

Building evidence for conservation globally

Journal of Threatened Taxa



Open Access

10.11609/jott.2024.16.12.26187-26330

www.threatenedtaxa.org

26 December 2024 (Online & Print)

16(12): 26187-26330

ISSN 0974-7907 (Online)

ISSN 0974-7893 (Print)





ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher
Wildlife Information Liaison Development Society
www.wild.zooreach.org

Host
Zoo Outreach Organization
www.zooreach.org

Srivari Illam, No. 61, Karthik Nagar, 10th Street, Saravanampatti, Coimbatore, Tamil Nadu 641035, India
Registered Office: 3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore, Tamil Nadu 641006, India
Ph: +91 9385339863 | www.threatenedtaxa.org
Email: sanjay@threatenedtaxa.org

EDITORS

Founder & Chief Editor

Dr. Sanjay Molur

Wildlife Information Liaison Development (WILD) Society & Zoo Outreach Organization (ZOO),
Coimbatore, Tamil Nadu 641006, India

Deputy Chief Editor

Dr. Neelesh Dahanukar

Noida, Uttar Pradesh, India

Assistant Editor

Dr. Chaithra Shree J., WILD/ZOO, Coimbatore, Tamil Nadu 641006, India

Managing Editor

Mr. B. Ravichandran, WILD/ZOO, Coimbatore, Tamil Nadu 641006, India

Associate Editors

Dr. Mandar Paingankar, Government Science College Gadchiroli, Maharashtra 442605, India

Dr. Ulrike Streicher, Wildlife Veterinarian, Eugene, Oregon, USA

Ms. Priyanka Iyer, ZOO/WILD, Coimbatore, Tamil Nadu 641006, India

Editorial Board

Dr. Russel Mittermeier

Executive Vice Chair, Conservation International, Arlington, Virginia 22202, USA

Prof. Mewa Singh Ph.D., FASc, FNA, FNASC, FNAPs

Ramanna Fellow and Life-Long Distinguished Professor, Biopsychology Laboratory, and
Institute of Excellence, University of Mysore, Mysuru, Karnataka 570006, India; Honorary
Professor, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore; and Adjunct
Professor, National Institute of Advanced Studies, Bangalore

Stephen D. Nash

Scientific Illustrator, Conservation International, Dept. of Anatomical Sciences, Health Sciences
Center, T-8, Room 045, Stony Brook University, Stony Brook, NY 11794-8081, USA

Dr. Fred Pluthero

Toronto, Canada

Dr. Priya Davidar

Sigur Nature Trust, Chadapatti, Mavinhalla PO, Nilgiris, Tamil Nadu 643223, India

Dr. John Fellowes

Honorary Assistant Professor, The Kadoorie Institute, 8/F, T.T. Tsui Building, The University of
Hong Kong, Pokfulam Road, Hong Kong

Prof. Dr. Mirco Solé

Universidade Estadual de Santa Cruz, Departamento de Ciências Biológicas, Vice-coordenador
do Programa de Pós-Graduação em Zoologia, Rodovia Ilhéus/Itabuna, Km 16 (45662-000)
Salobrinho, Ilhéus - Bahia - Brasil

Dr. Rajeev Raghavan

Professor of Taxonomy, Kerala University of Fisheries & Ocean Studies, Kochi, Kerala, India

English Editors

Mrs. Mira Bhojwani, Pune, India

Dr. Fred Pluthero, Toronto, Canada

Mr. P. Ilangovan, Chennai, India

Ms. Sindhura Stothra Bhashyam, Hyderabad, India

Web Development

Mrs. Latha G. Ravikumar, ZOO/WILD, Coimbatore, India

Typesetting

Mrs. Radhika, ZOO, Coimbatore, India

Mrs. Geetha, ZOO, Coimbatore India

Fundraising/Communications

Mrs. Payal B. Molur, Coimbatore, India

Subject Editors 2021–2023

Fungi

Dr. B. Shivaraju, Bengaluru, Karnataka, India

Dr. R.K. Verma, Tropical Forest Research Institute, Jabalpur, India

Dr. Vatsavaya S. Raju, Kakatiya University, Warangal, Andhra Pradesh, India

Dr. M. Krishnappa, Jnana Sahyadri, Kuvempu University, Shimoga, Karnataka, India

Dr. K.R. Sridhar, Mangalore University, Mangalagangothri, Mangalore, Karnataka, India

Dr. Gunjan Biswas, Vidyasagar University, Midnapore, West Bengal, India

Dr. Kiran Ramchandra Ranadive, Annasaheb Magar Mahavidyalaya, Maharashtra, India

Plants

Dr. G.P. Sinha, Botanical Survey of India, Allahabad, India

Dr. N.P. Balakrishnan, Ret. Joint Director, BSI, Coimbatore, India

Dr. Shonil Bhagwat, Open University and University of Oxford, UK

Prof. D.J. Bhat, Retd. Professor, Goa University, Goa, India

Dr. Ferdinando Boero, Università del Salento, Lecce, Italy

Dr. Dale R. Calder, Royal Ontario Museum, Toronto, Ontario, Canada

Dr. Cleofas Cervancia, Univ. of Philippines Los Baños College Laguna, Philippines

Dr. F.B. Vincent Florens, University of Mauritius, Mauritius

Dr. Merlin Franco, Curtin University, Malaysia

Dr. V. Irudayaraj, St. Xavier's College, Palayamkottai, Tamil Nadu, India

Dr. B.S. Kholia, Botanical Survey of India, Gangtok, Sikkim, India

Dr. Pankaj Kumar, Department of Plant and Soil Science, Texas Tech University, Lubbock, Texas, USA.

Dr. V. Sampath Kumar, Botanical Survey of India, Howrah, West Bengal, India

Dr. A.J. Solomon Raju, Andhra University, Visakhapatnam, India

Dr. Vijayasankar Raman, University of Mississippi, USA

Dr. B. Ravi Prasad Rao, Sri Krishnadevaraya University, Anantpur, India

Dr. K. Ravikumar, FRLHT, Bengaluru, Karnataka, India

Dr. Aparna Watve, Pune, Maharashtra, India

Dr. Qiang Liu, Xishuangbanna Tropical Botanical Garden, Yunnan, China

Dr. Noor Azhar Mohamed Shazili, Universiti Malaysia Terengganu, Kuala Terengganu, Malaysia

Dr. M.K. Vasudeva Rao, Shiv Ranjani Housing Society, Pune, Maharashtra, India

Prof. A.J. Solomon Raju, Andhra University, Visakhapatnam, India

Dr. Mandar Datar, Agharkar Research Institute, Pune, Maharashtra, India

Dr. M.K. Janarthanam, Goa University, Goa, India

Dr. K. Karthikeyan, Botanical Survey of India, India

Dr. Errol Vela, University of Montpellier, Montpellier, France

Dr. P. Lakshminarasimhan, Botanical Survey of India, Howrah, India

Dr. Larry R. Noblick, Montgomery Botanical Center, Miami, USA

Dr. K. Haridasan, Pallavur, Palakkad District, Kerala, India

Dr. Analinda Manila-Fajard, University of the Philippines Los Banos, Laguna, Philippines

Dr. P.A. Sinu, Central University of Kerala, Kasaragod, Kerala, India

Dr. Afroz Alam, Banasthali Vidyapith (accredited A grade by NAAC), Rajasthan, India

