xenikophyton,* that have been transferred to *Schoenorchis* (*S. smeeana*). In addition to that, four *Schoenorchis* species (Fig. 3 A - I) and morphologically allied taxa, viz. *Seidenfadenia mitrata* (Fig. 3 J - K), *Vanda lamellata, V. coerulea, Aerides rosea, Christensonia vietnamica* (Syn. *Vanda vietnamica*), and *Holcoglossum rupestre* were examined for comparative studies. Critical analysis of the literature (Reichenbach 1887, Christenson 1986, Fischer 1927, Saldanha 1973, Garay 1974, Karthikeyan et al., 1989, Kumar et al., 2002, Pridgeon et al., 2014, POWO, 2025), as well as from the scrutiny of vouchers deposited in K, NY, PE, MH, CAL, W, KFRI, TBGT, and KUBH has been conducted. Online databases were also consulted in Tropicos.org (https://tropicos.org), JSTOR Global Plant database (https://plants.jstor.org/), and GBIF (https://www.gbif.org/).

Standardized protocols in the molecular studies were employed. Genomic DNA extracted from silica-dried leaf material using a rapid extraction protocol of Kasajima et al., (2004). The plastid *maturase K* (*matK*) gene was amplified. PCR products were purified and sequenced bidirectionally using Sanger sequencing. Comparative sequences of relative taxa were retrieved from GenBank (https://www.ncbi.nlm.nih.gov/genbank/) to construct a broader phylogenetic framework. Sequence alignments, trimming, concatenation and phylogenetic analyses were performed, and the sequence quality has checked using Sequence Scanner Software v1 (Applied Biosystems). The alignment of sequences and the necessary editing of the acquired sequences were performed utilizing

Geneious Pro v5.1 (Drummond et al., 2010). Phylogenetic tree is reconstructed using Bayesian Inference (BI) and Maximum Likelihood (ML). The best substitution model has estimated with MEGA 11.0.13 (Tamura et al., 2021).

3. RESULT AND DISCUSSION

Within the context of the reduction of *Xenikophyton* to *Schoenorchis*, Jalal et al., (2014) has enlisted the similarities in between them as: "Very small flowers in racemes or panicles, largely opening simultaneously — spurred, three lobed, immobile lip, longer than the sepals — spur basal, without internal callosities — callus present at base of mid-lobe near mouth of spur and also on abaxial side of midlobe (these callosities not always present in Schoenorchis) — column very short, without foot — rostellum large, erect, subentire to bidentate or bifurcate — viscidium large — anther cap with reflexed apex — pollinia 4".

And in the case of dissimilarities, they were considered two factors; "*Xenikophyton* differs from *Schoenorchis* in the thicker, hairy-papillose roots and in the four pollinia being presented as four equal, separate bodies, while in *Schoenorchis* the four pollinia are held tight together in two pairs, so that they superficially appear as two bodies"., "Apart from the roots, there are no vegetative characters that set *Xenikophyton* apart from *Schoenorchis*".

But they did not discuss the key factors that differentiate *Xenikophyton* from *Schoenorchis,* such as sepal-petal size, papillose nature of labellum, spur, and rostellum characters, etc. While the variations in the root characters still exist, the pollinium nature is presented in a very simplified manner. And above all, the plant [*J. Jayanthi 195943* (BSI!) see Fig. 1 & 2 (Jalal et al., 2014)] used in the article (as mentioned *Schoenorchis smeeana*) for the reduction of *Xenikophyton* to *Schoenorchis* is neither *X. seidenfadenianum* nor *X. smeeanum* (Fig. 1).

As a result of the present study on *Xenikophyton*, when compared to *Schoenorchis* the following characters were identified as diagnostic: (1) roots papillose (vs. roots glabrous in *Schoenorchis*); (2) sepals and petals similar (vs. petals smaller than sepals); (3) papillose labellum (vs. glabrous labellum); (4) column foot prominent, slightly shorter than column part (vs column foot inconspicuous or absent); (5) pollinia equal, free, distinctly attenuate basally, with a shallow groove here (vs. pollinia in two unequal pairs, rounded basally and apically, flat on the inner surface and convex on the outer ones).

