



Further Additions to the Plasticolous Lichens from India

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Abstract The present paper describes diversity of plasticolous lichens colonizing a 15-year-old nylon net house at Chamoli district, Garhwal Himalaya, documenting a total of 19 species of lichens, in which 12 species are being reported for the first time as plasticolous lichen mycota from India and out of these 12 species, 09 species are being reported first time across the world as plasticolous.

Keywords India · Lichen · New report · Plasticolous

Lichen is an association of fungi, green algae or cyanobacteria, and recently, Spribille et al. [1] discovered yeast in the cortex of some lichen thalli. These are cosmopolitan in distribution along tropical to alpine regions of the world and are classified into various groups on the basis of substrates on which they colonize (viz. Corticolous, Saxicolous, Terricolous, Foliicolous, Ramicolous and Muscicolous). The above-mentioned groups of lichens colonize natural substrates, and besides these natural substrates, they have also been found colonizing manmade substrates such as rope, plastics, fences, glass, leather, iron, pottery, aluminum, roof, concretes, brick, metals, and

collectively referred to as omnicolous. Still there is no distinct terminology available for lichens colonizing different artificial substrates, except plasticolous which represents the lichen individuals colonizing plastic. Till date, there are only eight publications on plasticolous lichens across the globe [2–9]. During a field visit to Chamoli district, Garhwal Himalaya, the author (SU) encountered a nylon net house which was harboring lichens; on extensively examining the net house, it revealed some lichen taxa which were not reported colonizing plastic earlier from the globe.

The present study is based on the 15-year-old nylon net house in Lata village on the way to Malari (a part of Nanda Devi National Park and Biosphere Reserve), Chamoli district in Garhwal Himalaya (altitude 2700 m asl), which was developed by GBPNIHESD Kosi-Katarmal, Almora, in 2002 for the conservation of high-value medicinal plants of alpine region. The samples were collected with the help of scissor and snapper [(cutter) the nylon net containing the lichen material was cut] on October 12, 2014, by authors and deposited at herbarium of Kumaun University, Almora (ALM), Uttarakhand, India.

Morphological and anatomical characters were examined under stereo-zoom dissecting microscope (SZM 2LED OPTIKA) and compound microscope (B-150 DB OPTIKA). Color spot test reactions were carried out on the thalli, and reproductive bodies using reagents K (10% solution of sodium hydroxide), C (calcium hypochlorite) and Pd (*para*-phenylenediamine) and TLC was performed as per Orange et al. [10]. The identification of lichens was based on the published literature [11–13].

A total of 19 plasticolous lichen species belonging to 14 genera and 6 families were found colonizing the nylon net and were occurring all over the nylon net house. Parmeliaceae was the dominant family with 8 species followed by

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Physciaceae (7 species), Candelariaceae, Chrysothricaceae, Collemataceae and Ramalinaceae (one species each). However, *Heterodermia* was the dominant genus (4 species) followed by *Parmotrema* and *Phaeophyscia* (2 species each) and the remaining 11 genera were having single species (Table 1). Of these 19 plasticolous lichens, 7 species were previously reported from Nature Interpretation and Learning Centre (NILC) of GBPNIHESD, Kosi-Katarmal, Almora, while rest 12 species are new plasticolous lichen mycota for India (Table 1). Besides this, the present paper is a documentation of 9 species as plasticolous for the first time from the globe out of 12 newly reported plasticolous lichens for India. Two species, viz. *C. limosum* and *H. lutescens*, showed habitat and altitudinal range extension (2700 m asl) in India.

Upreti and Dixit [6] reported 11 species of lichens in plastic net of Royal Botanic Garden Kathmandu, Nepal. Out of those 11 species, 4 species, viz. *Heterodermia*

diademata, *Phaeophyscia endococcina*, *P. hispidula* and *Xanthoria candelaria*, are similar to the present study.

The present study is showing that many lichen taxa have extended their range of substrates; this may be a suitable option for their conservation. The broad spectrum of manmade objects may be a potential source for lichen conservation. It is far easy to protect nylon net in our nearby area instead of protecting a patch of forest. Forests are generally prone to forest fire; besides this, the trees the best hosts of lichens in a forest ecosystem are lopped for fodder and fuel wood requirements of the human community which causes a major loss in lichen diversity. To cope up with the loss in diversity, lichens seem to be capable of changing their hosts. Using manmade objects can provide a suitable substrate for lichens to colonize and conserve their diversity to some extent.

