



DIVERSITY AND DISTRIBUTION OF LICHENICOLOUS FUNGI AND LICHENICOLOUS LICHENS IN UTTARAKHAND: FIRST COMPREHENSIVE CHECKLIST

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Based on the study of specimens from quoted institutional herbarium, the author's collections and on analysis of literature records, a total of 104 lichenicolous fungi and lichens belonging to 51 genera hosted by 117 lichen species are reported from 11 districts of Uttarakhand (excluding Haridwar and Udham Singh Nagar) including three unidentified specimens of *Clypeococcum* sp. (on *Dendriscosticta praetextata*), *Pyrenidium* sp. (on *Dimelaena oreina*) and *Sclerococcum* sp. (on *Dendriscosticta platyphyloides*, *D. wrightii* and *Sticta henryana*). Besides this, 1 species viz. *Llimoniella ramalinae* is new to India, 10 species viz. *Abrothallus parmiliarum*, *Abrothallus peyritschii*, *Endococcus rugulosus*, *Lichenoconium usneae*, *Lichenostigma maureri*, *Opegrapha foreaui*, *Polycoccum pulvinatum*, *Sclerococcum homoclinellum*, *Spirographa fuisisporella* and *Zwackhiomyces coepulonus* are reported new for Uttarakhand, and 26 species (including five from Uttarakhand) are extending their distributional range in India. Within Uttarakhand, maximum 46 species were reported from Chamoli district, followed by Uttarkashi (40), Pithoragarh (30), Bageshwar (22), Nainital (12), Almora and Pauri Garhwal (9 each), Champawat (6), Dehradun and Tehri Garhwal (5 each) and Rudrapur (2). The genera *Sphaerellothecium* and *Opegrapha* were speciose rich with 7 and 6 species, respectively.

Keywords: Fungi, Himalaya, Lichens, Lichenicolous index, Mycota

Lichenicolous fungi are a highly specialized and successful group of organisms which live exclusively on lichens, most commonly as parasites, but sometimes as broad-spectrum pathogens, saprotrophs and commensals (Diederich *et al.* 2018) and are assumed to represent an important source of new species in many groups of fungi (Hawksworth & Rossman 1997), but their overall diversity remained unexplored subject. So far 2319 species of lichenicolous fungi belonging to 10 different classes of Fungi (Ascomycota and Basidiomycota), 55 orders, 115 families and 397 genera have been reported till date (Diederich *et al.* 2018), of which 96% (2219) are ascomycetes and 4% (100) basidiomycetes. Of these 2319 taxa, 2000 are obligately lichenicolous species, subspecies or varieties, 257 lichenicolous lichens and 62 facultatively lichenicolous taxa (Diederich *et al.* 2018). These fungi usually studied by lichenologists and often included in lichen floras, have resulted in the publication of uncountable checklists from the world mentioning their occurrence throughout the world.

India being a hot spot of lichen diversity is also a hub for large number of

lichenicolous fungi. Despite this, the lichenicolous fungal diversity has not been studied in detail and very few sporadic publications appeared until 2013 (Moreau 1951a, Poelt 1961, Awasthi & Singh 1975, Rairkar & Patwardhan 1979, Sherwood *et al.* 1981, Hertel 1983, Pant & Awasthi 1989, Triebel 1989, Awasthi 1991, Hariharan *et al.* 1996, Coppins & Kondratyuk 1998, Alstrup & Ahti 2007) when Zhurbenko (2013) for the first time reported 42 species of lichenicolous fungi from Jammu & Kashmir (including Ladakh). However, the first report of lichenicolous fungus from India is that of Moreau (1951a) on the basis of a collection of *Opegrapha foreaui* (C. Moreau & M. Moreau) Hafellner & R. Sant. [as *Telimena foreaui* C. Moreau & M. Moreau] colonizing thallus of *Heterodermia speciosa* [as *Anaptychia speciosa*]. Later several publications pertaining to lichenicolous fungi come from Joshi *et al.* (2013), Joseph & Sinha (2015), Joshi (2018), Joshi *et al.* (2016abc, 2017abc, 2018), Singh *et al.* (2017) and Singh & Singh (2018), thus raising the tally of these fungi to ca. 200 in India.

In India, the western Himalayan region comprising 2 states and 2 Union Territories viz.

Himachal Pradesh, Jammu & Kashmir, Ladakh and Uttarakhand exhibits a varied geographical and climatic variation which provides a suitable habitat for varied group of organisms to grow and flourish and lichens are no exception. Uttarakhand is well explored for the diversity of lichens since the beginning of lichenological studies in India in 1950s. During this period of time a number of workers explored different regions and carried out an exhaustive survey of the lichen diversity in Uttarakhand. Despite of such exhaustive exploration the studies on lichenicolous fungal diversity were greatly ignored. One of the author (YJ) paid great attention to the search of lichenicolous fungi of India and Uttarakhand and presented the first account of lichenicolous fungi of Uttarakhand with 6 species while compiling the checklist of lichenicolous fungal diversity of India (Joshi *et al.* 2015a). Later, he along with his team identified several species (Joshi 2018, Joshi *et al.* 2015b, 2016abc, 2017abc, 2018, Singh *et al.* 2017) including 07 new species (*Didymocyrtis rhizoplacae* Y. Joshi & K. Bisht, *Endococcus physciae* Y. Joshi, *Epicladonia heterodermiae* Y. Joshi, A. Falswal & R. Joshi, *Opegrapha gyalolechia* Y. Joshi, *Plectocarpon diedertianum* Y. Joshi, Upadhyay & Chandra, *Plectocarpon parmeliarum* Y. Joshi, *Polycoccum ochvarianum* Y. Joshi) from Uttarakhand and the tally of lichenicolous fungi from Uttarakhand thus raised up to 104 (Joshi *et al.* 2015b, 2016a, 2018).

In the present paper we are providing the complete checklist of lichenicolous fungi [including lichenicolous lichens which are defined as those taxa which are juvenile non-lichenized parasites on lichenized fungi which ultimately emerge (morph) out the thallus of the host, forming an independent lichenized thallus (Kocourková *et al.* 2012)] of Uttarakhand. The catalogue includes 105 species (101 lichenicolous fungi + 04 lichenicolous lichens), three unidentified specimens of *Clypeococcum* sp. (on *Dendriscosticta praetextata*), *Pyrenidium* sp. (on *Dimelaena oreina*) and *Sclerococcum* sp.

(on *Dendriscosticta platyphylloides*, *D. wrightii* and *Sticta henryana*), 1 new record for the country and 10 regional records. Amongst these lichenicolous lichens, taxa such as *Carbonea assimilis* and *Diploschistes muscorum* are obligate on specific species or genera. Other taxon, such as *Monerolechia badia* occur on a wide range of hosts, while taxon such as *Verrucula latericola* are apparently not obligatory juvenile parasites, but opportunistic, and rarely are found morphing out of other lichens.

MATERIALS AND METHODS

Study Area: The broad objective of the present study overarches the state of Uttarakhand which is divided into 13 districts and covers a geographical area of 53,483 km². It borders Tibet Autonomous Region of China to the north; the Sudurpashchim Pradesh of Nepal to the east; the Indian states of Uttar Pradesh to the south and Himachal Pradesh to the west and north-west. Most of the area falls under montane region hence provides variations in topography and climate. The altitude of varied landscapes ranges from 200 to 7816 m asl. The variations in forest types (tropical-alpine) provide habitats for numerous biodiversity elements including many rare and endemic faunal and floral species.

Methodology: The present study includes all species found by examination of available literature, specimens from the author's own field collections and specimens kindly given to the author by other scientists. Specimens examined were from the institutional herbaria LWG, LWU and from the private herbaria of Dr. D.D. Awasthi (all from CSIR-National Botanical Research Institute). The author's collections are deposited in the herbarium of the Department of Botany, University of Rajasthan, Jaipur (RUBL) and Department of Botany, SSJ Campus, Kumaun University, Almora (ALM).

In the abbreviation of authors' names we follow the style of Brummitt and Powell

(1992), and in the nomenclature that of Diederich *et al.* (2018). Distributional data are not to be considered as complete as there are based only on critical revision of specimens, but it may help in the study of lichenicolous fungi by colleagues interested in this subject.

Samples were studied with routine mycological techniques. Macroscopic features were examined with a stereozoom dissecting microscope (Olympus Sz61). Thin hand-cut sections were made for studying the anatomy of fruiting bodies and examined under Olympus BX53 compound microscope (up to 1000×) fitted with a Olympus differential interference contrast. Microscopical examination was done in water, 10 % KOH (K), lactophenol cotton blue (LCB), Melzer's reagent (MLZ), Lugol's iodine, directly (I) or after a KOH pre-treatment (K/I), Congo red (CR) solution.

RESULT

ABROTHALLUS De Not.

The genus is represented by 42 species throughout the world (Diederich *et al.* 2018) of which 05 and 03 are reported from India and Uttarakhand, respectively (Joshi *et al.* 2016a, 2018).

1) *Abrothallus microspermus* Tul.

Host(s): *Flavoparmelia caperata*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Arunachal Pradesh, Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Pithoragarh

Notes: Joshi *et al.* (2018) also reported the anamorphic stage of this fungus - *Vouauxiomyces truncatus* (B. de Lesd.) Dyko and D. Hawksw. from above mentioned states.

2) *Abrothallus parmeliarum* (Sommerf.) Arnold

Host(s): *Emodomelanelia masonii*, *Parmelia sulcata*, *P. squarrosa*, *Parmotrema saxatilis*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Himachal Pradesh, Sikkim, Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar, Uttarkashi

Note: The species was previously reported from Sikkim (Joshi *et al.* 2016a), and in the present study it is extending its distributional range up to Himachal Pradesh and Uttarakhand.

