



RESEARCH ARTICLE

# New additional records to Assam biota from Golaghat District, Northeast India

Sabnam Sultana<sup>1</sup>, Gaurav Kumar Mishra<sup>2</sup>, Jintu Sarma<sup>3</sup>, Demsai Reang<sup>4</sup> & Anushree Baruah<sup>1\*</sup>

<sup>1</sup>Department of Botany, Royal School of Life sciences, The Assam Royal Global University, Guwahati 781 035, Assam, India

<sup>2</sup>Lichenology Laboratory, CSIR - National Botanical Research Institute, Rana Pratap Marg 226 001, Lucknow, India

<sup>3</sup>Department of Botany, Guwahati College, Guwahati 781 021, Assam, India

<sup>4</sup>Department of Forestry, The Assam Royal Global University, Guwahati 781 035, Assam, India

\*Correspondence email - [anushree611.official@gmail.com](mailto:anushree611.official@gmail.com)

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## Abstract

A total of 18 lichen species representing 13 genera and 9 families were identified as first report from the Nambor-Doigrung and Garampani Wildlife Sanctuaries of Golaghat district, Assam. This study presents 3 additional lichen taxa as new records from the state, including *Herpothallon antillarum*, *Herpothallon minutum* and *Ramalina nervulosa*. Specimens were examined using standard taxonomic keys to corroborate the morphological and anatomical features for identifying the species. Results highlight the significance of Assam as an important biodiversity hotspot for lichenised fungi, underscoring the considerable potential for further floristic exploration in the region, which may substantially enhance the understanding of its lichen diversity. Furthermore, the study stresses the necessity of implementing appropriate conservation strategies to safeguard lichen communities within this ecologically unique landscape. A comprehensive systematic account of the newly recorded taxa is provided in this report.

**Keywords:** Assam; distribution; lichens; lichenised fungi; new records; taxonomy; wildlife sanctuary

## Introduction

Approximately 2400 lichen species belonging to 305 genera and 74 families have been reported from India, occurring across a wide range of substrata in tropical, subtropical, temperate and alpine regions (1). Among these, the Western Ghats represent the most species-rich region, harbouring nearly 800 species, which account for about 39 % of the currently known lichen diversity of the country. This is followed by the Eastern Himalayas with 759 species (37 %) and the Western Himalayas with 550 species (27 %). Northeast India is one of the most biodiverse areas of India which is much underexplored in terms of Lichen biota. The state of Assam, recognised as one of the biodiversity hotspots globally owing to its location in the transitional zones of Eastern Himalayan. Its unique physiography constitutes a remarkable diversity of flora and fauna making it the “Biological gateway” of Northeast India.

Lichens form a significant yet insufficiently studied component of this biodiversity. Recent checklists documented a total of 657 lichen species belonging to 146 genera and 41 families from Assam (2, 3). Floristic investigations in the Ultapani Forest Range of Kokrajhar district reported 52 species distributed among 25 genera and 14 families (4). In a parallel study, the same authors recorded 55 lichen species from various localities of southern Assam.

In a subsequent study, 42 lichen species across 10 families and 16 genera in the district of Dhubri were documented including

several noteworthy additions to the state’s lichen flora, thereby highlighting the continued scope for exploration and documentation (5). Although many lichen species have been reported, large, forested tracts across Assam remain inadequately surveyed, suggesting that the lichen diversity of the region is still far from fully documented. The present study forms part of an ongoing effort to assess the lichen biota of Assam, with a particular focus on Golaghat district. The investigation resulted in the identification of 3 lichen species newly recorded for the state, thereby contributing further to the understanding of lichen diversity in Northeast India.

## Materials and Methods

The specimens were collected from various parts of Golaghat District of Assam, India, geographically located within coordinates of 26.42° N latitude to 93.725° E longitude (Fig. 1). Systematic field surveys were carried out 3 times annually during the period 2022–24 to ensure comprehensive sampling across different sites within the study area. The lichen specimens were collected from a variety of substrata, including tree barks, twigs, rocks and leaves. Several tropical evergreen tree species - *Lagerstroemia speciosa* (L.) Martyn, *Tectona grandis* L. f., *Magnolia champaca* (L.) Baill. ex-Pierre, *Ficus bengalensis* L., *Mangifera indica* L., *Shorea robusta* C.F.Gaertn. and *Quercus* spp. (Oak) were observed to support luxuriant lichen growth.

