Studies in Fungi 3(1): 349–356 (2018) www.studiesinfungi.org ISSN 2465-4973
Article

Doi 10.5943/sif/3/1/35

New and noteworthy records of lichens from Pathanamthitta district, Kerala, India

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Zachariah SA, Nayaka S, Joseph S, Gupta P, Thomas S, Varghese SK 2018 – New and noteworthy records of lichens from Pathanamthitta district, Kerala, India. Studies in Fungi 3(1), 349–356, Doi 10.5943/sif/3/1/35

Abstract

Lichen biota of Pathanamthitta district of Kerala state was thoroughly studied which resulted in 24 lichen species as new to Kerala and one species, *Phaeographis nylanderi* (Vain.) Zahlbr. as new to India. All the species identified are either crustose or foliose forms belonging to families Graphidaceae and Caliciaceae indicating the dominance of these groups in the study area. List of all the 25 species are provided along with their distribution.

Key words – Biodiversity – Caliciaceae – Endemic – Graphidaceae – Lichenized fungi – Western Ghats

Introduction

Lichens dominate the terrestrial ecosystem and are the noticeable components of coastal and forest ecosystems (Nash 2008). India has a rich lichen diversity as it constitutes about 5.17% of the total plants of the country (Singh & Dash 2017) represented by 2714 species (Sinha et al. 2018). Abundant lichen growth is usually observed in areas with high altitude however, in moist as well as coastal areas of Kerala their luxuriant growth is noticed. Lichens from Kerala state are studied as a part of the exploration of Western Ghats (Patwardhan 1983, Singh & Sinha 1997) and till date more than 400 species have been identified by various researchers. Singh & Sinha (2010) listed a total of 75 reference related to lichen studies in Kerala available till then. Later on Nayaka & Upreti 2011, Biju et al. 2010, 2012, Bhat et al. 2011, Pandit 2012, Mesta & Kanivebagilu 2015, Sreekumar et al. 2017 further contributed to knowledge of lichen biota of the state. However, within the state several interesting habitats such as croplands, wetlands and coastal areas remain unexplored. Pathanamthitta district of Kerala state is one such area with diverse habitat requiring intensive lichen documentation. Earlier, Easa (2003) listed 54 species of lichens form various localities of Pathanamthitta district.

The Pathanamthitta district of Kerala state comprises of three distinct natural geographical regions; the highlands – part of Western Ghats covering thick forests and tall hills with an average altitude of 800 m; the midland – which comprises areas with small hills with altitude ranging from 20-100 m; and the lowlands with less than 20 m altitude and wetlands lying closer to the western coastal boundaries. The highland comprises of the forest areas while the midland and lowland areas include human-inhabited and cultivated lands. The district has a reserve forest area of 1385.27 km^2 comprising 50% of the total district area (Kumar 2003) and is completely devoted for the conservation of biodiversity. The major floral diversity of the region includes 1249 angiosperms

Submitted 15 November 2018, Accepted 17 December 2018, Published 24 December 2018
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(Kumar et al. 2005) which clearly indicates the scarcity of data on lower group of plants. Therefore, a comprehensive documentation of the lichen biota of Pathanamthitta district is initiated for the first time and several novel taxa are encountered.

