

The Macrolichens of Barluk Mountain National Nature Reserve, Xinjiang Province, China

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Abstract

A checklist of the macrolichens (foliose, fruticose & squamulose) of Barluk Mountain National Nature Reserve located in northwestern China is presented. It was derived from 47 inventories of preserved and undeveloped areas which yielded more than 670 collections containing 102 taxa (99 species, 1 subspecies, 2 varieties). Eight species were found that were new to Xinjiang, China. Twenty-eight species and 2 varieties were found on rock, 31 species on bark of deciduous and coniferous trees, 26 species on soil and 14 species and 1 subspecies over mosses. Foliose lichens were dominant with 76 species, followed by 16 species of squamulose lichens and 7 species of fruticose lichens.

Keywords

Biodiversity, Mountain Ecosystems, Monitoring Climate Change, Nature Conservation

1. Introduction

Biodiversity is fundamental to human well-being, a healthy planet, and economic prosperity for living in balance and harmony with Mother Earth. We depend on it for food, medicine, energy, clean water, and recovery from natural disasters. Biodiversity supports all systems of life on Earth (Xu & Wang, 2023). As a result of the human disturbance including habitat modification, over-exploitation, pollution and climate change, major reductions in biodiversity are occurring and are predicted for the 21st century (Irfan & Alatawi, 2019). Nowadays, the protection

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of biodiversity is a key issue in environmental protection and is a global task (Xue et al., 2012). Indeed, it was recently agreed that funding should be increased substantially to protect biodiversity (David, 2013), and such protection has become an important part of sustainable development, ecological management, and construction in China.

Lichens are enormously successful and evolutionarily ancient composite organisms comprising members of two, and sometimes three, biological kingdoms. They contribute to biological diversity in terrestrial ecosystems, especially macrolichens which are an ecologically significant component of a forest ecosystem, and play important roles in mineral and hydrological cycles, notably nitrogen fixation (McCune & Geiser, 2009; Bartels & Chen, 2015). In the Pacific Northwest macrolichens are ecologically important as food, shelter and nesting material for wildlife (Richardson, 1991; McCune & Geiser, 2009). Lichens, which have a special morphological structure due to their symbiotic lifestyle, are poikilohydric and their generally small thalli lack a cuticle, which makes them highly sensitive to environmental pollution and climate change (Purvis, 2000), and difficult to accurately predict species richness (Pharo et al., 2000). An estimated 13,500 to 30,000 species of lichens are distributed worldwide in a wide range of different terrestrial habitats (Purvis, 2000; Feuerer & Hawksworth, 2007), and c. 8% of the terrestrial surface of the earth is covered by lichen-dominated vegetation (Chen et al., 2000). China is undoubtedly a lichen-rich country, but currently only 3014 species have been documented (Chen, 1995; Wei, 2018).

Xinjiang (Xinjiang Uygur Autonomous Region of China) is the largest of China's five autonomous regions and 23 provinces. It occupies an area of 1.6 million km² (0.64 million square miles). The earliest lichen records from Xinjiang were listed by Elenkin (1901a, 1901b) and Vainio (1905) who studied the deserts and steppes in the western part of the Tianshan Mountains. The earliest list of 67 species, 19 varieties and 17 forms of lichens for Xinjiang was published by Wei (1991) and was extended by Abbas et al. (2002) to 278 species, 3 subspecies, 15 varieties and 17 forms, and then by Xahidin et al. (2005) to c. 398 species. In 2021 an updated checklist of lichens of Xinjiang by Tumur et al. (2021) increased the list to 596 taxa (580 species, 4 subspecies and 12 varieties) in 160 genera.

The Barluk Mountains are located in Yumin County and Toli County, Tacheng Prefecture in Xinjiang and are a distinct entity situated between the Tianshan Mts and the Altai Mts. The southwest part, of the Barluk Mts. is high and the northeast is low. The main peak of the mountain body is Tapkhan Peak, which is 3252 m above sea level. The region has a typical continental and temperate semi-desert climate. The average annual temperature is 6.2°C, with extreme maximum and minimum temperatures of 38.6°C and -35.9°C respectively. The annual precipitation is 289.2 mm.

In April 1980, the People's Government of Xinjiang Uygur Autonomous Region, China approved the establishment of the Xinjiang Wild Almond (Ye Badan Nature Reserve) in Yumin County, Tacheng Prefecture located at 82° 30'E, 45° 55'N).

On 18 January 2005, the Nature Reserve was expanded and renamed “Xinjiang Barluk Mountain National Nature Reserve”. The expanded protected area is located at 82°26'E-83°13'E, 45°42'N-46°03'N, with a total area of 115037.3 km²; of which 89.5% of the protected area is located in Yumin County and 10.5% in Toli County. The Nature Reserve is well known as a paradise for wildlife and plants; its main protected areas are in the forest ecosystem which harbours endangered rare plant species such as wild almonds and apples. The Nature Reserve has abundant biological resources in terms of vegetation types including coniferous forests, broad-leaved forests, shrubs, deserts, meadows, swamps and subalpine habitats (Nurbay, 2013). There are 1244 species of vascular plants, belonging to 444 genera and 81 families, accounting for 29.31% of the total number of vascular plant species in Xinjiang (Nurbay, 2013). Research in the Barluk Mts. National Nature Reserve has mainly focused on higher plant diversity (Wang & Abdusali, 2011), including the classification and boundary delimitation of its mowed pastures (Liu et al., 2010) and quantitative analyses of its plant communities (Zheng, 2013).

Although lichens are a significant component of the forest ecosystem of Barluk Mts. National Nature Reserve, they have received limited research. The first list of 36 species belonging to 25 genera was reported by Nurbay (2013), followed by lists of crustose lichens (27 species belonging to 17 genera) by Mamatali et al. (2023a) and macrolichens (38 species belonging to 20 genera) by Mamatali et al. (2023b) which also provided a floristic analysis. The list was extended to 102 species, 2 subspecies and 2 varieties by Mamatali et al. (2024).

The aim of the present study is to provide a revised checklist of macrolichens for the Barluk Mts. National Nature Reserve as well as detailed information on the eight newly recorded macrolichen species.

2. Material and Methods

2.1. Study Area

The study sites in the Barluk Mts. National Nature Reserve are located within latitude 45°42'N-46°03'N and longitude 82°26'E-83°13'E. The conservation area covers an area of 115,037.3 km² and encompasses a wide range of elevation from 800 to 2800 m asl (Nurbay, 2013). The diverse topography and climate make BMNNR an ideal location for studying lichen diversity and patterns of species distribution.

2.2. Lichen Collection and Identification

Fieldwork was conducted during June to July in 2022 and May and August in 2023 from various habitats. The specimens were gathered using a knife or chisel hammer and placed in separate paper envelopes. Details such as localities, elevation, life forms, and substrate types of each collected sample were recorded. Collections were made within an elevation range of 980 to 2585 m asl. The collected lichen specimens were identified at the Laboratory of the College of Life Sciences and Technology, Xinjiang University in China. To identify the lichens, keys and checklists were used, especially those by Abbas et al. (1998, 2001, 2002), Brodo

(2016) and Tumur et al. (2021), and the nomenclature generally follows *Index Fungorum*. The identification process involved studying the morphology, anatomy and chemistry of the specimens. Lichens were examined using a Nikon Eclipse E200 stereomicroscope. Hand-cut sections using a razor blade were mounted and observed in water and iodine. The internal structures were studied with a Zeiss Axioskop 2 plus light microscope and photographed using a Nikon Digital Camera D50. The chemical constituents of the collected lichens were identified by colour spot tests and thin-layer chromatography (Orange et al., 2010; Brodo et al., 2001). Voucher specimens are deposited in the Lichen Herbarium of College of Life Science and Technology, Xinjiang University (XJU), China.