3) *Abrothallus peyritschii* (Stein) I. Kotte

Host(s): *Vulpicida pinastris*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Uttarkashi

Note: The species was previously reported from Himachal Pradesh (Alstrup & Ahti 2007), and in the present study it is extending its distributional range up to Uttarakhand.

ARTHONIA Ach.

The genus is represented by 139 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 09 (excluding *Arthonia pantherina*) and 05 are reported from India and Uttarakhand, respectively (Joshi 2018; Joshi *et al.* 2016a).

Note: *Arthonia pantherina* Etayo reported from the thallus of *Pertusaria* from Madhya Pradesh (Joshi *et al.* 2017a) was wrongly identified, hence should be excluded from Indian flora.

4) *Arthonia ayseniae* Halici & Candan

Host(s): *Pleospidium oxytonum*

Infected part: thallus and apothecial disc

Lichen habitat: saxicolous

Distribution in India: So far the species is known from Uttarakhand.

Distribution in various districts of Uttarakhand: Pithoragarh

5) *Arthonia clemens* (Tul.) Th. Fr.

Host(s): *Omphalodina chrysoleuca*, *Protoparmeliopsis peltata*

Infected part: thallus and apothecial disc

Lichen habitat: saxicolous

Distribution in India: Himachal Pradesh, Jammu & Kashmir, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Pithoragarh, Uttarkashi

6) *Arthonia coronata* Etayo

Host(s): *Flavoparmelia caperata*

Infected part: soredia

Lichen habitat: corticolous, saxicolous

Distribution in India: Arunachal Pradesh, Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

7) *Arthonia epiphyscia* Nyl.

Host(s): *Physcia* sp., *Physcia stellaris*

Infected part: thallus

Lichen habitat: corticolous, saxicolous

Distribution in India: Himachal Pradesh, Ladakh, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Uttarkashi

Notes: The species was previously reported from Ladakh and Uttarakhand (Joshi *et al.* 2016a), and in the present study it is extending its distributional range up to Himachal Pradesh.

8) *Arthonia phaeophysciae* Grube & Matzer

Host(s): *Phaeophyscia* sp., *P. endococcina*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Almora, Nainital

Notes: The species was previously reported from Uttarakhand (Joshi *et al.* 2016a), and in the present study it is extending its distributional range up to Himachal Pradesh.

BACHMANNIOMYCES D. Hawksw.

The genus is represented by 06 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 01 is reported from India and that too from Himachal Pradesh

and Uttarakhand (Joshi *et al.* 2018).

9) *Bachmanniomyces punctum* (A. Massal.) Diederich & Pino-Bodas = *Phaeopyxis punctum* (A. Massal.) Rambold, Triebel & Coppins

Host(s): *Cladonia cartilaginea*, *C. pyxidata*

Infected part: thallus

Lichen habitat: corticolous, terricolous

Distribution in India: Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Uttarkashi

Notes: The species was previously reported by Joshi *et al.* (2018) under the name *Phaeopyxis punctum* (A. Massal.) Rambold, Triebel & Coppins, which is now synonymised under *B. punctum*.

BACIDIA De Not.

The genus is represented by 01 species throughout the world (Diederich *et al.* 2018) which is also reported from Uttarakhand (Joshi *et al.* 2018).

10) *Bacidia killiasii* (Hepp) D. Hawksw.

Host(s): *Peltigera rufescens*

Infected part: thallus

Lichen habitat: terricolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

BELLEMERELLA Hafellner & Cl. Roux

The genus is represented by 04 species throughout the world (Diederich *et al.* 2018) of which 01 is reported from India and that too from Uttarakhand (Joshi *et al.* 2016a).

11) *Bellemerella acarosporae* Calat. & Nav.-Ros.

Host(s): *Acarospora* sp., *Silobia rufescens*

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Uttarakhand

Distribution in various districts of

Uttarakhand: Bageshwar, Chamoli, Uttarkashi

BIATOROPSIS Räsänen

The genus is represented by 04 species throughout the world (Diederich *et al.* 2018) of which 02 and 01 are reported from India and Uttarakhand, respectively (Joshi *et al.* 2015a; Millanes *et al.* 2016).

12) *Biatoropsis minuta* Millanes, Diederich, M. Westb. & Wedin

Host(s): *Usnea* sp.

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

BUELLIELLA Fink

The genus is represented by 12 species throughout the world (Diederich *et al.* 2018) of which 06 and 04 are reported from India and Uttarakhand, respectively (Joshi *et al.* 2016a, 2018; Singh & Singh 2018).

13) *Buelliella inops* (Triebe & Rambold) Hafellner

Host(s): *Gyalolechia flavorubescens*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar

14) *Buelliella lecanorae* Suija & Alstrup

Host(s): *Lecanora* sp., *L. rugosella*

Infected part: thallus and apothecial disc

Lichen habitat: corticolous

Distribution in India: Odisha, Uttarakhand

Distribution in various districts of Uttarakhand: Dehradun, Nainital

Notes: The species was previously reported from Uttarakhand (Joshi *et al.* 2016a), and in the present study it is extending its distributional range up to Odisha.

15) *Buelliella minimula* (Tuck.) Fink

Host(s): *Graphis* sp., *Lepra amara*, *Ochrolechia androgyna*, *O. rosella*, *Pertusaria acuta*, *P. amarkantakana*, *P. concinna*, *P.*

coronata, *P. depressa*, *P. himalayensis*, *P. indica*, *P. leioplacella*, *P. melastomella*, *P. pertusa*, *P. pseudococcodes*, *P. quassiae*, *P. rigida*, *P. subochracea*, *P. tuberculifera*, *P. wattiana*

Infected part: thallus and/or apothecial disc margin

Lichen habitat: corticolous, saxicolous

Distribution in India: Bihar, Chhattisgarh, Himachal Pradesh, Kerala, Madhya Pradesh, Uttarakhand, West Bengal

Distribution in various districts of Uttarakhand: Bageshwar, Chamoli, Pithoragarh

Notes: The species was previously reported from Madhya Pradesh and Uttarakhand (Joshi *et al.* 2016a), and in the present study it is extending its distributional range in different states of India, viz. Bihar, Chhattisgarh, Himachal Pradesh, Kerala, West Bengal. *Graphis* sp. and *Lepra amara* are the new hosts for this fungus.

16) *Buelliella protoparmeliopsis* Etayo & Pérez-Ort.

Host(s): *Protoparmeliopsis muralis*

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Jammu & Kashmir, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

CAERULEOCONIDIA Zhurb. & Diederich

The genus is represented by 02 species lichenicolous throughout the world (Diederich *et al.* 2018) of which 01 is reported from India and that too from Uttarakhand (Joshi *et al.* 2018).

17) *Caeruleoconidia ochrolechiae* Zhurb. & Diederich

Host(s): *Lepra variolosa*, *Ochrolechia rosella*

Infected part: thallus and apothecial disc margin

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of

Uttarakhand: Bageshwar, Chamoli

CARBONEA (Hertel) Hertel

The genus is represented by 11 and 06 species of lichenicolous fungi and lichenicolous lichens, respectively, throughout the world (Diederich *et al.* 2018) of which 04 are reported from India (Hertel 1983, Poelt 1961, Zhurbenko 2013, Joshi *et al.* 2016a, 2018) and 02 from Uttarakhand, one of which is lichenicolous fungus (i.e. *C. aggregantula*) and another lichenicolous lichen (i.e. *C. assimilis*). Recently the genus has been synonymised under *Huea* C.W. Dodge & G.E. Baker (Wijayawardene *et al.* 2020), but till date no new combinations for its species are available and as mentioned earlier we are following Diederich *et al.* (2018) for generic nomenclature, hence we are treating it here as *Carbonea*.

18) *Carbonea aggregantula* (Müll. Arg.) Diederich & Triebel

Host(s): *Lecanora* sp., *L. impudens*, *L. leproplaca*, *L. subgranulata*, *Protopermeliopsis muralis*

Infected part: thallus and apothecial disc margin

Lichen habitat: corticolous

Distribution in India: Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh

Notes: The species was previously reported from Jammu & Kashmir, Madhya Pradesh and Uttarakhand (Joshi *et al.* 2016a), and in the present study it is extending its distributional range in Himachal Pradesh.

19) *Carbonea assimilis* (Hampe ex Körb.) Hafellner & Hertel

Host(s): *Lecanora* sp., *Lecanora subimmersa*

Infected part: thallus and rarely on apothecial disc

Lichen habitat: saxicolous

Distribution in India: Uttarakhand

Distribution in various districts of

Uttarakhand: Chamoli, Uttarkashi

CERCIDOSPORA Körb.

The genus is represented by 40 species throughout the world (Diederich *et al.* 2018) of which 07 are reported from India (Zhurbenko 2013, Joshi *et al.* 2016a, 2018) including 04 from Uttarakhand.

20) *Cercidospora caudata* Kernst.

Host(s): *Amundsenia approximata*, *Calogaya biatorina*, *Caloplaca* sp., *Rusavskia elegans*

Infected part: thallus and/or apothecial disc

Lichen habitat: saxicolous

Distribution in India: Himachal Pradesh, Jammu & Kashmir, Ladakh, Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar, Pithoragarh

21) *Cercidospora epicarphinea* (Nyl.) Grube & Hafellner

Host(s): *Caloplaca* sect. *Gasparrinia*

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar

22) *Cercidospora melanophthalmae* Nav.-Ros., Calat. & Hafellner

Host(s): *Omphalodina chrysoleuca*, *Protopermeliopsis peltata*, *Rhizoplaca melanophthalma*

Infected part: thallus and apothecial disc

Lichen habitat: saxicolous, terricolous

Distribution in India: Himachal Pradesh, Ladakh, Uttarakhand

Distribution in various districts of Uttarakhand: Uttarkashi

23) *Cercidospora xanthoriae* (Wedd.) R. Sant.

