KEW BULLETIN
DOI 10.1007/S12225-025-10280-1

ISSN 1874-933X (print)
ISSN 0075-5974 (electronic)

Rediscovery of the endemic *Vanda thwaitesii* (Orchidaceae) after 160 years in the central highlands of Sri Lanka and its lectotypification

Bhathiya Gopallawa[1], Indrakheela Madola[2], Deepthi Yakandawala[3], Himesh Jayasinghe[4] & Subhani Ranasinghe[5]

Summary. *Vanda thwaitesii*, an endemic species to Sri Lanka was rediscovered nearly 160 years after its presumed extinction from the Rangala area of the Knuckles Mountain range, marking the first sighting since its initial record in 1861. The occurrence of this species in India was reported in 1998, however, later it was identified as a different species, *Vanda sathishii*. Rediscovery of *V. thwaitesii* was a part of a project 'National Botanical Survey' conducted by Department of National Botanic Gardens, Sri Lanka. A lectotypification, a detailed taxonomic description and a detailed illustration are provided. Based on the IUCN Red List categories and criteria, *V. thwaitesii* is assessed as Critically Endangered.

Key Words. Biodiversity Conservation, Critically Endangered, Knuckles Mountain, *Vanda sathishii*.

Introduction

The genus *Vanda* Jones ex R.Br. (Brown 1820: 506) comprises 75–85 species and is primarily found in South-East Asia, ranging from subtropical and tropical Asia to Australia (Gardiner *et al.* 2013; Zou *et al.* 2016; POWO 2023). Members of the genus are mostly epiphytic or occasionally lithophytic herbs, growing from small to large-sized plants that produce a variety of bright to pale-coloured flowers that are occasionally fragrant (Gardiner *et al.* 2013). The genus *Vanda* is regarded as one of the five most significant orchid genera in the horticultural industry because of the wide range of floral colours and morphological variations it exhibits in its flowers, particularly in the labellum (Motes 1997). In addition to its horticultural importance, the genus is also valued for its medicinal properties in the traditional pharmaceutical industry (Khan *et al.* 2019).

In Sri Lanka, the genus *Vanda* is represented by four species; *V. tessellata* (Roxb.) Lodd. ex G.Don (1830: 372), *V. testacea* Rchb.f. (Reichenbach 1877: 166) *V. thwaitesii* Hook.f. (Hooker 1898: 193) and *V. wightii* Rchb.f. (Reichenbach 1864: 932) (Jayaweera 1981; The National Red List 2020).

Vanda thwaitesii was first described by J. D. Hooker in part iv of Trimen's *A handbook to the flora of Ceylon* in 1898, produced from a manuscript by Henry Trimen, completed after his demise in 1896 (Stafleu & Cowan 1986). The species was published based on two drawings made by Haramanis de Alwis from specimens gathered under number C.P. 3378. The drawings were deposited at National Herbarium Peradeniya (PDA; herbarium codes follow Thiers 2025, continuously updated) but it appears that no herbarium specimens were made. The species represented by these two drawings was doubtfully included under *Aerides tessellata* (Roxb.) Wight ex Lindl. (Lindley 1833: 240) by G. H. K. Thwaites (1861). The description provided by Thwaites was based on the two drawings, as no specimens were available, and Thwaites had not observed the species himself. Information on the species' distribution was based on an annotation on the drawing by de Alwis. Jayaweera (1981) considered *V. thawaitesii* probably extinct, as no collections had been made since the original drawings. Fernando & Ormerod (2008), in their annotated checklist of orchids of Sri Lanka, included *V. thwaitesii* with a note stating that the 'type locality of this species still has a significant amount of forest cover and habitats that are suitable for Vandaceous plants and therefore the existence of the plant is possible'. In 2014, a news item was published in a local newspaper that a researcher and environmentalist, Ajantha Palihawadana, had rediscovered *V. thwaitesii* in 2011 from a number of huge trees that had been cut down and transported for firewood. The plants were

Accepted for publication 14 April 2025.

