

LICHEN SPECIES NEW TO MONGOLIA

KARINA PALKA & LUCYNA ŚLIWA

Abstract: Three species of *Lecanora* and five predominantly sterile lichens are reported for the first time from Mongolia: *Lecanora flotoviana* Spreng., *L. mughicola* Nyl., *L. zosteræ* (Ach.) Nyl., *Buellia griseovirens* (Turner & Borrer ex Sm.) Almb., *Lichenomphalia umbellifera* (L.: Fr.) Redhead et al., *Placynthiella icmalea* (Ach.) Coppins & P. James, *Trapeliopsis flexuosa* (Fr.) Coppins & P. James and *Xylographa vitiligo* (Ach.) J. R. Laundon. Two of the taxa, *L. flotoviana* and *L. zosteræ*, are new findings for Central Asia.

Key words: lichens, distribution, Khubsugul [Hövsgöl] region, Altai, Mongolia, Central Asia

Karina Palka & Lucyna Śliwa, Laboratory of Lichenology, W. Szafer Institute of Botany, Polish Academy of Sciences, Lubicz 46, PL-31-512 Kraków, Poland; e-mail: palka@ib-pan.krakow.pl & sliwa@ib-pan.krakow.pl

INTRODUCTION

Mongolian lichens were hardly investigated up to the 1960s (Golubkova 1981). Then Nina S. Golubkova devoted much attention to this subject and significantly increased our knowledge of Mongolian lichen flora. Together with Ulzijn Cogt she participated in Soviet-Mongolian Complex Biological Expeditions to Mongolia in 1970–1974. The expeditions' goal was to obtain comprehensive data about Mongolian nature. As a result, a lichenological collection including more than 6000 herbarium specimens (Golubkova 1981) was gathered and many interesting papers were published (e.g., Golubkova 1973, 1979, 1980, 1981; Golubkova & Cogt 1974a, b; Cogt 1976). Lichen species diversity in Mongolia was outlined in the first monograph written by Golubkova (1983).

Lev Biazrov took part in the same series of expeditions in 1970–1980 (Biazrov 1998). His careful investigations were focused on floristic and some ecological aspects of the lichens of the Khangai Mts located in west-central Mongolia (e.g., Biazrov 1974, 1976, 1978, 1998, 2001; Biazrov & Vitikainen 2001). Mongolian lichens were studied by other lichenologists including Klement (1966), Vězda (1965), Schubert and Klement (1971), Ahti (1976), Olech (1979, 1982), Huneck et al. (1987, 1992) and Ahti and Biazrov

(2001). Cogt (1995) includes 912 lichen species in a checklist of Mongolian lichens. A checklist of lichens reported from the area by Biazrov in electronic form (2003) contains 965 taxa. A more complete overview of lichenological research in the territory of Mongolia is supplied by Golubkova (1981).

The present contribution is based on a lichenological survey conducted by the first author during an expedition to Mongolia in the summer of 2000. Eight species are reported for the first time from Mongolia. They represent crustose lichens and are members of the genus *Lecanora* or a group of taxa producing mostly sterile thalli.

REMARKS ON THE COLLECTION SITES

The reported lichens originate from two different parts of Mongolia (Fig. 1). Following Grubov and Yunantov (1952), the collection sites belong to two regions: Khubsugul and Khobdo.

1. Khubsugul is located in north-central Mongolia. The site is situated in the close vicinity of Lake Khubsugul (also called Hövsgöl, Chövsgöl, Hubsugul or Khovsgol), a part of Lake Khubsugul National Park. The Khubsugul region is characterized by significant diversity of plant

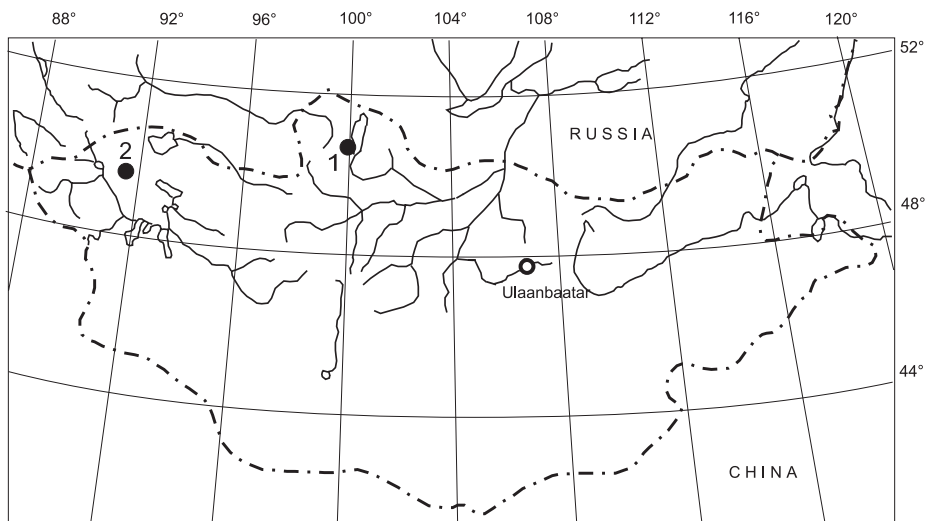


Fig. 1. Lichen collection sites in Mongolia: 1 – Bayan Ula Mts (Khubsugul region), 2 – Kharkhira massif of Mongolian Altai Mts (Khubdo region).

communities, consisting of steppe grassland, taiga forest and high mountain tundra. Lake Khubsugul National Park and the nearest area are designated a UNESCO World Cultural Heritage Landscape (Collins 2001). The Park is also the first site of the Long-Term Ecological Research network in Mongolia (Goulden *et al.* 2000).