The phylogenetic tree and affinities

Phylogenetic trees inferred from the *matK* datasets separately showed (Fig. 4) that the *Xenikophyton smeeanum* positioned within the *Seidenfadenia* clade (monotypic epiphytic orchid native to Southeast Asia, specifically found in Thailand and Myanmar). Specifically, it clusters tightly with *S. mitrata*, supported by very high bootstrap values (>95). Their close clustering and short branch length indicate a recent common ancestry, which is consistent with placement within the same clade.

The genus *Schoenorchis* is recovered as a distinct, well-supported clade, separate from *Seidenfadenia*. *Xenikophyton* did not group with *Schoenorchis*, and the branch lengths between the two lineages were considerably larger than between Xenikophyton and *Seidenfadenia*. It demonstrates that the *Xenikophyton* shares only a distant relationship with *Schoenorchis*, at the subtribal (Aeridinae) level, but no close genetic affinity. In other words, while both genera belong to the same subtribe, the unknown sample is evolutionarily closer to *Seidenfadenia* than to *Schoenorchis.* Other genera present in the tree (*Aerides, Holcoglossum, Vanda,* and *Christensonia*) each formed their own distinct and well-supported clades, clearly separated from the *Seidenfadenia* cluster.

Note: The phylogenetic analysis clearly shows that the unknown orchid sample is most closely related to *Seidenfadenia mitrata*. However, *Xenikophyton* mainly differs from *Seidenfadenia* by its dorsiventrally flattened coriaceous leaves with unequally bilobed at apex (vs. pendent, semi-terete in *Seidenfadenia*), pollinia 4 (vs. pollinia 2), and a short, stout column (vs. a long, fleshy column in *Seidenfadenia*).

4. TAXONOMY

Xenikophyton smeeanum (Rchb. f.) Garay (1974: 375)

Basionym: *Saccolabium smeeanum* Rchb. f., Gard. Chron. 2: 214 (Reichenbach 1887). Type: *A.H.Smee s.n*. (holotype W; isotype K!).

= *Rhynchostylis latifolia* C. E. C. Fisch. (Fischer 1927: 358 & 1928: 1440); Type: India, Karnataka, Hassan Distr., Kadumane (Cadamanay), *C.A.Barber 6093* (holotype K!). ≡*Schoenorchis latifolia* (C. E. C. Fisch.) C. J. Saldanha (1973: 415; 1976: 847).

= *Xenikophyton seidenfadenianum* M. Kumar, Sequiera & J.J. Wood (2002: 227). Type: India, Kerala, Palghat Dist., *Stephen 0020621* (holotype KFRI).

Fig. 1. Genus *Xenikophyton* (previous classification) — A– B: *X. smeeanum*. — C –D: *X. seidenfadenianum*. (Photograph by Mathew J.M.).