[1] Postgraduate Institute of Science, University of Peradeniya, Peradeniya 24000, Sri Lanka. e-mail: bgopallawa@gmail.com
[2] Department of Horticulture & Landscape Gardening, Faculty of Agriculture & Plantation Management, Wayamba University of Sri Lanka, Kuliyapitiya 60200, Sri Lanka
[3] Department of Botany, University of Peradeniya, Peradeniya 24000, Sri Lanka
[4] National Institute of Fundamental Studies, Hantane Road, Kandy 20000, Sri Lanka
[5] National Herbarium, Department of National Botanic Gardens, Peradeniya 24000, Sri Lanka

then grown in his personal collection, and when they flowered in 2014, he confirmed their identity as *V. thwaitesii* (Hettiarachchi 2014). Based on our understanding from the article's image, the plant discovered in 2014 is unlikely to be *V. thwaitesii*. It appears to be more similar to *V. testacea* or possibly a hybrid. As there is no useful published information apart from the newspaper article, and no specimen has been deposited, this identification remains uncertain. For these reasons, *V. thwaitesii* was categorised as a Critically Endangered possibly Extinct species (The National Red List 2020).

Kumar & Kumar (1998) reported the occurrence of *Vanda thwaitesii* from India, from a specimen collected in 1982 at Silent valley. They recognised several other specimens from various localities in Kerala, which were previously identified as *V. tessellata*, as representing this species. However, Motes (2021) identified these Indian specimens as an undescribed species, named by him *V. sathishii* Motes, and he considered *V. thwaitesii* to be an endemic species to Sri Lanka. Unfortunately, the initial publication by Motes (2021) was invalid due to the omission of the herbarium where the holotype was deposited. Motes validated the description in the following year (Motes 2022: 20).

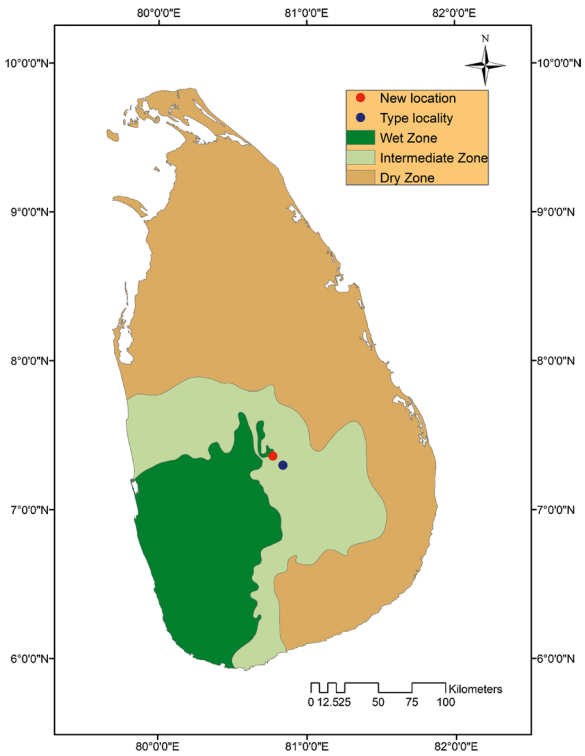
In October 2020, the first author received a photograph of a *Vanda* species from Pradeep Kodithuwakku, a nature enthusiast from Rangala in the Knuckles Mountain Range, Sri Lanka, consistent with the distribution area of *V. thwaitesii* recorded by H. de Alwis.

Based on these photographs, taken in his home garden, we tentatively identified the plant as the elusive *Vanda thwaitesii*. Later, a detailed field examination confirmed this identification. Here, we also designate a lectotype.