The spatial distribution of the recorded species within the study region was mapped using the geographic information system (GIS) environment in ArcGIS version 10.1. The boundary shapefiles of protected areas (wildlife sanctuaries) were obtained from the GeoNode spatial data repository (6). Field-collected geographic coordinates of species occurrences were imported into the GIS environment and converted into point feature layers, which were subsequently overlaid with the protected area boundary layers. The final map layout illustrating the locations of protected areas and species occurrences is presented in Fig. 1.

The specimens were studied morphologically, anatomically and chemically. The morphological structures were studied under LEICA stereo zoom microscope. The anatomical details of the thallus and fruiting bodies were studied in free hand section with water as mounting medium under compound microscope. The chemical substance in the thallus were identified through colour test technique by applying aqueous potassium hydroxide (K), Steiner's stable paraphenylenediamine (PD) and aqueous calcium hypochlorite (C) reagents. For the authentic identification of the lichen taxa, previous literatures were consulted (7–9). The identified specimens were preserved in the Department of Botany, Royal School of Life sciences, The Assam Royal Global University, Guwahati after collection and then deposited in the herbarium of CSIR–National Botanical Research Institute, Lucknow (LWG) with accession numbers. The nomenclature of the identified species was updated based on the modern concept of lichen systematic (10).

## Results and Discussion

During the extensive survey conducted in the Nambor and Garampani Wildlife Sanctuaries has yielded a total of 18 lichen species representing 13 genera and 9 families showcasing a rich diversity of lichens in the Golaghat district in Assam. This research has led to addition of 3 new records, *Herpothallon antillarum*, *Herpothallon minutum* and *Ramalina nervulosa* to the lichen flora of Assam. A list of 18 species identified is represented in Table 1.

### Taxonomy

#### *Herpothallon antillarum* (Graphidaceae)

(Vain.) Aptroot, Lücking & G. Thor, in Aptroot, Thor, Lücking, Elix &

Chaves, *Bibliotheca Lichenol.* 99: 30 (2009) (Fig. 2).

**Accession number:** LC65624

**Description:** Thallus corticolous, crustose, up to 12 cm wide, typically pale grey to greyish brown. Upper surface smooth. The thickness of thallus ranges from 0.1–0.3 mm in diameter. Medulla white or pale, epihymenium dark or pigmented in colour. Ascospores not found in the examined species.

**Chemistry:** Thallus K+, C-, P+, UV-

**Habitat and distribution in India:** *Herpothallon antillarum* is a corticolous, crustose lichen was collected from the bark of *L. speciosa* tree from Nambor wildlife sanctuary, Assam. It is a new record in Golaghat District, Assam, India. Earlier it was reported from Kerala, Karnataka, Manipur and Maharashtra.

**Specimen examined:** INDIA: Golaghat district, Nambor Wildlife Sanctuary, 26°23'41.8" N, 93°52'65.7" E, on bark, alt. 120 m, 3 September 2023, S. Sultana & N. Nazma, LC65624 (LWG).

#### *Herpothallon minutum* (Arthoniaceae)

Jagadeesh Ram & Aptroot, *The Lichenologist* 46: 39–49 (2014) (Fig. 3).

**Accession Number:** LC65626

**Description:** Thallus saxicolous, crustose, smooth to slightly uneven, loosely attached, up to 4–10 cm in diameter, surface whitish to greyish. Prothallus and hypothallus white, medulla indistinct, white. Lower cortex and Apothecia absent. Ascospores not observed in the examined material.