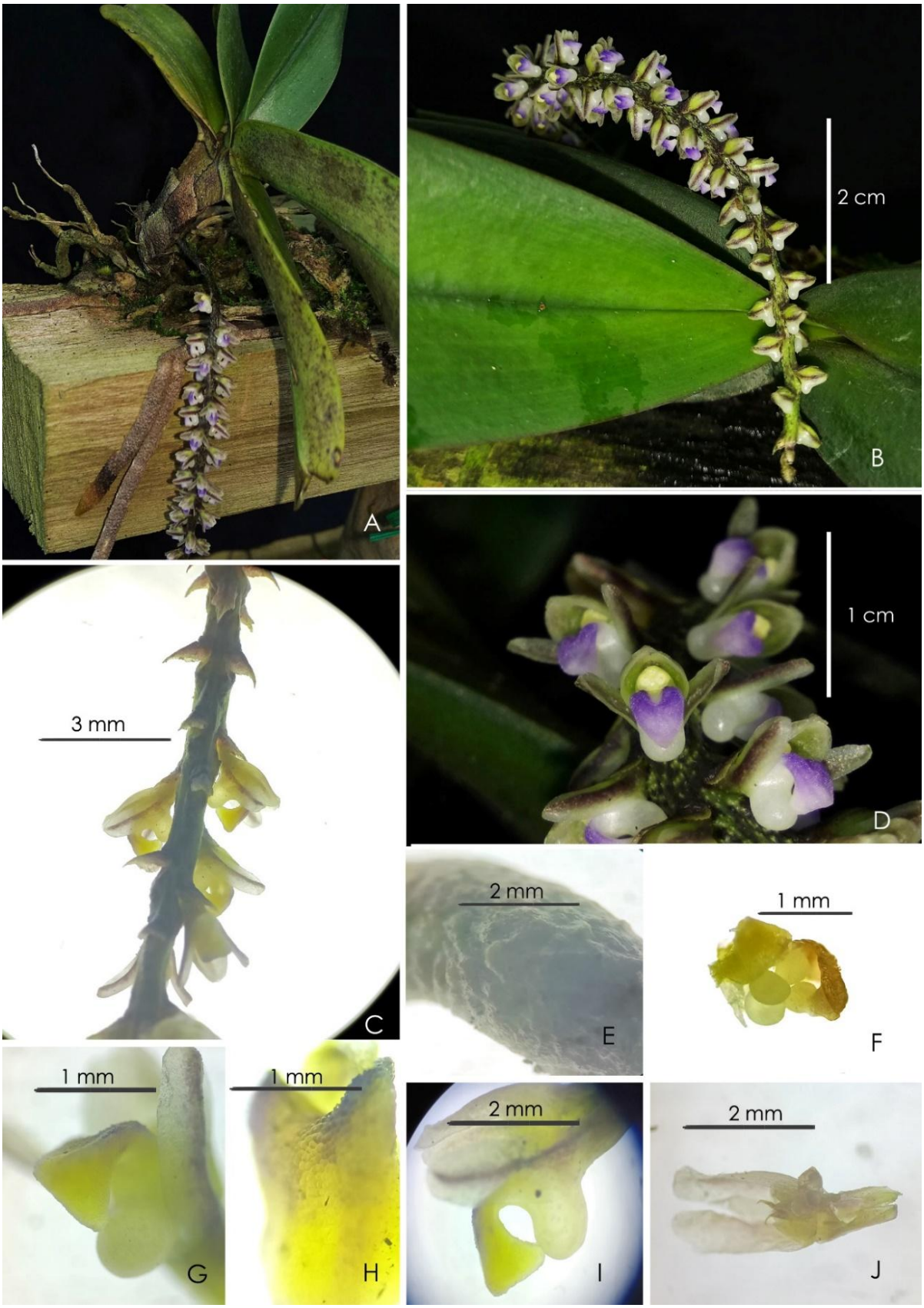

Fig. 2. *Xenikophyton smeeanum*. — A– B: Flowering plant. — C: Closeup of inflorescence. — D: Flowers in closeup. – E: Papillose root. — F: Pollinium. — G: Abaxial side of flower. — H: Papillose labellum. — I: Spur and mid lobe of the labellum. — J: Prominent bi-dentate rostellum (Photograph by J. Mathew).

