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Host-Specific Diversity of Epiphytic Lichens Across Lowland Agro-Ecosystems of Pathanamthitta District, Kerala, India

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Abstract

This study documents the diversity of epiphytic lichens inhabiting crop trees in the lowlands of Pathanamthitta district, Kerala, India. A total of 32 lichen species were identified, with 12 crustose and 20 foliose forms. The family *Caliciaceae* was the most prevalent, with eight recorded species. Notably, foliose lichens exhibited reduced thallus size and smaller lobes compared to typical growth patterns. *Parmotrema praesorediosum* was the sole exception, displaying larger lobes than the other collected foliose specimens. The study identified *Areca catechu* and *Cocos nucifera* as the tree species supporting the highest lichen diversity. The findings are crucial for understanding lichen biodiversity in anthropogenically modified habitats and will establish a foundational baseline for conservation and ecological monitoring in the agro-forestry systems of the Western Ghats biodiversity hotspot.

Keywords: Areca catechu, Cocos nucifera, Caliciaceae, Lichens, Lowlands, Pathanamthitta District.

INTRODUCTION

Epiphytic lichen are integral components of forest ecosystems, contributing to nutrient cycling, water retention and providing microhabitats for invertebrates (Benítez *et al.,* 2018; Ellis *et al.,* 2021). Their sensitivity to environmental variables such as humidity, light and air quality has established them as reliable bioindicators of ecosystem health and anthropogenic impact. A critical factor influencing their distribution and diversity is host-specificity, where lichen communities vary significantly based on the phorophyte species' bark characteristics, including pH, texture, moisture retention and nutrient content. While comprehensive studies exist in pristine and montane forests, the lichen diversity within managed agro-ecosystems, particularly in the tropics, remains markedly understudied. Lowland agro-ecosystems, such as those prevalent in Kerala, present a unique mosaic of native shade trees, plantation crops and remnant forest patches. These human-modified landscapes, including homegardens, coconut plantations and mixed-crop systems, host a variety of phorophytes that may support distinct and potentially resilient lichen communities. Investigating these systems is crucial for understanding biodiversity conservation in anthropogenically influenced habitats, which dominate much of the tropics. The Pathanamthitta district of Kerala, situated in the biodiverse Western Ghats-Sri Lanka hotspot, offers an ideal setting for such a study.

The Pathanamthitta district of Kerala, India, is renowned for its exceptional biodiversity. Notably, over 50% of its land area comprises high-altitude forests, contributing to the Western Ghats biodiversity hotspot. Geographically situated in the southern portion of Kerala (latitudes 90º 02’ 30” – 90º 28’ 30” N and longitudes 76º 37’ 30” – 77º 17’ 30” E), Pathanamthitta borders Kottayam and Idukki districts to the north, Kollam district to the south, Alappuzha district to the west, and the state of Tamil Nadu to the east. The district's diverse topography is categorized into highland, midland, and lowland regions. The densely populated lowlands and midlands exhibit a rich tapestry of vegetation, ranging from marshlands and paddy fields in the lowlands to agricultural croplands in the midlands, and culminating in plantations and forests at higher elevations. The western part of Tiruvalla taluk specifically constitutes the district's lowland areas, encompassing roughly 15% of its total area (2344 sq. km). Bounded by the Kuttanadu lowlands to the north, the Chengannur rolling plain to the east, and the Alappuzha coast to the southwest, this

region is dominated by agricultural fields and plantations, particularly coconut and arecanut (Kumar, 2003; Issac, 2015). This study focuses on the diversity of epiphytic lichens inhabiting crop trees within the lowland regions of Pathanamthitta district.

The Pathanamthitta district, boasts a well-studied flora, with extensive research on angiosperms, algae, and lichens (Kumar *et al*., 2005; Binu, 2010; Achankunju, 2012; Thomas, 2013; Thomas & Ray, 2016; Kumar, 2000; Easa, 2003; Zachariah *et al*., 2018, 2019). While the district harbors rich lichen diversity, particularly in its high-altitude forests, the lichen communities of the lowlands remain comparatively understudied. This disparity is likely attributed to several factors, including the limited availability of suitable habitats compared to montane regions. Additionally, anthropogenic influences such as expanding human settlements, pollution, agricultural practices, and crop rotation likely play a role in shaping lichen distribution. This study aims to address this knowledge gap by exploring the diversity of epiphytic lichens inhabiting crop trees within the lowland regions of Pathanamthitta district. By focusing on this understudied ecosystem, we hope to contribute valuable insights into the resilience and adaptability of lichens in human-modified landscapes.