Dr. K.P. Rajesh, Zamorin's Guruvayurappan College, GA College PO, Kozhikode, Kerala, India

Dr. David E. Boufford, Harvard University Herbaria, Cambridge, MA 02138-2020, USA

Dr. Ritesh Kumar Choudhary, Agharkar Research Institute, Pune, Maharashtra, India

Dr. A.G. Pandurangan, Thiruvananthapuram, Kerala, India

Dr. Navendu Page, Wildlife Institute of India, Chandrabani, Dehradun, Uttarakhand, India

Dr. Kannan C.S. Warriar, Institute of Forest Genetics and Tree Breeding, Tamil Nadu, India

Invertebrates

Dr. R.K. Avasthi, Rohtak University, Haryana, India

Dr. D.B. Bastawade, Maharashtra, India

Dr. Partha Pratim Bhattacharjee, Tripura University, Suryamaninagar, India

Dr. Kailash Chandra, Zoological Survey of India, Jabalpur, Madhya Pradesh, India

Dr. Ansie Dippenaar-Schoeman, University of Pretoria, Queenswood, South Africa

Dr. Rory Dow, National Museum of natural History Naturalis, The Netherlands

Dr. Brian Fisher, California Academy of Sciences, USA

Dr. Richard Gallon, Llandudno, North Wales, LL30 1UP

Dr. Hemant V. Ghate, Modern College, Pune, India

Dr. M. Monwar Hossain, Jahangirnagar University, Dhaka, Bangladesh

For Focus, Scope, Aims, and Policies, visit https://threatenedtaxa.org/index.php/JoTT/aims_scope
For Article Submission Guidelines, visit <https://threatenedtaxa.org/index.php/JoTT/about/submissions>
For Policies against Scientific Misconduct, visit https://threatenedtaxa.org/index.php/JoTT/policies_various

continued on the back inside cover

Cover: Life and death in one night - wolf hunting the hare. Mixed media—gouache, acrylics, pen & colour pencils. © Dupati Poojitha.



INTRODUCTION

The genus *Psilotum* (belonging to the primitive family Psilotaceae), with its two Indian species, i.e., *P. nudum* (L.) P.Beauv. and *P. complantum* Sw. (Pande 2002; Chauhan et al. 2003; Muthukumar et al. 2009), is often grouped with the extinct psilophytes, the Rhyniales, and Zosterophyllales dating from the Devonian some 400 million years ago (Roux 2003). Many paleobotanists and plant morphologists considered the members under *Psilotum* as 'living fossils' or 'living rhyniophytes' (Kidston & Lang 1917; Banks 1975; Kaplan 1977; Wagner 1977; Rothwell 1999); but unfortunately, no fossils of psilophytes are known to exist. Recent morpho-anatomical studies (Bell & Hemsley 1992; Stewart & Rothwell 1993) suggest that the genus is not closely related to rhyniophytes; rather, the primitive characters present in living psilophytes represent a reduction from a more typical modern fern plant. Similarly, according to molecular data, it is evident that *Psilotum* is a fern and that psilophytes are sister to ophioglossoid ferns (Qiu & Palmer 1999; Pryer et al. 2001; Smith et al. 2006; Schneider et al. 2009).

Psilotum nudum (Greek—'psilos' means smooth or naked and Latin—'nudus' means naked, and both referring to the smooth and naked character of the stems; commonly known as whisk fern - Qiu & Palmer 1999), one of the two species in the genus *Psilotum*, is widely distributed across tropical and sub-tropical areas of both hemispheres (Zhang & Yatskievych 2013). In India, the species is reported to be found in Andaman Islands, Nicobar Islands, Western Ghats, Eastern Ghats, central India, eastern India, northwestern India (Thothathri et al. 1970; Pande 2002; Chauhan et al. 2003; Valavan et al. 2016; Kanivalan & Rajendran 2017) with its first report in Barren Island, an isolated one in the Andaman group of islands (Prain 1893). In West Bengal, the species is reported to occur in Darjeeling (Pande 2002), Cooch Behar (Biswas 1956; Bandyopadhyay et al. 2006; Mandal 2023) and Jhargram (Sen & Bhakat 2021) districts. *P. nudum* has most recently been assessed for The IUCN Red List of Threatened Species in 2020 and is listed as 'Least Concern' (Bárrios & Copeland 2021).

The whisk fern became a popular pot plant in Japan during the Edo Period (1603–1867), leading to the selection of slightly over 100 ornamental garden varieties, most of which are illustrated in the 'Matsubaran fu' (Hoshizaki & Moran 2001; Chernova et al. 2020). The plant is also reported to be used for different medicinal purposes in India and Hawaii (Foster & Gifford 1974; Benjamin & Manickam 2007; Mannan et

al. 2008; Karthik et al 2011; Kumari et al. 2011; Revathi et al. 2013; Valavan et al. 2016, Mandal 2023).

Until now, several morpho-anatomical studies of *P. nudum* have been published from the different parts of the world (Ford 1904; Sporne 1962; Schulte et al. 1987; Nazarian et al. 2010; Vahdati et al. 2014; Rahman et al. 2015; Valavan et al. 2016); as per literature survey, detailed morpho-anatomical studies of the species from India especially from the state of West Bengal is lacking. Keeping all these in mind, the present study has been designed to investigate the present conservation status and to describe the morpho-anatomical characters of the species from the Cooch Behar District of West Bengal, India for the first time which will enrich the botanical information of the species. The current study will also report a new site of the occurrence of the species.

MATERIALS AND METHODS

The Cooch Behar District (Image 1), situated in the foothills of the eastern Indo-Himalaya, is known for its rich floristic composition. Field visits have been conducted across different seasons during January 2021 to September 2022 to observe the habitat and population growth pattern. The plant, *P. nudum* has been collected from the previously reported study area (Biswas 1956; Bandyopadhyay et al. 2006), i.e., Narendra Narayan Park (26.325 °N, 89.450 °E; elevation 14.5 m; Image 1), Cooch Behar for morphological and anatomical studies. Morphological description has also been done from the new site of occurrence of the species, i.e., Madan Mohan Temple (26.320 °N, 89.444 °E; elevation 14.5 m; Image 1), Cooch Behar based on the available plant specimens. Geographical locations of the study areas were recorded using the device GARMIN, eTrex® 22x. Anatomical studies have been performed through hand-sectioning of rhizome, aerial shoot of different orders and synangium. Slides were prepared after double staining and photographs were taken for photographic documentation. Spore morphology was examined under a light microscope (10X × 40X) and described as per Erdtman (1945, 1971). Identification of the plant specimen was made using relevant floras (Chinnock 1998; Diggs et al. 2006) and proper nomenclature was maintained following POWO (2022). Voucher specimens were deposited in the Department of Botany, A.B.N. Seal College, Cooch Behar.

