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# New distributional records of lichen species from Kumarakom bird sanctuary, Kerala, India

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**ABSTRACT**

This study presents the first comprehensive survey report of lichen species in Kumarakom Bird Sanctuary, a wetland ecosystem and popular tourist destination in Kerala, India. A total of 19 lichen species were identified. Two of these species, *Bacidia incongruens* and *Physcia clementei*, are found to be new records for the state of Kerala. The findings highlight the biodiversity potential of the sanctuary and emphasize the need for conservation efforts to protect this unique and sensitive ecosystem.

**Key words:** Lichenized ascomycota, new records, taxonomy, wetlands

## INTRODUCTION

Kottayam district, a relatively under-explored region for lichen diversity, encompasses Kumarakom Bird Sanctuary. Located near Kumarakom village, Kumarakom Bird Sanctuary spans 14 acres along the banks of Vembanad lake. This sanctuary, renowned for its wetlands and mangroves, is a popular destination for migratory birds from Siberia and Europe. A survey of the lichen biota in Kumarakom Bird Sanctuary, based on a record of 93 samples, revealed two lichen species new to the state of Kerala.

Kerala holds a rich diversity of lichens in its diverse habitats. Unfortunately, the inventory of lichens in Kerala has not received much attention compared to other plant groups. Purushothaman et al. (2021) mentioned 798 species of lichens from Kerala. Later many species were added to the lichen biota of Kerala and according to the current status, the total lichens of Kerala reported to 832 species (Biju et al. 2021; Biju and Sabeena 2021; Anilkumar et al. 2022; Sequeira et al. 2022). The recent publication by Nayaka and Biju (2024) reported that Kerala holds 783 species. However, Sinha et al. (2024) mentioned 816 species from Kerala in the Indian lichens checklist. Consequently, there appears to be a discrepancy in the reported total number of lichen species in Kerala.

## MATERIALS AND METHODS

The Kumarakom bird sanctuary is geographically located between N 9.62762° and E 76.42861°, the area boasts a rich diversity of flora and fauna. The sanctuary experiences a moderate climate with average temperatures ranging from 22 to 37°C and an annual rainfall of approximately 1100 mm, primarily distributed during the southwest and northeast monsoons (Chettiparamb and Kokkranikal 2012; Joby and Samson 2014). A total of 93 specimens were collected from the lichen-rich areas of the said sanctuary (Kottayam, Kerala) based on our field survey conducted during the period between January 2023 and May 2023. These were deposited at the herbarium of Kerala Forest Research Institute, Kerala (KFRI). Morphological and anatomical characters were examined using dissecting microscopes (Olympus SZ61 and LEICA S9i) and LEICA DM2000 compound microscopes attached to the camera and the image analysis software. The amyloid reactions were tested in Lugol's iodine solution (I) with and without pre-treatment of KOH. The measurements were conducted on material mounted in distilled water. Chemical analysis was performed on species with regular spot tests and thin-layer

chromatography with solvent system A following Orange et al. (2001). The specimens were identified up to the species level with the help of the literatures by Awasthi (1991, 2007), Breuss and Lücking (2015), Lücking et al. (2009), and Jagadeesh Ram et al. (2016). The recent classification compiled by Hyde et al. (2024) was followed for segregating species, and nomenclatures are updated following MycoBank

## RESULTS AND DISCUSSION

The study on lichens from Kumarakom Bird Sanctuary documented 19 species belonging to 10 genera and 9 families, which includes 13 crustose, one byssoid, one squamulose and four foliose, of which two species are new to Kerala, namely *Bacidia incongruens* (Stirt.) Zahlbr., and *Physcia clementei* (Turner) Lynge. Of the 93 specimens, those with sterile, immature thalli and that were unable to find ascospores were not identified. A list of all 19 species with their habitats and families from Kumarakom Bird Sanctuary, Kerala is provided in Table 1.

### New records to the flora of Kerala

### *Bacidia incongruens* (Stirt.) Zahlbr.

*Bacidia incongruens* (Stirt.) Zahlbr. Cat. Lich. Univers. 4: 208 (1926). *Lecidea incongruens* Stirt., Proc. Roy. Philos. Soc. Glasgow 11: 314 (1879) presented in Fig. 1.