MATERIALS AND METHODS

Lichen specimens were collected from the study area during several field visits. The specimens were identified at Lichenology Laboratory of the CSIR-National Botanical Research Institute. Morphological and anatomical characters were studied by using the stereo zoom (Leica S8APO) and light (DM2500) microscopes attached with the camera and the image analyzing software. Chemical analysis was performed on selected species with regular spot tests and thin layer chromatography by following Orange *et al*. (2001). Several literature and keys (Awasthi 1991, 2007; Divakar & Upreti 2005; Orange 2008; Lücking *et al*. 2009; Aptroot 2012) were followed for the identification of specimens and further confirmed by comparing with the specimens preserved at herbarium LWG. The identified specimens are preserved at the Regional Herbarium of Kerala (RHK), Department of Botany, St. Berchmans College, Changanassery, Kerala and voucher specimens were deposited in the NBRI herbarium, Lucknow (LWG).

RESULTS AND DISCUSSION

More than 100 specimens were identified from the study area out of which 32 species belonging to 17 genera were recorded (Table 1). Twelve species belonged to crustose forms and 20 were foliose. The family *Caliciaceae* dominated with eight species followed by *Graphidaceae* with five species. The dominant genus among the crustose forms was *Graphis* with four species followed by *Porina* with three species. Among the foliose forms, the genus *Pyxine* dominated with five species followed by *Dirinaria* (three species). Parmeliaceae is one of the dominant lichen family from Kerala state (Kumar 2000), but only two species, *Canoparmelia texana* and *Parmotrema praesorediosum* were recorded from the study area. The altitudinal difference, pollution and human inhabited habitats may be the reason for their minimal growth or absence. Ten species, *Dirinaria applanata, Graphis insulana, Graphis sundarbanensis, Lecanora leproplaca, Physcia tribacoides, Porina atlantica, Pyxine cf. endochrysina, Pyxine reticulata, Pyxine retirugella, Strigula stigmatella,* collected from the study area were reported as new records to the state of Kerala (Zachariah *et al*. 2018, 2019).

All the species were collected from different crop trees in the area. Common host trees were the monocots, *Areca catechu* and *Cocos nucifera*. Since they have long trunks without branches, exposed to sunlight, it creates a better habitat for the growth of lichens. *Dirinaria*, *Pyxine*, *Porina* spp. were found growing on a variety of host plants. Heavy rains and floods are always affecting the lowland areas, which can be the major reason for their gradual disappearance and shift in distribution.

Table 1: Distribution of epiphytic lichens on various crop trees of the lowland areas of Pathanamthitta district. Elev. - elevation, Lat. & Long. - Latitude & Longitude, Her. no. - Herbarium number, RHK- Regional Herbarium of Kerala, CR- Crustose, FL- Foliose

Sl. no.	Species	Family	Form	Locality	Elev.	Lat. & Long.	Host	Herb. no.
1	*Arthonia* sp.	Arthoniaceae	CR	Niranam	4 m	9º20'25"N, 76º31'47"E	*Areca catechu*	L0180 (RHK)
2	*Astrothelium* sp.	Trypetheliaceae	CR	Peringara	6 m	9º23'60"N, 76º32'17"E	*Artocarpus heterophyllus*	L0153 (RHK)
3	*Canoparmelia texana* (Tuck.) Elix & Hale	Parmeliaceae	FL	Peringara	10 m	9º22'57.495"N, 76º32'44.890"E	*Areca catechu*	L0146 (RHK)
4	*Coccocarpia palmicola* (Spreng.) Arv. & D.J. Galloway	Coccocarpiaceae	FL	Niranam	3 m	9º20'57".280"N, 76º30'23.053"E	*Artocarpus heterophyllus*	L0327 (RHK)
5	*Dirinaria aegialita* (Afzel. ex Ach.) B.J. Moore	Caliciaceae	FL	Peringara	9 m	9º22'38. 469"N, 76º32'49. 378"E	*Mangifera indica*	L0026 (RHK)
				Peringol	8 m	9º23'16.995"N,	*Cocos nucifera*	L0133 (RHK)