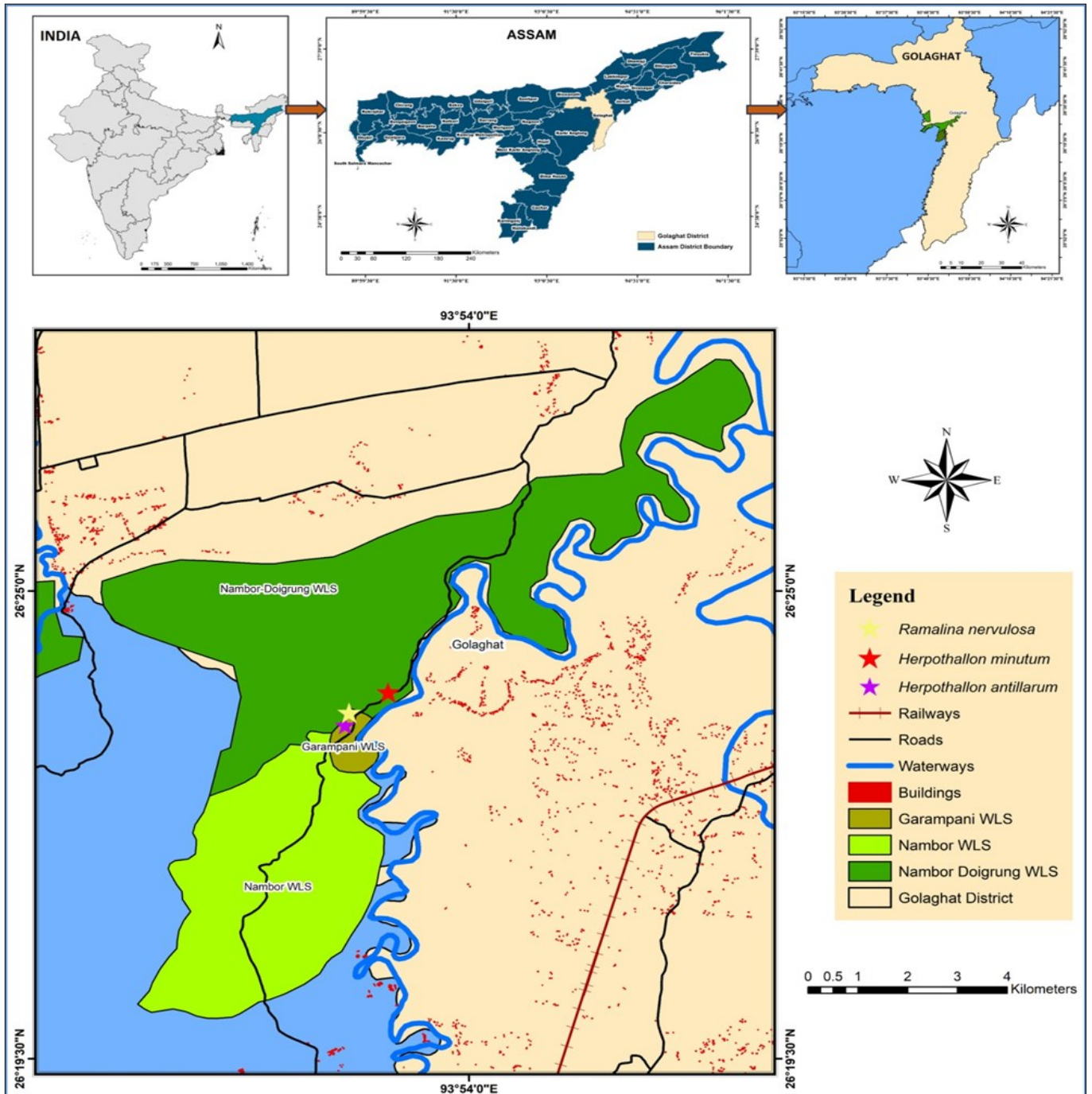
**Chemistry:** Thallus K-, C+, P-, UV-

**Habitat and distribution:** *Herpothallon minutum* is a saxicolous species occurring predominantly in tropical and subtropical regions, typically inhabiting moist and shaded habitats. In the present study, the species was collected from rock surfaces and a land bridge area within the Garampani Wildlife Sanctuary, Assam. This taxon represents a new addition to the lichen flora of Assam. Previously, it has been reported from the Andaman and Nicobar Islands, Arunachal Pradesh, Uttarakhand and West Bengal.