Materials & Methods

Lichen specimens were collected from the natural habitats of highland, midland and lowland regions of the Pathanamthitta district during several field visit following standard procedure (Nayaka 2014). A total of 260 specimens were collected from 44 localities within Amalloor, Anathode, Attappara, Elanthoor, Elavumthitta, Kakki, Kambothumvalavu, Kaviyoor, Kuttapuzha, Kuzhikala, Moozhiyaar, Pancharamon, Peringara and Peringol areas of the district (Fig. 1, Table 1). The specimens were identified at Lichenology Laboratory of the CSIR-National Botanical Research Institute, Lucknow by studying their morphology, anatomy and chemistry. The morphological details were examined using a stereo zoom Leica S8APO microscope while anatomical details were studied using DM2500 optical microscopes attached with camera and image analysis software. The chemistry was studied by spot tests and thin layer chromatography was performed in solvent system C following Orange et al. (2001). Recent literature, keys and descriptions (Awasthi 1991, 2007, Sparrius 2004, Divakar & Upreti 2005, Orange 2008, Aptroot et al. 2009, Lücking et al. 2009, Saag et al. 2009, Aptroot 2012, Breuss et al. 2015, Seavey et al. 2017) were followed for identification and finally identity was confirmed by comparing with the specimens preserved at herbarium LWG. Lücking et al. (2017) was followed for classification of lichens. The identified specimens are preserved at the Regional Herbarium of Kerala (RHK), Department of Botany, SB College, Changanacherry, Kerala.