Material and Methods

The 1st and 4th author visited the location in Rangala, Knuckles Mountain Range (Map 1) and collected two plants from the field and raised them in the live collection of Royal Botanic Gardens (RBG) Peradeniya, Sri Lanka. The authors were able to locate two more populations consisting of 2–5 individuals on a *Mangifera zeylanica* (Blume) Hook.f. (Hooker 1879: 16) tree (vernacular name:අඹ ['Atamba']) and on a *Mesua ferrea* L. (Linnaeus 1753: 515) tree (vernacular name:නා ['Na']) respectively. In April 2021, one of the plants flowered for the first time. Since the specimen had only three flowers, one flower was dissected and used for obtaining measurements and photographs, and the dissected parts were preserved in FAA solution (Formaldehyde, Glacial Acetic Acid, 95% Ethanol and distilled Water (5:5:50:40)) as a spirit collection, which also included a part of a leaf. Macroscopic parts were observed under a dissecting microscope and a stereomicroscope (LEICA L2). All character measurements were obtained using a ruler (smallest measurement 1 mm) or an eyepiece graticule (smallest measurement 0.1 mm) where applicable. A Canon EOS 7D Mark II and Canon EOS 6D Mark 1 camera bodies fitted with Canon 100 mm macro and 50 mm lenses were used for obtaining digital photographs for the colour plates. It became clear after careful examination and comparison with the two illustrations in the National Herbarium (Figs 1 & 2) and descriptions (Jayaweera 1981) that the gathered specimens were undoubtedly *Vanda thwaitesii*, which had not been found for more than 160 years. The other two flowers were manually self-pollinated using a paintbrush. Later, in August 2021, once the seed capsules were advanced enough, seed was sown in the Floriculture and Research Division of RBG by following a standard orchid seed culture procedure.

The distribution map was prepared using ArcGIS version 10.4 software (ESRI 2017) and a conservation assessment was carried out following IUCN (2022). For this purpose, the Extent of Occurrence (EOO) and the Area of Occupancy (AOO) were calculated.



Map 1. Map indicating the type locality and newly recorded location of *Vanda thwaitesii* in Knuckles Mountain range, Central highlands, Sri Lanka. PREPARED BY INDRAKHEELA MADOLA.

Fig. 1. A detailed drawing of *Vanda thwaitesii*, made by Haramanis de Alwis, available in the National Herbarium, Department of National Herbarium Sri Lanka (taxa number; CP 3378) which is designated as the lectotype in the present study. Image reproduced with the kind permission of the Director General of the Department of National Botanic Gardens, Sri Lanka.

Taxonomic Treatment

Vanda thwaitesii *Hook.f.* (Hooker 1898: 193); Jayaweera (1981: 220). Type: Sri Lanka, Knuckles Mountains, Rangala area, Hunnasgiriya, coloured painting with floral analysis by H. de Alwis labelled *Aerides tessellata* and numbered C.P. 3378 (lectotype: icon. PDA!, designated here), here reproduced as Fig. 1.

Aerides tessellata auct. non (Roxb.) Wight: Thwaites (1861: 305).

Epiphytic *herb. Stems* erect, terete, 10–30 cm long, frequently rooting at the base and occasionally branched, lower internodes covered with closely arranged brown coriaceous sheaths. *Leaves* 7–15×1.2 cm, aggregated at the base, thick, fleshy, coriaceous, falcately curved, V-shaped in cross section, unequally bifid at apex, mid rib extended and pointed at the apex. *Inflorescence* a raceme, peduncle green, 3–8 cm long, axillary. Floral bracts very small, pale green-pale brown, 2–6 mm long, triangular-ovate, acute at apex. *Flowers* usually 3 (2–3), yellowish-brown, fragrant, 2.8–3.8 cm across. Sepals and petals marked with brown tessellations and streaks and brownish dots, deep orange brown towards their bases and abaxially greenish-yellow. Dorsal sepal obovate-oblong, obtuse at the apex, narrowed at the base curving backward, with wavy margins, smaller than the lateral sepals, 8–12-veined, 1.6–2×0.9–1 cm. Lateral sepals 1.8–2×1–1.5 cm, elliptic-obovate to orbicular. Petals 1.7×0.7–1 cm, obovate-oblong, 6–8 veined, smaller than lateral sepals, much narrowed at the base, apex obtuse, with slightly wavy margins. Labellum white marked with orange, with a saccate spur, side lobes pointing slightly downward, apex acute, 0.6×0.3 cm, oblong, falcate. Mid-lobe broad, fleshy, with 8 thick orange-coloured, inwardly curved blunt ridges towards the apex, with two knobs. Spur shorter than the lobes, straight, acute; column short stout; rostellum truncate; anther trapezoid-orbicular in outline, shortly rostrate, depressed, 2-loculed; pollinarium with two pollinia, each 1–1.5 mm in diam., obovoid, sulcate; stipe short, subulate on a large orbicular viscidium. *Ovary* with pedicel 2.5 cm long. *Fruits* 6 ridged capsules, 6–12×1.4–3 cm, oblong, and *Vanda* type. Figs 1, 2, 3, 4, 5.