Host(s): *Rusavskia elegans*, *R. sorediata*

Infected part: thallus and apothecia

Lichen habitat: saxicolous

Distribution in India: Himachal Pradesh, Ladakh, Uttarakhand

Distribution in various districts of

Uttarakhand: Bageshwar

Notes: The species was previously reported from Ladakh and Uttarakhand (Zhurbenko 2013, Joshi *et al.* 2016a), and in the present study it is extending its distributional range in Himachal Pradesh.

CLYPEOCOCCUM D. Hawksw.

The genus is represented by 13 species of lichenicolous fungus throughout the world (Shivarov 2019, Diederich *et al.* 2018) of which 02 is (including one undescribed specie) also reported from India and that too from Uttarakhand (Joshi *et al.* 2018).

24) *Clypeococcum grossum* (Körb.) D. Hawksw.

Host(s): *Umbilicaria vellea*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh

25) *Clypeococcum* sp.

Diagnostic characters: Ascomata perithecioid (pseudothecia), black, both on upper and lower side of the thallus. Ascomata 80–90 µm diam. Asci narrowly cylindrical, 65–120 × 7.5–10 µm, 8-spored. Ascospores pale brown to brown, (0–)1-septate, 13–17 × 3.5–4.5 µm, l/b ratio = 3–5. Conidiomata unknown.

Host(s): *Dendrocosticta praetextata*

Infected part: upper and lower sides of thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

26) *Clypeococcum* sp.

Host(s): *Dendrocosticta praetextata*

Infected part: upper and lower side of thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

CORTICIFRAGAD. Hawksw. & R. Sant.

The genus is represented by 07 species throughout the world (Diederich *et al.* 2018) of which 01 is also reported from India and that too from Uttarakhand (Zhurbenko 2013, Joshi *et al.* 2016a).

26) *Corticifraga peltigerae* (Fuckel) D. Hawksw. & R. Sant.

Host(s): *Peltigera canina*

Infected part: thallus

Lichen habitat: terricolous

Distribution in India: Jammu & Kashmir, Uttarakhand

Distribution in various districts of Uttarakhand: Uttarkashi

DIDYMOCYRTIS Vain.

Now most of the lichenicolous *Phoma* species (14) and one *Leptosphaeria* species (*Leptosphaeria protousneae* Etayo) are placed under *Didymocyrtis*, which is represented by 26 species throughout the world (Diederich *et al.* 2018, Joshi *et al.* 2018, Zhurbenko *et al.* 2019) of which 07 (including two species of *Phoma*) and 04 (including one species of *Phoma*) are reported from India and Uttarakhand, respectively (Joshi 2018, Joshi *et al.* 2016a, 2018).

27) *Didymocyrtis bryonthae* (Arnold) Hafellner

Host(s): *Lecanora* sp.

Infected part: thallus and apothecial disc

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Nainital

28) *Didymocyrtis consimilis* Vain.

Host(s): *Melanohalea exasperatula*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Uttarkashi

29) *Didymocyrtis rhizoplacae* Y. Joshi & K.

Bisht

Host(s): *Omphalodina chrysoleuca*

Infected part: thallus and apothecial disc

Lichen habitat: saxicolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh, Uttarkashi

DIPLOSCHISTES Norman

The genus is represented by 04 species of lichenicolous lichens throughout the world (Diederich *et al.* 2018) of which 01 is also reported from India and that too from Uttarakhand.

30) *Diploschistes muscorum* (Scop.) R. Sant.

Host(s): *Cladonia fimbriata*

Infected part: thallus

Lichen habitat: terricolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Uttarkashi

ECHINOTHECIUM Zopf

The genus is represented by 02 species throughout the world (Diederich *et al.* 2018) of which 01 is also reported from India and that too from Uttarakhand (Joshi *et al.* 2016a).

31) *Echinothecium reticulatum* Zopf

Host(s): *Flavoparmelia caperata*, *Parmotrema reticulatum*

Infected part: thallus

Lichen habitat: corticolous, saxicolous

Distribution in India: Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttarakhand

Distribution in various districts of Uttarakhand: Almora, Chamoli, Uttarkashi

Notes: The species was previously reported from Uttarakhand under the name *Sphaerellothecium reticulatum* (Zopf) Etayo (Joshi *et al.* 2016a), and in the present study it is extending its distributional range in different states of India *viz.* Himachal Pradesh, Jammu & Kashmir, Sikkim.

ENDOCOCCUS Nyl.

The genus is represented by 45 species throughout the world (Diederich *et al.* 2018; Joshi 2018) of which 07 and 03 are reported

from India and Uttarakhand, respectively (Zhurbenko 2013, Joshi 2018, Joshi *et al.* 2016a, 2018).

32) *Endococcus physciae* Y. Joshi

Host(s): *Physcia* sp., *P. adscendens*, *P. gomukhensis*, *P. sinuosa*

Infected part: thallus

Lichen habitat: saxicolous, terricolous

Distribution in India: Jammu & Kashmir, Karnataka, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Uttarkashi

Notes: Joshi (2018) when described this new species from India reported hymenial gel and asci, I+ orange and ascus and ascospores of $(22-27) \cdot 42-35-42 \cdot 57(-45) \times (5-6) \cdot 74-11.57-16.39(-17) \mu\text{m}$ and $(12-12) \cdot 19-13.14-14.09(-15) \times (4-4) \cdot 67-5.42-6.18(-7) \mu\text{m}$ dimensions, respectively. Recently one of the author (YJ) encountered some other specimens of this species and found slight variations in characters, which are mentioned here and should be considered whenever identifying this species: *Ascomata* $(80-96) \cdot 81-116 \cdot 13-135 \cdot 45(-135) \times (80-90) \cdot 54-110-129 \cdot 46(-130) \mu\text{m}$. Hymenial gel and asci, I+ orange, K/I+ blue. *Asci* $4-6(-8)$ -spored, $(20-22) \cdot 8-30 \cdot 2-37 \cdot 6(-45) \times 9-12 \cdot 4-15 \cdot 8(-20) \mu\text{m}$, K/I+ blue. *Ascospores* uni- to bi-seriately arranged in the asci, ellipsoid to somewhat fusiform, hyaline to pale brown when young and golden brown at maturity, K+ intense, simple to 1-septate when mature, not or slightly constricted at the septum, the outermost layer faintly verruculose, $0.5 \mu\text{m}$ thick, perispore $0.5 \mu\text{m}$ thick, $(7-9) \cdot 88-12 \cdot 65-15 \cdot 45(-18) \times (4-4) \cdot 03-4 \cdot 63-5 \cdot 23(-6) \mu\text{m}$.

34) *Endococcus propinquus* (Körb.) D. Hawksw.

Host(s): *Aspicilia* sp., *A. almorensis*, *Lecidella alaiensis*, *L. carpathica*, *Porpidia macrocarpa*

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Himachal Pradesh,

Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar, Chamoli, Uttarkashi

34) *Endococcus rugulosus* (Borrer ex Leight.) Nyl.

Host(s): *Aspicilia* sp.

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Jammu & Kashmir, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

Notes: The species was previously reported from Jammu & Kashmir (Zhurbenko 2013), and in the present study it is extending its distributional range in Uttarakhand.

EPICLADONIA D. Hawksw.

The genus is represented by 03 species throughout the world (Diederich *et al.* 2018) of which 01 is reported from India and that too from Uttarakhand (Joshi *et al.* 2017b).

35) *Epicladonia heterodermiae* Y. Joshi, A. Falswal & R. Joshi

Host(s): *Heterodermia* sp.

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh

HETEROCEPHALACRIA Berthier

The genus is represented by 02 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 01 is also reported from India and that too from Himachal Pradesh, Jammu & Kashmir, Kerala and Uttarakhand (Joshi *et al.* 2018).

37) *Heterocephalacria physciacearum* (Diederich) Millanes & Wedin

Host(s): *Heterodermia diademata*, *H. dissecta* var. *koyana*, *H. incana*, *Physcia gomukhensis*, *P. grisea*, *P. stellaris* var. *intestiniformis*, *P. stellaris* var. *stellaris*, *Polyblastidium*

hypocaesium

Infected part: thallus

Lichen habitat: corticolous, saxicolous

Distribution in India: Himachal Pradesh, Jammu & Kashmir, Kerala, Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar, Uttarkashi

Notes: The species was previously reported from Jammu & Kashmir, Kerala and Uttarakhand (Joshi *et al.* 2018), and in the present study it is extending its distributional range in Himachal Pradesh.

HOMOSTEGIA Fockel

The genus is represented by 02 species of lichenicolous fungi (Diederich *et al.* 2018) throughout the world, and both are also reported from India and that too from Uttarakhand (Alstrup & Ahti 2007, Joshi *et al.* 2016a).

38) *Homostegia hertelii* D. Hawksw.

Host(s): *Flavoparmelia caperata*, *Punctelia rudecta*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Almora

Notes: Till date the species is reported from Uttarakhand, and hence can be considered endemic to this region.

39) *Homostegia piggotii* (Berk. & Broome) P. Karst.

Host(s): *Parmelia* sp.

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Dehradun

Notes: Till date the species is reported from Uttarakhand, and hence can be considered endemic to this region.

INTRALICHEND. Hawksw. & M.S. Cole

The genus is represented by 04 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 02 are reported from India and that too from Jammu &

Kashmir and Uttarakhand (Zhurbenko 2013, Joshi *et al.* 2016a).

40) *Intralichen christiansenii* (D. Hawksw.) D. Hawksw. & M.S. Cole

Host(s): *Amundsenia approximata*, *Caloplaca pachycheila*, *Candelariella aurella*, *Lobothallia alphoplaca*

Infected part: apothecial disc

Lichen habitat: saxicolous

Distribution in India: Jammu & Kashmir, Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar

41) *Intralichen lichenicola* (M.S. Christ. & D. Hawksw.) D. Hawksw. & M.S. Cole

Host(s): *Candelaria* sp.