3. Results

As a result of collecting and identifying lichen specimens from different habitats and altitudes in Barluk Mts. National Nature Reserve, 102 taxa comprised 99 species, 1 subspecies and 2 varieties of macrolichens in 31 genera, 11 families, and 6 orders were identified. They included the following 8 previously unreported species: *Cladonia kurokawae* Ahti & Stenroos, *Dermatocarpon arnoldianum* Degel., *Enchylium polycarpon* (Hoffm.) Otálora, P.M. Jørg. & Wedin, *Fuscopannaria cheiroloba* (Müll. Arg.) P.M. Jørg, *Leptogium hirsutum* Sierk, *Peltigera monticola* Vitik., *Physconia rossica* Urban. and *Umbilicaria aprina* Nyl.

These studies conducted in the Barluk Mts. National Nature Reserve reveal the important macrolichen richness in the various landscapes and elevations. The presence of 102 taxa composed of 99 species, 1 subspecies and 2 varieties of macrolichens in 31 genera, highlights the remarkable diversity of macrolichen in this region. The lichen species exhibit a variety of growth forms; foliose lichens are dominant (76 species), followed by squamulose lichens (16 species) and fruticose lichen (7 species). As regards genera, *Cladonia* is the most diverse, followed by *Peltigera*, which corresponds with the findings of Tumur et al. (2021) for the lichen flora of Xinjiang. The number of species and % of the total number of species respectively of the six commonest genera are *Cladonia* (19 spp. & 19.2%), *Peltigera* (14 spp. & 14.1%), *Physcia* (9 spp. & 9.1%), *Xanthoparmelia* (7 spp. & 7.1%), *Physconia* (6 spp. & 6.1%) and *Melanelia* Essl. (6 spp. & 6.1%). Only single species are recorded from the genera *Arctoparmelia*, *Bryoria*, *Cetraria*, *Evernia*, *Enchylium*, *Flavocetraria*, *Flavoparmelia*, *Flavopunctelia*, *Fuscopannaria*, *Heterodermia*, *Melanohalea*, *Myelochroa*, *Nephroma*, *Normandina*, *Parmelia*, *Pseudevernia*, *Siphula* and *Usnea*. Furthermore, lichens showed preferences for specific habitats, with corticolous species being the most abundant, followed by saxicolous, terricolous and muscicolous species.

3.1. Annotated Checklist of Macrolichens

Anaptychia Körb.

A. ciliaris (L.) Flot.—Corticolous, on bark of birch, Yumin Tasite, 82°45'51"E, 45°53'42"N, alt. 1211 m, Reyhangul & Anwar [No. 202308193]; 82°44'45"E,

45°55'02"N, alt. 1184 m, Reyhangul [No. 202207485].

A. setifera Mereschk. ex Räsänen—Corticolous and muscicolous, Yumin Tasite, 82°45'43"E, 45°53'48"N, alt. 1187 m, Reyhangul [No. 202308256]; 82°44'22"E, 45°55'15"N, alt. 1179 m; 82°44'45"E, 45°55'02"N, alt. 1184 m, Reyhangul [No. 20230518]; 82°45'36"E, 45°53'54"N, alt. 1210 m, Reyhangul [No. 20238145].

***Arctoparmelia* Hale**

A. separata (Th. Fr.) Hale—Muscicolous, Yumin Tasite, 82°44'45"E, 45°55'02"N, alt. 1781 m, Reyhangul & Dolathan [No. 202207462]; 83°02'08"E, 46°01'04"N, alt. 1302 m, Reyhangul [No. 202207555].

***Bryoria* Brodo & D. Hawksw.**

B. confusa (D.D. Awasthi) Brodo & D. Hawksw.—Corticolous, Tuoli Tasite, 82°54'42"E, 45°47'18"N, alt. 2198 m, Reyhangul [No. 202308018]; 82°54'39"E, 45°47'15"N, alt. 2210 m, Reyhangul [No. 202207498]; Aketouyuke, 82°30'41"E, 45°44'26"N, alt. 2202 m, Reyhangul [No. 202308164].

***Cetraria* Ach.**

C. islandica (L.) Ach.—Terricolous, Tuoli Tasite, 82°54'33"E, 45°47'15"N, alt. 2198 m, Reyhangul & Anwar [No. 202207202]; 82°54'44"E, 45°47'20"N, alt. 2014 m, Reyhangul & Anwar [No. 202207123].

***Cladonia* P. Browne**

C. acuminata (Ach.) Norrl.—Muscicolous, Tuoli Tasite, 82°56'16"E, 45°47'15"N, alt. 2014 m, Reyhangul [No. 202207101].

C. cenotea (Ach.) Schaer.—Terricolous, Yumin Tasite, 82°44'42"E, 45°54'57"N, alt. 1219 m, Reyhangul [No. 202308143]; Tuoli Tasite, 82°54'41"E, 45°47'17"N, alt. 2201 m, Reyhangul [No. 202207170].

C. chlorophaea (Flörke ex Sommerf.) Spreng.—Terricolous, Tuoli Tasite, 82°56'14"E, 45°47'12"N, alt. 2052 m, Reyhangul & Dolathan [No. 202207201]; 82°54'05"E, 45°47'22"N, alt. 2138 m, Reyhangul & Dolathan [No. 202207201]; Yumin Tasite, 82°45'38"E, 45°53'51"N, alt. 1219 m, Reyhangul & Anwar [No. 202308130]; 82°44'38"E, 45°54'22"N, alt. 1252 m, Reyhangul & Dolathan [No. 202207029].

C. coniocraea (Flörke) Spreng.—Terricolous, Tuoli Tasite, 82°54'44"E, 45°47'20"N, alt. 2185 m, Reyhangul [No. 202207424]; 82°56'15"E, 45°47'13"N, alt. 2042 m, Reyhangul [No. 202207236]; 82°54'38"E, 45°47'15"N, alt. 2215 m, Reyhangul [No. 202308162]; 82°54'44"E, 45°47'20"N, alt. 2185 m, Reyhangul [No. 202207219]; Karabura reservoir, 82°02'17"E, 45°45'24"N, alt. 2052 m, Reyhangul [No. 202207420]; Yumin Tasite, 82°44'21"E, 45°55'14"N, alt. 1198 m, Reyhangul [No. 202305032]; 82°44'13"E, 45°52'07"N, alt. 1355 m, Reyhangul [No. 202207061].

C. conista (Ach.) Robbins ex Allen—Terricolous, Yumin Tasite, 82°44'23"E, 45°55'14"N, alt. 1186 m, Reyhangul & Anwar [No. 202305007].

C. cornuta (L.) Baumg.—Terricolous, Yumin Tasite, 82°44'21"E, 45°55'14"N, alt. 1193 m, Reyhangul & Anwar [No. 202305009].

C. ecmocyna (Ach.) Leight.—Corticolous, on bark of dead tree, Yumin Tasite, 82°44'42"E, 45°54'57"N, alt. 1219 m, Reyhangul & Anwar [No. 202207042-2];

Tuoli Tasite, 82°54'44"E, 45°47'20"N, alt. 2185 m, Reyhangul & Anwar [No. 202207227].

C. fimbriata (L.) Fr.—Terricolous and corticolous (on bark of decayed tree), Yumin Tasite, 82°42'19"E, 45°56'02"N, alt. 1121 m; 82°54'33"E, 45°47'15"N, alt. 2198 m, Reyhangul [No. 202207232]; 82°44'33"E, 45°55'14"N, alt. 1184 m, Reyhangul [No. 202308169]; Tuoli Tasite, 82°54'44"E, 45°47'20"N, alt. 1219 m, Reyhangul [No. 20220775]; 82°56'15"E, 45°47'13"N, alt. 1206 m, Reyhangul [No. 202308306]; 82°56'14"E, 45°47'12"N, alt. 2052 m, Reyhangul [No. 202207111]; Karabura reservoir, 83°05'49"E, 45°57'40"N, alt. 1773 m, Reyhangul [No. 202308304]; Suyunhe, 82°30'31"E, 45°44'23"N, alt. 1338 m, Reyhangul [No. 202308023].