DISTRIBUTION. Sri Lanka, Knuckles Mountain range, endemic. Map 1.

SPECIMENS EXAMINED. SRI LANKA. Rangala, 810 m a.s.l., 15 April 2021, *Gopallawa & Jayasinghe* RAN 001 (spirit PDA!); cult. in R.B.G. Peradeniya (from Rangala population), 460 m a.s.l., 15 April 2021, *Gopallawa & Jayasinghe* BG 002 (PDA!).

HABITAT. Epiphyte on *Mangifera zeylanica* and *Mesua ferrea* in riverine forest along the Hulu Ganga, elevation 810 m.

CONSERVATION STATUS. *Vanda thwaitesii* is restricted to one locality spread over a stretch of about 50 m. The population consists of fewer than 10 individuals and is not within the nearby protected area. Therefore, the plants are exposed to anthropogenic activities. According to our observation habitat loss, degradation and fragmentation are identified as threats to the habitat. The calculated AOO amounted to 4 km^2 while we were unable to calculate the EOO due to the presence of only one data point. Therefore, the EOO was taken as equal to AOO. Considering that *Vanda thwaitesii* is restricted to only one locality in the country, and the number of healthy individuals being fewer than 10 mature individuals, spread along the bank of Hulu Ganga outside the protected area and is subjected to anthropogenic activities, the population could be considered as under severe threat. According to present IUCN guidelines (2022); this species qualifies for the Critically Endangered category (CR) under the thresholds for both B1 and B2, with number of locations is

Fig. 2. A detailed drawing of *Vanda thwaitesii*, made by Haramanis de Alwis, available in the National Herbarium, Department of National Herbarium Sri Lanka (taxa number; CP 3378). Image reproduced with the kind permission of the Director General of the Department of National Botanic Gardens, Sri Lanka.

Fig. 3. *Vanda thwaitesii*; **A** habit; **B** habitat. PHOTOS: BHATHIYA GOPALLAWA.