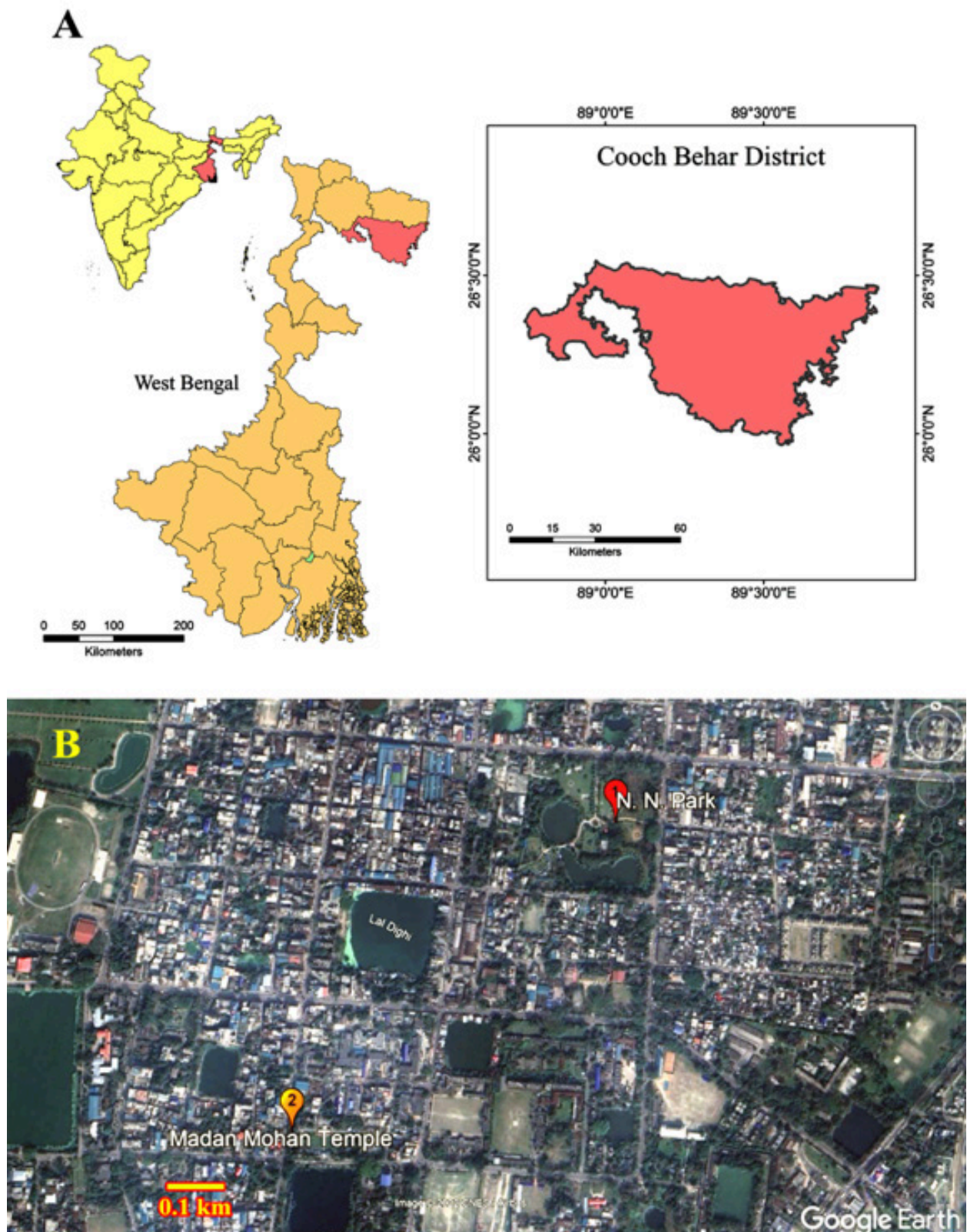


Image 1. A—Map of India and West Bengal highlighting the district Cooch Behar (red- orange color) | B—Study areas; Narendra Narayan Park (marked in red pin 1) & Madan Mohan Temple (marked in orange pin 2). Map prepared using an open source QGIS Desktop 3.22.

RESULTS AND DISCUSSION

Habitat, ecology and conservation status

The plant population of *Psilotum nudum* recorded from the new site of occurrence (Madan Mohan Temple) was found to grow on the tree trunk base (up to 1.5 m) of an old katgolap tree (*Plumeria* sp.) in association with *Drynaria quercifolia* (L.) J.Sm., *Pyrrhosia lanceolata* (L.) Farw. and some species of orchids and mosses (Image 2). Approximately, 35 *Psilotum* plants were found to be grown in the tree trunk of which only a few with sporangium. The host tree is very old and eventually dying day by day as per the information provided by the gardener of the temple. Cleaning and white painting of the tree trunks of the temple before the ancient and traditional Rash Utsav is a very common practice for the beautification of the garden and may harm the concerned species and lead to loss from the site. Hence, in situ and ex situ conservation strategies should be taken to protect the species. The author made the gardener aware of the importance of the species and suggested barricading the tree and not to paint the tree trunk so that the species can grow in its natural habitat.

Biswas (1956) only reported a few plants of the species growing on *Polyalthia longifolia* along with an orchid (*Dendrobium* sp.) in the main park (now named Narendra Narayan Park) and predicted the species has been introduced from south India along with the orchid collection. Later on, a team from ENVIS, Botanical Survey of India, Kolkata visited the same park and reported that the species on the trunk of five very old trees (out of six trees) of *P. longifolia* in association with *D. quercifolia* and some orchid species (Bandyopadhyay et al. 2006). The present study revealed that approximately 15 plant species are found to be grown in the first tree; the second tree becomes dead and only the remnants of trunk remains without having *Psilotum* plant; the third tree also contains no *Psilotum* species as reported earlier; more than 50 plant species are found to be grown in the fourth tree (Image 2); there is no trace of the fifth tree and no plants are found to be grown on the tree number six, though the previous authors reported that many plants were found to be grown in fifth and sixth trees. From the current study it is clear that the plant population decreased day by day which may be due to the natural falling of host plants and or cleaning and painting of the tree trunks. The park authority made aware by the present author regarding the present status of this significant plant species in the park with a suggestion for taking necessary measures to protect this declining species.

Morphological description

Plants are perennial medium-sized herbs, that grow as an epiphyte and pendent in nature (Image 3). Rhizome is brown (achlorophyllous), cylindrical, slender, freely branched, 2.0–3.0 cm long, 1.5 mm in diameter, and covered with hair-like structures, called rhizoids. The rhizome merges above the surface with the aerial part of the plant. The aerial stem is 16–36 cm in long and 0.5–2.0 mm in diameter, repeatedly dichotomously branched above with 30–42 branches, often pentagonal towards the main stem, first and second dichotomy, quadrangular towards the third and fourth dichotomy and triangular in the most distal portions (fifth dichotomy), glabrous and green in color (chlorophyllous), with longitudinal parallel lines twisted slowly around the stem. Leaves are scale-like (Image 3), lacking a midrib, 1.5–2.0 mm long, spirally arranged on the stem, lanceolate to ovate in outline, pointed, and without any ligules. Synangia (Image 3) is 2.5–3.0 mm in diameter, orbicular, smooth, light green during young stages, become yellowish when mature and composed of three fused sporangia (Image 3) separated by three longitudinal and arched depressions, bearing numerous kidney or bean-shaped spores, a dichotomous bract is present around the synangium. Spores are homosporous, monad, bilaterally symmetrical, monolete, prolate to per-prolate in shape, large sized (polar axis: 76.68–88.52 μm , equatorial diameter: 36.42–45.92 μm), exine thick (3.26–4.98 μm), exine ornamentation verrucate-tuberculate (Image 3).