C. gracilis (L.) Willd.—subsp. *turbinata* (Ach.) Ahti, Muscicolous and corticolous (on bark of decayed tree), Tuoli Tasite, 82°56'14"E, 45°47'12"N, alt. 2052 m, Reyhangul & Anwar [No. 202207124]; Yumin Tasite, 82°44'21"E, 45°55'14"N, alt. 1186 m, Reyhangul & Anwar [No. 202305027]; 82°44'21"E, 45°55'14"N, alt. 1193m, Reyhangul & Anwar [No. 202305036]; 82°44'21"E, 45°55'14"N, alt. 1193 m, Reyhangul & Anwar [No. 202305031]; Suyunhe, 82°30'30"E, 45°44'23"N, alt. 1338 m, Anwar [No. 202308184]; 82°30'31"E, 45°44'23"N, alt. 1336 m, Reyhangul & Anwar [No. 202308307].

C. humilis (With.) J.R. Laundon—Terricolous and corticolous (on bark of decayed tree), Karabura reservoir, 83°02'11"E, 46°01'04"N, alt. 1307 m, Reyhangul [No. 202207010]; Yumin Tasite, 82°44'22"E, 45°55'14"N, alt. 1094 m, Reyhangul [No. 202305014]; 82°44'01"E, 45°55'25"N, alt. 1176 m, Reyhangul [No. 202207099]; Tuoli Tasite, 82°54'44"E, 45°47'20"N, alt. 2038 m, Reyhangul [No. 202308183]; 82°54'33"E, 45°47'15"N, alt. 2198 m, Reyhangul [No. 202207307].

C. kurokawae Ahti & S. Stenroos—Corticolous (on dead tree), Yumin Tasite, 82°44'22"E, 45°55'13"N, alt. 1202 m, Reyhangul & Anwar [No. 202305002].

C. ochrochlora Flörke—Terricolous, Yumin Tasite, 82°44'09"E, 45°52'24"N, alt. 1337 m, Reyhangul & Anwar [No. 202207417]; 82°44'22"E, 45°55'14"N, alt. 1185 m, Reyhangul & Anwar [No. 202308034]; Tuoli Tasite, 82°56'16"E, 45°47'15"N, alt. 2014 m, Reyhangul & Anwar [No. 202207126]; 82°54'44"E, 45°47'20"N, alt. 2185 m, Reyhangul & Anwar [No. 202207221].

C. pocillum (Ach.) O.J. Rich.—Terricolous, Tuoli Tasite, 82°54'44"E, 45°47'20"N, alt. 1255 m, Reyhangul [No. 202207181]; Karabura reservoir, 83°01'26"E, 46°01'35"N, alt. 1179 m, Reyhangul [No. 202305004]; Suyunhe, 82°27'19"E, 45°44'58"N, alt. 1094 m, Reyhangul [No. 202308044-2]; Aketuyouke, 82°30'17"E, 45°44'27"N, alt. 1222 m, Reyhangul [No. 202308244].

C. phyllophora Ehrh. ex Hoffm.—Muscicolous, Tuoli Tasite, 82°55'31"E, 45°47'16"N, alt. 2118 m, Reyhangul [No. 202207145]; Aketuyouke, 82°30'30"E, 45°44'23"N, alt. 1338 m, Reyhangul [No. 202308177]; Yumin Tasite, 82°44'21"E, 45°55'14"N, alt. 1186 m, Reyhangul [No. 202305025].

C. pyxidata (L.) Hoffm.—Terricolous, Yumin Tasite, 82°43'31"E, 46°05'31"N, alt. 994 m, Reyhangul [No. 202207231]; 82°45'30"E, 45°53'59"N, alt. 1075 m,

Reyhangul [No. 202308303]; 82°44'33"E, 45°55'17"N, alt. 1137 m, Reyhangul [No. 202308086]; 82°44'22"E, 45°55'13"N, alt. 1208 m, Reyhangul [No. 202305050]; 82°45'05"E, 45°53'45"N, alt. 1250 m, Reyhangul [No. 202207079]; 82°44'09"E, 45°52'24"N, alt. 1337 m, Reyhangul [No. 202207259]; Aketuyouke, 82°30'54"E, 45°44'34"N, alt. 1366 m, Reyhangul [No. 202308020].

C. scabriuscula (Delise) Nyl.—Terricolous, Tuoli Tasite, 82°56'14"E, 45°47'13"N, alt. 2038 m, Reyhangul [No. 202308252]; 82°56'16"E, 45°47'15"N, alt. 2052 m, Reyhangul [No. 202207172; No. 202207173]; 82°54'05"E, 45°47'22"N, alt. 2138 m, Reyhangul [No. 202207145]; Yumin Tasite, 82°44'19"E, 45°52'14"N, alt. 1350 m, Reyhangul [No. 202207242]; Karabura reservoir, 83°01'26"E, 46°01'35"N, alt. 2052 m, Reyhangul [No. 202308058].

C. squamosa Kremp.—Terricolous, Tuoli Tasite, Tuoli Tasite, 82°57'50"E, 45°47'32"N, alt. 1925 m, Reyhangul [No. 202207145].

C. subulata (L.) F.H. Wigg.—Terricolous, Tuoli Tasite, 82°56'15"E, 45°47'13"N, alt. 2037 m, Reyhangul [No. 202308220]; 82°54'44"E, 45°47'20"N, alt. 2185 m, Reyhangul [No. 202207163]; Tuoli Tasite, 82°56'14"E, 45°47'12"N, alt. 2052 m, Reyhangul [No. 202207102].

C. subsquamosa (Nyl.) Vain.—Terricolous, Tuoli Tasite, 82°54'40"E, 45°47'17"N, alt. 2203 m, Reyhangul [No. 202308048]; Yebandanxing, 82°30'31"E, 45°44'23"N, alt. 1336 m, Reyhangul [No. 202308027].

***Collema* Weber ex F. H. Wigg.**

C. furfuraceum (Schaer.) Du Rietz—Saxicolous, Tuoli Tasite, 82°54'33"E, 45°47'15"N, alt. 1220 m, Reyhangul [No. 202308253]; Yumin Tasite, 82°45'52"E, 45°53'39"N, alt. 2198 m, Reyhangul [No. 202207162].

C. subflaccidum Degel.—Corticolous, Suyunhe, 82°26'49"E, 45°47'31"N, alt. 1076 m, Reyhangul [No. 202207354]; Yumin Tasite, 82°45'52"E, 45°53'39"N, alt. 1220 m, Reyhangul [No. 202308320].

C. subconveniensi Nyl.—Corticolous, Yumin Tasite, 82°44'15"E, 45°52'12"N, alt. 1347 m, Reyhangul [No. 202207145].

***Dermatocarpon* Eschw.**

D. arnoldianum Degel.—Saxicolous, Tolitasite, 82°45'01"E, 45°53'16"N, alt. 1283 m, Reyhangul & Anwar [No. 202207431]; Aketuyouke, 82°26'53"E, 45°47'31"N, alt. 1073 m, Reyhangul & Anwar [No. 202207355].