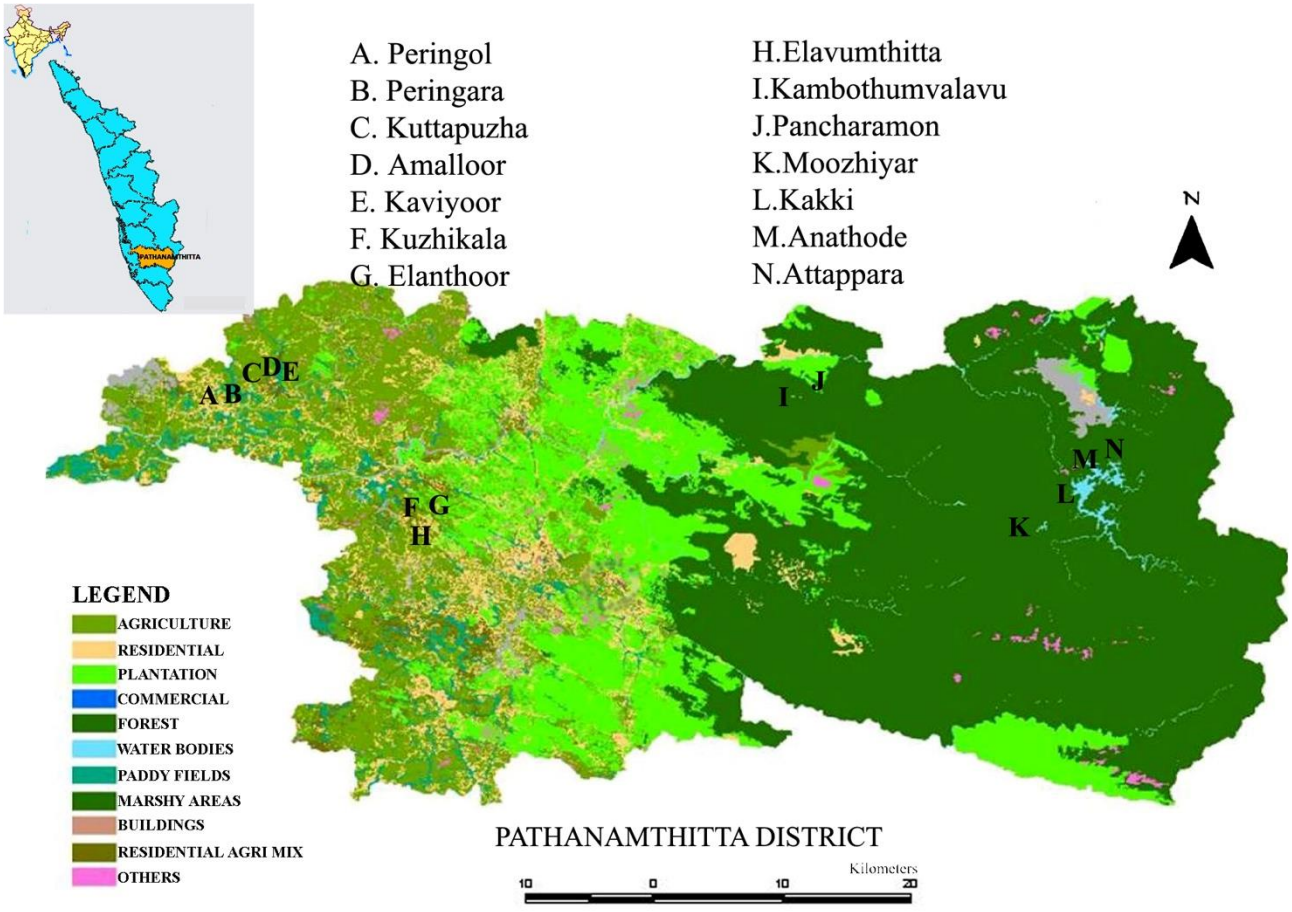

Fig. 1 – Map of the study area

Table 1 List of Lichens new to the state of Kerala. (Note: GF= Growth Form, CR= Crustose, FL= Foliose, Sub= Substratum, Corti= Corticolous, Rami= Ramicolous, Lat. & Long. = Latitude & Longitude, EL= Elevation, EI= Endemic to India, *= New record to India, AP: Andhra Pradesh, AR: Arunachal Pradesh, AS: Assam, GA: Goa, HP: Himachal Pradesh, JK: Jammu & Kashmir, KA: Karnataka, KL: Kerala, MP: Madhya Pradesh, MH: Maharashtra, MN: Manipur, NL: Nagaland, OR: Orissa, SK: Sikkim, TN: Tamil Nadu, UK: Uttarakhand, UP: Uttar Pradesh, WB: West Bengal, AN: Andaman & Nicobar islands

Sl. no	Name	Family	GF	Sub	Locality (Pathanamthitta district, Kerala)	Lat. & Long.	EL (m)	Earlier Reports from India/ Status (Singh & Sinha 2010, Singh 2018, Sinha et al. 2018)
1	*Dirinaria applanata* (Fée) D.D. Awasthi	Caliciaceae	FL	Corti	Kuttapuzha	9º24'2.114"N, 76º35'2.799"E	29	AN, KA, MP, MH, NG, SK, TN, UP, UK, WB
					Peringara,	9º23'5.818"N, 76º32'17.218"E	6	
					Kaviyoor	9º23'37.663"N, 76º37'4.288"E	17	
					Kuzhikala	9º17'29.313"N, 76º42'37.219"E	36	
					Elavumthitta	9º16'28.452"N, 76º42'38.758"E	49	
2	*D. confusa* D.D. Awasthi	Caliciaceae	FL	Corti	Kaviyoor	9º23'36.879"N, 76º37'5.915"E	19	AR
3	*Enterographa micrographa* (Nyl.) Redinger	Roccellaceae	CR	Corti	Kuttapuzha	9º24'3.443"N, 76º35'4.287"E	32	MH
4	*Graphis cinnamomea* Adaw. & Makhija	Graphidaceae	CR	Corti	Kuttapuzha	9º24'2.456"N, 76º35'5.065"E	29	TN, Status: EI
5	*G. insulana* (Müll. Arg.) Lücking & Sipman	Graphidaceae	CR	Corti	Peringara	9º23'3.678"N, 76º32'15.919"E	8	KA, MH
					Kaviyoor	9º23'32.221"N, 76º37'5.040"E	16	
					Peringol	9º23'8.510"N, 76º33'12.089"E	13	
6	*G. pinicola* Zahlbr.	Graphidaceae	CR	Corti	Amalloor	9º23'31.960"N, 76º35'16.257"E	32	TN
7	*G. sayeri* Müll. Arg.	Graphidaceae	CR	Corti	Amalloor	9º23'31.304"N, 76º35'18.174"E	25	UK
8	*G. sundarbanensis* Jagadeesh Ram & G.P. Sinha	Graphidaceae	CR	Corti	Peringara	9º23'8.316"N, 76º32'20.695"E	6	WB, Status: EI

Table 1 Continued.