### *Ramalinaceae*

Thallus corticolous, greenish. Apothecia rounded, adnate and sessile, slightly convex, biatorine, 0.2-0.9 mm in diameter, disc flat, pale yellow to orange. Margin clearly defined, thin, and pale yellow to orange; exciple colourless, 29-34 µm thick; epithecium colourless, K−; hymenium 46–51 µm thick, I+; hypothecium colourless, 15-19 µm thick, K−. Ascospores fusiform, 1–3 (or up to 5) transversely septate, 19–23 x 2–3 µm.

Chemistry: K−, C−, KC−, P−. No lichen substances detected.

Remarks: Earlier reported from Arunachal Pradesh, Assam, Chhattisgarh, Himachal Pradesh, Karnataka, Maharashtra, Manipur, Meghalaya, Punjab, Tamil Nadu, Uttar Pradesh, Uttarakhand, and West Bengal (Sinha et al., 2024).

Specimens examined: India, Kerala, Kottayam district, Kumarakom Bird Sanctuary, elev. 6 m, N 9.636° E 76.400°, 04 February 2023, *Reshma Ajanthi* 23-40033 (KFRI 1001); *ibid*., elev. 7 m, N 9.685° E 76.429°, 04 February 2023, *Reshma Ajanthi* 23-40075 (KFRI 1002).

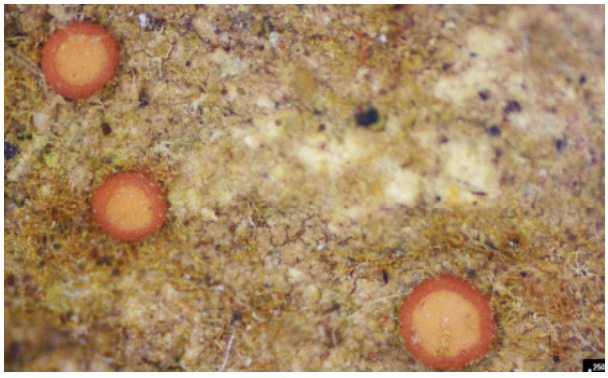

**Fig. 1.** Thallus of *Bacidia incongruens* (Stirt.) Zahlbr.

### *Physcia clementei* (Turner) Lynge

*Physcia clementei* (Turner) Lynge Rabenh. Krypt.-Fl., ed 2: 93 (1935). *Parmelia clementei* Turner in Smith & Sowerby, Engl. Bot., 25: tab. 1779 (1807) presented in Fig. 2.

**Fig. 2.** Thallus of *Physcia clementei* (Turner) Lynge

### *Physciaceae*

Thallus corticolous, firmly attached, measures up to 2 cm in diameter; delicate lobes, 0.3–0.5 mm wide; upper surface light grey in colour with short pustular isidia that rupture to form a sorediate crust; lower cortex ± prosoplectenchymatous. Apothecia not seen.

**Table 1.** List of lichen species recorded from Kumarakom Bird Sanctuary (* = new to Kerala, BY = byssoid, CR = crustose, FO = foliose, SQ = squamulose)