D. miniatum (L.) W. Mann—Saxicolous, Suyunhe, 82°26'53"E, 45°47'31"N, alt. 1073 m, Reyhangul & Anwar [No. 202207355]; var. *imbricatum* (Nyl.) Dalla Torre & Sarnth. Yumin Tasite, 82°44'06"E, 45°55'26"N, alt. 1093 m, Reyhangul & Anwar [No. 202207496]; var. *complicatum* (Leight.) Th. Fr., Karabura reservoir, 83°02'46"E, 46°04'35"N, alt. 1026 m, Reyhangul & Anwar [No. 202308198], Aketuyouke, 82°30'01"E, 45°44'26"N, alt. 1228 m, Reyhangul & Anwar [No. 202207224].

D. moulinsii (Mont.) Zahlbr.—Saxicolous, Yumin Tasite, 82°45'30"E, 45°53'56"N, alt. 1219 m, Reyhangul & Anwar [No. 202308077].

D. velleureum Zschacke—Saxicolous, Yumin Tasite, 82°44'06"E, 45°55'26"N, alt. 1177 m, Reyhangul [No. 202207094; 202207095]; 82°44'21"E, 45°55'14"N, alt.

1186 m, Reyhangul [No. 202308161]; Suyunhe, 82°27'19"E, 45°47'34"N, alt. 1124 m, Reyhangul [No. 202308181]; 82°27'01"E, 45°47'02"N, alt. 1098 m, Reyhangul [No. 202308315].

***Evernia* Ach.**

E. divaricata (L.) Ach.—Corticolous, Yumin Tasite, 82°44'45"E, 45°55'02"N, alt. 1186 m, Reyhangul & Anwar [No. 202305013]; 82°44'33"E, 45°55'14"N, alt. 1179 m, Reyhangul [No. 202305038]; 82°44'22"E, 45°55'15"N, alt. 1180 m, Reyhangul [No. 202205011]; 82°45'01"E, 45°53'16"N, alt. 1283 m, Reyhangul [No. 202207248]; 82°44'22"E, 45°55'15"N, alt. 1184 m, Reyhangul [No. 202308123].

***Enchylium* (Ach.) Gray**

E. polycarpon (Hoffm.) Otálora, P.M. Jørg. & Wedin—Saxicolous (overgrowing bryophytes), Toli Tasite, 82°55'53"E, 45°47'11"N, alt. 2080 m, Reyhangul & Anwar [No. 202207194]; Yumin Tasite, 82°44'21"E, 45°55'14"N, alt. 1197 m, Reyhangul & Anwar [No. 202305024].

***Flavocetraria* Kärnefelt & A. Thell**

F. nivalis (L.) Kärnefelt & A. Thell—Terricolous, Tuoli Tasite, 82°55'53"E, 45°47'11"N, alt. 2080 m, Reyhangul & Anwar [No. 202207143].

***Flavoparmelia* Hale**

F. baltimorensis (Gyeln. & Foriss) Hale—Muscicolous, Karabura reservoir, 83°00'15"E, 45°04'07"N, alt. 982 m, Reyhangul & Anwar [No. 202207003].

***Flavopunctelia* (Krog) Hale**

F. flaventior (Stirt.) Hale—Corticolous, Yumin Tasite, 82°44'45"E, 45°55'02"N, alt. 1185 m, Reyhangul & Anwar [No. 202207410].

***Fuscopannaria* P. M. Jørg.**

F. cheiroloba (Müll. Arg.) P.M. Jørg—Saxicolous (overgrowing bryophytes), Toli Tasite, 82°54'33"E, 45°47'15"N, alt. 2198 m, Reyhangul & Anwar [No. 202207498].

***Heterodermia* Trevis.**

H. speciosa (Wulfen) Trevis.—Saxicolous, Suyunhe, 82°30'17"E, 45°44'27"N, alt. 1222 m, Reyhangul & Anwar [No. 202308196].

***Leptogium* (Ach.) Gray**

L. hirsutum Sierk—Muscicolous, Toli Tasite, 82°55'53"E, 45°47'11"N, alt. 2080 m, Reyhangul & Anwar [No. 202207133]; 82°55'56"E, 45°47'11"N, alt. 2065 m, Reyhangul & Anwar [No. 202207131].

L. saturninum (Dicks.) Nyl.—Corticolous and muscicolous, Yumin Tasite, 82°44'21"E, 45°55'16"N, alt. 1175 m, Reyhangul [No. 202207053]; 82°44'14"E, 45°52'09"N, alt. 1345 m, Reyhangul [No. 202207044]; 82°44'45"E, 45°55'02"N, alt. 1185 m, Reyhangul [No. 202207008]; 82°46'01"E, 45°53'39"N, alt. 1250 m, Reyhangul [No. 202207070]; Tuoli Tasite, 82°57'50"E, 45°47'32"N, alt. 1925 m, Reyhangul [No. 202207190].

***Melanelia* Essl.**

M. exasperatula (Nyl.) Essl.—Corticolous, Aketuyouke, 82°30'20"E, 45°44'21"N, alt. 1259 m, Reyhangul & Anwar [No. 20207412]; Yumin Tasite, 82°44'04"E,

45°55'02"N, alt. 1185 m, Reyhangul & Anwar [No. 202207472]; 82°45'30"E, 45°53'59"N, alt. 1219 m, Reyhangul & Anwar [No. 202308011]; Suyunhe, 82°27'33"E, 45°47'37"N, 1133 m, Reyhangul & Anwar [No. 202305019]; Tuoli Tasite, 82°57'06"E, 45°47'15"N, alt. 2014 m, Reyhangul & Anwar [No. 202308179].

M. glabra (Schaer.) Essl.—Corticolous, Yebadanxing, 82°30'9"E, 45°44'30"N, alt. 1370 m, Reyhangul & Anwar [No. 202308028]; Karabura reservoir, 83°01'24"E, 46°01'40"N, alt. 1173 m, Reyhangul & Anwar [No. 202207298]; 83°05'03"E, 45°58'10"N, alt. 1842 m, Reyhangul & Anwar [No. 202207464]; Suyunhe, 82°26'50"E, 45°04'65"N, alt. 1321 m, Reyhangul & Anwar [No. 202207457].

M. granulosa Essl.—Saxicolous, Yumin Tasite, 82°43'27"E, 45°55'43"N, alt. 2146 m, Reyhangul & Anwar [No. 202305035]; Suyunhe, 82°26'53"E, 45°47'31"N, alt. 1073 m, Reyhangul & Anwar [No. 202207338]; 82°30'58"E, 45°44'36"N, alt. 1369 m, Reyhangul & Anwar [No. 202308258].

M. incolorata (Parrique) Essl.—Saxicolous, Yumin Tasite, 82°42'36"E, 45°55'55"N, alt. 1219 m, Reyhangul & Anwar [No. 202308117, 202308141]; 82°44'42"E, 45°54'55"N, alt. 1249 m, Reyhangul & Anwar [No.202207115]; Karabura reservoir, 83°02'19"E, 46°01'18"N, alt. 1184 m, Reyhangul & Anwar [No. 202308121].

M. panniformis (Nyl.) Essl.—Saxicolous, Suyunhe, 82°29'56"E, 45°44'29"N, alt. 1207 m, Reyhangul & Anwar [No.202207076]; Karabura reservoir, 83°02'18"E, 46°01'06"N, alt. 1366 m, Reyhangul & Anwar [No. 202308200].

M. stygia (L.) Essl.—Saxicolous, Karabura reservoir, 83°01'26"E, 46°01'35"N, alt. 1084 m, Reyhangul & Anwar [No. 202305028].

***Melanohalea* O. Blanco et al.**

M. elegantula (Zahlbr.) O. Blanco et al.—Corticolous, Yumin Tasite, 82°45'43"E, 45°53'48"N, alt. 1187 m, Reyhangul & Anwar [No. 202308113].