Anatomical description

A model plant drawing of *P. nudum* has been displayed in the image (Image 3) to show the scheme of sampling sites for transverse sections (T.S.) of rhizome and aerial stem of different dichotomies.

Rhizome

The T.S. of the rhizome is more or less circular in shape (Image 3). Epidermis is thin, inconspicuous and single layered. Most of the epidermal cells extend into two celled absorptive rhizoids. Below the epidermal layer, there is a broad cortex of thin-walled cells. Stele is protostele (haplostele) in nature. Pith is absent and the xylem mass is usually chain-like / rod-like in outline and without any protoxylem. The xylem is surrounded by uniform layers of phloem which in turn is surrounded by the pericycle. Outside the pericycle, a distinguishable endodermal layer is present with conspicuous Casparian strips on radial walls. Vahdati et al. (2014) have also reported the presence of haplostele in the rhizome;



Image 2. Photographs of host plants bearing *Psilotum nudum*: A—Painted tree trunk of *Plumeria* sp. at Madan Mohan Temple | B—Tree trunk of *Polyalthia longifolia* at N.N. Park. © Aninda Mandal.

Nazarian et al. (2010) have reported the stellar type as actinostele.

Aerial stem

In T.S., the aerial stem appeared pentagonal towards the main stem (Image 3), first (Image 3) and second (Image 3) dichotomy, quadrangular towards the third (Image 3) and fourth (Image 3) dichotomy and triangular in the most distal portions (fifth dichotomy; Image 3). The aerial stem shows a well-marked single-layered cuticularized epidermis, and large numbers of stomata are found to be present in the grooves of the stem. The cortex is broad and is differentiated into three zones. The outermost zone is 3-layered, cells are thin-walled, vertically elongated with intercellular spaces, parenchymatous, nucleated, and contain chlorophyll. The middle cortex is 3–4 layered, and cells are thick-walled and sclerenchymatous. The inner cortex is 5–7 layered, cells are thin-walled, parenchymatous, and without any intercellular spaces. The stele is surrounded by well-marked endodermis.

Pericycle is not distinguishable. The stele in the aerial stem is of actinostele type. Xylem is star-shaped and the protoxylem lies at the tip of each ray. Presence of actinostele has also been reported earlier by different authors (Schulte et al. 1987; Khoshravesh et al. 2009; Vahdati et al. 2014); however, Gifford & Foster (1989) and Nazarian et al. (2010) interpreted the stele as siphonostele.

CONCLUSION

Psilotum nudum is one of the primitive vascular plants still living and often considered as ‘living fossil’. In the present study, the species is found to grow as an epiphyte in the tree trunks of very old aged plants in the studied areas. The host trees are gradually falling down due to their very old age. Cleaning and sometimes white painting of host tree trunk for beautification of park and garden lead to habitat destruction. Continuous habitat loss may lead to extinction of the species from

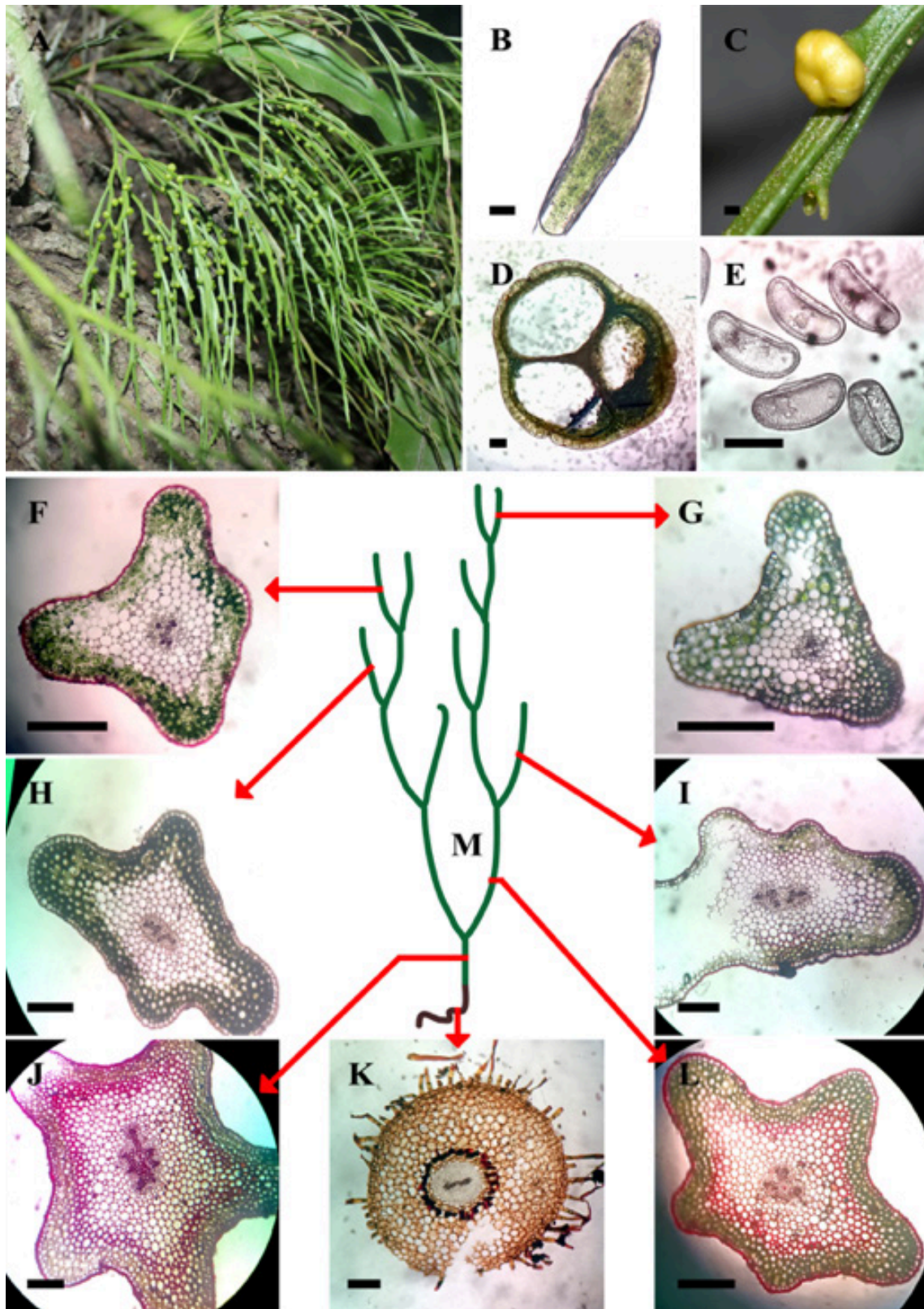


Image 3. Morpho-anatomy of *Psilotum nudum*: A—Sporophytic plant body growing on tree trunk | B—Scale leaf | C—Matured synangium | D—Transverse section of synangium with trilobed structure | E—Monolete spores | F—Fourth dichotomy | G—Fifth dichotomy | H—Third dichotomy | I—Second dichotomy | J—Transverse section of main stem | K—Transverse section of rhizome showing two-celled rhizoids | L—First dichotomy | M—Scheme of sampling sites on a typical model plant for transverse-sections of different dichotomies (Scale bar: B, D, F, G, H, I, J, K, L—0.25 mm, C—0.5 mm, E—50 μ m). © Aninda Mandal.

the studied areas. So, necessary measures should be taken immediately for in situ and ex situ conservation of the botanically interesting species. Detailed morpho-anatomical description of the species is also carried out for the first time from the district Cooch Behar of West Bengal, India which will enrich the botanical information of the species.