Despite the contributions of a number of scientists (e.g., Golubkova 1971; Cogt 1976, 1995; Huneck *et al.* 1987, 1992), knowledge of the lichen diversity of that region is still insufficient. During the most recent Polish expedition to the Park a significant collection of lichens was made. The materials are currently under study and the results will be published in subsequent papers.

2. Khobdo is situated in northwestern Mongolia and includes the northeasternmost ranges of the Mongolian Altai Mts (Grubov & Yunantov 1952). The collection was made in the Kharkhira massif in *Larix sibirica* forest and mountain steppe grassland. The massif complex of Kharkhira and Turgun constitutes one of four parts of theUvs Lake Basin Strictly Protected Area (see: <http://www.un-mongolia.mn/archives/wildher/uvs.htm>).

The lichen flora of the Kharkhira massif and the entire Mongolian Altai Mts is very poorly in-

vestigated. Notable contributions were made by Vězda (1965), Golubkova (1971), Schubert and Klement (1971) and Huneck *et al.* (1987, 1992).

SPECIES NEW TO MONGOLIAN LICHEN FLORA

Buellia griseovirens (Turner & Borrer *ex Sm.*) Almb.

Inconspicuous, almost always sterile species, characteristic for its bluish prothallus. Usually corticolous on a wide range of phorophytes but also lignicolous. Widely distributed but perhaps still overlooked in some areas.

The taxon is widespread in Europe, where it occurs in the boreal zone up to the Mediterranean area including northernmost Africa and the Middle East (Turkey) (Nordin 2000). It is also known from New Zealand (Galloway 1985) and North America (Esslinger & Egan 1995). It is probably cosmopolitan in the northern and southern temperate zones (Orange *et al.* 1992). The species has more recently been recorded in Asia in the territory of Siberian Russia (Sedelnikova 1996).

In Mongolia, *Buellia griseovirens* was found on hard or rotting wood associated with *Lecanora mughicola* Nyl., *L. symmicta* (Ach.) Ach., *Rino-*

dina conradii Körb. and *Xylographa parallela* (Ach.: Fr.) Behlen & Desberger.

For comparison with other sorediate taxa, see: Tønsberg (1992) and Orange *et al.* (1992).

SPECIMENS EXAMINED. MONGOLIA. KHUBSUGUL AIMAK. Lake Khubsugul National Park, Oran Dosh Specially Protected Area, Bayan Ula Mts: NE slope of Khunzlun Mt., alt. 1800 m, mountain taiga forest dominated by *Larix sibirica*, on rotting wood, *K. Palka* 567 (KRA); high plateau W of peak of Khunzlun Mt., alt. 2500 m, mountain forest tundra, on wood, *K. Palka* 663 (KRA).

Lecanora flotoviana Spreng.

A remarkable representative of the *L. dispersa* group, neglected for several decades but more recently treated by Poelt and Leuckert (1995). Epilithic, calciphilous species, often characterized as containing vinetorin.

The species is widely distributed in Europe, where it inhabits calcareous substrates (e.g., rocks and concrete or mortar) and occasionally wood or bark of trees. It is a relatively frequent species at all altitudes (Poelt & Leuckert 1995). *Lecanora flotoviana* has recently been reported from the Scandinavian Peninsula (Frøberg 1997), Belgium and Luxembourg (Diederich & Sérusiaux 2000), the British Isles (Coppins 2002), Iberian Peninsula (Llimona & Hladun 2001), Carpathian Mts (Bielczyk *et al.* 2004) and North America (Ryan *et al.* 2004). In Europe the most eastern localities of the species are the Baltic Sea Coast in the north, in the vicinity of the Russian-Lithuanian border (Dolnik & Petrenko 2003) and the Mediterranean part of Turkey in the south (John 1996).

This is the first record of *Lecanora flotoviana* in Central Asia. The species was found on calcareous rock, and was accompanied by *Lecanora crenulata* Hook. and *Xanthoria* spp.