***Myelochroa* (Asahina) Elix & Hale**

M. obsessa (Ach.) Elix & Hale—Corticolous (on dry bark), Yumin Tasite, 82°44'42"E, 45°54'55"N, alt. 1243 m, Reyhangul & Anwar [No. 202207018].

***Nephroma* Ach.**

N. parile (Ach.) Ach.—Muscicolous, Yumin Tasite, 82°44'01"E, 45°55'25"N, alt. 1176 m, Reyhangul [No. 202207326].

***Normandina* Nyl.**

N. pulchella (Borrer) Nyl.—Corticolous, Yumin Tasite, 82°44'09"E, 45°52'06"N, alt. 1344 m, Reyhangul & Dolathan [No. 202207040].

***Parmelia* Ach.**

P. sulcata Taylor—Corticolous (on bark and branch of tree), Karabura, 83°05'03"E, 45°58'10"N, alt. 1338 m, Reyhangul & Anwar [No. 202308154].

***Peltigera* Willd.**

P. canina (L.) Willd.—Terricolous and muscicolous, Tuoli Tasite, 82°56'16"E, 45°47'15"N, alt. 2014 m, Reyhangul [No. 202207125]; 82°55'31"E, 45°47'16"N, alt. 2118 m, Reyhangul [No. 202207137]; 82°56'14"E, 45°47'12"N, alt. 2052 m, Reyhangul [No. 202207130]; 82°57'50"E, 45°47'32"N, alt. 1925 m, Reyhangul [No. 202207130].

202207178]; 82°56'13"E, 45°47'12"N, alt. 2059 m, Reyhangul [No. 202308234]; Yumin Tasite, 82°44'33"E, 45°55'17"N, alt. 1130 m, Reyhangul [No. 202308087]; 82°46'27"E, 45°53'23"N, alt. 1261 m, Reyhangul [No. 202308079]; 82°46'27"E, 45°53'23"N, alt. 1248 m, Reyhangul [No. 202308217]; 82°45'49"E, 45°53'43"N, alt. 1209 m, Reyhangul [No. 202308191].

P. continentalis Vitik.—Muscicolous, Yumin Tasite, 82°44'01"E, 45°55'25"N, alt. 1176 m, Reyhangul & Anwar [No. 202207334]; Tuoli Tasite, 82°56'08"E, 45°47'24"N, alt. 2038 m, Reyhangul & Anwar [No. 202308176].

P. elisabethae Gyelnik—Terricolous, Yumin Tasite, 82°44'02"E, 45°55'24"N, alt. 1176 m, Reyhangul [No. 202207411]; 82°44'21"E, 45°55'14"N, alt. 1197 m, Reyhangul [No. 202305024]; Tuoli Tasite, 82°54'44"E, 45°47'20"N, alt. 2185 m, Reyhangul [No. 202207372]; 82°56'16"E, 45°47'15"N, alt. 2014 m, Reyhangul [No. 202207477]; 82°54'44"E, 45°47'20"N, alt. 2185 m, Reyhangul [No. 202207379]; Suyunhe, 82°30'31"E, 45°44'22"N, alt. 1336 m, Reyhangul [No. 202308326].

P. horizontalis (Huds.) Baumg.—Terricolous, Tuoli Tasite, 82°56'16"E, 45°47'15"N, alt. 1336 m, Reyhangul [No. 202308185].

P. malacea (Ach.) Funck—Terricolous, Tuoli Tasite, 82°55'56"E, 45°47'11"N, alt. 2065 m, Reyhangul [No. 202207497].

P. membranacea (Ach.) Nyl.—Muscicolous, Yumin Tasite, 82°44'27"E, 45°52'22"N, alt. 1342 m, Reyhangul [No. 202207478].

P. monticola Vitik.—Terricolous, Toli Tasite, 82°55'53"E, 45°47'11"N, alt. 2080 m, Reyhangul & Anwar [No. 202207132]; Yumin Tasite, 82°44'01"E, 45°55'25"N, alt. 1176 m, Reyhangul & Anwar [No. 202207334]; 82°44'13"E, 45°52'07"N, alt. 1355 m, Reyhangul & Anwar [No. 202207023].

P. neckeri Hepp ex Müll.—Muscicolous, Yumin Tasite, 82°44'22"E, 45°55'13"N, alt. 1209 m, Reyhangul [No. 202205012]; 82°44'22"E, 45°55'15"N, alt. 1179 m, Reyhangul [No. 202305005].

P. neopolydactyla (Gyeln.) Gyeln.—Muscicolous, Tuoli Tasite, 82°55'31"E, 45°47'16"N, alt. 2118 m, Reyhangul [No. 202207142].

P. polydactylon (Neck.) Hoffm.—Muscicolous, Yumin Tasite, 82°44'27"E, 45°52'22"N, alt. 1342 m, Reyhangul & Dolathan [No. 202207482]; Tuoli Tasite, 82°54'44"E, 45°47'20"N, alt. 2185 m, Reyhangul & Dolathan [No. 202207218]; 82°56'14"E, 45°47'12"N, alt. 2052 m, Reyhangul & Dolathan [No. 202207380]; 82°54'44"E, 45°47'20"N, alt. 2185 m; 82°55'56"E, 45°47'11"N, alt. 2025 m, Reyhangul & Dolathan [No. 202207218].

P. ponojensis Gyeln.—Muscicolous, Yumin Tasite, 82°44'38"E, 45°54'22"N, alt. 1255 m, Reyhangul & Anwar [No. 202207036].

P. praetextata (Flörke ex Sommerf.) Zopf—Terricolous, Yumin Tasite, 82°46'27"E, 45°53'23"N, alt. 1226 m, Reyhangul & Dolathan [No. 202308330]; 82°44'21"E, 45°55'14"N, alt. 1198 m, Reyhangul & Dolathan [No. 202305056].

P. rufescens (Weiss) Humb.—Terricolous, Tuoli Tasite, 82°55'56"E, 45°47'44"N, alt. 2065 m, Reyhangul [No. 202207139]; 82°55'57"E, 45°47'11"N, alt. 2054 m, Reyhangul [No. 202308070]; 82°55'53"E, 45°47'11"N, alt. 2080 m, Reyhangul [No.

202207258]; 82°54'44"E, 45°47'20"N, alt. 1174 m, Reyhangul [No. 202207155].

P. venosa (L.) Hoffm.—Terricolous, Yumin Tasite, 82°45'37"E, 45°53'49"N, alt. 1206 m, Reyhangul & Dolathan [No. 202308306]; Tuoli Tasite, 82°54'32"E, 45°47'15"N, alt. 2198 m, Reyhangul & Dolathan [No. 202207161].

***Phaeophyscia* Moberg**

P. ciliata (Hoffm.) Moberg—Corticolous, Karabura reservoir, 82°02'08"E, 46°01'04"E, alt. 1073 m, Reyhangul & Dolathan [No. 202207455].

P. constipata (Nyl.) Moberg—Corticolous, Suyunhe, 82°27'18"E, 45°47'34"N, alt. 1169 m, Reyhangul & Dolathan [No. 202308259].

P. hispidula (Ach.) Moberg—Corticolous, Suyunhe, 82°26'47"N, 45°47'31"N, alt. 1075 m, Reyhangul & Dolathan [No. 202207336].

P. limbata (Poelt) Kashiw.—Corticolous, Yumin Tasite, 82°42'19"E, 45°56'02"N, alt. 1123 m, Reyhangul & Dolathan [No. 202207006].

P. orbicularis (Neck.) Moberg—Corticolous, Yumin Tasite, 82°44'38"E, 45°54'54"N, alt. 1252 m, Reyhangul & Dolathan [No. 202207034]; 82°42'19"E, 45°56'02"N, alt. 1121 m, Reyhangul & Dolathan [No. 202207007].