REFERENCES

- Bandyopadhyay, S., A. Bose, S. Nandi, T. Chakraborty, S. Bandyopadhyay & M.S. Mondal (2006). On the occurrence of *Psilotum nudum* (L.) P. Beauv. (Psilotaceae) in Koch Behar, West Bengal. *ENVIS Newsletter* 11(1&2): 7. <https://bsi.gov.in/uploads/userfiles/file/ENVIS/ENVIS%20NEWSLETTER/ENVIS%20Newsletter%20Vol.%2011%202006.pdf>
- Banks, H.P. (1975). Reclassification of Psilophyta. *Taxon* 24(4): 401–413. <https://doi.org/10.2307/1219491>
- Bárrios, S. & A. Copeland (2021). *Psilotum nudum*. The IUCN Red List of Threatened Species 2021: e.T18821051A192161425. <https://doi.org/10.2305/IUCN.UK.2021-3.RLTS.T18821051A192161425.en>. Accessed on 28 December 2022.
- Bell, P.R. & A.R. Hemsley (1992). *Green Plants: Their Origin and Diversity*, 2nd Edition. Cambridge University Press, Cambridge, UK, 360 pp.
- Benjamin, A. & V.S. Manickam (2007). Medicinal pteridophytes from the Western Ghats. *Indian Journal of Traditional Knowledge* 6(4): 611–618.
- Biswas, K.C. (1956). Pteridophytes of Cooch Behar. *Journal of the Bombay Natural History Society* 53(3): 493–493. <https://www.biodiversitylibrary.org/page/48180961>
- Chauhan, N., H. Padalia, S. Gupta, M.C. Porwal & P.S. Roy (2003). *Psilotum complanatum* Sw., a rare epiphytic fern ally of Great Nicobar Island: exploration and habitat monitoring. *Current Science* 85(2): 193–197.
- Chernova, T., M. Ageeva, P. Mikshina, O. Trofimova, L. Kozlova, S. Lev-Yadun & T. Gorshkova (2020). The living fossil *Psilotum nudum* has cortical fibers with mannan-based cell wall matrix. *Frontiers in Plant Science* 11: 488. <https://doi.org/10.3389/fpls.2020.00488>
- Chinnock, R.J. (1998). Psilotaceae. *Flora of Australia* 48: 47–53.
- Diggs, G.M., B.L. Lipscomb, M.D. Reed & R.J. O'Kennon (2006). *Illustrated Flora of East Texas, Vol 1: Introduction, Pteridophytes, Gymnosperms, and Monocotyledons*. Sida, Botanical Miscellany, No. 26, Botanical Research Institute of Texas & Austin College, 322 pp.
- Erdtman, G. (1945). Pollen morphology and plant taxonomy. IV. Labiatae, Verbenaceae, and Aviceniaceae. *Svensk Botanisk Tidskrift* 39(3): 279–285.
- Erdtman, G. (1971). *Pollen Morphology and Plant Taxonomy. Angiosperms (An Introduction to Palynology. I)*. Hafner Publishing Co; New York, 553 pp.
- Ford, S.O. (1904). The anatomy of *Psilotum triquetrum*. *Annals of Botany* 18(4): 589–605. <https://doi.org/10.1093/oxfordjournals.aob.a088978>
- Foster, A.S. & E.M. Gifford (1974). *Comparative Morphology of Vascular Plants*. 2nd Edition. W. H. Freeman and Co., San Francisco, 751 pp.
- Gifford, E.M. & A.S. Foster (1989). *Morphology and Evolution of Vascular Plants*, 3rd Edition. W.H. Freeman and Company, New York, 626 pp.
- Hoshizaki, B.J. & R.C. Moran (2001). *Fern Grower's Manual*. Timber Press, Inc., Portland, Oregon, 604 pp.
- Kanivalan, I. & A. Rajendran (2017). Living fossils in southern Western Ghats of Theni District, India. *Research & Reviews: Journal of Botany* 6(3): 14–16.
- Kaplan, D.R. (1977). Morphological status of the shoot systems of Psilotaceae. *Brittonia* 29(1): 30–53. <https://doi.org/10.2307/2805740>
- Karthik, V., K. Raju, M. Ayyanar, K. Gowrishankar & T. Sekar (2011). Ethnomedicinal uses of pteridophytes in Kolli Hills, Eastern Ghats of Tamil Nadu, India. *Journal of Natural Product and Plant Resources* 1(2): 50–55.
- Khoshravesh, R., H. Akhiani, M. Eskandari & W. Greuter (2009). Ferns and fern allies of Iran. *Rostaniha* 10(Supplement 1): 1–130.
- Kidston, R. & W.H. Lang (1917). On old red sandstone plants showing structure from the Rhynie chert bed, Aberdeenshire. I. *Rhynia Gwynne-vaughanii*, Kidston and Lang. *Earth and Environmental Science Transactions of the Royal Society of Edinburgh* 51(3): 761–784. <https://doi.org/10.1017/S008045680008991>
- Kumari, P., A.M. Otaghviri, H. Govindaparyi, Y.M. Bahuguna & P.L. Uniyal (2011). Some ethno-medically important pteridophytes of India. *International Journal of Medicinal and Aromatic Plants* 1(1): 18–22.
- Mandal, A. (2023). The epiphytic pteridophyte flora of Cooch Behar District of West Bengal, India, and its ethnomedicinal value. *Journal of Threatened Taxa* 15(8): 23799–23804. <https://doi.org/10.11609/jott.8224.15.8.23799-23804>
- Mannan, M., M. Maridass & B. Victor (2008). A review on the potential uses of ferns. *Ethnobotanical Leaflets* 12: 281–285.
- Muthukumar, T., K. Sathiyadash, E. Uma & V. Muniappan (2009). Arbuscular mycorrhizal morphology in sporophyte of *Psilotum nudum*. *Phytomorphology* 59(3&4): 141–146.
- Nazarian, H., R. Taghavizad & E. Khosravi (2010). The first anatomical report and morphological reexamination of *Psilotum nudum* L., in Iran. *Pakistan Journal of Botany* 42(6): 3723–3728.
- Pande, H.C. (2002). Dwindling population of *Psilotum nudum* (L.) P. Beauv. — a case study. *Bulletin of the Botanical Survey of India* 44(1–4): 157–159.
- POWO (2022). <https://powo.science.kew.org/>. Accessed on December 2022.
- Prain, D. (1893). On the flora of Narcondam and Barren Island. *The Journal of the Asiatic Society of Bengal* 62: 39–86.
- Pryer, K.M., H. Schneider, A.R. Smith, R. Cranfill, P.G. Wolf, J.S. Hunt & S.D. Sipes (2001). Horsetails and ferns are a monophyletic group and the closest relatives to seed plants. *Nature* 409: 618–622. <https://doi.org/10.1038/35054555>
- Qiu, Y.L. & J. Palmer (1999). Phylogeny of early land plants: insights from genes and genomes. *Trends in Plant Science* 4(1): 26–30. [https://doi.org/10.1016/S1360-1385\(98\)01361-2](https://doi.org/10.1016/S1360-1385(98)01361-2)
- Rahman, F., A.S. Mumtaz & S.A. Shah (2015). *Psilotum nudum*: a new pteridophyte record for the cryptogamic flora of Pakistan. *Pakistan Journal of Botany* 47(2): 493–494.
- Revathi, R., R. Muthuraja, B. Thomas & K. Raju (2013). Ethno medicinal fern and fern allies used by tribe of Malayalis of Kolli Hills, Eastern Ghats, Tamil Nadu. *Pteridological Research* 2(1): 1–10.
- Rothwell, G.W. (1999). Fossils and ferns in the resolution of land plant phylogeny. *The Botanical Review (Lancaster)* 65(3): 188–218. <https://doi.org/10.1007/BF02857629>
- Roux, J.P. (2003). *Swaziland Ferns and Fern Allies*. Southern African Botanical Diversity Network Report No. 19, Pretoria, 241 pp.
- Schneider, H., A. Smith & K. Pryer (2009). Is morphology really at odds with molecules in estimating fern phylogeny? *Systematic Botany* 34(3): 455–475. <https://doi.org/10.1600/036364409789271209>
- Schulte, P.J., A.C. Gibson & P.S. Nobel (1987). Xylem anatomy and hydraulic conductance of *Psilotum nudum*. *American Journal of Botany* 74(9): 1438–1445. <https://doi.org/10.1002/j.1537-2197.1987.tb08757.x>
- Sen, U.K. & R.K. Bhakat (2021). Assessment of pteridophytes' composition and conservation status in sacred groves of Jhargram District, south West Bengal, India. *Biodiversitas* 22(5): 3171–3178. <https://doi.org/10.13057/biodiv/d220620>
- Smith, A.R., K.M. Pryer, E. Schuettpelz, P. Korall, H. Schneider & P.G. Wolf (2006). A classification for extant ferns. *Taxon* 55(3): 705–731.