Two other related taxa are known from Asia: *L. invadens* H. Magn. and *L. semipallida* H. Magn. Both species were described from China (Magnusson 1940) but noted later from Mongolia. *Lecanora invadens* was reported from Mongolian Altai by Schubert and Klement (1971) and subsequently by Golubkova (1981). This species occurs on noncalcareous substrata and was also

recognized during the present survey [Mongolia. E end of Gobi Altai Mts: Gurvan Sayhan range, Yolyn Am valley ca 2200 m, desert steppe, on soil in fissures of siliceous rock, *K. Palka* 244 (KRAM); Gurvan Sayhan range above Yolyn Am valley, alt. 2400 m, mountain steppe, over lichens on siliceous rock, *K. Palka* 155 (on *Dermatocarpon* sp.) and 166 (on *Acarospora* sp.) (KRAM)]. Calciferous *L. semipallida*, which is characterized by its widely sessile apothecia with a thick margin and lack of superficial thallus, is known from Gobi Altai (Golubkova 1981). From Asia the last species was also recorded in Kyrgyzstan, Central Tien-Shan Mts (Baibulatova 1988). The taxonomic status of the three taxa is uncertain and requires further studies. This group of species is currently under detailed investigation by the second author.

SPECIMENS EXAMINED. MONGOLIA. KHUBSUGUL AIMAK. Lake Khubsugul National Park, Oran Dosh Specially Protected Area, Bayan Ula Mts, peak of Khunzlun Mt., alt. 2648 m, high mountain stony *Dryas* tundra, on calcareous rock, *K. Palka* 389, 391 (KRAM).

Lecanora mughicola Nyl.

Within the group of *Lecanora* containing isousnic acid as the main lichen compound, *Lecanora mughicola* is characterized by a relatively well-developed thallus, distinct apothecial margin (both somewhat glossy) and dark, often nearly black, usually slightly convex apothecial disc. The taxon most often inhabits hard lignum.

Lecanora mughicola was considered a rare Central European and high montane species by Wirth (1995). Besides Central Europe (e.g., Clauzade & Roux 1985; Hafellner & Türk 2001; Bielczyk *et al.* 2004) the species occurs in Scandinavia (Santesson 1993), the British Isles (Purvis *et al.* 1993), Iberian Peninsula (Llimona & Hladun 2001), Italy (Nimis 1993) and Turkey (John 1996). It is also known to occur in Africa (Hafellner 1995) and North America (Esslinger & Egan 1995).

Lecanora mughicola was previously reported from Asia from the Baikal region (Russia) by Makryj (1990). In Mongolia the species was found on wood accompanied by the following taxa: *Bryoria* sp., *Buellia griseovirens*, *Japewia tornoensis*

(Nyl.) Tønsberg, *Lecanora varia* (Hoffm.) Ach., *Pseudephebe pubescens* (L.) M. Choisy and *Xylographa parallela*. It was abundant and well developed, with numerous apothecia.

Two other similar taxa of *Lecanora* are known from the area: *L. saligna* (Schrad.) Zahlbr., characterized by its poorly developed and usually mat thallus as well as beige-, orange- or red-brown apothecial discs; and *L. albellula* Nyl. (Cogt 1995, as *L. piniperda* Körb.), which has smaller apothecia, with an often excluded thalline margin and finely pruinose apothecial discs. For general characteristics of the group of taxa and for species delimitation, see: Śliwa and Wetmore (2000) and Printzen (2001).

SPECIMENS EXAMINED. MONGOLIA. KHUBSUGUL AIMAK. Lake Khubsugul National Park, Oran Dosh Specially Protected Area, Bayan Ula Mts, high plateau W of peak of Khunzlun Mt., alt. 2500 m, mountain forest tundra, on hard lignum, *K. Palka* 605, 606, 614, 615, 664, 666 (KRA).

Lecanora zosteræ (Ach.) Nyl.

Lecanora zosteræ is a member of the *L. dispersa* complex and belongs to the group of taxa characterized by negative spot tests due to the lack of any lichen compounds. It has no visible thallus and is distinguished by its large apothecia, constricted at the base, with brown or deep brown epruinose discs and persistent whitish grey margins. The typical habitat of *L. zosteræ* includes dead vegetation, stems and branches of plants (e.g., *Lycium barbarum*) and lignum. It also develops on decaying leaves of plants such as *Zostera* sp. or *Armeria maritima*.

Lecanora zosteræ is a common species in northern regions of North America (Brodo *et al.* 2001). It is also reported from southwestern coastal parts of the continent (Ryan *et al.* 2004). This species was identified in the British Isles, where it is regarded as a rather rare maritime taxon and reported exclusively from coasts there (Laundon 2003). Recently, *L. zosteræ* was noted as a new species in the Netherlands (Serusiaux *et al.* 2003). Historical data on the distribution range of the species include Sweden and western France (see Brodo & Vitikainen 1984; Laundon 2003). The

worldwide distribution of this neglected species is very poorly known.

The species is reported for the first time from Central Asia. It was discovered at exposed sites on the sparsely wooded shore of Lake Khubsugul (alt. 1645 m), and on the peak of Khunzlun Mt. (alt. 2648 m) in high mountain stony *Dryas* tundra. At the collection sites, *L. zosteræ* occupied hard lignum and plant debris and was accompanied by *Caloplaca citrina* (Hoffm.) Th. Fr., *Candelariella aurella* (Hoffm.) Zahlbr., *Lecidella euphorea* (Flörke) Hertel and *Rinodina conradii*. The species was represented by inconspicuous thalli with numerous well-developed young and old apothecia.