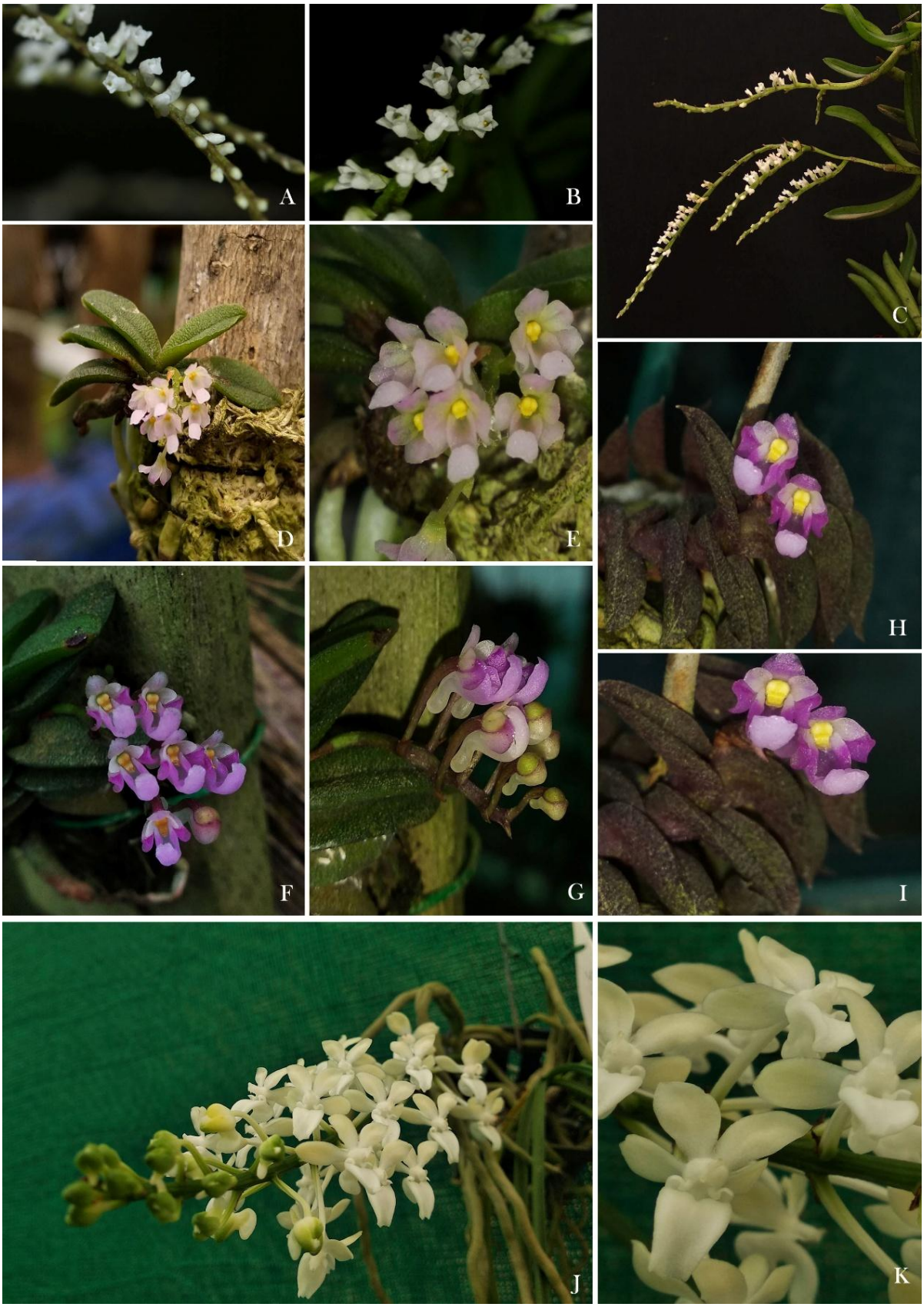

Fig. 3. Morphologically similar taxa to *Xenikophyton*. A– C: *Schoenorchis nivea* (Lindl.) Schltr. — D–E: *Schoenorchis tixieri* (Guillaumin) Seidenf.. — F– G: *Schoenorchis fragrans* (C.S.P.Parish & Rchb.f.) Seidenf. & Smitinand — H–I: *Schoenorchis scolopendria* Aver. J– K: *Seidenfadenia mitrata* (Rchb.f.) Garay (Photograph by Mathew J. M.).