<https://doi.org/10.2307/25065646>

- Sporne, K.R. (1962).** *The Morphology of Pteridophytes: The Structure of Ferns and Allied Plants*. Hutchinson and Company, New York, 192 pp.
- Stewart, W.N. & G.N. Rothwell (1993).** *Palaeobotany and the Evolution of Plants*, 2nd Edition. Cambridge University Press, Cambridge, U.K., 521 pp.
- Thothathri, K., S.P. Banerjee, P.K. Hazra & G.D. Pal (1970).** On a collection of *Psilotum* Sw. from the great Nicobar Islands. *Bulletin of the Botanical Survey of India* 12(1–4): 280–281.
- Vahdati, F.A., S.S. Mehrvarz, A. Naqinezhad & R.S. Shavvon (2014).** The morphological and anatomical reinvestigation of the *Psilotum nudum*, in Hyrcanian forests, N Iran. *Taxonomy and Biosystematics* 6(21): 87–96.

- Valavan, R.E., M. Mayilsamy & A. Rajendran (2016).** *Psilotum nudum*: a new medicinal pteridophyte record for the cryptogamic flora of Sirumalai Hills, Dindigul District, Tamilnadu, India. *Shanlax International Journal of Arts, Science & Humanities* 3(4): 48–52.
- Wagner, W.H.Jr. (1977).** Systematic implications of the Psilotaceae. *Brittonia* 29(1): 54–63. <https://doi.org/10.2307/2805741>
- Zhang, L.B. & G. Yatskievych (2013).** Psilotaceae, p. 81. In: Wu, Z.Y., P.H. Raven & D.Y. Hong (eds.). *Flora of China*, Vol. 2 & 3: (Pteridophytes). Science Press, Beijing, Missouri Botanical Garden Press, St. Louis. http://flora.huh.harvard.edu/china/mss/volume02/Flora_of_China_Volume_2_3_Psilotaceae.pdf



Mr. Jatishwor Singh Irungbam, Biology Centre CAS, Branišovská, Czech Republic.
Dr. Ian J. Kitching, Natural History Museum, Cromwell Road, UK
Dr. George Mathew, Kerala Forest Research Institute, Peechi, India
Dr. John Noyes, Natural History Museum, London, UK
Dr. Albert G. Orr, Griffith University, Nathan, Australia
Dr. Sameer Padhye, Katholieke Universiteit Leuven, Belgium
Dr. Nancy van der Poorten, Toronto, Canada
Dr. Kareen Schnabel, NIWA, Wellington, New Zealand
Dr. R.M. Sharma, (Retd.) Scientist, Zoological Survey of India, Pune, India
Dr. Manju Siliwal, WILD, Coimbatore, Tamil Nadu, India
Dr. G.P. Sinha, Botanical Survey of India, Allahabad, India
Dr. K.A. Subramanian, Zoological Survey of India, New Alipore, Kolkata, India
Dr. P.M. Sureshan, Zoological Survey of India, Kozhikode, Kerala, India
Dr. R. Varatharajan, Manipur University, Imphal, Manipur, India
Dr. Eduard Vives, Museu de Ciències Naturals de Barcelona, Terrassa, Spain
Dr. James Young, Hong Kong Lepidopterists' Society, Hong Kong
Dr. R. Sundararaj, Institute of Wood Science & Technology, Bengaluru, India
Dr. M. Nithyanandan, Environmental Department, La Ala Al Kuwait Real Estate. Co. K.S.C., Kuwait
Dr. Himender Bharti, Punjabi University, Punjab, India
Mr. Purnendu Roy, London, UK
Dr. Saito Motoki, The Butterfly Society of Japan, Tokyo, Japan
Dr. Sanjay Sondhi, TITLI TRUST, Kalpavriksh, Dehradun, India
Dr. Nguyen Thi Phuong Lien, Vietnam Academy of Science and Technology, Hanoi, Vietnam
Dr. Nitin Kulkarni, Tropical Research Institute, Jabalpur, India
Dr. Robin Wen Jiang Ngiam, National Parks Board, Singapore
Dr. Lionel Monod, Natural History Museum of Geneva, Genève, Switzerland.
Dr. Asheesh Shivam, Nehru Gram Bharti University, Allahabad, India
Dr. Rosana Moreira da Rocha, Universidade Federal do Paraná, Curitiba, Brasil
Dr. Kurt R. Arnold, North Dakota State University, Saxony, Germany
Dr. James M. Carpenter, American Museum of Natural History, New York, USA
Dr. David M. Claborn, Missouri State University, Springfield, USA
Dr. Kareen Schnabel, Marine Biologist, Wellington, New Zealand
Dr. Amazonas Chagas Júnior, Universidade Federal de Mato Grosso, Cuiabá, Brasil
Mr. Monsoon Jyoti Gogoi, Assam University, Silchar, Assam, India
Dr. Heo Chong Chin, Universiti Teknologi MARA (UiTM), Selangor, Malaysia
Dr. R.J. Shiel, University of Adelaide, SA 5005, Australia
Dr. Siddharth Kulkarni, The George Washington University, Washington, USA
Dr. Priyadarsanan Dharma Rajan, ATREE, Bengaluru, India
Dr. Phil Alderslade, CSIRO Marine And Atmospheric Research, Hobart, Australia
Dr. John E.N. Veron, Coral Reef Research, Townsville, Australia
Dr. Daniel Whitmore, State Museum of Natural History Stuttgart, Rosenstein, Germany.
Dr. Yu-Feng Hsu, National Taiwan Normal University, Taipei City, Taiwan
Dr. Keith V. Wolfe, Antioch, California, USA
Dr. Siddharth Kulkarni, The Hormiga Lab, The George Washington University, Washington, D.C., USA
Dr. Tomas Ditrich, Faculty of Education, University of South Bohemia in Ceske Budejovice, Czech Republic
Dr. Mihaly Foldvari, Natural History Museum, University of Oslo, Norway
Dr. V.P. Uniyal, Wildlife Institute of India, Dehradun, Uttarakhand 248001, India
Dr. John T.D. Caleb, Zoological Survey of India, Kolkata, West Bengal, India
Dr. Priyadarsanan Dharma Rajan, Ashoka Trust for Research in Ecology and the Environment (ATREE), Royal Enclave, Bangalore, Karnataka, India