The species may be mistaken for two other taxa occurring in the area, *L. hagenii* (Ach.) Ach. and *L. umbrina* (Ach.) A. Massal. Both species have significantly smaller, sessile apothecia and plane discs, which are pruinose in the case of *L. hagenii*. Two other related species are described from north-east Russia: *L. palanderi* Vain. and *L. beringii* Nyl. *Lecanora palanderi* Vain. was regarded as conspecific with *L. zosteræ*, and the species were synonymized by Brodo and Vitikainen (1984). The differences between the two taxa and *L. beringii* are not clear (Brodo 1976: 395) and the complex is in need of further critical evaluation.

SPECIMENS EXAMINED. MONGOLIA. KHUBSUGUL AIMAK. Lake Khubsugul National Park, Oran Dosh Specially Protected Area, Bayan Ula Mts: shore of Lake Khubsugul, alt. 1645 m, open, exposed site in sparsely wooded area, on hard lignum, *K. Palka* 603a (KRA); peak of Khunzlun Mt., alt. 2648 m, high mountain stony *Dryas* tundra, on plant debris, *K. Palka* 352 (KRA).

Lichenomphalia umbellifera (L.: Fr.) Redhead, Lutzoni, Moncalvo & Vilgalys

This species belongs to the minority of lichen-forming fungi representing *Basidiomycota*. *Lichenomphalia umbellifera* is characteristic for its greenish thallus consisting of minute granules and containing *Coccomyxa* as photobiont. It is the most frequent member of basidiolichens, distinct in fertile form but inconspicuous and perhaps under-recorded when sterile. It occurs on soil, rotting

wood and tree trunks, especially in humid habitats, less commonly on *Sphagnum* spp.

This is a widely distributed species throughout Europe and North America, where is considered rather common (Orange & Watling 1992). It is possibly frequent elsewhere but overlooked. *Lichenomphalia umbellifera* is regarded as a boreal, submediterranean and montane lichen (Wirth 1995). Besides Europe and North America, it was reported from New Zealand (Galloway 1985), Australia (Lumbsch & Ewers 1992), Tasmania (Kantvilas & Elix 1992) and South America (Sipman 2002).

The collected specimen of *L. umbellifera* is a sterile thallus. The species grew on lignum, among primary squamules of *Cladonia coniocraea* (Flörke) Spreng.

Of the seven lichenized species within this basidiomycete genus, only one other species is known from Mongolia (Khangai Mts): *L. hudsoniana* (Jenn.) Redhead, Lutzoni, Moncalvo & Vilgalys [Huneck *et al.* 1987, as *Omphalina hudsoniana* (Jenn.) Bigelow].

SPECIMEN EXAMINED. MONGOLIA. KHUBSUGUL AIMAK. Lake Khubsugul National Park, Oran Dosh Specially Protected Area, Bayan Ula Mts, NE slope of Khunzlun Mt., alt. 1800 m, mountain taiga forest dominated by *Larix sibirica*, on rotting wood, *K. Palka* 794 (KRA).

Placynthiella icmalea (Ach.) Coppins & P. James

Within the genus *Placynthiella* it is characterized by isidioid or minutely coralloid projections of the thallus and a positive reaction with C. It is corticolous on acidic bark, but may also grow on other substrates such as soil, plant debris and decaying lignum.

This long-neglected taxon seems to be widespread in Europe and recently has been reported by many authors such as Clauzade and Roux (1985), Diederich (1986), Purvis (1992a), Nimis (1993), Santesson (1993), Vitikainen *et al.* (1997), Diederich and Sérusiaux (2000), Hafellner and Türk (2001), Llimona and Hladun (2001) and Bielczyk *et al.* (2004). It is considered a boreal and Mediterranean species (Wirth 1995). Most recently it was recorded in the Balkan Peninsula from

Croatia (Ozimec 2000), and from many localities in the European part of Russia ranging from the northeast (Hermansson *et al.* 1998; Kuznetsova & Himelbrant 2002) through the central part (Moutchnick 2003) to the Russian Caucasus in the south (Himelbrant & Kuznetsova 2002). The species also occurs in North America (Esslinger & Egan 1995), South America (Sipman 2002), Australia (McCarthy 2001) and Antarctica (Øvstedal & Lewis Smith 2001).

The present record of *P. icmalea* is probably the first from Central Asia. At the collection site the species grew over mosses, between primary thallus squamules of *Cladonia* sp. and lobes of *Peltigera didactyla* (With.) J. R. Laundon.

Previously only *P. uliginosa* (Schrad.) Coppins & P. James has been reported from Mongolia (Cogt 1995). Unlike *P. icmalea*, *P. uliginosa* has a thallus consisting of rounded, never elongated granules, and shows a negative reaction with C.

SPECIMEN EXAMINED. MONGOLIA. KHUBSUGUL AIMAK. Lake Khubsugul National Park, Oran Dosh Specially Protected Area, Bayan Ula Mts, NE slope of Khunzlun Mt., alt. 1800 m, mountain taiga forest dominated by *Larix sibirica*, over mosses on ground, *K. Palka* 793b (KRA).

Trapeliopsis flexuosa (Fr.) Coppins & P. James

A widespread sorediate species commonly occurring on lignum and acid bark (mostly of conifers), rarely plant debris or sandstone rocks.