Sl. no	Name	Family	GF	Sub	Locality (Pathanamthitta district, Kerala)	Lat. & Long.	EL (m)	Earlier Reports from India/ Status (Singh & Sinha 2010, Singh 2018, Sinha et al. 2018)
9	*Herpothallon* cf. *sticticum* Jagadeesh Ram & G.P. Sinha	Arthoniaceae	CR	Corti	Moozhiyaar	9º18'27.601"N, 77º3'56.465"E	189	*H. sticticum* Jagadeesh Ram & G.P. Sinha AR, SK
10	*Heterodermia albidiflava* (Kurok.) D.D. Awasthi	Physciaceae	FL	Corti	Kambothum Valavu	9º22'55.1"N, 76º57'25.5"E	401	HP, KA, MP, SK, WB Status: EI
11	*Lecanora fimbriatula* Stirt.	Lecanoraceae	FL	Corti	Attappara	9º20'50.405"N, 77º9'23.805"E	1099	GA, HP, KA, MH, SK, TN, UK
12	*L. leproplaca* Zahlbr.	Lecanoraceae	FL	Corti	Peringara	9º23'8.919"N, 76º32'22.527"E	8	MH
					Elanthoor	9º17'59.772"N, 76º43'0.928"E	28	
13	*Lepraria membranacea* (Dicks.) Vain.	Stereocaulaceae	CR	Corti	Amalloor	9º23'33.560"N, 76º35'17.489"E	34	JK, UK
					Pancharamon	9º23'46.120"N, 76º57'54.358"E	313	
					Elavumthitta	9º16'28.767"N, 76º42'38.737"E	47	
					Kaviyoor	9º23'32.913"N, 76º37'5.221"E	16	
14	*Leptogium javanicum* (Mont. & Bosch) Mont.	Collemataceae	FL	Corti	Kakki	9º19'31.777"N, 77º8'42.707"E	1020	AR, MP, MN, UK, WB
					Attappara	9º20'50.142"N, 77º9'24.870"E	1102	
15	*Malmidea granifera* (Ach.) Kalb, Rivas Plata & Lumbsch	Malmideaceae	CR	Corti	Moozhiyaar	9º18'24.792"N, 77º3'55.839"E	200	AP, GA, JK, MP, MN, TN, UP, UK, WB
16	*Pannaria lurida* (Mont.) Nyl.	Pannariaceae	FL	Corti	Kakki	9º19'31.273"N, 77º8'42.132"E	1012	AN
17	**Phaeographis nylanderi* (Vain.) Zahlbr.	Graphidaceae	CR	Rami	Kuttapuzha	9º24'1.750"N, 76º35'5.786"E	29	New report from KL
18	*Phyllopsora nemoralis* Timdal & Krog	Ramalinaceae	FL	Corti	Amalloor	9º23'34.281"N, 76º35'20.824"E	21	AS
					Elavumthitta	9º16'28.963"N, 76º42'38.484"E	47	

Table 1 Continued.