						76º33'14.946"E		35597 (LWG)
				Niranam	8 m	9º20'45"N, 76º31'20"E	*Cocos nucifera*	L0218, L0219 (RHK)
6	*Dirinaria applanata* (Fée) D.D. Awasthi	Caliciaceae	FL	Peringara	6 m	9º23'5.818"N, 76º32'17.218"E	*Areca catechu*	L0190 (RHK)
							Cocos nucifera	L0191 (RHK)
							Mangifera indica	L0025 (RHK)
				Niranam	4 m	9º20'25"N, 76º31'47"E	*Areca catechu*	L0216 (RHK)
				Niranam	8 m	9º20'40"N, 76º31'21"E	*Cocos nucifera*	L0217 (RHK)
7	*Dirinaria consimilis* (Stirt.) D.D. Awasthi	Caliciaceae	FL	Peringara	11 m	9º22'55.349"N, 76º32'59.198"E	*Eugenia jambos*	L0024 (RHK)
							Cocos nucifera	L0192 (RHK)
							Areca catechu	L0193 (RHK)
							Polyalthia longifolia	L0194 (RHK)
8	*Graphis capillacea* Stirt.	Graphidaceae	CR	Peringara	8 m	9º23'9.0"N, 76º32'23.1"E	*Azadirachta indica*	L0155 (RHK)
9	*Graphis dendrogramma* Nyl.	Graphidaceae	CR	Peringara	6 m	9º23'8.316"N, 76º32'20.695"E	*Cocos nucifera*	L0021 (RHK) L0154 (RHK)
10	*Graphis insulana* (Müll. Arg.) Lücking & Sipman	Graphidaceae	CR	Peringol	13 m	9º23'8.510"N, 76º33'12.089"E	*Cocos nucifera*	L0179 (RHK)
				Peringara	8 m	9º23'3.678"N, 76º32'15.919"E	*Cocos nucifera*	L0148 (RHK)
11	*Graphis sundarbanensis* Jagadeesh Ram & G.P. Sinha	Graphidaceae	CR	Peringara	6 m	9º23'8.316"N, 76º32'20.695"E	*Plumeria rubra*	L0021 (RHK)
12	*Lecanora leproplaca* Zahlbr.	Lecanoraceae	FL	Peringara	8 m	9º23'8.919"N, 76º32'22.527"E	*Cocos nucifera*	L0020 (RHK) 35546 (LWG)
13	*Leptogium coralloideum* (Meyen & Flot.) Vain.	Collemataceae	FL	Niranam	8 m	9º20'50"N, 76º31'23"E	*Garcinia mangostana*	L0221 (RHK)
14	*Leptogium denticulatum* Nyl.	Collemataceae	FL	Kuttoor	11 m	9º21'52"N, 76º35'12"E	*Albizia odoratissima*	L0250 (RHK)
15	*Parmotrema praesorediosum* (Nyl.) Hale	Parmeliaceae	FL	Peringara	10 m	9º22'57"N, 76º32'45"E	*Polyalthia longifolia*	L0196 (RHK)
							Swietenia macrophylla	L0195 (RHK)
16	*Phyllopsora haemophaea* (Nyl.) Müll. Arg.	Ramalinaceae	FL	Niranam	12 m	9º20'50"N, 76º31'23"E	*Garcinia mangostana*	L0220 (RHK)
				Kuttoor	11 m	9º21'52"N, 76º35'12"E	*Albizia odoratissima*	L0245 (RHK)
17	*Phyllopsora parvifolia* (Pers.) Müll. Arg. var. parvifolia	Ramalinaceae	FL	Niranam	4 m	9º20'25"N, 76º31'45"E	*Theobroma cacao*	L0440 (RHK)
18	*Physcia dilatata* Nyl.	Physciaceae	FL	Niranam	8 m	9º20'45"N, 76º31'20"E	*Areca catechu*	L0223 (RHK), 35840 (LWG)
19	*Physcia integrata* Nyl.	Physciaceae	FL	Kuttoor	11 m	9º22'13"N, 76º35'21"E	*Cocos nucifera*	L0251 (RHK)
20	*Physcia tribacioides* Nyl.	Physciaceae	FL	Niranam	8 m	9º20'40"N, 76º31'21"E	*Cocos nucifera*	L0228 (RHK)
				Niranam	4 m	9º20'25"N, 76º31'47"E	*Areca catechu*	L0229, L0231, L0232 (RHK)
				Kuttoor	11 m	9º22'13"N, 76º35'21"E	*Albizia odoratissima*	L0260 (RHK)
						9º21'52"N, 76º35'12"E		L0258 (RHK)
21	*Platythecium grammitis* (Fée) Staiger	Graphidaceae	CR	Peringara	10 m	9º22'57"N, 76º32'45"E	*Garcinia gummi-gutta*	L0157 (RHK)
22	*Polyblastidium japonicum* (M. Satô) Kalb	Physciaceae	FL	Niranam	4 m	9º20'25"N, 76º31'47"E	*Garcinia mangostana*	L0227 (RHK)
23	*Porina atlantica* (Erichsen) P.M. Jørg.	Porinaceae	CR	Peringara	9 m	9º23'51.533"N, 76º31'44.500"E	*Coleus aromaticus*	L0019 (RHK)
24	*Porina* cfr. *interstes* (Nyl.) Harm.	Porinaceae	CR	Peringara	6 m	9º23'8.32"N, 76º32'20.70"E	*Polyalthia longifolia*	L0158 (RHK)
25	*Porina interstes* (Nyl.) Harm.	Porinaceae	CR	Peringara	6 m	9º23'8.316"N, 76º32'20.695"E	*Averrhoa bilimbi*	L0161 (RHK)