Trapeliopsis flexuosa is a circumpolar boreal and temperate lichen occurring in Europe from boreal to Mediterranean regions (Wirth 1995). It is common throughout Europe and North America (Purvis 1992b). The species was reported in recent decades as new from the following areas: Alaska (Talbot *et al.* 1992), Greenland (Alstrup 1989), Iceland (Kristinsson 1999), Morocco (Egea 1996), Turkey (John 1996), Australia (McCarthy 2001), including Tasmania (Kantvilas & Elix 1992), New Zealand (Wirth 1997a) and Oceania (Wirth 1997b). The most recent new record is from the Russian Caucasus (Himelbrant & Kuznetsova 2002).

The present record of *T. flexuosa* is probably the first published record of the species in that

part of Asia. The species was accompanied by *Bryoria fuscescens* (Gyeln.) Brodo & D. Hawksw., *Parmelia sulcata* Taylor, *Rinodina* sp. and *Vulpicida pinastri* (Scop.) J.-E. Mattsson & M. J. Lai. The collected specimens are often fertile with well-developed apothecia.

Of several species distinguished within the genus, two others have been reported from Mongolia: *T. granulosa* (Hoffm.) Lubmsch (Golubkova 1981) and *T. percrenata* (Nyl.) Gotth. Schneid. (Biazrov 1989). *Trapeliopsis granulosa* is a predominantly terricolous lichen, also growing over decaying mosses and plant debris; it is only occasionally corticolous. The morphological differences between the taxa are these: coloration of the soralia (aeruginose in *T. flexuosa*, whitish grey, grey, yellow-green or pink in *T. granulosa*); and in *T. granulosa* the soredia are frequently aggregated in consoredia. *Trapeliopsis percrenata* is distinctive for its squamulose thallus and lack of reaction with C (Wirth 1995).

SPECIMENS EXAMINED. MONGOLIA. KHUBSUGUL AIMAK. Lake Khubsugul National Park, Oran Dosh Specially Protected Area, Bayan Ula Mts, NE slope of Khunzlun Mt., alt. 1800 m, mountain taiga forest dominated by *Larix sibirica*, on bark and wood, *K. Palka* 572, 747, 748, 809, 813, 825 (KRA), 827 (KRAM). Uvs Aimak, Mongolian Altai Mts, Kharkhira range: alt. 1500 m, *Larix sibirica* forest, on rotting wood, *K. Palka* 253 (KRAM); alt. 2600 m, mountain steppe, on rotting wood, *K. Palka* 292a, 299 (KRAM).

Xylographa vitiligo (Ach.) J. R. Laundon

Rare, lignicolous and predominantly sterile lichen with characteristic elongate soralia. It grows exclusively on lignum, mostly on decaying trunks of conifers.

The species represents a holarctic element and occurs in Europe from the boreal zone to oroboreal belts in submediterranean regions (Wirth 1995). Considered rare, it may be fairly common locally, particularly in the upper montane and subalpine belts (Nimis 1993). It is known from the British Isles (Orange 1992), Scandinavian Peninsula (Santesson 1993; Vitikainen *et al.* 1997), Central Europe (Clauzade & Roux 1985; Wirth 1995; Diederich & Sérusiaux 2000; Hafellner & Türk 2001; Bielczyk *et al.*

2004), Iberian Peninsula (Limona & Hladun 2001) and Apennine Peninsula (Nimis 1993). The taxon is also reported from North America (Esslinger & Egan 1995), Macaronesia (Hafellner 1995) and India (Nayaka & Upreti 2002).

The Mongolian specimen originated from a rotting tree stump and was accompanied by *Bryoria nachvornikiana* (Gyeln.) Brodo & D. Hawksw., *Cladonia coniocraea*, *Lecanora symmicta*, *L. varia*, *Rinodina turfacea* (Wahlenb.) Körb. and *Vulpicida pinastri*. The specimen has well-developed sterile thalli.

Xylographa vitiligo is distinguished from other species of the genus, such as *X. parallela* occurring in Mongolia (Cogt 1995), by the presence of soralia. When sterile, *X. vitiligo* is likely to be confused with various sorediate species, from which it may be distinguished by the reactions of the soralia (P+ distinctly orange, K+ yellow, never turning into crystals, always C-). The reactions and roundish to narrowly elliptic soralia differentiate *X. vitiligo* from *B. griseovirens*, which has crowded soralia often becoming confluent and reacts P+ yellow or yellow-orange, K+ yellowish, turning red (crystals), C- or C+ yellowish.

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REFERENCES

- AHTI T. 1976. The lichen genus *Cladonia* in Mongolia. *J. Jap. Bot.* **51**(12): 365–373.
- AHTI T. & BIAZROV L. G. 2001. New records of *Cladonia* (Lichenized Ascomycetes, Lecanorales) from Khangai (Mongolia). *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* **106**(6): 71–73 (in Russian).
- ALSTRUP V. 1989. *Gyalidea diaphana* and *Trapeliopsis flexuosa* new to Greenland. *Graphis Scripta* **2**(4): 161.