Sl. no	Name	Family	GF	Sub	Locality (Pathanamthitta district, Kerala)	Lat. & Long.	EL (m)	Earlier Reports from India/ Status (Singh & Sinha 2010, Singh 2018, Sinha et al. 2018)
					Kuttapuzha	9º24'1.832"N, 76º35'6.486"E	29	
19	*Physcia tribacioides* Nyl.	Physciaceae	FL	Corti	Kaviyoor	9º23'32.221"N, 76º37'5.040"E	16	AR, HP, MP, MH, MN, NL, SK, TN, WB
20	*Porina atlantica* (Erichsen) P.M. Jørg.	Porinaceae	CR	Corti	Peringara	9º23'51.533"N, 76º31'44.500"E	9	AP, AS, GA, HP, KL, KN, MN, NL, SK, TN, WB
21	*Pseudocyphellaria intricata* (Delise) Vain.	Lobariaceae	FL	Corti	Anathode	9º20'43.495"N, 77º9'9.915"E	994	TN
22	*Pyrenula maravalensis* Vain.	Pyrenulaceae	CR	Corti	Kuttapuzha	9º24'1.618"N, 76º35'3.557"E	30	AP, GA, KN, OR Status: EI
23	*Pyxine* cf. *endochrysina* Nyl.	Caliciaceae	FL	Corti	Amalloor	9º23'34.111"N, 76º35'19.451"E	30	*P. endochrysina* Nyl. (MN)
					Peringara	9º23'49.609"N, 76º31'41.400"E	7	
					Kuttapuzha	9º24'2.114"N, 76º35'2.799"E	29	
					Elavumthitta	9º16'28.642"N, 76º42'36.485"E	53	
					Kaviyoor	9º23'32.913"N, 76º37'5.221"E	16	
24	*P. reticulata* (Vain.) Vain.	Caliciaceae	FL	Corti	Elavumthitta	9º16'29.282"N, 76º42'36.220"E	53	AN, KA, TN
					Kuttapuzha	9º24'2.028"N, 76º35'3.444"E	29	
					Peringara	9º23'55.138"N, 76º31'39.592"E	6	
					Amalloor	9º23'31.960"N, 76º35'16.257"E	32	
					Kuzhikala	9º17'30.158"N, 76º42'37.119"E	34	
					Kaviyoor	9º23'31.306"N, 76º37'6.567"E	15	

Table 1 Continued.

Sl. no	Name	Family	GF	Sub	Locality (Pathanamthitta district, Kerala)	Lat. & Long.	EL (m)	Earlier Reports from India/ Status (Singh & Sinha 2010, Singh 2018, Sinha et al. 2018)
25	*Strigula stigmatella* (Ach.) R.C. Harris	Strigulaceae	CR	Corti	Peringara	9º23'51.533"N, 76º31'44.500"E	9	AP, JK

Results

Identification of all the collected specimens resulted in 85 species of which 25 species belonging to 18 genera and 14 families are new to Kerala. Among the 25 species, *Phaeographis nylanderi* (Vain.) Zahlbr. is new to India. The list of new records is presented in Table 1 with their family, growth form, substratum, details of collection site, earlier known areas of the country and status.

New to India

Phaeographis nylanderi (Vain.) Zahlbr., *Cat. Lich. Univers.* 2: 382. 1923. Fig. 2

Graphis nylanderi Vain., *Bot. Tidsskr.* 29: 130. 1909. (Graphidaceae)

Thallus crustose, corticolous, greyish-yellow to brownish yellow. Apothecia lirellate, prominent, simple to furcate, straight to flexuose, up to 1–6.5 mm long, 0.4–0.7 mm wide; margin thin; disc black, wide open, faintly pruinose or epruinose; excipulum carbonized apically, dimidiate, thin, pale brown to yellowish at lower region; hymenium colourless, inspersed; hypothecium yellowish; asci 8-spored; ascospores brown, oblong-ellipsoid, transversely 5 septate, 18–19 × 6–7 µm, I+ red violet.

Chemistry: Thallus K+ red, C–, KC–, P+ yellow; norstictic acid present in TLC.

Notes – It is a pantropical species earlier known from America and Australia (Seavey et al. 2017) and in the present study it is found on tree trunk of *Swietenia macrophylla* in Kuttapuzha area of Pathanamthitta district. The species has resemblance to *P. intricans* (Nyl.) Staiger which differs by the long, stellate branched lirellae, clear hymenium and uncarbonized excipulum. Morphologically very much similar to the *P. inusta* (Ach.) Müll. Arg. that can be distinguished by the absence of lichen substance (Seavey et al. 2017).

Material examined – India, Kerala, Pathanamthitta district, Tiruvalla taluk, Kuttapuzha locality, Mar Thoma College campus, 9º24'1.750"N, 76º35'5.786"E, 18 October 2016, Sonia Anna Zachariah L0001 (RHK).