***Physcia* (Schreb.) Michx.**

P. aipolia (Ehrh. ex Humb.) Fűrnr.—Corticolous, Yumin Tasite, 82°44'38"E, 45°54'54"N, alt. 1252 m, Reyhangul & Dolathan [No. 202207015]; 82°42'19"E, 45°56'02"N, alt. 1121 m, Reyhangul & Dolathan [No. 202207017]; Tuoli Tasite, 82°56'16"E, 45°47'15"N, alt. 2015 m; 82°44'06"E, 45°55'26"N, alt. 1177 m, Reyhangul & Dolathan [No. 202207064].

P. biziana (A. Massal.) Zahlbr.—Corticolous, Karabura reservoir, 83°02'34"E, 46°04'33"N, alt. 983 m, Reyhangul [No. 202207467]; Suyunhe, 82°31'16"E, 45°53'24"N, alt. 1164 m, Reyhangul [No. 202305042]; Yumin Tasite, 82°44'04"E, 45°55'02"N, alt. 1185 m, Reyhangul [No. 202207476].

P. caesia (Hoffm.) Fűrnr.—Saxicolous, Yumin Tasite, 82°42'36"E, 45°55'55"N, alt. 1122 m, Reyhangul [No. 202207019]; Tuoli Tasite, 82°55'53"E, 45°47'11"N, alt. 2080 m, Reyhangul [No. 202207171]; Suyunhe, 82°29'59"E, 45°44'27"N, alt. 1215 m, Reyhangul [No. 202207169].

P. clementei (Sm.) Lynge—Corticolous, Karabura reservoir, 83°02'08"E, 46°01'04"N, alt. 1302 m, Reyhangul & Dolathan [No. 202207315].

P. dimidiata (Arnold) Nyl.—Corticolous, Aketuyouke, 82°30'05"E, 45°44'29"N, alt. 1273 m, Reyhangul & Dolathan [No. 202308094].

P. dubia (Hoffm.) Lettau—Corticolous, Suyunhe, 82°29'54"E, 45°44'31"N, alt. 1213 m, Reyhangul & Dolathan [No. 202207205]; Karabura reservoir, 83°02'12"E, 46°00'44"N, alt. 1353 m, Reyhangul & Dolathan [No. 202207465].

P. phaea (Tuck.) J.W. Thomson—Saxicolous, Suyunhe, 82°27'33"E, 45°47'37"N, alt. 1133 m, Reyhangul & Dolathan [No. 202305052].

P. stellaris (L.) Nyl.—Corticolous, Yumin Tasite, 82°44'38"N, 45°54'54"N, alt. 1252 m, Reyhangul [No. 202207041]; 82°44'04"E, 45°55'02"N, alt. 1185 m, Reyhangul [No. 202207027]; 82°42'19"E, 45°56'02"N, alt. 1121 m, Reyhangul [No. 202207425].

P. tribacia (Ach.) Nyl.—Corticolous, Yumin Tasite, 82°45'53"E, 45°53'43"N, alt. 1287 m, Reyhangul & Dolathan [No. 202308127].

***Physconia* Poelt**

P. americana Essl.—Muscicolous, Yumin Tasite, 82°44'21"E, 45°55'16"N, alt. 1174 m, Reyhangul [No. 202207075]; 82°44'33"E, 45°55'14"N, alt. 1184 m, Reyhangul [No. 202308150]; Tuoli Tasite, 82°55'46"E, 45°47'15"N, alt. 2056 m, Reyhangul [No. 202207121].

P. grisea (Lam.) Poelt—Saxicolous, but occasionally on bark, Yumin Tasite, 82°45'50"E, 45°53'42"N, alt. 1214 m, Reyhangul [No. 202308213]; 82°42'36"E, 45°55'56"N, alt. 1121 m, Reyhangul [No. 202207028].

P. kansuensis (H. Magn.) Wu—Saxicolous, Karabura reservoir, 83°02'08"E, 46°01'04"N, alt. 1302 m, Reyhangul [No. 202207004]; 83°02'11"E, 46°01'04"N, alt. 1307 m, Reyhangul [No. 202207443]; Suyunhe, 82°26'45"E, 45°47'31"N, alt. 1066 m, Reyhangul [No. 202207214].

P. muscigena (Ach.) J.C. Wei & Y.M. Jiang—Muscicolous, Yumin Tasite, 83°45'06"E, 45°53'46"N, alt. 1260 m, Reyhangul [No. 202207256]; 82°44'23"E, 45°55'14"N, alt. 1186 m, Reyhangul [No. 202305023]; Tuoli Tasite, 82°55'53"E, 45°47'11"N, alt. 2080 m, Reyhangul [No. 202207151].

P. perisidiosa (Erichson) Moberg.—Muscicolous, Yumin Tasite, 82°44'21"E, 45°55'16"N, alt. 1220 m, Reyhangul & Dolathan [No. 202308013].

P. rossica Urbanav.—Terricolous and muscicolous, Aketuyouke, 82°30'20"E, 45°44'21"N, alt. 1259 m, Reyhangul & Dolathan [No. 202207474].

***Pseudevernia* Zopf**

P. furfuracea (L.) Zopf—Corticolous, Tuoli Tasite, 82°54'37"N, 45°47'15"N, alt. 2206 m, Reyhangul & Dolathan [No. 202308336].

***Ramalina* Ach.**

R. intermedia (Delise ex Nyl.) Nyl.—Saxicolous, Yumin Tasite, 82°44'27"E, 45°52'22"N, alt. 1342 m, Reyhangul [No. 202207498].

R. sinensis Jatta—Corticolous, Yumin Tasite, 82°44'09"E, 45°52'06"N, alt. 1344 m, Reyhangul & Dolathan [No. 202207381]; 82°44'32"E, 45°52'26"N, alt. 2056 m, Reyhangul & Dolathan [No. 202207233].

***Siphula* Fr.**

S. pteruloides Nyl.—Saxicolous, Karabura reservoir, 83°04'42"E, 45°58'41"N, alt. 1781 m, Reyhangul & Dolathan [No. 202207110]; 83°05'38"E, 45°57'31"N, alt. 1833 m, Reyhangul & Dolathan [No. 202308263].

***Umbilicaria* Hoffm.**

U. aprina Nyl.—Saxicolous, Toli Tasite, 82°55'53"E, 45°07'11"N, alt. 2080 m, Reyhangul & Dolathan [No. 202207499].

U. proboscidea (L.) Schrad.—Saxicolous, Tuoli Tasite, 82°56'16"E, 45°47'15"N, alt. 2015 m, Reyhangul & Dolathan [No. 202207459].

U. virginis Schrad.—Saxicolous, Tuoli Tasite, 82°56'16"E, 45°47'15"N, alt. 2014 m, Reyhangul [No. 202207120]; 82°55'53"E, 45°47'11"N, alt. 2080 m, Reyhangul [No. 202207176]; Suyunhe, 82°27'01"E, 45°47'02"N, alt. 1098 m, Reyhangul [No. 202207176].

202308316].

***Usnea* Dill. ex Adans.**

U. subfloridana Stirt.—Corticolous, Tuoli Tasite, 82°54'39"E, 45°47'15"N, alt. 2201 m, Reyhangul [No. 202308064]; 82°54'41"E, 45°47'17"N, alt. 2192 m, Reyhangul [No. 202308088]; 82°34'34"E, 45°47'14"N, alt. 2215 m, Reyhangul [No. 202308166]; 82°54'40"E, 45°47'16"N, alt. 2198 m, Reyhangul [No. 202308168].

***Xanthoparmelia* (Vain.) Hale**

X. coreana (Gyeln.) Hale—Saxicolous, Tuoli Tasite, 82°54'44"E, 45°47'20"N, alt. 2185 m, Reyhangul & Dolathan [No. 202207209].