- BAIBULATOVA N. E. 1988. Lichens of Sary-Dzhaz river basin (Central Tien-Shan). *Bot. Zhurn.* **73**(3): 349–354 (in Russian).
- BLAZOV L. G. 1974. Lichen synusiae in herb larch forests (Khangai mountain ridge, Mongolia). *Bot. Zhurn.* **59**(10): 1425–1438 (in Russian with English summary).
- BLAZOV L. G. 1976. Zapas massy epigeynykh makrolishaynikov v nekotorykh gorno-stepnykh soobshchestvakh Khangaya (MNR). *Ekologiya* **2**: 81–84. Akademiya Nauk SSSR, Nauka.
- BLAZOV L. G. 1978. O vodnom rezhime lishaynikov gornoj lesostepi Vostochnogo Khangaya. *Biol. Resursy Prir. Uslov. Mongolsk. Nar. Resp.* **10**: 119–123.
- BLAZOV L. G. 1989. Lishayniki. *Biol. Resursy Prir. Uslov. Mongolsk. Nar. Resp.* **33**: 17–73.
- BLAZOV L. G. 1998. High-Mountain lichen elements of the Khangai range of mountain. *Sauteria* **9**: 387–395.
- BLAZOV L. G. 2001. Species lichenum pro montibus Changaj (Mongolia) novae. *Novosti Sist. Nizsh. Rast.* **35**: 120–124 (in Russian).
- BLAZOV L. G. 2003. Checklist of the Mongolian lichens. Version 1. http://www.sevin.ru/laboratories_eng/blazov.html.
- BLAZOV L. G. & VITIKAINEN O. 2001. New records of *Peltigera* from Khangai (Mongolia). *Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol.* **106**(6): 73–74 (in Russian).
- BIELCZYK U., LACKOVICOVÁ A., FARKAS E., LOKOS L., LIŠKA J., BROUSS O. & KONDRATYUK S. 2004. Checklist of lichens of the Western Carpathians. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- BRODO I. M. 1976. Lichenes Canadenses Exsiccati: Fascicle II. *Bryologist* **79**(4): 395.
- BRODO I. M. & VITIKAINEN O. 1984. The typification of *Lecanora subfusca* (L.) Ach., its varieties, and some of its related taxa published before 1850. *Mycotaxon* **21**: 281–289.
- BRODO I. M., SHARNOFF S. D. & SHARNOFF S. 2001. Lichens of North America. Yale University Press, New Haven.
- CLAUZADE G. & ROUX C. 1985. Likenoj de okcidenta Europo. Ilustrita determinlibro. *Bull. Soc. Bot. Centre-Ouest, Numero Special* **7**: 1–893.
- COGT U. 1976. Napochvennyye lishayniki rayona Prikhubsugulya MNR. *Biol. Resursy Prir. Uslov. Mongolsk. Nar. Resp.* **8**: 17–34.
- COGT U. 1995. Die Flechten der Mongolei. *Willdenowia*. **25**: 289–397.
- COLLINS L. 2001. Hovsgol national park up for UNESCO protection. The Mongol Messenger, June 20. http://www.ultramongolia.com/press_mm.html.
- COPPINS B. J. 2002. Checklist of lichens of Great Britain and Ireland. British Lichen Society, London.
- DIEDERICH P. 1986. Lichenicolous fungi from the Grand Duchy of Luxembourg and surrounding areas. *Lejeunia* **119**: 1–26.
- DIEDERICH P. & SÉRUSIAUX E. 2000. The lichens and lichenicolous fungi of Belgium and Luxembourg. An annotated checklist. Musée National d'Histoire Naturelle, Luxembourg.
- DOLNIK C. & PETRENKO D. E. 2003. Lichens of the southern Curonian Spit in the Baltic Sea. *Bot. Zhurn.* **88**(2): 41–59.
- EGEA J. M. 1996. Catalogue of lichenized and lichenicolous fungi of Morocco. *Bocconea* **6**: 19–114.
- ESSLINGER T. & EGAN R. S. 1995. A sixth checklist of the lichen-forming, lichenicolous, and allied fungi of the continental United States and Canada. *Bryologist* **98**(4): 467–549.
- FRÖBERG L. 1997. Variation of the *Lecanora dispersa* group in South Sweden. *Symb. Bot. Ups.* **32**: 29–34.
- GALLOWAY D. J. 1985. Flora of New Zealand. Lichens. P. D. Hasselberg, Wellington, New Zealand.
- GOLUBKOVA N. S. 1971. A contribution to the knowledge of the lichenoflora of Mongolian People's Republic. *Bot. Zhurn.* **56**(6): 777–786 (in Russian with English summary).
- GOLUBKOVA N. S. 1973. New species of the genus *Toninia* Mass., found in the Mongolian People's Republic. *Bot. Zhurn.* **58**: 838–840 (in Russian).
- GOLUBKOVA N. S. 1979. *Acarospora fluva* Golubk. – species lichenis nova in Mongolia inventa. *Novosti Sist. Nizsh. Rast.* **16**: 129–133 (in Russian).
- GOLUBKOVA N. S. 1980. Species *Acarosporae* Massal. xanthochroae in Mongolia inventae. *Novosti Sist. Nizsh. Rast.* **17**: 120–134 (in Russian).
- GOLUBKOVA N. S. 1981. Konspekt flory lishaynikov Mongolskoy Narodnoy Respubliki. *Biol. Resursy Prir. Uslov. Mongolsk. Nar. Resp.* **16**: 1–201.
- GOLUBKOVA N. S. 1983. Analiz flory lishaynikov Mongolii. Nauka, Leningrad.
- GOLUBKOVA N. S. & COGT U. 1974a. On lichens of the southern deserts of Mongolian Peoples' Republic. *Bot. Zhurn.* **59**(1): 43–52 (in Russian).
- GOLUBKOVA N. S. & COGT U. 1974b. De lichenibus partis Republicae Popularis Mongoliae Dolina Ozer Dictae Notula. *Novosti Sist. Nizsh. Rast.* **11**: 281–294 (in Russian).
- GOULDEN C. E., TSOGTBAATAR J., CHULUUNKHUYAG, HESSION W. C., TUMURBAATAR D., DUGARJAV C., CIANFRANI C., BRUSILOVSKIY P., NAMKHAJANTSEN G. & BAATAR R. 2000. The Mongolian LTER: Hövsgöl National Park. *Korean J. Ecol.* **23**(2): 135–140.
- GRUBOV V. I. & YUNANTOV A. A. 1952. Osnovnye osobennosti flory Mongolskoy Narodnoy Respubliki v svyazi s ee rayonirovanem. *Bot. Zhurn.* **37**(1): 45–64.
- HAFELLNER J. 1995. Bemerkenswerte Funde von Flechten und lichenicolen Pilzen auf makaronesischen Inseln III. Einige