Infected part: thallus and apothecial disc

Lichen habitat: saxicolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh

Notes: Till date the species is reported from Uttarakhand, and hence can be considered endemic to this region.

***LASIOSPHAERIOPSIS* D. Hawksw. & Sivan.**

The genus is represented by 07 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 01 is also reported from India and that too from Himachal Pradesh and Uttarakhand.

42) *Lasiosphaeriopsis salisburyi* D. Hawksw. & Sivan.

Host(s): *Peltigera* sp., *P. didactyla*, *P. horizontalis*, *P. rufescens*

Infected part: thallus

Lichen habitat: saxicolous, terricolous

Distribution in India: Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

Notes: The species was previously reported from Uttarakhand (Joshi *et al.* 2018), and in the present study it is extending its distributional range in Himachal Pradesh.

LAWALREEA Diederich

The genus is represented by 01 species of lichenicolous fungus throughout the world (Diederich *et al.* 2018) which is also known from India and that too from Uttarakhand (Joshi *et al.* 2018).

43) *Lawalreea lecanorae* Diederich

Host(s): *Lecanora* sp.

Infected part: thallus and apothecial disc margin but rarely on apothecial disc

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh

Notes: Till date the species is reported from Uttarakhand, and hence can be considered endemic to this region.

***LICHENOCONIUM* Petr. & Syd.**

The genus is represented by 15 species of lichenicolous fungus throughout the world (Diederich *et al.* 2018) of which 04 and 03 are also reported from India and Uttarakhand, respectively (Joshi *et al.* 2016a, 2018).

44) *Lichenoconium lecanorae* (Jaap) D. Hawksw.

Host(s): *Omphalodina chrysoleuca*

Infected part: apothecial disc

Lichen habitat: saxicolous

Distribution in India: Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh

45) *Lichenoconium usneae* (Anzi) D. Hawksw.

Host(s): *Flavoparmelia caperata*, *Physcia* sp.

Infected part: thallus and apothecial disc

Lichen habitat: corticolous

Distribution in India: Jammu & Kashmir, Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh

Notes: The species was previously reported from Jammu & Kashmir (Zhurbenko 2013), and in the present study it is extending its distributional range in Uttarakhand.

46) *Lichenoconium xanthoriae* M.S. Christ.

Host(s): *Melanelixia subargentifera*,
Rusavskia elegans

Infected part: thallus and apothecial disc

Lichen habitat: saxicolous

Distribution in India: Jammu & Kashmir,
Uttarakhand

**Distribution in various districts of
Uttarakhand:** Chamoli

***LICHENODIPLIS* Dyko & D. Hawksw.**

The genus is represented by 12 species of
lichenicolous fungus throughout the world
(Diederich *et al.* 2018) of which 02 are also
reported from Himachal Pradesh, Jammu &
Kashmir, Karnataka, Madhya Pradesh, Sikkim,
Uttarakhand states of India (Zhurbenko 2013;
Joshi *et al.* 2015a, 2016a, 2017c).

**47) *Lichenodiplis lecanorae* (Vouaux) Dyko
& D. Hawksw.**

Host(s): *Acarospora*, *Caloplaca* sp., *Lecanora*
sp., *L. allophana*, *L. flavidofusca*, *L.*
somervelli, *L. tropica*, *Ochrolechia rosella*,
Pertusaria leioplacella, *Porpidia crustulata*, *P.*
hydrophila, *P. macrocarpa*, *Rhizocarpon*
geographicum, *Rusavskia elegans*

Infected part: thallus and apothecial disc

Lichen habitat: corticolous, saxicolous

Distribution in India: Himachal Pradesh,
Jammu & Kashmir, Karnataka, Madhya
Pradesh, Sikkim, Uttarakhand

**Distribution in various districts of
Uttarakhand:** Almora, Chamoli, Champawat,
Nainital, Pauri Garhwal

Notes: The species was previously reported
from Himachal Pradesh, Jammu & Kashmir,
Karnataka, Madhya Pradesh and Uttarakhand
(Zhurbenko 2013; Joshi *et al.* 2016a), and in the
present study it is extending its distributional
range in Sikkim.

**48) *Lichenodiplis lichenicola* Dyko & D.
Hawksw.**

Host(s): *Rinodina* sp.

Infected part: apothecia

Lichen habitat: saxicolous

Distribution in India: Uttarakhand

**Distribution in various districts of
Uttarakhand:** Rudraprayag

***LICHENOSTIGMA* Hafellner s. lat.**

The genus is represented by 25 species of
lichenicolous fungus throughout the world
(Diederich *et al.* 2018) of which 04 and 02 are
also reported from India and Uttarakhand,
respectively (Zhurbenko 2013, Joshi *et al.*
2016a, 2018).

**49) *Lichenostigma cosmopolites* Hafellner &
Calat.**

Host(s): *Xanthoparmelia* sp., *X. australasica*,
X. congensis, *X. conspersa*, *X. coreana*, *X.*
mexicana, *X. pseudocongensis*, *X. somloensis*,
X. stenophylla, *X. taractica*, *X. terricola*

Infected part: thallus

Lichen habitat: saxicolous, terricolous

Distribution in India: Himachal Pradesh,
Jammu & Kashmir, Rajasthan, Sikkim,
Uttarakhand

**Distribution in various districts of
Uttarakhand:** Almora, Chamoli, Pauri
Garhwal, Pithoragarh, Uttarkashi

**50) *Lichenostigma elongatum* Nav.-Ros. &
Hafellner**

Host(s): *Lobothallia* sp., *L. alphoplaca*

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Uttarakhand

**Distribution in various districts of
Uttarakhand:** Bageshwar, Chamoli

***LICHENOSTIGMA* Hafellner s. str.**

The genus is represented by 05 species of
lichenicolous fungus throughout the world
(Diederich *et al.* 2018) of which 02 and 01 are
also reported from India and Uttarakhand,
respectively (Zhurbenko 2013, Joshi *et al.*
2016a).

51) *Lichenostigma maureri* Hafellner

Host(s): *Ramalina conduplicans*, *R. confusa*,
R. sinensis, *R. subcomplanata*, *Usnea*
perplexans

Infected part: thallus and apothecial disc

Lichen habitat: corticolous, saxicolous
Distribution in India: Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Nainital, Pithoragarh, Tehri Garhwal, Uttarkashi

Notes: Joshi *et al.* (2016a) misidentified this species colonizing thallus of *Xanthoparmelia stenophylla* from Jammu & Kashmir. In the present study it is reported from Himachal Pradesh and Uttarakhand.

LICHENOTHELIAD. Hawksw.

The genus is represented by 03 species of lichenicolous fungus throughout the world (Diederich *et al.* 2018) of which 01 is also reported from Himachal Pradesh and Uttarakhand states of India.

52) *Lichenothelia convexa* Henssen

Host(s): *Aspicilia almorensis*, *A. dwaliensis*, *Circinaria calcarea*, *Oxneriaria verruculosa*, *Rhizocarpon* sp.

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Tehri Garhwal, Uttarkashi

Notes: The species was previously reported from Uttarakhand (Joshi *et al.* 2016a), and in the present study it is extending its distributional range in Himachal Pradesh.

MELASPILEA Nyl.

The genus is represented by 10 species of lichenicolous fungus throughout the world (Diederich *et al.* 2018) of which 03 and 01 are also reported from India and Uttarakhand, respectively (Joseph & Sinha 2015, Joshi *et al.* 2016a, Singh *et al.* 2017).

53) *Melaspilea insitiva* Stirt.

Host(s): *Pertusaria* sp.

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand, West Bengal

Distribution in various districts of Uttarakhand: Almora

MONEROLECHIA Trevis.

The genus is represented by 04 species of lichenicolous lichen throughout the world (Diederich *et al.* 2018) of which 01 is also reported from Himachal Pradesh, Sikkim, Tamil Nadu and Uttarakhand states of India (Joshi *et al.* 2016a).

54) *Monerolechia badia* (Fr.) Kalb

Host(s): *Aspicilia almorensis*, *A. cinerea*, *Circinaria caesiocinerea*, *Myriospora smaragdula*

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Himachal Pradesh, Sikkim, Tamil Nadu, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Pithoragarh, Uttarkashi

Notes: The species was previously reported from Himachal Pradesh, Sikkim and Uttarakhand (Joshi *et al.* 2016a), and in the present study it is extending its distributional range in Tamil Nadu.

MONODICTYSS. Hughes

The genus is represented by 05 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 02 and 01 are also reported from India and Uttarakhand, respectively (Zhurbenko 2013, Joshi *et al.* 2016a).

55) *Monodictys cellulosa* S. Hughes

Host(s): *Lecanora leprosa*

Infected part: thallus and apothecial disc margin but rarely on apothecial disc

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Pauri Garhwal

Notes: Till date the species is reported from Uttarakhand, and hence can be considered endemic to this region.

MUELLERELLA Mull. Arg.

The genus is represented by 12 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 04 and 03 are also reported from India and Uttarakhand, respectively (Zhurbneko 2013. Joshi *et al.* 2016a).

56) *Muellerella erratica* (A. Massal.) Hafellner & Volk. John

Host(s): *Acarospora badiofusca*, *A. bullata*, *A. fuscata*, *A. superans*, *A. veronensis*, *Circinaria caesiocinerea*, *C. maculata*, *Lecidea auriculata*, *Lecidella stigmatea*, *Lobothallia alphoplaca*, *L. praeradiosa*, *Pertusaria* sp., *Pleopsisidium oxytonum*, *Protoparmeliopsis garovaglii*, *P. muralis* *Rhizoplaca melanophthalma*, *Rusavskia elegans*

Infected part: thallus and apothecial disc

Lichen habitat: saxicolous

Distribution in India: Himachal Pradesh, Jammu & Kashmir, Kerala, Ladakh, Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar, Chamoli, Pithoragarh, Uttarkashi

Notes: The species was previously reported from Himachal Pradesh, Jammu & Kashmir, Ladakh and Uttarakhand (Joshi *et al.* 2016a), and in the present study it is extending its distributional range in Kerala.