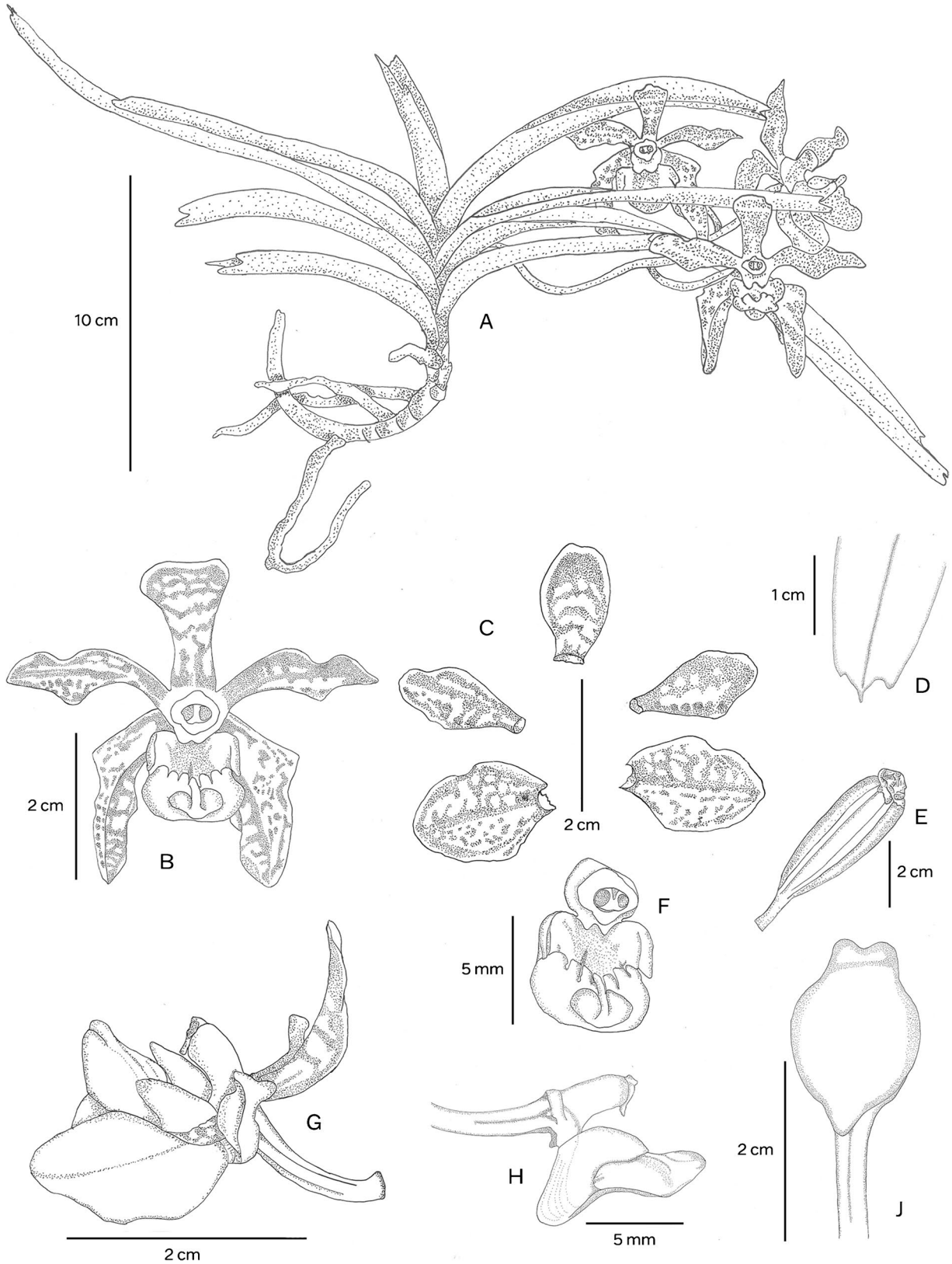


Fig. 4. *Vanda thwaitesii*. **A** habit; **B** flower (front view); **C** petals and sepals (front view); **D** leaf tip; **E** seed capsule; **F** column and labellum (front view); **G** flower (lateral view); **H** column and labellum (lateral view); **J** lip (abaxial view). DRAWN BY INDRAKHEELA MADOLA.

