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Floristic Lichen Records from Uşak Province, Turkey

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Abstract: A contribution to the lichen flora of Turkey presented. A total of 123 lichen species belonging to *Ascomycotina* are reported from 7 different localities in Uşak Province in the Aegean Region of Turkey. Of these, 115 are new for Uşak Province. For every each species, the habitat pattern and distribution data are presented.

Key words: Biodiversity, biota, flora, lichenized fungi, Banaz

INTRODUCTION

Large parts of Turkey are still really unexplored with regards to their lichen biota. Recently, however, much research on lichens has been carried out in various regions in the country (e.g., Çobanoğlu and Akdemir, 2004; Çobanoğlu and Sevgi, 2006; Güvenç *et al*., 2006; Halıcı *et al*., 2005, 2007; John and Breuss, 2004; Kınalıoğlu, 2007, 2008; Oran and Öztürk, 2006; Türk, 2003; Tufan *et al*., 2005; Yıldız *et al*., 2002).

Altogether only 24 different lichen species are reported so far from Uşak province and its lichen flora should be considered as very poorly known (Ludwig, 1866; Szatala, 1960; Türk and John, 2005).

This present study aims at improving the knowledge of the lichen flora of Turkey and in particular of Uşak Province (Fig. 1).

MATERIALS AND METHODS

Study area: Uşak province is located in the Aegean Region in the west of Turkey. This province is surrounded Izmir, Denizli, Kütahya and Afyon provinces (Fig. 1).

This Mediterranean climate is predominant in the area and characterized by hot and dry summer and cold and snowfall winter.

The total rainfall per year 557 mm (Fig. 2) and the distribution of rainfall according to season is W.S.A.S. (Winter, Spring, Autumn, Summer). This is the firs type of East Mediterranean rain Regime (Akman, 1999).

The annual mean temperature is 12.5 °C, the maximum mean temperature of the hottest month is 23.6°C (July) and the minimum mean temperature of the coldest month is 2.4°C (January).

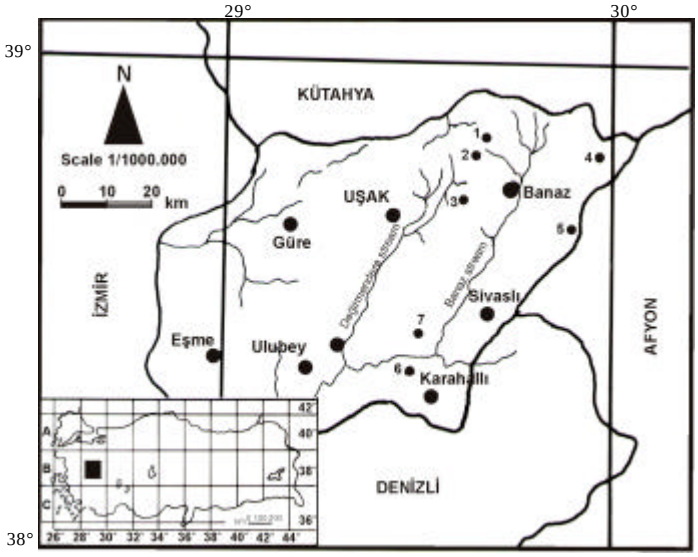

Fig. 1: The study area: Stations indicated by No. (1-7)