Fishes

Dr. Neelesh Dahanukar, IISER, Pune, Maharashtra, India
Dr. Topiltzin Contreras MacBeath, Universidad Autónoma del estado de Morelos, México
Dr. Heok Hee Ng, National University of Singapore, Science Drive, Singapore
Dr. Rajeev Raghavan, St. Albert's College, Kochi, Kerala, India
Dr. Robert D. Sluka, Chiltern Gateway Project, A Rocha UK, Southall, Middlesex, UK
Dr. E. Vivekanandan, Central Marine Fisheries Research Institute, Chennai, India
Dr. Davor Zanella, University of Zagreb, Zagreb, Croatia
Dr. A. Biju Kumar, University of Kerala, Thiruvananthapuram, Kerala, India
Dr. Akhilesh K.V., ICAR-Central Marine Fisheries Research Institute, Mumbai Research Centre, Mumbai, Maharashtra, India
Dr. J.A. Johnson, Wildlife Institute of India, Dehradun, Uttarakhand, India
Dr. R. Ravinesh, Gujarat Institute of Desert Ecology, Gujarat, India

Amphibians

Dr. Sushil K. Dutta, Indian Institute of Science, Bengaluru, Karnataka, India
Dr. Annemarie Ohler, Muséum national d'Histoire naturelle, Paris, France

Reptiles

Dr. Gernot Vogel, Heidelberg, Germany
Dr. Raju Vyas, Vadodara, Gujarat, India
Dr. Pritpal S. Soorae, Environment Agency, Abu Dubai, UAE.
Prof. Dr. Wayne J. Fuller, Near East University, Mersin, Turkey
Prof. Chandrashekher U. Rivoner, Goa University, Taleigao Plateau, Goa. India
Dr. S.R. Ganesh, Chennai Snake Park, Chennai, Tamil Nadu, India
Dr. Himansu Sekhar Das, Terrestrial & Marine Biodiversity, Abu Dhabi, UAE

Birds

Dr. Hem Sagar Baral, Charles Sturt University, NSW Australia
Mr. H. Byju, Coimbatore, Tamil Nadu, India
Dr. Chris Bowden, Royal Society for the Protection of Birds, Sandy, UK
Dr. Priya Davidar, Pondicherry University, Kalapet, Puducherry, India
Dr. J.W. Duckworth, IUCN SSC, Bath, UK
Dr. Rajah Jayapal, SAGON, Coimbatore, Tamil Nadu, India
Dr. Rajiv S. Kalsi, M.L.N. College, Yamuna Nagar, Haryana, India
Dr. V. Santharam, Rishi Valley Education Centre, Chittoor Dt., Andhra Pradesh, India
Dr. S. Balachandran, Bombay Natural History Society, Mumbai, India
Mr. J. Praveen, Bengaluru, India
Dr. C. Srinivasulu, Osmania University, Hyderabad, India
Dr. K.S. Gopi Sundar, International Crane Foundation, Baraboo, USA
Dr. Gombobaatar Sunde, Professor of Ornithology, Ulaanbaatar, Mongolia
Prof. Reuven Yosef, International Birding & Research Centre, Eilat, Israel
Dr. Taej Mundkur, Wetlands International, Wageningen, The Netherlands
Dr. Carol Inskipp, Bishop Auckland Co., Durham, UK
Dr. Tim Inskipp, Bishop Auckland Co., Durham, UK
Dr. V. Gokula, National College, Tiruchirappalli, Tamil Nadu, India
Dr. Arkady Lelej, Russian Academy of Sciences, Vladivostok, Russia
Dr. Simon Dowell, Science Director, Chester Zoo, UK
Dr. Mário Gabriel Santiago dos Santos, Universidade de Trás-os-Montes e Alto Douro, Quinta de Prados, Vila Real, Portugal
Dr. Grant Connette, Smithsonian Institution, Royal, VA, USA
Dr. P.A. Azeez, Coimbatore, Tamil Nadu, India

Mammals

Dr. Giovanni Amori, CNR - Institute of Ecosystem Studies, Rome, Italy
Dr. Anwaruddin Chowdhury, Guwahati, India
Dr. David Mallon, Zoological Society of London, UK
Dr. Shomita Mukherjee, SAGON, Coimbatore, Tamil Nadu, India
Dr. Angie Appel, Wild Cat Network, Germany
Dr. P.O. Nameer, Kerala Agricultural University, Thrissur, Kerala, India
Dr. Ian Redmond, UNEP Convention on Migratory Species, Lansdown, UK
Dr. Heidi S. Riddle, Riddle's Elephant and Wildlife Sanctuary, Arkansas, USA
Dr. Karin Schwartz, George Mason University, Fairfax, Virginia.
Dr. Lala A.K. Singh, Bhubaneswar, Orissa, India
Dr. Mewa Singh, Mysore University, Mysore, India
Dr. Paul Racey, University of Exeter, Devon, UK
Dr. Honnavalli N. Kumara, SAGON, Anaikatty P.O., Coimbatore, Tamil Nadu, India
Dr. Nishith Dharaiya, HNG University, Patan, Gujarat, India
Dr. Spartaco Gippoliti, Socio Onorario Società Italiana per la Storia della Fauna "Giuseppe Altobello", Rome, Italy
Dr. Justus Joshua, Green Future Foundation, Tiruchirappalli, Tamil Nadu, India
Dr. H. Raghuram, The American College, Madurai, Tamil Nadu, India
Dr. Paul Bates, Harison Institute, Kent, UK
Dr. Jim Sanderson, Small Wild Cat Conservation Foundation, Hartford, USA
Dr. Dan Challender, University of Kent, Canterbury, UK
Dr. David Mallon, Manchester Metropolitan University, Derbyshire, UK
Dr. Brian L. Cypher, California State University-Stanislaus, Bakersfield, CA
Dr. S.S. Talmale, Zoological Survey of India, Pune, Maharashtra, India
Prof. Karan Bahadur Shah, Budhanilakantha Municipality, Kathmandu, Nepal
Dr. Susan Cheyne, Borneo Nature Foundation International, Palangkaraja, Indonesia
Dr. Hemanta Kafley, Wildlife Sciences, Tarleton State University, Texas, USA