| Sl. . | Lichen taxa | Family | Growth form | Voucher number, Accession number |
|---|---|---|---|---|
| 1 | **Bacidia incongruens* (Stirt.) Zahlbr. | Ramalinaceae | CR | 23-40033 (KFRI 1001), 23-40075 (KFRI 1002) |
| 2 | *Cryptothecia faveomaculata* Makhija & Patw. | Arthoniaceae | CR | 23-40070 (KFRI 1003), 23-40071 (KFRI 1004) |
| 3 | *Dichosporidium boschianum* (Mont.) G. Thor | Roccellaceae | BY | 23-40028 (KFRI 1005), 23-40067 (KFRI 1006), 23-40090 (KFRI 1007) |
| 4 | *Graphis arecae* Vain. | Graphidaceae | CR | 23-40025 (KFRI 1008) |
| 5 | *Graphis glaucescens* Fée | Graphidaceae | CR | 23-40021 (KFRI 1009), 23-40049 (KFRI 1010), 23-40056 (KFRI 1011), 23-40079 (KFRI 1012) |
| 6 | *Graphis modesta* Zahlbr. | Graphidaceae | CR | 23-40087 (KFRI 1013) |
| 7 | *Graphis subserpentina* Nyl. | Graphidaceae | CR | 23-40097 (KFRI 1014) |
| 8 | *Herpothallon echinatum* Aptroot, Lucking & Will-wolf | Arthoniaceae | CR | 23-40042 (KFRI 1015), 23-40029 (KFRI 1016), 23-40018 (KFRI 1017), 23-40014 (KFRI 1018) |
| 9 | *Herpothallon granulare* (Sipman) Aptroot & Lücking | Arthoniaceae | CR | 23-40055 (KFRI 1019), 23-40063 (KFRI 1020), 23-40027 (KFRI 1021) |
| 10 | *Leptogium cyanescens* (Ach.) Körb. | Collemataceae | FO | 23-40013 (KFRI 1022), 23-40019 (KFRI 1023) |
| 11 | *Letrouitia* sp. | Brigantiaeaceae | CR | 23-40095 (KFRI 1024) |
| 12 | *Malmidea piae* (Kalb) Kalb | Malmideaceae | CR | 23-40009 (KFRI 1025), 23-40040 (KFRI 1026), 23-40090 (KFRI 1027) |
| 13 | *Phyllopsora corallina* (Eschw.) Müll. Arg. | Ramalinaceae | SQ | 23-40018 (KFRI 1028) |
| 14 | **Physcia clementei* (Turner) Lynge | Physciaceae | FO | 23-40074 (KFRI 1029) |
| 15 | *Physcia sorediosa* (Vain.) Lynge | Physciaceae | FO | 23-40015 (KFRI 1030), 23-40031 (KFRI 1031), 23-40037 (KFRI 1032), 23-40045 (KFRI 1033), 23-40082 (KFRI 1034), 23-40083 (KFRI 1035), 23-40084 (KFRI 1036) |
| 16 | *Physcia tribacioides* Nyl. | Physciaceae | FO | 23-40016 (KFRI 1037), 23-40088 (KFRI 1038) |
| 17 | *Porina* sp. | Trichotheliaceae | CR | 23-40036 (KFRI 1039), 23-40039 (KFRI 1040) |
| 18 | *Porina interstes* (Nyl.) Harm. | Trichotheliaceae | CR | 23-40072 (KFRI 1041), 23-40081 (KFRI 1042) |
| 19 | *Porina tetracerae* (Ach.) Müll. Arg. | Trichotheliaceae | CR | 23-40022 (KFRI 1043), 23-40030 (KFRI 1044), 23-40034 (KFRI 1045), 23-40038 (KFRI 1046), 23-40041 (KFRI 1047), 23-40043 (KFRI 1048), 23-40044 (KFRI 1049), 23-40046 (KFRI 1050), 23-40047 (KFRI 1051), 23-40048 (KFRI 1052), 23-40051 (KFRI 1053), 23-40057 (KFRI 1054), 23-40058 (KFRI 1055), 23-40060 (KFRI 1056), 23-40062 (KFRI 1057), 23-40064 (KFRI 1058), 23-40069 (KFRI 1059), 23-40073 (KFRI 1060), 23-40086 (KFRI 1061), 23-40093 (KFRI 1062), 23-40096 (KFRI 1063) |

Chemistry: Medulla K+ yellow, C−, KC−, P+ pale yellow. Leucotylin and terpenoids are present.

Remarks: Earlier reported from Andaman & Nicobar Islands, and Uttarakhand (Sinha et al., 2024).

Specimen examined: India, Kerala, Kottayam district, Kumarakom Bird Sanctuary, elev. 7 m, N 9.685° E 76.429°, 04 February 2023, *Reshma Ajanthi* 23-40074 (KFRI 1029).

Though Kerala holds a pretty good number of identified lichens (Purushothaman et al., 2021; Nayaka and Biju, 2024), the systematic study of lichens in Kottayam District and also in a wetland ecosystem in Kerala begin with an examination of the biodiversity within the Kumarakom Bird Sanctuary. This initial research serves as a foundation for further surveys to enhance our understanding of lichen diversity in Kerala. Notably, *Bacidia incongruens* and *Physcia clementei* have been identified in this region, marking their first recorded presence in Kerala. However, the dual pressures of backwater tourism and environmental pollution significantly impact these sanctuary ecosystems, leading to a concerning depletion of lichen diversity and growth. To counteract these threats, effective conservation measures must be implemented. Such efforts will protect these unique habitats and preserve the ecological integrity of natural heritage for future generations in Kerala.

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