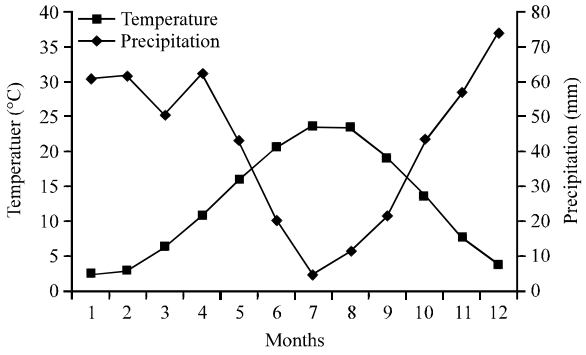

Fig. 2: Climatic diagram of Uşak

Table 1: The 7 localities, their altitudes, coordinates and collecting data

Localities	Altitudes	Coordinates	Dates
Banaz, W of Ovacık village, forest area	1260 m	38° 47' 19" N 29° 38' 42" E	13.5.2008
Banaz, Ovacık village, rocky area	1269 m	38° 47' 55" N 29° 37' 08" E	16.5.2008
NE of city centre of Uşak, Bozköy village	965 m	38° 43' 53" N 29° 34' 03" E	16.5.2008
Banaz, E of Paşacık village, next to forest area	1220 m	38° 47' 19" N 29° 55' 37" E	18.5.2008
Banaz, W of Yazıtepe village	1076 m	38° 38' 33" N 29° 52' 36" E,	18.5.2008.
Karahallı, around of Kavaklı village	743 m	38° 21' 47" N 29° 27' 33" E,	19.5.2008
Karahallı, N of Karayakuplu village	684 m	38° 24' 30" N 29° 29' 06" E,	19.5.2008

According to Emberger's Mediterranean bioclimate layers classification, Uşak is semi-arid upper-cold (Akman, 1999).

Quercus cerris, Q. infectoria, Pinus brutia and *Pinus sylvestris* as abundant trees in the study area. These trees provide suitable ecological habitats for corticolous lichen species (Atalay and Mortan, 1997).

The main rock types of the study area are marn, dolomite, limestone, konglomerate and travertine of Neogene age (Dubertret, 1964). Dominant soil groups are red and brown soils.

Lichens were collected from 4 different stations in Banaz, 2 stations in Karahallı districts and 1 station in NE of city centre of Uşak Province in 2008 (Table 1). The specimens were identified with aid of various flora and identification keys (Brodo *et al*., 2001; Purvis *et al*., 1992; Wasser and Nevo, 2005; Wirth, 1995). The lichen samples are kept in the herbarium of Faculty of Sciences and Arts, Giresun University, Giresun.

Brummit and Powell (1992) in use of authors' names and abbreviations.

RESULTS

In this study, 293 lichen samples were collected from 7 different localities of Uşak Province. The identification of the lichen specimens was made with the aid of several literature and in total 123 lichenized taxa were determined. The taxa are listed in alphabetical order followed by the collection locality number and substrata.

Acarospora cervina A. Massal., Loc. 2, 3, 5, 6 and 7: on calcareous rock.

A. fuscata (Nyl.) Arnold, Loc. 5: on calcareous rock, Loc. 2: on siliceous rock.

A. glaucocarpa (Wahlenb. ex Ach.) Körb., Loc. 6: on calcareous rock.

A. macrospora (Hepp) A. Massal. ex Bagl., Loc. 5, 7: on calcareous rock.

A. umbilicata Bagl., Loc. 3, 6, 7: on calcareous rock.

Aspicilia calcarea (L.) Mudd., Loc. 2, 3, 4, 5, 6 and 7: on calcareous rock.

A. cinerea (L.) Körb., Loc. 2: on siliceous rock.

A. contorta (Hoffm.) Kremp, Loc. 7: on calcareous rock., Loc. 2: on siliceous rock.

A. desertorum (Kremp.) Mereschk., Loc. 2: on siliceous rock.

A. intermutans (Nyl.) Arnold, Loc. 2: on siliceous rock.

Bryoria fuscescens (Gyeln.) Brodo and D. Hawksw., Loc. 1, 4: on *Pinus* sp.

Caloplaca alociza (A. Massal.) Mig., Loc. 6, 7: on calcareous rock.