57) *Muellerella lichenicola* (Sommerf.) D. Hawksw.

Host(s): *Calogaya saxicola*, *Caloplaca* sp., *C. lithophila*, *Catilaria* sp., *Golubkovia trachyphylla*, *Gyalolechia flavorubescens*, *G. flavovirescens*, *Lecanora* sp., *L. indica*, *Psora decipiens*, *Pyrenodesmia variabilis*, *Squamulea subsoluta*, *Rusavskia elegans*

Infected part: thallus and apothecial disc

Lichen habitat: corticolous, saxicolous, terricolous

Distribution in India: Himachal Pradesh, Jammu & Kashmir, Ladakh, Tamil Nadu, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Dehradun, Nainital,

Pithoragarh, Rudraprayag, Tehri Garhwal, Uttarkashi

Notes: The species was previously reported from Himachal Pradesh, Jammu & Kashmir, Ladakh and Uttarakhand (Joshi *et al.* 2016a), and in the present study it is extending its distributional range in Tamil Nadu.

58) *Muellerella ventosicola* (Mudd) D. Hawksw.

Host(s): *Rhizocarpon disporum*, *R. geographicum*

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Ladakh, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

NESOLECHIA A. Massal.

The genus is represented by 07 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 01 is also reported from India and that too from Uttarakhand (Joshi *et al.* 2016a).

59) *Nesolechia oxyspora* var. *fusca* (Triebel & Rambold) Diederich

Host(s): *Xanthoparmelia* sp., *X. conspersa*, *X. pseudocongensis*, *X. taractica*, *X. terricola*

Infected part: thallus

Lichen habitat: saxicolous, terricolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Uttarkashi

Notes: The species was reported by Joshi *et al.* (2016a) under the name *Nesolechia fusca* and till date is being reported from Uttarakhand, and hence can be considered endemic to this region.

OPEGRAPHA Ach.

The genus is represented by 73 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018, Joshi 2018) of which 06 are reported from India, including Uttarakhand (Moreau 1951; Coppins & Kondratyuk 1998; Diederich & Ertz 2018; Joshi 2018; Joshi *et al.* 2015ab, 2016a, 2017a).

60) *Opegrapha anomea* Nyl.

Host(s): *Lepra albescens*, *Pertusaria* sp., *P. amarkantakana*, *P. coronata*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Madhya Pradesh, Uttarakhand, West Bengal

Distribution in various districts of Uttarakhand: Bageshwar, Pithoragarh

61) *Opegrapha brigantina* Hafellner

Host(s): *Brigantiaea leucoxantha*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Nainital

Notes: Till date the species is reported from Uttarakhand, and hence can be considered endemic to this region.

62) *Opegrapha foreaui* (Moreau) Hafellner & R. Sant.

Host(s): *Heterodermia* sp., *H. coronata*, *H. diademata*, *H. incana*, *H. leucomelos*, *H. pseudospeciosa*, *Polyblastidium hypocaustium*, *P. japonicum*, *P. togashii*.

Infected part: thallus

Lichen habitat: corticolous, terricolous

Distribution in India: Himachal Pradesh, Kerala, Tamil Nadu, Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh

Notes: The species was previously reported from Kerala and Tamil Nadu (Moreau 1951; Coppins & Kondratyuk 1998, Joshi *et al.* 2016a), and in the present study it is extending its distributional range in Himachal Pradesh and Uttarakhand.

63) *Opegrapha gyalolechia* Y. Joshi

Host(s): *Gyalolechia flavorubescens*

Infected part: thallus and apothecial disc

Lichen habitat: corticolous

Distribution in India: Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar

64) *Opegrapha melanospila* Müll. Arg.

Host(s): *Parmotrema* sp., *P. tinctorum*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand, West Bengal

Distribution in various districts of Uttarakhand: Pithoragarh

Notes: The species was previously reported from Uttarakhand (Diederich & Ertz 2018; Joshi 2018), and in the present study it is extending its distributional range in West Bengal.

65) *Opegrapha phaeophysciae* R. Sant., Diederich, Ertz & Christnach

Host(s): *Phaeophyscia hispidula*, *P. orbicularis*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh, Uttarkashi

Notes: Till date the species is reported from Uttarakhand, and hence can be considered endemic to this region.

66) *Phoma peltigerae* (P. Karst.) D. Hawksw.

Host(s): *Peltigera didactyla*

Infected part: thallus and in between soredia

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

Notes: Till date the species is reported from Uttarakhand, and hence can be considered endemic to this region (Joshi 2018).

PLECTOCARPON Fée

The genus is represented by 41 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018, Joshi 2018) of which 03 and 02 are also reported from India and Uttarakhand, respectively (Joshi *et al.* 2016b; 2018).

67) *Plectocarpon diedertianum* Y. Joshi, Upadhyay & Chandra

Host(s): *Myelochroa aurulenta*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh

Notes: Till date the species is reported from Uttarakhand, and hence can be considered endemic to this region.

68) *Plectocarpon parmeliarum* Y. Joshi

Host(s): *Parmelia meiophora*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Uttarkashi

Notes: Till date the species is reported from Uttarakhand, and hence can be considered endemic to this region.

POLYCOCCUM Körb.

The genus is represented by 60 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 07 and 05 are also reported from India and Uttarakhand, respectively (Zhurbenko 2007, 2013, Zhurbenko *et al.* 2015, Joshi 2018, Joshi *et al.* 2016a, 2017a, 2018).

69) *Polycoccum clauzadei* Nav.-Ros. & Cl. Roux

Host(s): *Rusavskia elegans*

Infected part: thallus and apothecial disc

Lichen habitat: saxicolous

Distribution in India: Ladakh, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Pithoragarh

70) *Polycoccum ochvarianum* Y. Joshi

Host(s): *Ochrolechia androgyna*, *Pertusaria acuta*, *P. amarkantakana*, *P. coccodes*, *P. coronata*, *P. granulata*, *P. himalayensis*, *P. melastomella*, *P. neilgherrensis*, *P. pertusa*, *P. quassiae*, *P. rigida*, *P. splendens*, *P. subdepressa*, *P. subochracea*, *P. tuberculifera*, *Varicellaria velata*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Bihar, Himachal Pradesh, Kerala, Madhya Pradesh, Odisha, Tamil Nadu, Uttarakhand, Uttar Pradesh

Distribution in various districts of Uttarakhand: Chamoli, Dehradun, Nainital, Pithoragarh

71) *Polycoccum peltigerae* (Fuckel) Vězda

Host(s): *Peltigera canina*

Infected part: thallus

Lichen habitat: terricolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar

72) *Polycoccum pulvinatum* (Eitner) R. Sant.

Host(s): *Physcia* sp., *P. stellaris*

Infected part: thallus and apothecial disc margin

Lichen habitat: corticolous, saxicolous

Distribution in India: Jammu & Kashmir, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Uttarkashi

Notes: The species was previously reported from Jammu & Kashmir (Zhurbenko 2013), and in the present study it is extending its distributional range in Uttarakhand.

73) *Polycoccum tinantii* Diederich

Host(s): *Gyalolechia flavorubescens*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Nainital, Pauri Garhwal, Uttarkashi

PYRENIDIUM Nyl.

The genus is represented by 13 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018, Joshi *et al.* 2018; Huanraluek *et al.* 2019) of which 04 and 02 are also reported from India and Uttarakhand, respectively (Zhurbenko 2013, Joshi *et al.* 2016a, 2018).

74) *Pyrenidium actinellum* Nyl.

Host(s): *Diploschistes* sp., *Peltigera canina*, *P. elisabethae*, *P. praetextata*

Infected part: thallus

Lichen habitat: corticolous, saxicolous, terricolous

Distribution in India: Jammu & Kashmir, Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar, Chamoli

75) *Pyrenidium* sp.

Diagnostic characters: Vegetative hyphae numerous, brown. Ascomata perithecia, 60–140 × 55–150 µm, sessile to semi-immersed, black, with light greenish-blue tint in ostiolar channel. Peridium 6–15 µm wide. Hymenium hyaline, I-, KI-. Hamathecial filaments numerous, persistent. Asci 60–80 × 10–15 µm, 4(-6)-spored, subcylindrical, I-, KI+ red. Ascospores 15–18 × 5–9 µm, hyaline to brown, oblong to ellipsoidal, 3-septate, with tips or rarely whole end cells subhyaline. Conidiomata not seen.

Host(s): *Dimelaena oreina*

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

Specimen examined: India, Uttarakhand, Chamoli district, way to Niti, 10 Km before Niti, alt. 3118 m, on thallus of *Dimelaena oreina* colonizing rocks, 20 Aug. 2007, D.K. Upreti & S. Nayaka 07-010293 (LWG 12335).

RHIZOCARPONDC.

The genus is represented by 07 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 01 is also reported from India and that too from Uttarakhand (Joshi *et al.* 2018).

76) *Rhizocarpon ochrolechia* (Poelt & Nimis) Hafellner

Host(s): *Ochrolechia rosella*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Uttarakashi

Notes: Till date the species is reported from Uttarakhand, and hence can be considered endemic to this region.

RHYMBOCARPUS Zopf

The genus is represented by 12 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 01 is also reported from India and that too from Uttarakhand (Joshi *et al.* 2016a).

77) *Rhymbocarpus pertusariae* Diederich, Zhurb. & Etayo

Host(s): *Pertusaria leioplacella*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Nainital

Notes: Till date the species is reported from Uttarakhand, and hence can be considered endemic to this region.