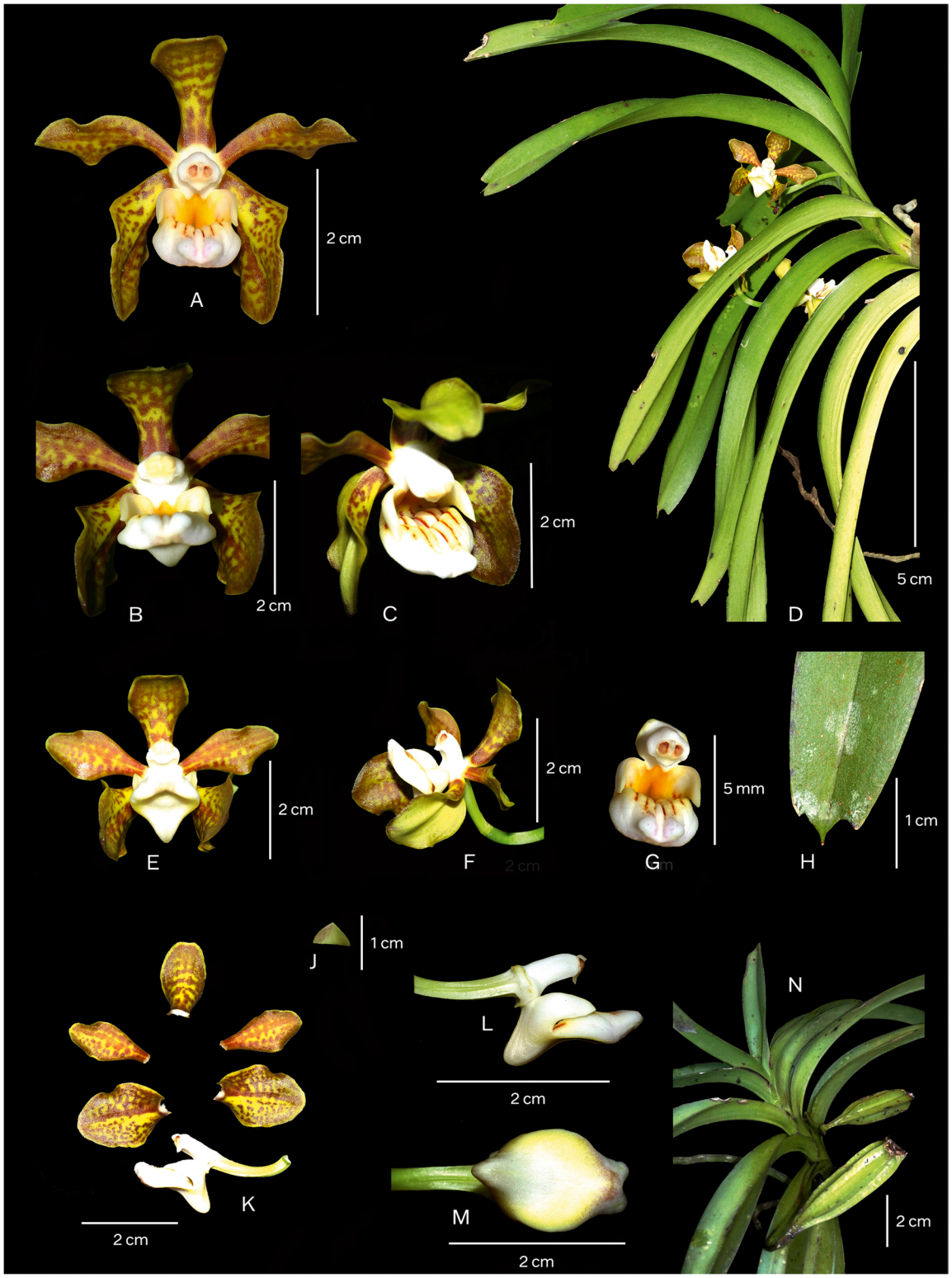


Fig. 5. *Vanda thwaitesii*. **A, B** flower (front view); **C** flower (side view); **D** habit; **E** flower (showing adaxial view of the lip); **F** flower (lateral view); **G** column and labellum (front view); **H** leaf tip (adaxial view); **J** floral bract (adaxial view); **K** dissected flower; **L** column and labellum (lateral view); **M** lip (abaxial view); **N** seed capsules. PHOTOS: HIMESH JAYASINGHE & BHATHIYA GOPALLAWA.

considered as 1 (a). Further, the populations exhibited a continuing decline in the quality of habitat (iii) and number of mature individuals (v). When considering all these factors, *V. thwaitesii* qualifies for CR category under B1ab (iii, v)+B2ab (iii,v). The rediscovery of *V. thwaitesii* offers valuable insights for conservation efforts, emphasising the importance of preserving native habitats and the potential for finding other species thought to be extinct.

PHENOLOGY. Flowering from February to May, fruiting May to October.