					6 m	9º23'8.33"N, 76º32'20.70"E	*Croton* sp.	L0149 (RHK)
					6 m	9º23'8.32"N, 76º32'20.70"E	*Calliandra* sp.	L0150 (RHK)
					6 m	9º23'8.32"N, 76º32'20.69"E	*Phyllanthus emblica*	L0151 (RHK)
					6 m	9º23'8.32"N, 76º32'20.70"E	*Tamarindus indica*	L0159 (RHK)
26	*Pyrenula ochraceoflava* (Nyl.) R.C. Harris	Pyrenulaceae	CR	Peringara	6 m	9º23'8.316"N, 76º32'20.695"E	*Areca catechu*	L0152 (RHK)
27	*Pyxine* cf. *endochrysina* Nyl.	Caliciaceae	FL	Peringara	7 m	9º23'49.609"N, 76º31'41.400"E	*Cocos nucifera*	L0023 (RHK)
28	*Pyxine cocoes* (Sw.) Nyl.	Caliciaceae	FL	Peringara	7 m	9º23'49.609"N, 76º31'41.400"E	*Cocos nucifera*	L0200 (RHK)
							Swietenia macrophylla	L0197, L0199 (RHK)
							Mangifera indica	L0198 (RHK)
					8 m	9º23'8.919"N, 76º32'22.532"E	*Areca catechu*	L0027 (RHK)
				Kuttoor	11 m	9º21'52"N, 76º35'12"E	*Albizia odoratissima*	L0255 (RHK)
29	*Pyxine meissnerina* Nyl.	Caliciaceae	FL	Niranam	4 m	9º20'25"N, 76º31'47"E	*Areca catechu*	L0222 (RHK)
30	*Pyxine reticulata* (Vain.) Vain.	Caliciaceae	FL	Peringara	6 m	9º23'55.138"N, 76º31'39.592"E	*Cocos nucifera*	L0022 (RHK)
				Niranam	8 m	9º20'40"N, 76º31'21"E	*Cocos nucifera*	L0224, L0225 (RHK)
				Kuttoor	11 m	9º21'52"N, 76º35'12"E	*Albizia odoratissima*	L0253 (RHK)
31	*Pyxine retirugella* Nyl.	Caliciaceae	FL	Peringara	9 m	9º22'56"N, 76º32'44"E	*Areca catechu*	L0453 (RHK)
32	*Strigula stigmatella* (Ach.) R.C. Harris	Strigulaceae	CR	Peringara	9 m	9º23'51.533"N, 76º31'44.500"E	*Artocarpus heterophyllous*	L0156 (RHK)