C. approximata (Lynge) H. Magn., Loc. 2, 5: on calcareous rock.

C. arenaria (Pers.) Mül.Arg., Loc. 5, 6 and 7: on calcareous rock.

C. cerina (Ehrh. ex Hedw.), Th. Fr., Loc. 4, 5: on *Pinus* sp., Loc. 3: on *Quercus* sp., Loc. 2: on mosses.

C. cerina var. *chloroleuca* (Sm.) Th. Fr., Loc. 2: on mosses.

C. cerinella (Nyl.) Flagey, Loc. 4, 5 and 7: on *Quercus* sp., Loc. 3: on *Salix* sp.

C. cerinelloides (Erichsen) Poelt, Loc. 4, 5: on *Pinus* sp, Loc. 1, 3: on *Quercus* sp.

C. coronata (Kremp. ex Körb.) J.Steiner, Loc. 2: on calcareous rock.

C. crenularia (With.) J.R.Laundon, Loc. 2: on calcareous rock.

C. flavescens (Huds.) J.R.Laundon, Loc. 3, 5 and 6: on calcareous rock.

C. flavorubescens (Huds.) J.R. Laundon, Loc. 1, 5: on *Quercus* sp.

C. flavovirescens (Wulfen) DT. and Sarnth., Loc. 3: on calcareous rock.

C. holocarpa (Ach.) Wade (Ach.) A.E.Wade, Loc. 2, 4: on calcareous rock., Loc. 3: on *Salix* sp.

C. lactea (A.Massal) Zahlbr., Loc. 2, 3 and 6: on calcareous rock.

C. variabilis (Pers.) Mull.Arg., Loc. 2, 5, 6 and 7: on calcareous rock.

Catillaria chalybaea (Borrer) A.Massal., Loc. 6: on calcareous rock.