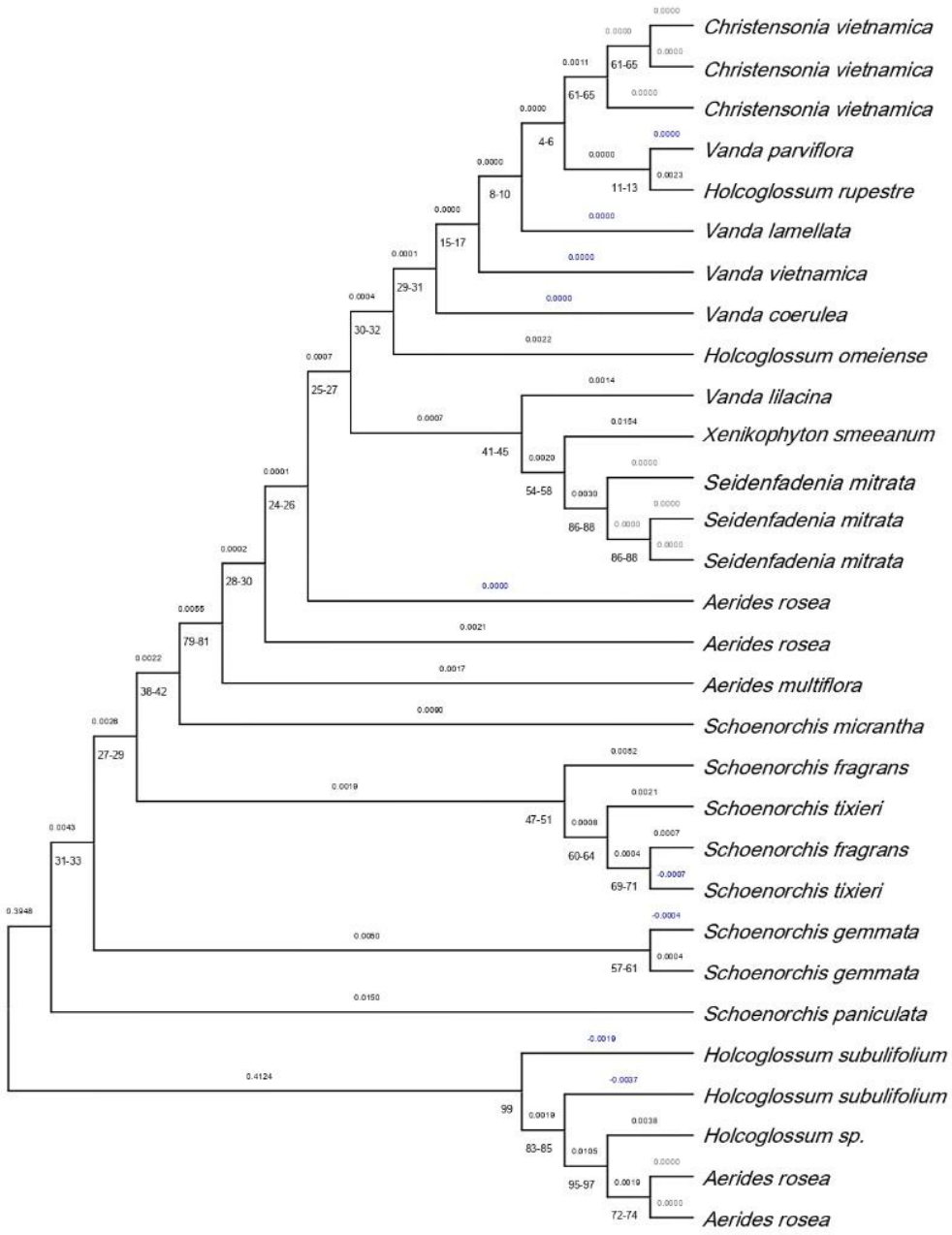

Fig. 4. Phylogenetic trees of concatenated marker *matK,* including the position of *Xenikophyton* with its relationships.

Epiphytic herb. Stems up to 30 cm long, Roots 2 – 4 mm diam., densely villose-papillose. Stems stout, almost woody, covered in old leaf sheaths. Leaves coriaceous, linear-oblong, 10 – 14.5 × 2 – 2.5 cm, unequally bilobed at apex with rounded lobes, obliquely articulate at base, channeled, dark green; leaf sheaths dull purple when older, overlapping, finely transversely wrinkled. Inflorescence arising from the leaf axil, simple or branched, patent to pendent, racemose, 6 – 13 cm long; peduncle-scales one or two, ovate-lanceolate, c. 5 × 3 mm, acuminate, floral bracts 1.75 x 1.4 mm, cymbiform, ovate, acuminate, gland-dotted. Pedicel with ovary c. 1.8 mm long. Flowers small, 4 - 4.2 x 2.9 - 3.1 mm, greenish-white with yellow tinge, sepals streaked with brown, spur pale greenish with a violet spot in the throat. Sepals and petals gland- dotted, subequal, free, 1-nerved. Dorsal sepal 2.4 - 2.7 x 1.2 - 1.3 mm, oblong-obovate, truncate. Lateral sepals 2.4 - 2.7 x 1 - 1.1 mm, ovate-oblong, slightly falcate, obtuse, strongly keeled on reverse. Petals 2.4 - 2.7 x 1.7 - 1.8 mm, obovate, obtuse. Lip sessile, spurred, fleshy, 3-lobed, channeled in throat; side lobes spongy, granulate; mid-lobe scrotiform, papillose, fleshy;

spur large, 1.5 x 1.2 mm, rounded, 3-nerved. Column short, somewhat rounded; column foot prominent, slightly shorter than column part; stigma erect; rostellum prominent, pointed, erect, bidentate; stigma somewhat prominent, erect; anther-cap terminal, 1 x 1 mm, orbicular, with a reflexed tip above, shallowly grooved; viscidium oblong; stipes slender, ribbon-like; pollinia 4, free, pale yellow, subglobose, c. 0.7 × 0.5 mm; stipe c. 1.7 mm long, slender. Figs. 1 & 2.