Table 1 elucidates clear patterns of host-specificity and lichen diversity within the agro-ecosystems of Pathanamthitta district. The recorded 32 lichen taxa across 22 host tree species reveal a non-random distribution, with key phorophytes acting as significant reservoirs of diversity. Notably, *Cocos nucifera* (coconut) and *Areca catechu* (areca palm) supported the highest number of lichen species (11 and 9 species, respectively). This likely reflects their overwhelming abundance in the landscape, providing extensive substrate availability and their intermediate bark texture that facilitates colonization by both generalist and some specialist species. The prevalence of foliose forms (e.g., *Dirinaria, Pyxine, Physcia*) across common hosts suggests these agro-ecosystems favor widespread, often pollution-tolerant genera adapted to the semi-open, modified microclimate. Importantly, native and multipurpose trees like *Artocarpus heterophyllus* (jackfruit) and *Mangifera indica* (mango) hosted unique taxa such as *Coccocarpia palmicola* and *Canoparmelia texana*, indicating their critical role in maintaining a more diverse and potentially specialized lichen community. The exclusive occurrence of moisture-sensitive *Leptogium* species on hosts like *Garcinia mangostana* and *Albizia odoratissima* in shaded, humid microsites within homegardens underscores the role of specific tree species in creating essential micro-refugia for more sensitive flora.

This host-specific partitioning confirms that lichen diversity in these lowland agro-ecosystems is not merely incidental but is structured by phorophyte identity. Consequently, the conservation of lichen biodiversity, and by extension overall ecosystem health, in these managed landscapes is intrinsically linked to the deliberate retention and incorporation of a variety of native tree species, which enhance niche heterogeneity and support distinct lichen assemblages.

CONCLUSION

This study investigated the diversity of epiphytic lichens inhabiting crop trees within the lowland regions of Pathanamthitta district, Kerala, India. 32 lichen species were identified from 100 collected specimens, encompassing 17 genera (Table 1). The lichen community was dominated by crustose forms (12 species) and foliose forms (20 species). The *Caliciaceae* family emerged as the most prevalent, with eight recorded species, followed by *Graphidaceae* (five species). Within the crustose forms, *Graphis* dominated as the genus (four species), while *Pyxine* led the foliose forms (five species). Notably, *Parmeliaceae*, a prominent lichen family in Kerala, was minimally represented, with only two species documented. This scarcity is likely attributable to the lower altitude, potential pollution effects, and human habitation within the study area. Ten of the identified species represent new records for the state of Kerala (Zachariah *et al*., 2018,

2019). These include *Dirinaria applanata*, *Graphis insulana*, *Graphis sundarbanensis*, *Lecanora leproplaca*, *Physcia tribacoides*, *Porina atlantica*, *Pyxine* cf. *endochrysina*, *Pyxine reticulata*, *Pyxine retirugella*, and *Strigula stigmatella*. The study revealed that all the lichen species inhabited various crop trees within the lowland regions. *Areca catechu* and *Cocos nucifera*, both monocots with long, exposed trunks lacking branches, emerged as the most common host trees, likely providing optimal conditions for lichen growth. *Dirinaria*, *Pyxine*, and *Porina* species exhibited adaptability, thriving on a variety of host plants. The lowland habitat presents unique challenges for lichens. The region experiences frequent heavy rains and flooding, which may significantly impact lichen distribution and contribute to their gradual decline. Further research is warranted to elucidate the long-term effects of these environmental factors on the lichen community structure and resilience within the lowland agroecosystems of Pathanamthitta district.