**Specimen examined:** INDIA: Assam: Golaghat district, Garampani Wildlife Sanctuary, 26°07'31.7" N, 91°50'86.6" E, on rock, elev. 57 m, 3 September 2023, S. Sultana, S. Mudoj & A. Baruah, LC65622

**Table 1.** List of lichen specimen identified from Nambor-Garampani Wildlife Sanctuary, Golaghat, Assam, India

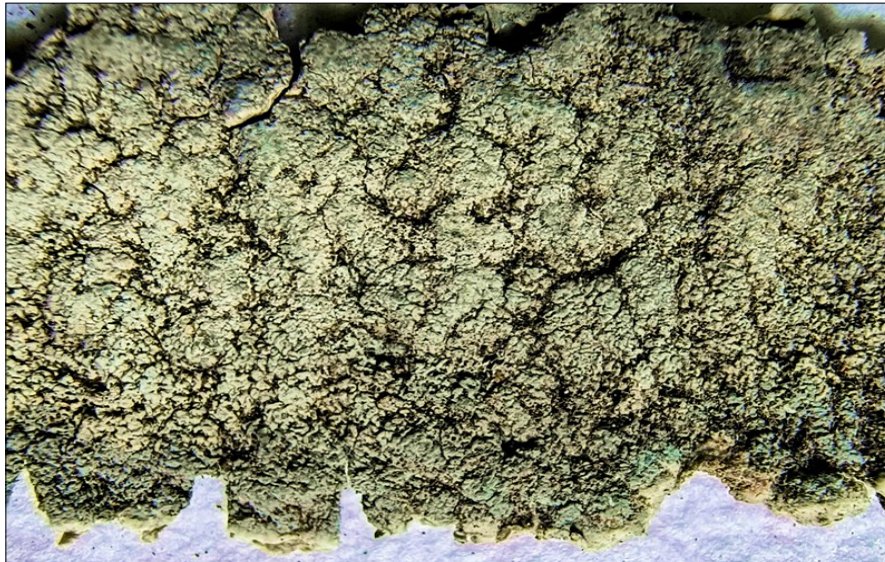
Sl.No.	Species name	Family	State	Locality	Acc. No.
1	<i>Anthracothecium prasinum</i>	Pyrenulaceae	Assam	Nambor Wildlife Sanctuary	LC65606
2	Cfr. <i>Leiorreuma exaltatum</i>	Graphidaceae	Assam	Garampani Wildlife Sanctuary	LC65608
3	<i>Cryptothecia</i> cfr. <i>faveolata</i>	Arthoniaceae	Assam	Nambor Wildlife Sanctuary	LC65623
4	<i>Dirinaria aegialita</i>	Caliciaceae	Assam	Nambor Wildlife Sanctuary	LC65621
5	<i>Dirinaria applanata</i>	Caliciaceae	Assam	Garampani Wildlife Sanctuary	LC65614
6	<i>Dirinaria applanata</i>	Caliciaceae	Assam	Garampani Wildlife Sanctuary	LC65607
7	<i>Graphis glaucescens</i>	Graphidaceae	Assam	Nambor Wildlife Sanctuary	LC65612
8	<i>Herpothallon antillarum</i>	Graphidaceae	Assam	Nambor Wildlife Sanctuary	LC65624
9	<i>Herpothallon echinatum</i>	Arthoniaceae	Assam	Garampani Wildlife Sanctuary	LC65611
10	<i>Herpothallon insidiatum</i>	Arthoniaceae	Assam	Nambor Wildlife Sanctuary	LC65613
11	<i>Herpothallon minutum</i>	Arthoniaceae	Assam	Nambor Wildlife Sanctuary	LC65626
12	<i>Herpothallon minutum</i>	Arthoniaceae	Assam	Garampani Wildlife Sanctuary	LC65622
13	<i>Myriostigma candidum</i>	Arthoniaceae	Assam	Garampani Wildlife Sanctuary	LC65618
14	<i>Ocellularia garoana</i>	Graphidaceae	Assam	Garampani Wildlife Sanctuary	LC65615
15	<i>Parmotrema tinctorum</i>	Parmeliaceae	Assam	Garampani Wildlife Sanctuary	LC65625
16	<i>Ramalina hossei</i>	Ramalinaceae	Assam	Garampani Wildlife Sanctuary	LC65619
17	<i>Ramalina hossei</i>	Ramalinaceae	Assam	Garampani Wildlife Sanctuary	LC65610
18	<i>Ramalina nervulosa</i>	Ramalinaceae	Assam	Garampani Wildlife Sanctuary	LC65620
19	<i>Sarcographa cinchonarum</i>	Graphidaceae	Assam	Nambor Wildlife Sanctuary	LC65609
20	<i>Sarcographa cinchonarum</i>	Graphidaceae	Assam	Garampani Wildlife Sanctuary	LC65617
21	<i>Sarcographina</i> cfr. <i>glyphiza</i>	Sarcographina	Assam	Nambor Wildlife Sanctuary	LC65616
22	<i>Strigula</i> sp. (sterile)	Strigulaceae	Assam	Garampani Wildlife Sanctuary	No Acc.