Other Disciplines

Dr. Aniruddha Belsare, Columbia MO 65203, USA (Veterinary)
Dr. Mandar S. Paingankar, University of Pune, Pune, Maharashtra, India (Molecular)
Dr. Jack Tordoff, Critical Ecosystem Partnership Fund, Arlington, USA (Communities)
Dr. Ulrike Streicher, University of Oregon, Eugene, USA (Veterinary)
Dr. Hari Balasubramanian, EcoAdvisors, Nova Scotia, Canada (Communities)
Dr. Rayanna Hellem Santos Bezerra, Universidade Federal de Sergipe, São Cristóvão, Brazil
Dr. Jamie R. Wood, Landcare Research, Canterbury, New Zealand
Dr. Wendy Collinson-Jonker, Endangered Wildlife Trust, Gauteng, South Africa
Dr. Rajeshkumar G. Jani, Anand Agricultural University, Anand, Gujarat, India
Dr. O.N. Tiwari, Senior Scientist, ICAR-Indian Agricultural Research Institute (IARI), New Delhi, India
Dr. L.D. Singla, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, India
Dr. Rupika S. Rajakaruna, University of Peradeniya, Peradeniya, Sri Lanka
Dr. Bahar Baviskar, Wild-CER, Nagpur, Maharashtra 440013, India

Reviewers 2021–2023

Due to pausity of space, the list of reviewers for 2021–2023 is available online.

The opinions expressed by the authors do not reflect the views of the Journal of Threatened Taxa, Wildlife Information Liaison Development Society, Zoo Outreach Organization, or any of the partners. The journal, the publisher, the host, and the partners are not responsible for the accuracy of the political boundaries shown in the maps by the authors.

Print copies of the Journal are available at cost. Write to:
The Managing Editor, JoTT,
c/o Wildlife Information Liaison Development Society,
3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore,
Tamil Nadu 641006, India
ravi@threatenedtaxa.org & ravi@zooreach.org

Journal of Threatened Taxa is indexed/abstracted in Bibliography of Systematic Mycology, Biological Abstracts, BIOSIS Previews, CAB Abstracts, EBSCO, Google Scholar, Index Copernicus, Index Fungorum, JournalSeek, National Academy of Agricultural Sciences, NewJour, OCLC WorldCat, SCOPUS, Stanford University Libraries, Virtual Library of Biology, Zoological Records.

NAAS rating (India) 5.64



OPEN ACCESS



The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

December 2024 | Vol. 16 | No. 12 | Pages: 26187–26330

Date of Publication: 26 December 2024 (Online & Print)

DOI: 10.11609/jott.2024.16.12.26187-26330

www.threatenedtaxa.org

Articles

Negative interaction or coexistence? Livestock predation and conservation of wild carnivores in Kazinag National Park and adjacent region in the Kashmir Himalaya, India

– Uzma Dawood & Bilal A. Bhat, Pp. 26187–26197

Avifaunal diversity and conservation significance of coastal ecosystems on Rameswaram Island, Tamil Nadu, India

– H. Byju, H. Maitreyi, S. Ravichandran & N. Raveendran, Pp. 26198–26212

Conservation of sea turtles on the beach areas from Sonadia Island to Saint Martin's Island in the Bay of Bengal in Bangladesh

– M. Farid Ahsan, Shital Kumar Nath & Ashim Barua, Pp. 26213–26224

Noteworthy records of vascular plants from the West Bank, occupied Palestinian territories

– Banan Al-Sheikh, Mazin B. Qumsiyeh & Abdel-Salam Hubbieh, Pp. 26225–26233

Communications

Citizen science conservation: a case study using two threatened large aquatic American salamanders (Amphibia: Urodela), the Common Mudpuppy *Necturus maculosus* (Proteidae) and the Eastern Hellbender *Cryptobranchus alleganiensis* (Cryptobranchidae) observations on iNaturalist

– Shem Unger, Pp. 26234–26239

A preliminary study of odonate fauna in the high ranges of Munnar, southern Western Ghats, India

– T.S. Krishnanunni, Nazar Neha, R. Arya & P.O. Nameer, Pp. 26240–26250

A new species of *Arctodiaptomus* Kiefer, 1932 (Copepoda: Diaptomidae) from the Kumaun Himalaya of India

– Shaikhom Inaotombi & Debajit Sarma, Pp. 26251–26263

Morpho-anatomical characterization and conservation status of the Whisk Fern *Psilotum nudum* (L.) P.Beauv. (Polypodiopsida: Psilotaceae) from Cooch Behar District of West Bengal, India

– Aninda Mandal, Pp. 26264–26271

Six new reports of corticioid fungi from India

– Poonam, Avneet Pal Singh & Gurpaul Singh Dhingra, Pp. 26272–26282

On the *Marvalia echinulata* (Niessl ex Rabenh.) Ono (Pucciniales: Chaconiaceae) with reference to its host range and distribution

– Sayantan Jash & Asit Baran De, Pp. 26283–26290

Short Communications

A rare low elevation photographic record of Himalayan Serow *Capricornis sumatraensis* ssp. *thar* (Hodgson, 1831) from Nameri National Park, Assam, India

– B. Piraisoodan, Asish Immanuel Baglary, Saumitro Das & Debasish Buragohain, Pp. 26291–26295

Sightings of Red Goral *Nemorhaedus baileyi* in the community forest of the Upper Siang region, Arunachal Pradesh: an insight into its conservation challenges and implications within a tribal-managed landscape

– Takhe Bamin, Kishon Tekseng & Daniel Mize, Pp. 26296–26300

New record of *Sapria himalayana* Griff. (Rafflesiaceae) from Eaglenest Wildlife Sanctuary, Arunachal Pradesh, India

– Anisha Mandal, Aman Bishwakarma, Dibi Soma Monpa, Kabir Pradhan, Karma Wangdi Monpa & Rohit Rai, Pp. 26301–26305

***Pinnatella limbata* (Bryophyta: Neckeraceae): reassessment of conservation status based on recent findings**

– O.M. Sruthi, C.N. Manju, K.P. Rajesh & J. Enroth, Pp. 26306–26311

Additions of two genera of liverworts (Marchantiophyta) to the bryoflora of Nagaland, India

– Kazhuhrii Eshuo, Kholi Kaini & S.K. Chaturvedi, Pp. 26312–26316

***Phycolepidozia indica* (Marchantiophyta: Jungermanniales) an endemic leafless liverwort from Kerala part of Western Ghats, India**

– T. Krishnendhu, C.N. Manju, Ravi Athira & K.P. Rajesh, Pp. 26317–26321

Notes

First photographic documentation of avian egg predation by Common Palm Civet *Paradoxurus hermaphroditus* (Pallas, 1777) (Mammalia: Carnivora: Viverridae)

– Aritra Bhattacharya, B.N. Achyutha, Nandini Iyer, Somaiah Sundarapandian & Kuppasamy Sivakumar, Pp. 26322–26324

First record of Eurasian Crag Martin *Ptyonoprogne rupestris* (Scopoli, 1769) (Aves: Passeriformes: Hirundinidae) from Tamil Nadu, India

– S. Naveenkumar, Pp. 26325–26327

***Megachile vera* Nurse, 1901 (Insecta: Hymenoptera: Megachilidae): a new record of leaf cutter bee from Kerala, India**

– Anju Sara Prakash & C. Bijoy, Pp. 26328–26330

Publisher & Host



Threatened Taxa