Distribution: India, Endemic to Western Ghats (Karnataka, Kerala and Tamil Nadu)

Habitat: On the main trunks of trees in moist deciduous and evergreen forests from 500 – 1800 m elevation.

Flowering and fruiting: September - June.

Etymology: The specific epithet '*smeeanum*' is named after A.H. Smee, an English surgeon who collected the material first.

Specimens Examined: INDIA. A. H. Smee s.n. (K!, type of *Saccolabium smeeanum*); **Karnataka State**, Hassan District: Kadumane (Cadamanay),10 Sept. 1903, C. A. Barber 6093 (K!, type of *Rhynchostylis latifolia*); near Madikeri (Mercara), 20 June 1935, E. Barnes 1218 (K!); Moskal, Biligiriranga Hills, Sept. – Oct. 1939, E. Barnes 2206 & 2207 (K!); Munjerabad, Nov. 1908, A. Meebold s.n. (K!); **Kerala State**, Palghat District: Silent Valley National Park, Aruvanpara Northern slope, elevation 1025 m, 17 Nov. 1994, *Stephen 020621* (KFRI!); **Tamil Nadu State**: Anamalai Hills, Topslip, elevation 1932 m, 11 May 2016 *J.Mathew 1168* (SDCH!- Herbarium of SD College Alappuzha, Kerala).

5. CONCLUSION

Morpho-taxonomical studies have been carried out on the Peninsular Indian orchid genus *Xenikophyton*. In the interim, they were reduced as the synonym of *Schoenorchis* Reinw. ex Blume. Through the integration of various methods, such as morphological and phylogenetic analyses along with field studies, we suggest that *Xenikophyton* ought to be recognized as a separate taxon from *Schoenorchis*.

Acknowledgement

The authors are grateful to the Kerala and Tamil Nadu Forest and Wildlife Departments for granting permission to conduct field studies. JM sincerely acknowledges the Head of the Department of Botany, the Principal, and the Management of Sanatana Dharma College, Alappuzha, Kerala, for their continuous support and encouragement; DBT Star College Scheme (Urban Category) under head no HRD -11011/8/2024-HRD –DBT dated 10/7/2024 for facilities; Kerala State Biodiversity Board (head no. 3435-03-101-99(P)-2) for financial assistance. The Third author is thankful to the officials of MS Swaminathan Research Foundation viz., Chairperson (Dr. Soumya Swaminathan); Executive Directors (Mr. Srinivas Raman and Dr. Rengalakshmi R.); Director (Dr. Niraj U. Joshi); Nandakumar P.M. (Conservator- Biodiversity); C.S. Dhanya (Scientist) and the colleagues at the MSSRF Community Agrobiodiversity Centre, Puthurvayal, Kalpetta, Kerala.

Author contributions

Research concept and design: Mathew JM.
Acquisition of data, data analysis, interpretation and drafting the article: J Mathew
Field study and data analysis: Salim PM.
Assembly of data and critical revision: DL Szlachetko

Funding

This research was financially supported by Kerala State Biodiversity Board (head no. 3435-03-101-99(P)-2).

Conflict of Interest

The authors declare that they have no conflicts of interest, competing financial interest or personal relationship that could have influenced the work reported in this paper.

Informed consent

Not applicable.

Ethical approval & declaration

In this article, as per the plant regulations followed in the Department of Botany, Sanatana Dharma College, Alappuzha 688003, Kerala, India; the authors observed that the reinstatement of the genus *Xenikophyton* Garay (Orchidaceae - Aeridinae), endemic to Peninsular India. The ethical guidelines for plants & plant materials are followed in the study for species observation, identification & experimentation.

Data and materials availability

All data associated with this study will be available based on the reasonable request to corresponding author.

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