Candelariella aurella (Hoffm.) Zahlbr., Loc. 2, 3, 5, 6 and 7: on calcareous rock.
C. medians (Nyl.) A.L.Sm., Loc. 3, 6 and 7: on calcareous rock.
C. vitellina (Hoffm.) Müll.Arg., Loc. 2, 6, 7: on calcareous rock, Loc. 3: on *Salix* sp., Loc. 1: on *Quercus* sp.
Catapyrenium pilosellum Breuss, Loc. 3: on soil.
C. squamulosum (Ach.)Breuss, Loc. 3, 6: on soil.
Cladonia fimbriata (L.) Fr., Loc. 1, 4, 6: on soil.
C. foliacea (Huds.) Willd., Loc. 3, 5: on soil.
C. pyxdidata (L.) Hoffm., Loc. 1, 3, 4: on soil
C. rangiformis Hoffm., Loc. 3, 6: on soil.
Collema crispum (Huds.) Weber ex F.H.Wigg., Loc. 3, 5: on soil.
C. cristatum (L.) Weber ex F.H.Wigg., Loc. 6, 7: on calcareous rock, Loc. 2, 3, 5: on soil.
C. flacidum (Flagey) Zahlbr., Loc. 2, 4: on mosses, Loc. 3, 5: on *Quercus* sp.
C. subflaccidum Degel., Loc. 1, 5: on *Pinus* sp.
C. tenax (Sw.) Ach., Loc. 3, 6: on soil.
Diplotomma alboratum (Hoffm.) Flot., Loc. 2, 5: on calcareous rock
D. epipolium (Ach.) Arnold, Loc. 2, 3, 6, 7: on calcareous rock
Diploschistes gypsaceus (Ach.) Zahlbr., Loc. 3: on calcareous rock
D. ocellatus (Vill.) Normann, Loc. 3, 6, 7: on calcareous rock
Endocarpon pusillum Hedw., Loc. 3: on calcareous rock
Evernia prunastri (L.) Ach., Loc. 4, 5: on *Pinus* sp., Loc 1, 4, 5: on *Quercus* sp.
Hypogymnia physodes (L.) Nyl., Loc. 1, 4: *Pinus* sp. and on *Quercus* sp.
Lecanora albella (Pers.) Ach., Loc. 4, 5: on *Pinus* sp., Loc. 1, 4, 5: on *Quercus* sp.
L. albescens (Hoffm.) Branth and Rostr., Loc. 1, 3: on calcareous rock
L. argentata (Ach.) Malme, Loc. 4, 5: *Pinus* sp., Loc. 3: on *Quercus* sp.
L. campestris (Schaer.) Hue, Loc. 2, 5: on calcareous rock
L. crenulata Hook, Loc. 2: on calcareous rock
L. dispersa (Pers.) Sommerf., Loc. 2, 3 and 6: on calcareous rock
L. hagenii (Ach.) Ach., Loc. 5, 7: on *Quercus* sp., Loc. 2, 3: on *Salix* sp.
L. rupicola (L.) Zahlbr., Loc. 2: on siliceous rock.
L. sambuci (Pers.) Nyl., Loc. 3: on *Quercus* sp.
L. subcarpinea Szatala, Loc. 4, 5: on *Pinus* sp., Loc. 3: on *Salix* sp.
Lecidella carpathica Körb., Loc. 2: on siliceous rock.
L. elaeochroma (Ach.) M.Choisy, Loc. 1, 3, 4, 5 and 6: on *Quercus* sp.
Leptogium corniculatum (Hoffm.) Minsk, Loc. 2: on calcareous rock, Loc. 3: on soil.
Lobothallia radiosa (Hoffm.) Hafellner, Loc. 1, 2, 3, 6 and 7: on calcareous rock.
Melanelia exasperata (De Not.) Essl., Loc. 1, 3, 4 and 5: on *Quercus* sp.
M. subaurifera (Nyl.) Essl., Loc. 1: on *Salix* sp.
Mycobilimbia lurida (Ach.) Hafellner and Türk, Loc. 3, 6: on soil.
Parmelia saxatilis (L.) Ach., Loc. 2: on calcareous rock.
Parmelia sulcata Taylor, Loc. 2: on calcareous rock., Loc. 4, 5: on *Quercus* sp.
Parmelina pastillifera (Harm.) Hale, Loc. 2: on calcareous rock.
P. tiliaceae (Hoffm.) Ach., Loc.1, 2: on calcareous rock.
Peltigera canina (L.) Willd., Loc. 1: on soil.
P. collina (Ach.) Schrad., Loc. 1, 4: on mosses.
P. praetextata (Flörke ex Sommerf.) Zopf, Loc. 1, 4: on soil.
P. amara (Ach.) Nyl., Loc. 1, 4, 7: on *Quercus* sp.
Pertusaria aspergilla (Ach.) J.R. Laundon, Loc. 7: on calcareous rock.
P. lactea (L.) Arnold, Loc. 2, 5: on siliceous rock.
Phaeophyscia orbicularis (Neck.) Moberg, Loc. 4, 5: on *Quercus* sp., Loc. 1, 3: on *Salix* sp.
P. pusilloides (Zahlbr.) Essl., Loc. 1, 5: on *Quercus* sp.
Physcia adscendens (Fr.) H.Olivier, Loc. 1, 3 and 5: on *Quercus* sp.
P. aipolia (Ehrh. ex Humb.) Hampe, Loc. 3: on *Salix* sp., Loc. 1, 6: on *Quercus* sp.
P. caesia (Hoffm.) Fürnt., Loc. 2: on siliceous rock and on calcareous rock.
P. dubia (Hoffm.) Lettau, Loc. 2, 5: on siliceous rock.
P.semipinnata (J.F. Gmel.) Moberg, Loc. 1, 4: on *Quercus* sp.
P. tenella (Scop.) DC., Loc. 3, 5: on *Quercus* sp.
Physconia distorta (With.) J.R. Laundon, Loc. 1, 5: on *Quercus* sp.
P. enteroxantha (Nyl.) Poelt, Loc. 1, 4: on *Pinus* sp.
P. perisidiosa (Erichsen) Moberg, Loc. 3, 5: on *Quercus* sp., Loc. 2: on mosses and on *Quercus* sp.
Placocarpus schaereri (Fr.), Breuss, Loc. 7: on calcareous rock.
Placynthium nigrum (Huds.) Gray, Loc. 3, 6 and 7: on calcareous rock.
Polychidium muscicola (Sw.) Gray, Loc. 2: on mosses.
Porpidia macrocarpa (DC.) Hertel and A.J. Schwab, Loc. 2: on calcareous rock.
Protoparmeliopsis muralis (Schreb.) M.Choisy, Loc. 2, 3, 4, 5, 6: on calcareous rock.
Pseudevernia furfuracea (Ach.) var. *ceratea* D.Hawksw., Loc. 4, 5: on *Pinus* sp., Loc. 6, 7: on *Quercus* sp.
P. furfuracea (L.) Zopf var. *furfuracea*, Loc. 2: on calcareous rock, Loc. 4, 5: on *Pinus* sp., Loc. 6, 7: on *Quercus* sp.