Plastic is considered harmful to the environment although it provides a suitable substrate for the growth of lichens. Plastic remains for a long time in the environment

Table 1 Plasticolous lichen species reported from Lata Kharak, Chamoli district, Garhwal Himalaya

S. no.	Plasticolous lichen species	Family	Previously reported	Reference	Herbarium number
1	<i>Bacidia</i> sp. De Not.	Ramalinaceae	GBPNIHESD, Kosi-Katarmal, Almora	[9]	12-10-14-01
2	<i>Candelaria concolor</i> (Dicks.) Arnold	Candelariaceae	-do-	-do-	12-10-14-02
3	<i>Cetrelia pseudovivitorum</i> (Asahina) W.L. Culb. & C.F. Culb.	Parmeliaceae	Present study ^a	Present study ^a	12-10-14-03
4	<i>Chrysothrix</i> sp Mont.	Chrysothricaceae	-do- ^a	-do- ^a	12-10-14-04
5	<i>Collema limosum</i> (Ach.) Ach.	Collemataceae	-do- ^a	-do- ^a	12-10-14-05
6	<i>Flavoparmelia caperata</i> (L.) Hale	Parmeliaceae	-do- ^a	-do- ^a	12-10-14-06
7	<i>Flavopunctelia flaventior</i> (Stirt.) Hale	Parmeliaceae	-do- ^a	-do- ^a	12-10-14-07
8	<i>Heterodermia boryi</i> (Fee) K.P. Singh & S.R. Singh	Physciaceae	-do- ^a	-do- ^a	12-10-14-08
9	<i>Heterodermia diademata</i> (Taylor) D. D. Awasthi	Physciaceae	Nepal	[6] ^b	12-10-14-09
10	<i>Heterodermia japonica</i> (M. Sato) Swinscow & Krog	Physciaceae	GBPNIHESD, Kosi-Katarmal, Almora	[9]	12-10-14-10
11	<i>Heterodermia lutescens</i> (Kurok.) Follmann	Physciaceae	Present study ^a	Present study ^a	12-10-14-11
12	<i>Hyperphyscia adglutinata</i> (Florke) H. Mayerhofer & Poelt	Parmeliaceae	GBPNIHESD, Kosi-Katarmal, Almora	[8, 9]	12-10-14-12
13	<i>Parmotrema grayanum</i> (Hue) Hale	Parmeliaceae	Present study ^a	Present study ^a	12-10-14-13
14	<i>Parmotrema melanothrix</i> (Mont.) Hale	Parmeliaceae	-do-	-do-	12-10-14-14
15	<i>Phaeophyscia endococcina</i> (Korb.) Moberg	Physciaceae	Nepal	[6] ^b	12-10-14-15
16	<i>Phaeophyscia hispidula</i> (Ach.) Essl.	Physciaceae	Nepal and GBPNIHESD, Kosi-Katarmal, Almora	[6, 9]	12-10-14-16
17	<i>Physcia dilatata</i> Nyl.	Physciaceae	GBPNIHESD, Kosi-Katarmal, Almora	[9]	12-10-14-17
18	<i>Punctelia subrudecta</i> (Nyl.) Krog	Parmeliaceae	GBPNIHESD, Kosi-Katarmal, Almora	[9]	12-10-14-18
19	<i>Xanthoria candelaria</i> (L.) Th. Fr.	Parmeliaceae	Nepal	[9] ^b	12-10-14-19

^aFirst time reported lichens from globe as plasticolous

^bNew plasticolous lichen mycota for India

because it is non-degradable. The process of colonization of lichens on substrates is facilitated by the insertion of rhizines into host and gradually the lichen degrades the substrate into small particles. Can lichen colonization on plastic degrade it? This can be a research question for the further studies. Lichens are slow-growing organisms, but they possess the capability of degrading substrates and are also known for pedogenesis because they are the primary colonizers on any bare substrate in the process of succession.

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