Discussion

Eighteen species were collected from the cultivated areas (midland and lowland) of Pathanamthitta district with an elevation range of 6–49 m. Common host plants of the cropland lichens include *Mangifera indica, Garcinia gummi-gutta, Cocos nucifera, Artocarpus heterophyllus, Tectona grandis, Artocarpus hirsutus, Areca catechu, Theobroma cacao, Syzygium samarangense, Anacardium occidentale, Macaranga peltata, Swietenia macrophylla, Hevea brasiliensis, Polyalthia longifolia* and *Peltophorum ferrugineum*. Seven species were collected from the forest areas of

Pathanamthitta with an elevation range of 189–1012 m. All the species identified are belonging to crustose (13 species) and foliose (12 species) forms with a maximum representation from the family Graphidaceae (6 species) followed by the family Caliciaceae with four species. Four species, viz. *Graphis cinnamomea* Adaw. & Makhija; *G. sundarbanensis* Jagadeesh Ram & G.P. Sinha; *Heterodermia albidiflava* (Kurok.) D.D. Awasthi and *Pyrenula maravalensis* Vain. are endemic to India (Singh & Sinha 2010, Singh 2018).

The present investigation is an initial attempt to get a clear picture of lichen richness of Pathanamthitta district in the state of Kerala. This can form a baseline data for impending biomonitoring studies. Based on the present observations, it has been obvious that Pathanamthitta district provides suitable locales for the diverse growth of lichens. More rigorous studies may certainly add new taxa to the lichen biota of the district and the state.

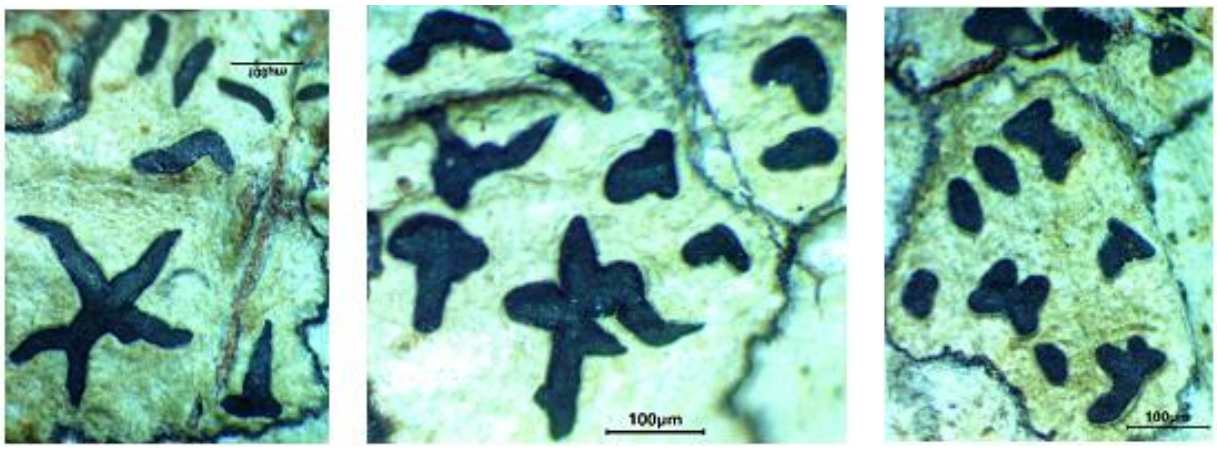

Fig. 2 – *Phaeographis nylanderi* (Vain.) Zahlbr.

Acknowledgement

We are thankful to the Principal, SB College, Changanacherry and the Director, CSIR- NBRI, Lucknow for providing laboratory facilities and herbarium consultations. Thanks, are also due to Dr. D.K. Upreti for his valuable suggestions. Author SAZ is thankful to UGC for FDP selection and Kerala Forest Department for permitting sample collection from the protected areas of Pathanamthitta district.

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