NOTES. This species was described from two drawings made by H. de Alwis from his own collection made at Hunnasgiriya. The drawings, preserved at PDA, both carry the number C.P. [Ceylonese Plants] 3378. One of the drawings shows detailed dissected parts of a flower as well as a flowering plant; this is selected here as the lectotype of *Vanda thwaitesii* based on article 9.3 and 9.4 of the *Code* (Turland *et al.* 2018). *Vanda sathishii*, initially confused with *V. thwaitesii*, differs in several key characteristics, including larger plant size, different flower colour and markings, the shape and posture of the side lobes, and the morphology of the mid-lobe. Our detailed examination of specimens of *V. thwaitesii* support the distinctions between the two species, highlighting the following differentiating traits: *V. thwaitesii* exhibits distinct tessellation, clawed petals and dorsal sepal, as opposed to the faint underlying tessellation, fuller, flatter petals and sepals of *V. sathishii*. Additionally, *V. thwaitesii* has a mid-lobe lip with two distinct calli, whereas *V. sathishii* displays a flat lip apex. Another notable difference is the presence of a distinct yellow callus at the rear entrance of the spur in *V. thwaitesii*, which is absent in *V. sathishii*. Moreover, the leaf apex in *V. thwaitesii* is evenly praemorse, whereas it is unevenly praemorse in *V. sathishii*. These findings corroborate the observations made by Motes (2021).

Acknowledgements

We are very grateful to Dr Shelomi Krishnarajah, former Director General of the Department of National Botanic Gardens, Dr Achala Attanayake, Deputy Director of the Royal Botanic Gardens & the staff members. The authors wish to acknowledge Trust Fund of the Department of National Botanic Gardens for the financial support for the National Botanical Survey. Dr Martin Motes and Dr Sathish Kumar are greatly acknowledged for providing valuable information and insightful comments on the distinction between *Vanda sathishii* and *V. thwaitesii*. Our special appreciation goes to Mr M. D Senarathne, Deputy Director, Floriculture Research Division, DNBG and Mr Manuja Maddumage. Finally, we greatly appreciate the support of Mr Pradeep Kodituwakku from Rangala Village for providing necessary information, help during the field work and taking care of plants.

Declarations

Authors'contributions BG: field work, photographs and manuscript preparation; IM: field assistance, drawings, map preparation and manuscript preparation; DY: manuscript preparation, editing, supervision; HJ: field work, photographs and manuscript preparation; SR: overall supervision, fund acquisition, editing of manuscript.

Funding Trust Fund of the Department of National Botanic Gardens.

Data availability Not applicable.

Conflicts of interest The authors declare that they have no conflicts of interest.

References

Brown, R. (1820). *Vanda roxburghii*. Chequer-flowered Vanda. *Bot. Reg.* 6: t. 506. https://www.biodiversitylibrary.org/page/62012018#page/330/mode/1up

Don, G. (1830). In: J. C. Loudon, *Hortus Britannicus*: p. 372. https://www.biodiversitylibrary.org/page/10904178#page/397/mode/1up

ESRI (2017). ArcGIS Desktop: Release 10.4. Environmental Systems Research Institute, Redlands.

Fernando, S. S. & Ormerod, P. (2008). An annotated checklist of the orchids of Sri Lanka. *Rheedea* 18 (1): 1 – 28. https://rheedea.in/journal/LsmUF9lu

Gardiner, L. M., Kocyan, A., Motes, M., Roberts, D. L. & Emerson, B. C. (2013). Molecular phylogenetics of *Vanda* and related genera (Orchidaceae). *Bot. J. Linn. Soc.* 173: 549 – 572. https://doi.org/10.1111/boj.12102

Hettiarachchi, K. (2014). *Vanda thwaitesii* blooms from extinction. *The Sunday Times Sri Lanka*. Available from: https://www.sundaytimes.lk/140803/plus/vanda-thwaitesii-blooms-from-extinction-109139.html. [Accessed 15 June 2023].