Ramalina farinacea (L.) Ach., Loc. 3: on *Salix* sp., Loc. 1, 4: on *Quercus* sp.
R. fraxinea (L.) Ach., Loc. 3, 5: on *Quercus* sp.
Rhizocarpon badioatrum (Flörke ex Spreng.) Th.Fr., Loc. 2: on siliceous rock.
R. geminatum Körb., Loc. 2, 5: on siliceous rock.
R. geographicum (L.) DC., Loc. 2, 6: on siliceous rock.
R. lecanorinum Anders, Loc. 2: on siliceous rock.
R. subgeminatum Eitner, Loc. 2, 5: on siliceous rock.
Rinodina atrocinerea (Sm. ex Hook.) Körb., Loc. 2: on siliceous rock.
R. bischoffii (Hepp.) A.Massal, Loc. 2, 3, 5 and 7: on calcareous rock.
R. sophodes (Ach.) A.Massal., Loc. 3, 4, 5: on *Quercus* sp.
R. teichophila (Nyl.) Arnold, Loc. 7: on calcareous rock., Loc. 2: on siliceous rock.
Sarcogyne clavus (DC.) Kremp., Loc. 3: on calcareous rock.
Squamarina cartilaginea (With.) P.James, Loc. 3, 4 and 6: on soil.
S. lentigera (Weber) Poelt, Loc. 3: on soil.
Tephromela atra (Huds.) Hafellner, Loc. 1, 5: on calcareous rock.
Toninia sedifolia (Scop.) Timdal, Loc. 3, 6: on soil.
T. toniniana (Massal) Zahlbr., Loc. 5: on soil.
Usnea florida (L.) Weber ex F.H.Wigg., Loc. 1, 4: *Pinus* sp.
Verrucaria calciseda DC., Loc. 3, 6 and 7: on calcareous rock.
Verrucaria fuscella (Turner) Winch, Loc. 7: on calcareous rock.
V. hochstetteri Fr., Loc. 7: on calcareous rock.
V. muralis Ach., Loc. 3, 6: on calcareous rock.
V. nigrescens Pers, Loc. 2, 5, 6 and 7: on calcareous rock.
Xanthoparmelia loxodes (Nyl.) O.Blanco, A.Crespo, Elix, D.Hawksw. and Lumbsch, Loc. 2: on siliceous rock.
X. pulla (Ach.) O.Blanco, A.Crespo, Elix, D.Hawksw. and Lumbsch, Loc. 2, 3, 5: on calcareous rock.
X. somloensis (Gylen.) Hale, Loc. 1: on calcareous rock.
X. verruculifera (Nyl.) O.Blanco, A.Crespo, Elix, D.Hawksw. and Lumbsch, Loc. 2 on siliceous rock.
Xanthoria fulva (Hoffm.) Poelt and Petutschnig, Loc. 3: on *Salix* sp.
X. parietina (L.) Th.Fr., Loc. 7: on *Pinus* sp., Loc. 1, 5, 6 and 7: on *Quercus* sp., Loc. 3: on *Salix* sp.
X. polycarpa (Hoffm.) Rieber, Loc. 3, 4: on *Quercus* sp.

DISCUSSION

In this study area all of the species were found on 8 different substrata. Of the these species, 62 are crustose (50.4%), 53 are foliose (43%) and 8 are fruticose (6.5%).

A total of 66 species were defined to be saxicolous only, 36 as epiphytic and 15 as terricolous only.

In addition, 4 species (*Caloplaca holocarpa*, *Candelariella vitellina*, *Parmelia sulcata* and *Pseudevernia furfuracea* var. *furfuracea*) were both epiphytic and saxicolous and 2 species (*Collema crispum* and *Leptogium corniculatum*) saxicolous and terricolous.

Of the 66 saxicolous lichen species, 49 prevail on calacareous rocks, 13 on siliceus rocks and 4 on both type rocks.

Due to the dominancy of calcareous rocks in localities 2, 3, 4, 5, 6, 7, as expected, calcicole lichen species, such as *Acarospora cervina*, *Aspicilia calcarea*, *Candelariella aurella*, *C. vitellina*, *Diplotomma epipolium*, *Lobothallia radiosa*, *Rinodina bischoffii*, *Protoparmeliopsis muralis*, *Verrucaria calciseda*, *V. nigrescens* and *Xanthoparmelia* pulla were seen very common.

On the other hand, silicicole saxicolous species, such as *Aspicilia cinerea*, *Lecanora rupicola*, *Rhizocarpon badioatrum*, *R. geographicum*, *R. subgeminatum* and *Rinodina atrocinerea* were also recorded in localities 2, 5, 6.

In the localities 1, 3, 4, 5, with *Pinus* and *Quercus* communities, are mostly dominated by acidophytic epiphytic species such as *Lecanora argentata, Lecidella elaeochroma*, *Melanelia exasperata*, *Physcia adscendens*, *P. semipinnata*, *Pseudevernia furfuracea* var. *ceratea* and *P. furfuracea* var. *furfuracea* which grow on the acidic barks of these trees.