ROSELLINIOPSIS Matzer & Hafellner

The genus is represented by 07 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 01 is also reported from Tamil Nadu and Uttarakhand states of India (Joshi *et al.* 2017a).

78) *Roselliniopsis tartaricola* (Nyl. ex Leight.) Matzer

Host(s): *Lepra amara*, *L. variolosa*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Tamil Nadu, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

Notes: The specimen from Tamil Nadu was wrongly identified as *Weddellomyces periphericus* (Taylor) Alstrup & D. Hawksw. (Joshi *et al.* 2017a), hence, *W. periphericus* should be omitted from Indian checklist.

SCLEROCOCCUM Fr.

The genus is represented by 60 species of lichenicolous fungi throughout the world (Diederich *et al.* 2018) of which 06 (excluding *S. sphaerale*) and 04 are also reported from

India and Uttarakhand, respectively (Joshi *et al.* 2016a, 2018). The genera *Dactylospora* and *Sclerococcum* which represent teleomorphic and anamorphic stages, respectively, are monophyletic and the former genus *Dactylospora* in accordance to the results of molecular phylogenetic studies, have now been merged into *Sclerococcum* (Diederich *et al.* 2013, 2018; Pino-Bodas *et al.* 2017). The anamorphic stage (*Sclerococcum*) was given precedence over teleomorphic stage (*Dactylospora*), because *Sclerococcum* (1821) predates *Dactylospora* (1855) and Art. 57.2 was deleted in the new Shenzhen Code (ICN). Hence, previously reported *Dactylospora* species from India are now placed under *Sclerococcum*.

Note: *S. sphaerale* reported earlier from India (Joshi *et al.* 2016a) is being excluded in the present study.

79) *Sclerococcum homoclinellum* (Nyl.) Ertz & Diederich

Host(s): *Lecanora fimbriatula*, *L. impudens*, *Protoparmeliopsis muralis*

Infected part: thallus

Lichen habitat: corticolous, saxicolous

Distribution in India: Himachal Pradesh, Madhya Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh

Notes: The species was previously reported from Himachal Pradesh and Madhya Pradesh under the name *Dactylospora homoclinella* (Nyl.) Hafellner (Joshi *et al.* 2016a), and in the present study it is extending its distributional range in Uttarakhand.

80) *Sclerococcum saxatile* (Schaer.) Ertz & Diederich

Host(s): *Pertusaria indica*, *P. leioplaca*, *P. pertusa*, *P. quassiae*

Infected part: thallus and apothecial disc

Lichen habitat: corticolous, saxicolous

Distribution in India: Jammu & Kashmir, Madhya Pradesh, Sikkim, Uttarakhand

Distribution in various districts of Uttarakhand: Almora

Notes: The species was previously reported from Jammu & Kashmir, Madhya Pradesh and Uttarakhand under the name *Dactylospora saxatilis* (Schaer.) Hafellner (Joshi *et al.* 2016a), and in the present study it is extending its distributional range in Sikkim.

81) *Sclerococcum simplex* D. Hawksw.

Host(s): *Lepora albescens*, *L. amara*, *L. multipuncta*, *Ochrolechia subpallescens*, *O. yasudae* var. *corallina*, *Pertusaria coronata*, *P. leioplaca*, *P. melastomella*

Infected part: thallus, soredia and apothecial disc

Lichen habitat: corticolous

Distribution in India: Madhya Pradesh, Sikkim, Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar, Chamoli, Champawat, Dehradun, Pithoragarh, Uttarkashi

Notes: The species was previously reported from Sikkim and Uttarakhand (Joshi *et al.* 2016a), and in the present study it is extending its distributional range in Madhya Pradesh.

82) *Sclerococcum* sp.

Diagnostic characters: Ascomata apothecia. 0.1–0.3(–0.4) mm diam., sessile to rarely constricted at base, black. Hymenium hyaline, (25–)35–50(–75) μ m high. Epihymenium brown, (6–)10–15(–18) μ m. Paraphyses septate, branched to anastomosed, 1–1.5 μ m thick. Asci 8-spored, (28–)32.7–44(–50) \times (9–)9.7–13.5(–15) μ m. Ascospores ellipsoid, brown, 1-septate, 9–11(–12) \times (3–)3.8–6.1(–7) \times (3–)3.8–6.1(–7) μ m.]

Host(s): *Dendrioscicta platyphylloides*, *D. wrightii*, *Sticta henryana*

Infected part: thallus and apothecial disc

Lichen habitat: corticolous, saxicolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar, Tehri Garhwal

SPHAERELLOTHECIUM Zopf

The genus is represented by 35 throughout the world (Diederich *et al.* 2018) of which 09 and

07 are also reported from India and Uttarakhand, respectively (Joshi *et al.* 2016a, 2018).

83) *Sphaerellothecium atryneae* (Arnold) Cl. Roux & Triebel

Host(s): *Protoparmeliopsis muralis*

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

84) *Sphaerellothecium cladoniae* (Alstrup & Zhurb.) Hafellner

Host(s): *Cladonia pyxidata*

Infected part: thallus

Lichen habitat: terricolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar, Uttarkashi

85) *Sphaerellothecium contextum* Triebel

Host(s): *Omphalodina chrysoleuca*, *Rhizoplaca* sp.

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Himachal Pradesh, Jammu & Kashmir, Ladakh, Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar, Chamoli, Uttarkashi

Notes: The species was previously reported from Uttarakhand (Joshi *et al.* 2016a), and in the present study it is extending its distributional range in Himachal Pradesh, Jammu & Kashmir and Ladakh.

86) *Sphaerellothecium gallowayi* Diederich

Host(s): *Heterodermia diademata*, *Polyblastidium hypocaesium*

Infected part: thallus

Lichen habitat: corticolous, saxicolous, terricolous

Distribution in India: Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh, Uttarkashi

87) *Sphaerellothecium parmeliae* Diederich & Etayo

Host(s): *Parmelia meiophora*, *P. sulcata*

Infected part: thallus

Lichen habitat: corticolous, saxicolous, terricolous

Distribution in India: Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Uttarkashi

Notes: The species was previously reported from Uttarakhand, and in the present study it is extending its distributional range in Himachal Pradesh.

88) *Sphaerellothecium parmotremae* van den Boom

Host(s): *Parmotrema crinitum*, *P. grayanum*, *P. kamatii*, *P. praesorediosum*, *P. reticulatum*

Infected part: thallus

Lichen habitat: corticolous, saxicolous, terricolous

Distribution in India: Himachal Pradesh, Kerala, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Nainital, Pauri Garhwal, Pithoragarh, Uttarkashi

89) *Sphaerellothecium pumilum* (Lettau) Nav.-Ros., Cl. Roux & Hafellner

Host(s): *Phaeophyscia ciliata*, *P. primaria*, *Physcia* sp., *P. albinea*, *P. caesia*, *P. gomukhensis*

Infected part: thallus

Lichen habitat: saxicolous, terricolous

Distribution in India: Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttarakhand

Distribution in various districts of Uttarakhand: Bageshwar, Chamoli, Tehri Garhwal, Uttarkashi

Notes: The species was reported by Joshi *et al.* (2016a) under the name *Stigmidium pumilum* (Lettau) Matzer & Hafellner from Jammu & Kashmir, Sikkim, Uttarakhand, and is now extending its distribution in Himachal Pradesh.

SPHINCTRINA Fr.

The genus is represented by 09 throughout the world (Diederich *et al.* 2018) of which 03 are

also reported from India including Uttarakhand (Awasthi & Singh 1975, Pant & Awasthi 1989, Joshi *et al.* 2015a, 2016a, 2018).

90) *Sphinctrina anglica* Nyl.

Host(s): *Lecanora interjecta*, *L. leprosa*

Infected part: thallus and apothecial disc

Lichen habitat: corticolous

Distribution in India: Tamil Nadu, Uttarakhand, Uttar Pradesh

Distribution in various districts of Uttarakhand: Pauri Garhwal

91) *Sphinctrina leucopoda* Nyl.

Host(s): *Pertusaria* sp.

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Champawat

92) *Sphinctrina tubaeformis* A. Massal.

Host(s): *Pertusaria* sp., *P. himalayensis*, *P. melastomella*, *P. rigida*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Assam, Madhya Pradesh, Manipur, Tamil Nadu, Uttarakhand

Distribution in various districts of Uttarakhand: Almora, Chamoli, Champawat, Pauri Garhwal

Notes: The species was previously reported from Assam, Manipur, Tamil Nadu, Uttarakhand (Pant & Awasthi 1989, Joshi *et al.* 2015a), and in the present study it is extending its distributional range in Madhya Pradesh.

***SPIROGRAPHA* Zahlbr.**

The genus is represented by 05 throughout the world (Diederich *et al.* 2018) of which 01 is also known from Madhya Pradesh, Tamil Nadu and Uttarakhand states of India.

93) *Spirographa fusisporella* (Nyl.) Zahlbr.

Host(s): *Lecanora* sp., *Ochrolechia androgyna*

Infected part: thallus and apothecial disc

Lichen habitat: corticolous, saxicolous

Distribution in India: Madhya Pradesh, Tamil Nadu, Uttarakhand

Distribution in various districts of Uttarakhand: Champawat, Pauri Garhwal

Notes: Joshi *et al.* (2016a). misidentified and reported this species from Jammu & Kashmir colonizing thallus of *Protoparmeliopsis muralis*. However, while examining lichen specimens of *Lecanora* and *Ochrolechia androgyna* collected from Madhya Pradesh, Tamil Nadu, Uttarakhand, the authors encountered this species infecting the thallus and apothecial disc of above mentioned lichens.

***STIGMIDIUM* Trevis.**

The genus is represented by 94 throughout the world (Diederich *et al.* 2018) of which 09 and 01 are also known from India and Uttarakhand, respectively (Joshi *et al.* 2016a, 2018).