**Fig. 1.** Map of the study area with species location (Nabor-Doigrung & Garampani Wildlife Sanctuary, Golaghat District) (Source: ArcGIS version 10.1 and GeoNode spatial data repository).



**Fig. 2.** Habitus of *Herpothallon antillarum*.



**Fig. 3.** Habit of *Herpothallum minutum*.

(LWG).

***Ramalina nervulosa* (Ramalinaceae)**

Müll. Arg. Des Abb., Bull. Inst. Fr. Afr. Noire 14: 25 (1952) (Fig. 4).

**Accession Number:** LC65620

**Description:** Thallus corticolous, fruticose, shrubby, up to 10 cm long. Branching irregular. Branches flattened to linear or angular towards the base, 1–3 mm wide; segments often contorted or twisted. Surface pale green to greyish-green or yellowish. Cortex thin, composed of thick-walled hyphae up to 15 µm broad, irregularly arranged. Rhizines present on the lower surface of the thallus. Apothecia and ascospores not observed in the examined material.

**Chemistry:** Thallus K+, C-, P+, UV-

**Habitat and Distribution:** *Ramalina nervulosa* is a fruticose lichen species. In the present study, the species was collected from tree bark, twigs, smaller branches and land bridge areas within the Garampani Wildlife Sanctuary, Assam. This taxon represents a new record for the lichen flora of Assam. Earlier reports document its occurrence from Arunachal Pradesh, Karnataka, Kerala and Tamil Nadu, India.

**Specimen examined:** INDIA: Assam, Golaghat district, Garampani Wildlife Sanctuary, 26°39'44.2" N, 93°87'90.7" E, on tree bark, elev.

97 m, 6 October 2022, S. Sultana, N. Nazma & A. Baruah, LC65609 (LWG).

The extensive surveys carried out in the Nambor and Garampani Wildlife Sanctuaries provided valuable insights into the lichen diversity of Golaghat district, Assam. The investigation resulted in the documentation of several new records for the state and the country. The study further revealed that lichen species within these protected areas occupy a broad spectrum of substrata, including corticolous, saxicolous and terricolous habitats, reflecting their pronounced ecological plasticity and integral role in forest ecosystem functioning. Favourable environmental conditions, including adequate light availability, minimal anthropogenic disturbance and moderate ambient temperatures ranging between 22–30 °C, were observed to support luxuriant lichen growth in the study area. The occurrence of diverse and structurally complex lichen assemblages underscores the high conservation value of the Nambor-Doigrung-Garampani landscape and highlights its importance as a refuge for cryptogamic biodiversity (2, 10).

The present documentation significantly enhances the existing knowledge of Indian lichen diversity establishing a robust baseline for future biodiversity inventories, long-term ecological monitoring and conservation prioritisation in Northeast India, a



**Fig. 4.** Growth form of *Ramalina nervulosa*.

region that remains markedly underexplored despite its recognised global biodiversity importance (11, 12).

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## Authors' contributions

SS collected the samples. SS and AB drafted the manuscript. SS and GKM carried out the identification and characterisation of the species. JS and GKM contributed to the correction, design of the manuscript and provided intellectual input. DR constructed the map of the study area showing the species locations. All authors have read and approved the final manuscript.

## Compliance with ethical standards

**Conflict of interest:** Authors do not have any conflict of interests to declare

**Ethical issues:** None

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