Caloplac cerina var. chloroleuca, *Collema crispum*, *Peltigera collina*, *Polychidium muscicola* and *Phyconia perisidiosa* collected on mosses in localities 1, 2, 4.

Terricolous lichens such as *Catapyrenium squamulosum*, *Cladonia foliacea*, *C. rangiformis*, *Squamarina cartilaginea* and *Toninia sedifolia* are mostly present in localities 3, 6.

As a result, the substara features of species are consistent with the literature findings.

In this study area; species showing the widest distrubition range are:

- *Aspicilia calcarea* (6 localities), *Xanthoria parietina* (6 localities), *Acarospora cervina* (5 localities), *Candelariella aurella* (5 localities), *C. vitellina* (5 localities), *Collema cristatum* (5 localities), *Evernia prunastri* (5 localities), *Lecanora albella* (5 localities), *Lecidella elaeochroma* (5 localities) and *Lobothallia radiosa* (5 localities)

They are common diverse provinces in Turkey. Besides, 3 of these, *Aspicilia calcarea*, *Candelariella aurella* and *C. vitellina*, are also common and widely distrubuted in Europe (Purvis *et al*., 1992).

The most diverse genera are *Caloplac*a (15 species), *Lecanora* (10 species) and *Physcia* (6 species).

The members of the genus *Caloplaca* and *Lecanora* were found all of the localities, while the members of *Physcia* in 6 localities.

The highest species densities were observed in localities 2 and 6.

It was determined that most lichen species identified in localities 3 and 6, while the least diversity was found in locality 4 and 6 (Table 2).

Crustose lichens were seen all of localities. Table 3 shows that the most diverse crustose lichen taxa were defined in locality 2 (28 species) and the least in locality 4 (10 species).

Generally in these areas those lichen species taxa prefer to grow mostly on deciduous and coniferous trees, on rocks and from time to time on mossess.

Caloplaca and *Lecanora* are the most common crustose lichen genera. They were collected all localities.

Caloplaca grows on rocks, deciduous, coniferous and mosses habitats in the most part of study area.

The genus *Lecanora* was found mostly on rocks, deciduous and coniferous habitats in the area.

The most foliose lichen taxa were found in locality 3 (28 species) and the least in locality 7 (5 species) (Table 3).

Common foliose lichen taxa such as *Collema*, *Physcia* and *Xanthoparmelia* were mostly found in localities 1, 2, 3 and 5. Of these, *Collema* was found abundantly on rocks, deciduous, coniferous and mosses.

Physcia grows both on rocks and deciduous habitats. Genus *Xanthoparmelia* grows only rocks.

Table 2: A presentation of the localities distribution of the lichens

Localities	No. of species
1	35
2	47
3	56
4	25
5	44
6	34
7	30

Table 3: Numerical distribution of foliose, crustose and fruticose lichen species according to localities

Localities	Crustose	Foliose	Fruticose
1	12	20	3
2	28	18	1
3	26	26	4
4	10	12	3
5	22	21	1
6	17	15	2
7	23	7	-

Five different fruticose genera defined only in total of 6 localities. These are *Cladonia*, *Ramalina*, *Bryoria*, *Polychidium* and *Usnea*.

Of these, *Cladonia* grows only on soil in localities 1, 3, 4 and 6. *Ramalina* were seen to grows only on decideous habitats in localities 1, 3, 4 and 5. *Bryoria* and *Usnea* were found abundantly on coniferous habitats in locality 1, 4. Genus *Polychidium* were collected on mosses in locality 2.

The result includes all of the 24 lichen species known so far from U°ak province. This indicates that the lichen flora of the area was very incompletely known and that the current distribution maps of Turkish lichen show many gaps and need much further recording.

Consultation of the existing literature (Ludwig, 1866; Szatala, 1960; Türk and John, 2005) showed that all encountered species are new records for the study area and 115 species are new records for Uşak province.

Medical lichen species such as *Cladonia rangiformis*, *Evernia prunastri*, *Peltigera canina*, *Pseudevernia furfuracea* var. *furfuracea*, *Ramalina farinacea* and *Xanthoria parietina* were also collected in the study area.

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