X. desertorum (Elenkin) Hale—Saxicolous, Yumin Tasite, 82°45'01"E, 45°53'16"N, alt. 1283 m, Reyhangul [No. 202207062]; Aketuyouke, 82°30'32"E, 45°44'23"N, alt. 1342 m, Reyhangul [No. 202308182].

X. durietzii Hale.—Saxicolous, Yumin Tasite, 82°44'21"E, 45°55'16"N alt. 1174 m, Reyhangul [No. 202207055]; 82°45'36"E, 45°53'48"N, alt. 1248 m, Reyhangul [No. 202308138]; Aketuyouke, 82°30'32"E, 45°44'23"N, alt. 1342 m, Reyhangul [No. 202308175].

X. mexicana (Gyelnik) Hale—Saxicolous, Yumin Tasite, 82°44'13"E, 45°52'07"N, alt. 1355 m, Reyhangul & Dolathan [No. 202207439]; Suyunhe, 82°25'20"E, 45°47'51"N, alt. 980 m, Reyhangul & Dolathan [No. 202207320].

X. stenophylla (Ach.) Ahti & D.Hawksw—Saxicolous, Yumin Tasite, 82°44'33"E, 45°55'14"N, alt. 1184 m, Reyhangul [No. 202308099]; 82°44'32"E, 45°55'17"N, alt. 1136 m, Reyhangul [No. 202308338]; Aketuyouke, 82°30'19"E, 45°44'21"N, alt. 1136 m, Reyhangul [No. 202308114]; 82°44'22"E, 45°55'16"N, alt. 1177 m, Reyhangul [No. 202305047].

X. wyomingica (Gyeln.) Hale—Saxicolous, Yumin Tasite, 82°44'01"E, 45°55'25"N, alt. 1176 m, Reyhangul & Dolathan [No. 202207461]; Karabura reservoir, 83°02'08"E, 46°01'04"N, alt. 1302 m, Reyhangul & Dolathan [No. 202207011]; Suyunhe, 82°26'49"E, 45°47'31"N, alt. 1075 m, Reyhangul & Dolathan [No. 202207363].

X. viriduloumbrina (Gyeln.) Lendemmer—Saxicolous, Yumin Tasite, 82°44'13"E, 45°52'07"N, alt. 1355 m, Reyhangul & Dolathan [No. 202207441].

3.2. Notes on New Records

***Cladonia kurokawae* Ahti & Stenroos**, in Ahti, Stenroos, Chen & Guo, *Mycosystema* **8-9**: 54 (1996) [1995-1996]

Description: Primary thallus squamulose, squamules mostly ephemeral, crenate, ascending, glaucescent above, white beneath. Podetia elongate, hollow inside, unbranched, up to 3 - 8 mm tall, green-grey, with pointed apices and a smooth surface. Algal layer is continuous or forms a mosaic intersected by thin white lines or dispersed in scattered clusters. Apothecia absent. Photobiont chlorococcoid.

Spot tests: K+ yellow, C-, KC-, P+ orange to red.

Chemistry: Atranorin and fumarprotocetraric acid.

Habitat: On bark and over the mosses on dead tree.

Collection sites and specimens examined: Yumin Tasite, Yumin County, Xinjiang, China. 82°44'22"E, 45°55'13"N, alt. 1202 m, 1 May 2023, Reyhangul & Anwar [No. 202305002].

***Dermatocarpon arnoldianum* Degel.**, *Nytt Mag. Natur.* **75**: 157 (1934)

Description: Thallus foliose umbilicate, attached by a central holdfast, usually monophyllous, 1.8 - 3.6 cm broad, 0.3 - 0.8 mm thick, upper surface smooth or slightly rippled, grey to (rarely) grey-brown when dry, greenish when wet, pruinose or epruinose; lower surface bright red-brown to yellowish, smooth to ridged but not veined, erhizinate; medulla white. Perithecia numerous, immersed in the thallus and scattered over almost the whole upper surface (appearing as black dots). Asci 8-spored, clavate, the wall thickened above, with an ocular chamber, dehiscent by extrusion of an endotunica to form a delicate rostrum. Ascospores 1-celled, hyaline, elongate-ellipsoid, (15 - 20) × (6 - 8) µm. Photobiont chlorococoid.

Spot tests: Cortex and medulla K-, C-, KC-, P-, UV-.

Chemistry: Without lichen substances.

Habitat: Saxicolous, distributed on the rocks in the shady broad-leaved forest, at altitudes between 1760 and 2250 m.

Collection sites and specimens examined: Toli Tasite, Toli County, Xinjiang, China. 82°45'01"E, 45°53'16"N, alt. 1283 m, 4 June 2022, Reyhangul & Anwar [No. 202207431]; Aketuyouke, Yumin County, Xinjiang, China. 82°26'53"E, 45°47'31"N, alt. 1073 m, 3 June 2022, Reyhangul & Anwar [No. 202207355].

***Enchylium polycarpon* (Hoffm.) Otálora P. M. Jørg. & Wedin**, *Fungal Diversity* **64** (1): 286 (2013) = *Collema polycarpon* Hoffm., *Deutschl. Fl., Zweiter Theil* (Erlangen): 102 (1796) [1795].

Description: Thallus foliose, forming rosette-like cushions, medium-sized to large, 1 - 3 cm wide, rounded, deeply branched, dark olive-green to black lobes with small leaf-like structure at their margins, lower surface tomentum present, apothecia common, numerous, superficial, apothecial surface dark brown, sessile, flat or concave, surface round, 0.5 - 1.5 mm wide. Photobiont cyanobacteria.

Spot tests: K-, C-, KC-.

Chemistry: Without lichen substances.

Habitat: On rock (overgrowing bryophytes).

Collection sites and specimens examined: Toli Tasite, Toli County, Xinjiang, China, 82°55'53"E, 45°47'11"N, alt. 2080 m, 7 June 2022, Reyhangul & Anwar [No. 202207194]; Yumin Tasite, Yumin County, Xinjiang, China, 82°44'21"E, 45°55'14"N, alt. 1197 m, 1 May 2023, Reyhangul & Anwar [No. 202305024].

***Fuscopannaria cheiroloba* (Müll. Arg.) P. M. Jørg.**, *Bryologist* **103**(4): 679 (2000).

Description: Thallus squamulose to small-foliose, occasionally crustose, diameter 6 cm; grey, brown, blue-grey, attached to substrate by well-developed blue to black hypothallus or by a tomentum of dark rhizohyphae; lobes generally 2.7 mm

wide; lower surface lacking a cortex; isidia or soredia absent; apothecia at first immersed, eventually sessile, with thalloid margin; disc reddish-brown or orange-brown; spores simple, hyaline, smooth or uneven, outer spore wall (epispore) sometimes thickened, warty, or pointed; photobiont blue-green.

Chemistry: Without lichen substances.

Habitat: On rocks and trees, often overgrowing bryophytes, mostly in sheltered humid habitats.

Collection sites and specimens examined: Toli Tasite, Tuoli County, Xinjiang, China. 82°54'33"E, 45°47'15"N, alt. 2198 m, 7 June 2022, Reyhangul & Anwar [No. 202207498].

***Leptogium hirsutum* Sierk**, *Bryologist* **67**: 267 (1964)

Description: Thallus foliose, closely to loosely adnate, 7 cm wide, dark grey to bluish. Lobes round to oblong, 3 - 6 mm wide; margins entire; surface smooth, isidia absent. Lower surface with sparse, tufted tomentum. Apothecia laminal, 0.5-1.5 mm wide; disc concave to flat, pale to dark red-brown; thalline exciple smooth, pale brown. Ascospores ellipsoid, muriform, (30 - 40) × (10 - 20) µm; pycnidia submarginal.