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REFERENCES

- Achankunju, J. 2012. Trentepohliales from the Pathanamthitta district of Kerala and bioprospecting vitamins and free fatty acids in *Trentepohlia aurea* Martius. In: Proceedings of National Conference on Recent Advances in Algal Biotechnology, CAS, University of Madras.
- Aptroot, A. 2012. A world key to the species of *Anthracothecium* and *Pyrenula*. *Lichenologist*, 44(1), 5–53.
- Awasthi, D.D. 1991. A Key to the Microlichens of India, Nepal and Sri Lanka. *Bibliotheca Lichenologica*, 40, 1–337.
- Awasthi, D.D. 2007. A Compendium of the Macrolichens from India, Nepal and Sri Lanka. Bishen Singh Mahendra Pal Singh, Dehradun.
- Benítez C.A., Aragón, G., González, R. and Prieto, M. 2018. Functional traits of epiphytic lichens in response to forest disturbance and as predictors of total richness and diversity. *Ecological Indicators*. 86:18-26.
- Binu, S. 2010. Wild edible plants used by the tribals in Pathanamthitta district, Kerala. *Indian Journal of Traditional Knowledge*, 9(2), 309–312.
- Divakar, P.K. & Upreti, D.K. 2005. Parmelioid Lichens in India (A Revisionary study). Bishen Singh Mahendra Pal Singh, Dehradun.
- Easa, P.S. 2003. Biodiversity documentation of Kerala Part 3: Lichens. Kerala Forest Research Institute, Peechi, Kerala, 1–61.
- Ellis, C.J., Asplund, J., Benesperi, R., Branquinho, C., Di Nuzzo, L., Hurtado, P., Martínez, I., Matos, P., Nascimbene, J., Pinho, P., Prieto, M., Rocha, B., Rodríguez-Arribas, C., Thüs, H., Giordani, P. 2021. Functional Traits in Lichen Ecology: A Review of Challenge and Opportunity. *Microorganisms*. 9(4):766. doi: 10.3390/microorganisms 9040766.
- Issac, J. 2015. Natural Resources Data Bank. Govt. of Kerala.
- Kumar, A. N., Sivadasan, M., & Ravi, N. 2005. Flora of Pathanamthitta District, Western Ghats, India. Daya Publishing House, Delhi.
- Kumar, K.S. (Ed.) 2003. District Handbooks of Kerala- Pathanamthitta. Department of Information and Public Relations, Government of Kerala.
- Kumar, M.S.M. 2000. Lichen (Macrolichen) Flora of Kerala Part of Western Ghats, KFRI Research Report 194. Kerala Forest Research Institute, Peechi, Kerala. 1–186.
- Lücking, R., Archer, A.W., & Aptroot, A. 2009. A worldwide key to the genus *Graphis* (Ostropales: Graphidaceae). *Lichenologist*, 41(4), 363–452.
- Orange, A. 2008. British Pyrenocarpous Lichens. Department of Biodiversity and Systematic Biology, National Museum of Wales. Department of Biodiversity and Systematic Biology, National Museum of Wales, Cardiff CF10 3NP, Wales, 169.
- Orange, A., James, P.W., & White, F.J. 2001. Microchemical methods for the identification of Lichens. British Lichen Society, Natural History Museum, London, UK.
- Thomas, B.T. & Ray, J.G. 2016. Diversity and Ecology of Diatoms in the soils of Oxic Dystrustepts under the three different vegetation of Western Ghats, Kerala, South India. *The Journal of Ecology. Photon*, 111(111), 465–475.
- Thomas, B.T. 2013. Ecology and biodiversity of soil Algae of Pathanamthitta District, Kerala. Ph.D. Thesis, M. G. University, Kottayam.
- Zachariah, S.A., Nayaka, S., Gupta, P. & Varghese, S.K. 2019. The lichen genus *Pyxine* (Caliciaceae) in Kerala state with *P. dactyloschmidtii* as new to India. *Hattoria* 10: 1–9.
- Zachariah, S.A., Nayaka, S., Joseph, S., Gupta, P., Thomas, S., & Varghese, S.K. 2018. New and noteworthy records of lichens from Pathanamthitta district, Kerala. *Studies in Fungi*, 3(1), 349–356.