- bisher auf den Kanarischen Inseln übersehene lecanorale Arten. *Linzer Biol. Beitr.* **27**(2): 489–505.
- HAFELLNER J. & TÜRK R. 2001. Die lichenisierten Pilze Österreichs – eine Checkliste der bisher nachgewiesenen Arten mit Verbreitungsangaben. *Stapfia* **76**: 3–167.
- HERMANSSON J., PYSTINA N. T. & KUDREJASHEVA D. I. 1998. Predvaritelny spisok lishainikov Respubliki Komi. Syktyvkar. <http://www.ib.komisc.ru/t/ru/os/arx/checklist.html>.
- HIMELBRANT D. & KUZNETSOVA E. 2002. Lichens of the Subtropical Botanical Garden of Kuban' (Krasnodar region, Russian Caucasus). *Botanica Lithuanica* **8**(2): 153–163.
- HUNECK S., POELT J., AHTI T., VITIKAINEN O. & COGT U. 1987. Zur Verbreitung und Chemie von Flechten der Mongolischen Volksrepublik. II. Ergebnisse der Mongolisch-Deutschen Botanischen Expeditionen seit 1962 Nr. 177. *Nova Hedwigia* **44**(1–2): 189–213.
- HUNECK S., AHTI T., COGT U., POELT J. & SIPMAN H. 1992. Zur Verbreitung und Chemie von Flechten der Mongolei. III. Ergebnisse der Mongolisch-Deutschen Botanischen Expeditionen seit 1962 Nr. 217. *Nova Hedwigia*. **54**(3–4): 277–308.
- JOHN V. 1996. Preliminary catalogue of lichenized and lichenicolous fungi of Mediterranean Turkey. *Bocconea* **6**: 173–216.
- KANTVILAS G. & ELIX J. A. 1992. A new species and new records from the Tasmanian lichen flora. *Muelleria* **7**(4): 507–517.
- KLEMENT O. 1966. Flechten aus der Mongolischen Volksrepublik. Ergebnisse der Mongolisch-Deutschen Biologischen Expedition seit 1962 Nr. 7. *Feddes Repert.* **72**(1965): 98–123.
- KRISTINSSON H. 1999. The 12th meeting of the Nordic Lichen Society in Eidar, Iceland 1997. *Graphis Scripta* **11**(1): 13–21.
- KUZNETSOVA E. S. & HIMELBRANT D. E. 2002. Addition to the lichen flora of the Nizhnesvirskii Reserve. *Novosti Sist. Nizsh. Rast.* **36**: 144–150 (in Russian).
- LAUNDON J. R. 2003. The status of *Lecanora zosterae* in the British Isles. *Lichenologist* **35**(2): 97–102.
- LLIMONA X. & HLADUN N. L. 2001. Checklist of the lichens and lichenicolous fungi of the Iberian Peninsula and Balearic Islands. *Bocconea* **14**: 5–581.
- LUMBSCH H. T. & EWERS W. H. 1992. Additional lichen records from Australia 10. *Omphalina umbilifera* [sic] (L. Fr.) Quélet. *Australasian Lichenological Newsletter* **30**: 5–6.
- MAGNUSSON H. 1940. Lichens from Central Asia. Reports from the scientific expedition to the north-western provinces of China under the leadership of dr. Sven Hedin – the Sino-Swedish expedition. 13, XI. Botany 1. Tryckeri Aktiebolaget Thule, Stockholm.
- MAKRYJ T. V. 1990. Lishayniki Baykalskovo khrebta. Nauka, Novosibirsk.
- MCCARTHY P. M. 2001. Checklist of Australian Lichens. <http://www.anbg.gov.au/abrs/lichenlist/introduction.html>
- MOUTCHNICK E. E. 2003. Materials on lichen flora of Tambov Region. *Bot. Zhurn.* **88**(4): 28–41 (in Russian with English summary).
- NAYAKA S. & UPRETI D. K. 2002. Lichens flora of Sharavathi River Basin, Shimoga District, Karnataka, India, with six new records. *J. Econ. Taxon. Bot.* **26**(3): 627–648.
- NIMIS P. L. 1993. The Lichens of Italy. An annotated catalogue. *Monografie. Museo Regionale di Scienze Naturali, Torino* **12**: 1–887.
- NORDIN A. 2000. Taxonomy and phylogeny of *Buellia* species with pluriseptate spores (Lecanorales, Ascomycotina). *Symb. Bot. Upsal.* **33**(1): 1–117.
- OLECH M. 1979. Materials to the lichen flora of the Khangai Mountains (Mongolia). *Fragm. Flor. Geobot.* **25**(3): 439–443.
- OLECH M. 1982. Materials to the Lichen Flora of the Khentei Mountains (Mongolia). *Fragm. Flor. Geobot.* **28**(2): 211–219.
- ORANGE A. 1992. *Xylographa* (Fr.) Fr. (1838). In: O. W. PURVIS, B. J. COPPINS, D. L. HAWKSWORTH, P. W. JAMES & D. M. MOORE (eds), *The lichen flora of Great Britain and Ireland*, pp. 648–649. Natural History Museum Publications, London.
- ORANGE A. & WATLING R. 1992. *Omphalina* Quel. (1886). In: O. W. PURVIS, B. J. COPPINS, D. L. HAWKSWORTH, P. W. JAMES & D. M. MOORE (eds), *The lichen flora of Great Britain and Ireland*, pp. 401–404. Natural History Museum Publications, London.
- ORANGE A., COPPINS B. J. & SCHEIDEGGER C. 1992. *Buellia* de Not. (1846). In: O. W. PURVIS, B. J. COPPINS, D. L. HAWKSWORTH, P. W. JAMES & D. M. MOORE (eds), *The lichen flora of Great Britain and Ireland*, pp. 129–137. Natural History Museum Publications, London.
- ØVSTEDAL D. O. & LEWIS SMITH R. I. 2001. Lichens of Antarctica and South Georgia. A Guide to their identification and ecology. Cambridge University Press, Cambridge.
- UZIMEC S. 2000. Five lichen species new to the Croatian flora. *Nat. Croat.* **9**(2): 133–138.
- POELT J. & LEUCKERT C. 1995. Die Arten der *Lecanora dispersa*-Gruppe (Lichenes, Lecanoraceae) auf kalkreichen Gesteinen im Bereich der Ostalpen – eine Vorstudie. *Biblioth. Lichenol.* **58**: 289–333.
- PRINTZEN C. 2001. Corticolous and lignicolous species of *Lecanora* (Lecanoraceae, Lecanorales) with usnic or isousnic acid in the Sonoran Desert Region. *Bryologist* **104**(3): 382–409.
- PURVIS O. W. 1992a. *Placynthiella* Elenkin (1909). In: O. W. PURVIS, B. J. COPPINS, D. L. HAWKSWORTH, P. W. JAMES & D. M. MOORE (eds), *The lichen flora of Great Britain and Ireland*, pp. 475–476. Natural History Museum Publications, London.