Chemistry: Without lichen substances.

Habitat: On soil among mosses.

Collection sites and specimens examined: Toli Tasite, Tuoli County, Xinjiang, China. 82°55'53"E, 45°47'11"N, alt. 2080 m, 7 June 2022, Reyhangul & Anwar [No. 202207133]; 82°55'56"E, 45°47'11"N, alt. 2065 m, 7 June 2022, Reyhangul & Anwar [No. 202207131].

***Peltigera monticola* Vitik.**, *Acta Bot. Fenn.* **152**: 64 (1994)

Description: Thallus foliose, heteromerous and dorsoventral, grey to brownish-grey when dry, blackish when wet, loosely attached, up to 5(-7) cm wide, margin tomentose, central dull to slightly glossy, margin often pruinose, lobes flattened to concave, contiguous, with rounded ends, 3 cm long and 5 mm wide. Lower surface pale, with diffuse veins which are pale in marginal parts, rusty-red to reddish-brown in central parts, the rhizines simple to fasciculate near margins, darkened and tufted towards the centre. Upper cortex pseudoparenchymatous; medulla white. Apothecia frequent, horizontal, terminal on erect lobules, brown. Paraphyses simple, distinctly thickened above. Asci 8-spored, fissitunicate. Ascospores 3(-5)-septate, hyaline to pale brown at maturity, fusiform, thin-walled, (4 - 17) × (3 - 4) µm. Photobiont cyanobacteria.

Chemistry: Without lichen substances.

Habitat: With mosses over soil.

Collection sites and specimens examined: Toli Tasite, Tuoli County, Xinjiang, China. 82°55'53"E, 45°47'11"N, alt. 2080 m, 7 July 2022, Reyhangul & Anwar [No. 202207132]; Yumin Tasite, Yumin County, Xinjiang, China. 4 June 2022, 82°44'01"E, 45°55'25"N, alt. 1176 m, Reyhangul & Anwar [No. 202207334]; 82°44'13"E, 45°52'07"N, alt. 1355 m, 4 June 2022, Reyhangul & Anwar [No. 202207023].

***Physconia rossica* Urban., *Botanicheskii Zhurnal* 93(2): 317 (2008).**

Description: Thallus foliose, greyish-white to greyish-brown, 3-5 cm wide, lobes long and narrow, irregularly branched; upper surface flat or slightly concave, usually soredia present, lip-shaped soralia apical or superficial. Cortical layer thick 37 - 55 μm , algae layer 29 - 54 μm thick, continuous; medulla 70 - 98 μm thick, white; lower surface white or light brown, cortex absent, or older part dark brown; subcortical layer 35 - 60 μm thick. Rhizines single or clustered, smooth, villous, white or light brown; apothecia absent.

Chemistry: Without lichen substances.

Habitat: On soil and on mosses.

Collection sites and specimens examined: Aketuyouke, Yumin County, Xinjiang, China. 82°30'20"E, 45°44'21"N, alt. 1259 m, 4 June 2022, Reyhangu & Dolathan [No. 202207474].

***Umbilicaria aprina* Nyl., *Syn. Meth. Lich. (Parisiis)* 2: 12 (1869).**

Description: Thallus foliose, umbilicate, monophyllous, rigid, up to 6 cm wide, upper surface pale grey to grey-brown, weakly reticulate and ridged, depressed, areolate and with radiating ridges in central parts; lower surface sooty black, pale grey along 1 - 2 mm wide marginal rim, smooth, with cream coloured, simple or sparingly branched, 2 - 3 mm long rhizinomorphs, which are usually lacking around the central holdfast. Apothecia extremely rare, omphalodisc or rarely leiodisc, black, stipitate, up to 2.5 mm wide. Ascospores usually poorly developed. Photobiont chlorococcoid.

Chemistry: Thallus K-, C-, KC-, P-; medulla with gyrophoric and lecanoric acids, C+ and KC+ red.

Habitat: On rock.

Collection sites and specimens examined: Toli Tasite, Tuoli County, Xinjiang, China. 82°55'53"E, 45°7'11' N, alt. 2080 m, 7 June 2022, Reyhangu & Dolathan [No. 202207499].

4. Conclusion

Lichens are useful indicators of air quality, forest ecosystem integrity and continuity (McMullin & Wiersma, 2019), and in recent years have been used to monitor the impacts of climate change on biodiversity (Allen & Lendemer, 2016a, 2016b). The continuous intensification of human activities has led to the destruction of natural ecosystems and over-exploitation of those lichens with medicinal and health benefits, resulting in reduced lichen biodiversity (Wei et al., 2020). Lichen communities develop extremely slowly and take a long time to recover when damaged. To provide effective protection of lichen biodiversity, it is first necessary to have information on their resource status (Wei et al., 2020). The current lack of available regional baseline species data is a barrier to monitoring lichen diversity changes resulting from climate change or environmental pollution. As a result, lichens are frequently excluded from conservation management planning (Paquette & McMullin, 2020) and thus valuable information from these important

environmental indicators is overlooked (Bergamini et al., 2007). Until recently, the lack of baseline data for lichens has been a barrier to monitoring environmental changes in the Barluk Mts. National Nature Reserve in Xinjiang Uygur Autonomous Region of China.

In this study, we found that the Barluk Mts. National Nature Reserve has abundant macrolichen resources. The most abundantly distributed and the most frequently collected species in this area was *Peltigera canina* followed by *P. elisabethae* and *Physcia caesia*, which are all foliose lichens. Among fruticose lichens, *Cladonia squamosa* was the most abundant followed by *C. subsquamosa*. The dominance of the Parmeliaceae family follows global trends; such species have ecological tolerance and adaptability, enabling its members to thrive in diverse habitats (Singh et al., 2013; Baniya et al., 2024). The prevalence of this family in the Barluk Mts. National Nature Reserve suggests its ecological significance in shaping the lichen community structure, which corresponds with the findings of Baniya et al. (2024) from the Manaslu Conservation Area in central Nepal. The Cladoniaceae family is often associated with other pioneer lichen species (Osyczka & Rola 2013) and its dominance reflects its ecological importance in early successional stages and its ability to establish in challenging environments (Baniya et al., 2024). This is evident in Barluk Mts. National Nature Reserve, where the 19 species of the genus *Cladonia* are widely distributed on exposed rocks and soil, demonstrating its ability to colonise harsh environmental conditions as noted by Osyczka and Rola (2013) and Baniya et al. (2024). As mentioned above lichens are frequently excluded from conservation management planning, but hopefully, the current research summarized above will provide the needed baseline data for future conservation and management strategies in the Barluk Mts. National Nature Reserve.

Habitat degradation and loss are the most serious threats to lichens. Loss of habitat leads to a reduction of local population sizes, and saxicolous, terricolous and epiphytic species are all similarly affected (Scheidegger & Werth, 2009). Deforestation and degradation of lichen habitats by the replacement of natural forests with plantation forests have a drastic effect on species richness and composition of lichen communities (Rose, 1992). Conservation measures for forest epiphytic and lignicolous lichens depend on the forest management type (Nascimbene et al., 2013; Ardelean et al., 2015). In our study region, prohibition of deforestation, strictly protected old-growth forests and increasing habitat heterogeneity may play an important role in the effective protection of epiphytic macrolichen diversity. In Barluk Mts. National Nature Reserve, the diversity of terricolous lichen has been changed by grazing. In order to conserve the terricolous macrolichen flora, restricting pasturing by domestic animals is recommended.

In summary, as a result of this study, we suggest conservation efforts should focus on safeguarding diverse substrates and managing human-related activities that include forestry, grazing and tourism in order to ensure the survival of the rich lichen diversity in Barluk Mts National Nature Reserve.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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