Hooker, J. D. (1879). Anacardiaceae. In: J. D. Hooker, *The Flora of British India*, vol. ii, L. Reeve & Co, London. https://www.biodiversitylibrary.org/page/18704633#page/28/mode/1up

____ (1898). Orchidaceae. In: H. Trimen, *A Handbook to the Flora of Ceylon* 4: 132 – 238. https://www.biodiversitylibrary.org/item/42155#page/205/mode/1up

IUCN Standards and Petitions Committee (2022). *Guidelines for Using the IUCN Red List Categories and Criteria. Version 15*. Prepared by the Standards and petitions committee. Available from: https:// www.iucnredlist.org/documents/RedListGuidelines.pdf [Accessed 26 Jan. 2024]

Jayaweera, D. M. A. (1981). Orchidaceae. In: M. D. Dassanayake (ed.), *A Revised Handbook to the Flora of Ceylon*, vol. ii. A. A. Balkema, Rotterdam.

Khan, H., Belwal, T., Tariq, M., Atanasov, A. G. & Devkota, H. P. (2019). Genus *Vanda*: A review on traditional uses, bioactive chemical constituents and pharmacological activities. *J. Ethnopharm.* 229: 46 – 53. https://doi.org/10.1016/j.jep.2018.09.031

Kumar, C. S. & Suresh Kumar, P. C. (1998). The reappearance of *Vanda thwaitesii* J.D. Hook. (Orchidaceae). *Rheedea* 8 (2): 249 – 253. https://rheedea.in/journal/7LdCI9Xw

Lindley, J. (1830 – 1840). *The Genera and Species of Orchidaceous Plants*. Ridgways, London. https://www.biodiversitylibrary.org/page/51596403#page/9/mode/1up

Linnaeus, C. (1753). *Species Plantarum 1*. Laurentius Salvius, Stockholm. https://www.biodiversitylibrary.org/page/358012#page/527/mode/1up

Motes, M. R. (1997). *Vandas: Their Botany, History, and Culture*. Timber Press, Portland.

____ (2021). *The Natural Genus Vanda*. Redland Press, Redland, Florida.

____ (2022). *Vanda sathishii*. *Orchid Rev.* 130 (1338, Suppl.): 20.

POWO (2023). Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; http://www.plantsoftheworldonline.org.

Reichenbach, H. G. (1864). *Vanda wightii*. *Ann. Bot. Syst.* 6: 932. https://www.biodiversitylibrary.org/item/32200#page/944/mode/1up. [Accessed 26 Jan. 2024].

____ (1877). *Vanda testacea*. *Gard. Chron.* 8: 166. https://www.biodiversitylibrary.org/item/89004#page/192/mode/1up

Stafleu, F. A. & Cowan, R. S. (1986). *Taxonomic Literature*, 2nd ed., vol. 6. *Regnum Veg.* 115. Bohn, Scheltema & Holkema, Utrecht & Antwerpen; dr. W. Junk b.v., The Hague & Boston.

The National Redlist 2020 — Conservation Status of the Flora of Sri Lanka. Biodiversity Secretariat of the Ministry of Environment, Sri Lanka and the National Herbarium, Department of the National Botanic Gardens, Peradeniya.

Thiers, B. (2025, continuously updated). *Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff. New York Botanical Garden's Virtual Herbarium*. Available online from: http://sweetgum.nybg.org/ih. [Accessed 18 June 2024].

Thwaites, G. H. K. (1861). *Enumeratio Plantarum Zeylaniae,* part iv. Dulau & Co, London. https://doi.org/10.5962/bhl.title.574.

Turland, N. J., Wiersema, J. H., Barrie, F. R., Greuter, W., Hawksworth, D. L., Herendeen, P. S., Knapp, S., Kusber, W.-H., Li, D.-Z., Marhold, K. *et al.* (eds) (2018). International Code of Nomenclature for Algae, Fungi, and Plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. *Regnum Veg.* 159. Koeltz Botanical Books, Glashütten.

Zou, L. H., Wu, X. Y., Lin, M., Chen, L. J. & Liu, Z. J. (2016). *Vanda funingensis*, a new species of Orchidaceae (Epidendroideae; Vandeae; Aeridinae) from China: evidence from morphology and DNA. *Phytotaxa* 260 (1): 1 – 13. https://phytotaxa.mapress.com/pt/article/view/phytotaxa.260.1.1

Publisher's Note