94) *Stigmidium cerinae* Cl. Roux & Triebel

Host(s): *Rusavskia elegans*

Infected part: thallus and apothecial disc

Lichen habitat: saxicolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

***TAENIOLELLAS* Hughes**

The genus is represented by 29 throughout the world (Diederich *et al.* 2018) of which 01 is also reported from India and that too from Uttarakhand (Joshi *et al.* 2018).

95) *Taeniolella delicata* M.S. Christ. & D. Hawksw.

Host(s): *Heterodermia* sp.

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Pithoragarh.

***TETRAMELAS* Norman**

The genus is represented by 02 throughout the world (Diederich *et al.* 2018) of which 01 is also reported from India and that too from Ladakh and Uttarakhand (Joshi *et al.* 2018)

96) *Tetramelas pulverulentus* (Anzi) A. Nordin & Tibell

Host(s): *Physcia* sp., *P. dubia*, *P. gomukhensis*,

P. stellaris

Infected part: thallus

Lichen habitat: corticolous, saxicolous

Distribution in India: Ladakh, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli, Uttarkashi

TREMELLA Pers.

The genus is represented by 60 throughout the world (Diederich *et al.* 2018) of which 05 and 04 are also reported from India and Uttarakhand, respectively (Joshi 2018, Joshi *et al.* 2018).

97) *Tremella cladoniae* Diederich & M.S. Christ.

Host(s): *Cladonia pyxidata*, *C. subradiata*

Infected part: thallus

Lichen habitat: corticolous, saxicolous

Distribution in India: Himachal Pradesh, Uttarakhand

Distribution in various districts of Uttarakhand: Uttarkashi

98) *Tremella everniae* Diederich

Host(s): *Evernia mesomorpha*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Uttarkashi

99) *Tremella parmeliarum* Diederich

Host(s): *Parmotrema* sp., *P. reticulatum*

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Almora, Champawat

100) *Tremella phaeophysciae* Diederich & M.S. Christ.

Host(s): *Phaeophyscia* sp.

Infected part: thallus

Lichen habitat: corticolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Pauri Garhwal

Verrucula J. Steiner

The genus is represented by 22 species throughout the world (Diederich *et al.* 2018) of which 01 is also reported from India and that too from Uttarakhand.

101) *Verrucula latericola* (Erichsen) Nav.-Ros. & Cl. Roux

Host(s): *Calogaya saxicola*

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

Notes: The species was reported by Joshi *et al.* (2018) from Uttarakhand under the name *Verrucaria latericola* Erichsen

ZWACKHIOMYCES Grube & Hafellner

The genus is represented by 35 species throughout the world (Diederich *et al.* 2018) of which 07 and 03 are reported from India and Uttarakhand, respectively (Zhurbenko 2013; Joshi 2018, Joshi *et al.* 2016a, 2018).

102) *Zwackhiomyces coepulonus* (Norman) Grube & R. Sant.

Host(s): *Caloplaca* sp., *Variospora flavescens*

Infected part: thallus and apothecial disc

Lichen habitat: saxicolous

Distribution in India: Himachal Pradesh, Ladakh, Uttarakhand

Distribution in various districts of Uttarakhand: Chamoli

Notes: The species was previously reported from Ladakh (Zhurbenko 2013), and in the present study it is extending its distributional range in Himachal Pradesh and Uttarakhand.

103) *Zwackhiomyces physciicola* Alstrup

Host(s): *Physcia gomukhensis*

Infected part: thallus

Lichen habitat: saxicolous

Distribution in India: Uttarakhand

Distribution in various districts of Uttarakhand: Uttarkashi

104) *Zwackhiomyces sphinctrinoides* (Zwackh) Grube & Hafellner

Host(s): *Lecanora* sp.

Infected part: thallus
Lichen habitat: corticolous
Distribution in India: Uttarakhand
Distribution in various districts of Uttarakhand: Nainital

HOST INDEX

Notes: It should always be kept in mind that any lichenicolous fungus listed under a genus could possibly occur on many species in the genus and should be eliminated when making a determination. Hence, herewith we are providing the list of host genera occurring in Uttarakhand which are infected by various lichenicolous fungi.

Acarospora species: *Bellemerella acarosporae*, *Lichenodiplis lecanorae*, *Muellerella erratica*

Amundsenia species: *Cercidospora caudata*, *Intralichen christiansenii*

Aspicilia species: *Endococcus propinquus*, *Lichenothelia convexa*, *Monerolechia badia*

Brigantiaea species: *Opegrapha briganteae*

Calogaya species: *Muellerella lichenicola*, *Verrucula latericola*

Caloplaca species: *Cercidospora caudata*, *Cercidospora epicarphinea*, *Lichenodiplis lecanorae*, *Muellerella lichenicola*, *Zwackhiomyces coepulonus*

Candelaria species: *Intralichen lichenicola*

Catilaria species: *Muellerella lichenicola*

Circinaria species: *Lichenothelia convexa*, *Monerolechia badia*

Cladonia species: *Bachmanniomyces punctum*, *Diploschistes muscorum*, *Sphaerellothecium cladoniae*, *Tremella cladoniae*

Dendrioscoticta species: *Clypeococcum* sp., *Sclerococcum* sp.

Dimelaena species: *Pyrenidium* sp.

Diploschistes species: *Pyrenidium actinellum*

Emodomelanelia species: *Abrothallus parmiliarum*

Evernia species: *Tremella everniae*

Flavoparmelia species: *Abrothallus microspermus*, *Arthonia coronata*, *Echinothecium reticulatum*, *Homostegia*

hertelii, *Lichenocodium usneae*

Graphis species: *Buelliella minimula*

Gyalolechia species: *Buelliella inops*, *Muellerella lichenicola*, *Opegrapha gyalolechia*, *Polycoccum tinantii*

Heterodermia species: *Epicladonia heterodermiae*, *Heterocephalacria physciacearum*, *Opegrapha foreaui*, *Sphaerellothecium gallowayi*, *Taeniolella delicata*

Lecanora species: *Buelliella lecanorae*, *Carbonea aggregantula*, *Carbonea assimilis*, *Didymocyrtis bryontheae*, *Lawalreea lecanorae*, *Lichenodiplis lecanorae*, *Monodictys cellulosa*, *Muellerella lichenicola*, *Sclerococcum homoclinellum*, *Sphinctrina anglica*, *Spirographa fusisporella*, *Zwackhiomyces sphinctrinoides*

Lecidella species: *Endococcus propinquus*

Lepra species: *Buelliella minimula*, *Caeruleoconidia ochrolechia*, *Opegrapha anomea*, *Roselliniopsis tartaricola*, *Sclerococcum simplex*

Lobothallia species: *Intralichen christiansenii*, *Lichenostigma elongatum*

Melanohalea species: *Didymocyrtis consimilis*

Myelochroa species: *Plectocarpon diedertianum*

Ochrolechia species: *Buelliella minimula*, *Caeruleoconidia ochrolechia*, *Lichenodiplis lecanorae*, *Polycoccum ochvarianum*, *Rhizocarpon ochrolechia*, *Sclerococcum simplex*, *Spirographa fusisporella*

Omphalodina species: *Arthonia clemens*, *Cercidospora melanophthalmae*, *Didymocyrtis rhizoplacae*, *Lichenocodium lecanorae*, *Sphaerellothecium contextum*

Oxneriaria species: *Lichenothelia convexa*

Parmelia species: *Abrothallus parmiliarum*, *Homostegia piggotii*, *Plectocarpon parmiliarum*, *Sphaerellothecium parmeliae*

Parmotrema species: *Echinothecium reticulatum*, *Opegrapha melanospila*, *Sphaerellothecium parmotremae*, *Tremella parmiliarum*

Peltigera species: *Bacidia killiasii*, *Corticifraga peltigerae*, *Lasiosphaeriopsis*

salisburyi, *Phoma peltigerae*, *Polycoccum peltigerae*, *Pyrenidium actinellum*

Pertusaria species: *Buelliella minimula*, *Lichenodiplis lecanorae*, *Melaspilea insitiva*, *Muellerella erratica*, *Opegrapha anomea*, *Polycoccum ochvarianum*, *Rhymbocarpus pertusariae*, *Sclerococcum saxatile*, *Sclerococcum simplex*, *Spirographa fusisporella*, *Sphinctrina leucopoda*, *Sphinctrina tubaeformis*

Phaeophyscia species: *Arthonia phaeophysciae*, *Opegrapha phaeophysciae*, *Sphaerellothecium pumilum*, *Tremella phaeophysciae*

Physcia species: *Arthonia epiphyscia*, *Endococcus physciae*, *Heterocephalacria physciacearum*, *Lichenocodium usneae*, *Polycoccum pulvinatum*, *Sphaerellothecium pumilum*, *Tetramelas pulverulentus*, *Zwackhiomyces physciicola*

Pleospidium species: *Arthonia ayseniae*, *Muellerella erratica*

Polyblastidium species: *Heterocephalacria physciacearum*, *Opegrapha foreaui*, *Sphaerellothecium gallowayi*

Porpidia species: *Endococcus propinquus*, *Lichenodiplis lecanorae*

Protoparmeliopsis species: *Buelliella protoparmeliopsis*, *Carbonea aggregantula*, *Muellerella erratica*, *Sclerococcum homoclinellum*, *Sphaerellothecium atryneae*

Psora species: *Muellerella lichenicola*

Punctelia species: *Homostegia hertelii*

Ramalina species: *Lichenostigma maureri*, *Llimoniella ramalinae*

Rhizocarpon species: *Lichenodiplis lecanorae*, *Muellerella ventosicola*

Rhizoplaca species: *Cercidospora melanophthalmae*, *Muellerella erratica*, *Sphaerellothecium contextum*

Rinodina species: *Lichenodiplis lichenicola*

Rusavskia species: *Cercidospora caudata*, *Cercidospora xanthoriae*, *Lichenocodium xanthoriae*, *Lichenodiplis lecanorae*, *Muellerella erratica*, *Muellerella lichenicola*, *Polycoccum clauzadei*, *Stigmatidium cerinae*

Silobia species: *Bellemerella acarosporae*

Sticta species: *Sclerococcum* sp.

Umbilicaria species: *Clypeococcum grossum*

Usnea species: *Biatoropsis minuta*, *Lichenostigma maureri*

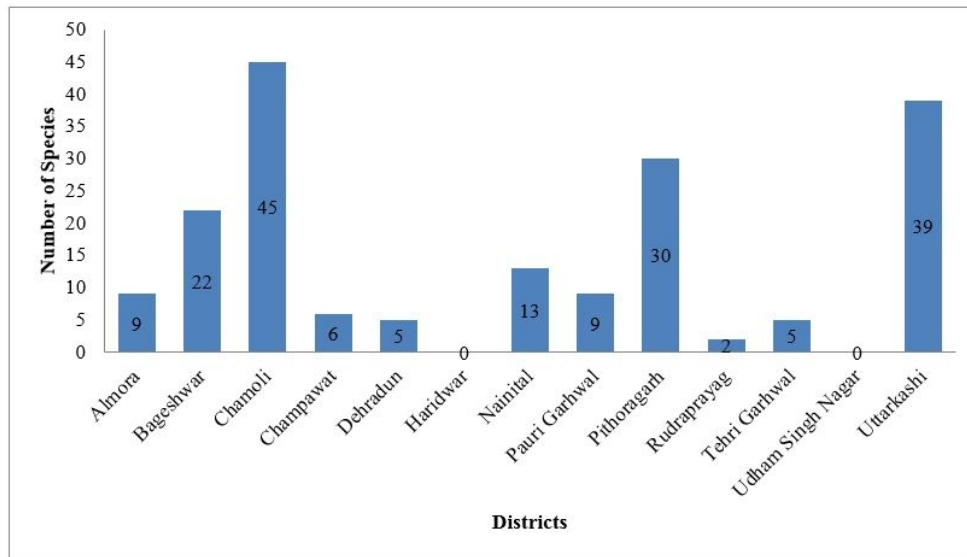
Variospora species: *Zwackhiomyces coepulonus*

Vulpicida species: *Abrothallus peyritschii*

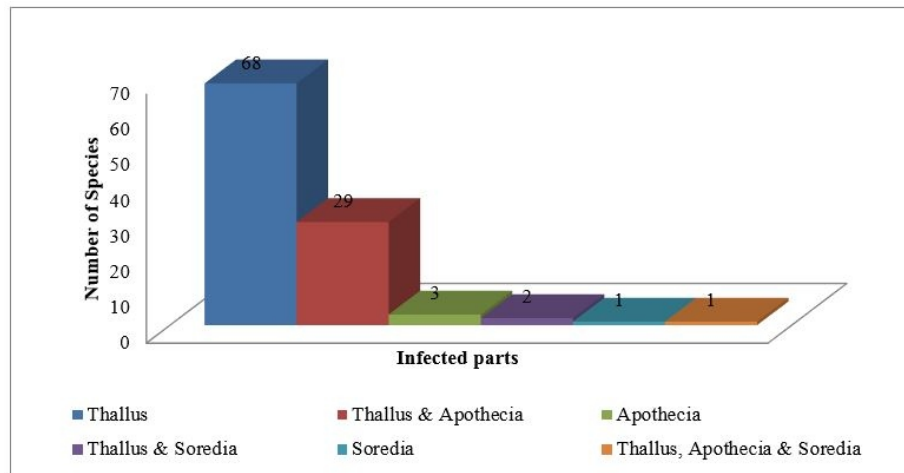
Xanthoparmelia species: *Lichenostigma cosmopolites*, *Nesolechia oxyspora* var. *fusca*

DISCUSSION

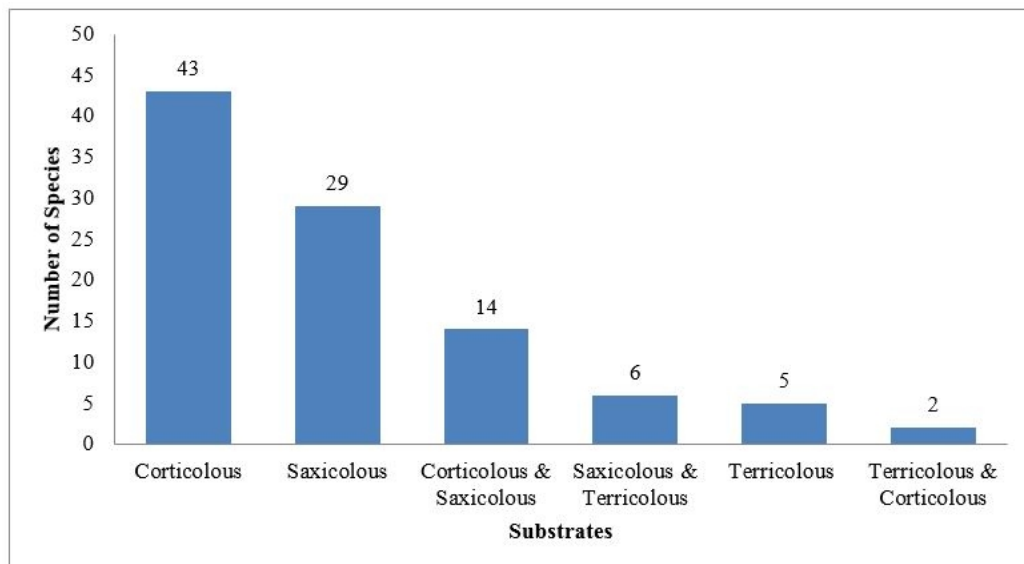
Based on the revised herbarium specimens, fresh field collections and reliable literature records, a total of 100 lichenicolous fungi (the anamorph with its teleomorph are counted as one taxon) and 04 lichenicolous lichens belonging to 51 genera hosted by 117 different lichen species from 11 districts of Uttarakhand (excluding Haridwar and Udham Singh Nagar) (Fig 1), three unidentified specimens of *Clypeococcum* sp. (on *Dendriscosticta praetextata*), *Pyrenidium* sp. (on *Dimelaena oreina*) and *Sclerococcum* sp. (on *Dendriscosticta platyphylloides*, *D. wrightii* and *Sticta henryana*), 1 new record for the country viz. *Llimoniella ramalinae* and 10 regional records viz. *Abrothallus parmeliarum*, *Abrothallus peyritschii*, *Endococcus rugulosus*, *Lichenocodium usneae*, *Lichenostigma maureri*, *Opegrapha foreaui*, *Polycoccum pulvinatum*, *Sclerococcum homoclinellum*, *Spirographa fusisporella* and *Zwackhiomyces coepulonus* are currently accepted in Uttarakhand, making it one of the best studied areas in India regarding lichenicolous mycobiota. Besides this, 26 species (including five species from Uttarakhand) are extending their distributional range in India viz. *Arthonia epiphyscia*, *Arthonia phaeophysciae*, *Buelliella lecanorae*, *Carbonea aggregantula*, *Cercidospora xanthoriae*, *Echinothecium reticulatum*, *Heterocephalacria physciacearum*, *Lasiosphaeriopsis salisburyi*, *Lichenodiplis lecanorae*, *Lichenothelia convexa*, *Monerolechia badia*, *Muellerella erratica*, *Muellerella lichenicola*, *Sclerococcum saxatile*, *Sphaerellothecium parmeliae*,



Graph 1: Number of lichenicolous fungi species in different districts of Uttarakhand



Graph 2: Infected part of lichens by lichenicolous fungi of Uttarakhand



Graph 3: Number of lichenicolous fungi species colonizing various substrates

Sphaerellothecium pumilum, *Sclerococcum simplex*, *Sphinctrina tubaeformis*, *Spiroa fusisporella* and *Zwackhiomyces coepulonus*.

Lichenicolous fungi *Sphaerellothecium* and *Opegrapha* were speciose rich genera and were represented by 7 and 6 species, respectively in Uttarakhand. As far as best host genera is considered, then it was *Lecanora* and *Pertusaria* which were being infected by 12 lichenicolous fungi, followed by *Rusavskia* and *Physcia* (8 each), *Ochrolechia* (7), *Peltigera* (6), and so on (see host index).

Maximum 46 species of lichenicolous fungi were reported from Chamoli district, followed by Uttarkashi (40), Pithoragarh (30), Bageshwar (22), Nainital (12), Almora and Pauri Garhwal (9 each), Champawat (6), Dehradun and Tehri Garhwal (5 each) and Rudraprayag (2) colonizing thallus, apothecia and soredia of various corticolous, saxicolous and terricolous lichens (Fig. 2 & 3).

In addition, *Cladosporium licheniphilum* Heuchert & U. Braun reported colonizing thallus of *Xanthoria candelaria* from Jammu & Kashmir (Zhurbenko 2013) is misidentified by Joshi *et al.* (2016a) colonizing thallus of *Pertusaria* sp. from Uttarakhand, hence is being excluded from Uttarakhand's checklist.

CONCLUSION

This checklist adds some new records of lichenicolous biota not only to India but also for Uttarakhand and establishes a baseline for further studies on this diverse guild of fungi. Due to the small number of collections and collectors of lichenicolous fungi in India, we have no clear idea of the distribution of these species in Uttarakhand or the country as a whole. This can also be justified by the fact that despite long history of lichenological studies in Uttarakhand, only 07 species of lichenicolous fungi are described as new to science from this region. The finding of such a huge number of lichenicolous fungi, including some taxa possibly unknown to science, shows that the

diversity of lichenicolous fungi in the region is still far from being revealed.

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