- PURVIS O. W. 1992b. *Trapeliopsis* Hertel & G. Schneider (1980). In: O. W. PURVIS, B. J. COPPINS, D. L. HAWKSWORTH, P. W. JAMES & D. M. MOORE (eds), *The lichen flora of Great Britain and Ireland*, pp. 612–615. Natural History Museum Publications, London.
- PURVIS O. W., COPPINS B. J. & JAMES P. W. 1993. Checklist of lichens of Great Britain and Ireland. British Lichen Society, London.
- RYAN B. D., LUMBSCH H. T., MESSUTI M. I., PRINTZEN C., ŠLIWA L. & NASH III T. H. 2004. *Lecanora* Ach. In: T. H. NASH III, B. D. RYAN, P. DIEDERICH, C. GRIES & F. BUNGARTZ (eds), *Lichen flora of the Greater Sonoran Desert region. 2*. Arizona State University, Tempe, Arizona (in press).
- SANTESSON R. 1993. The lichens und lichenicolous fungi of Sweden and Norway. SBT-förlaget, Lund.
- SCHUBERT R. & KLEMENT O. 1971. Beitrag zur Flechtenflora der Mongolischen Volksrepublik. *Feddes Repert.* **82** (3–4): 187–262.
- SEDELNIKOVA N. V. 1996. Conspectus systematicus lichenum montium Sajanensium Orientalium. *Novosti Sist. Nizsh. Rast.* **31**: 144–151 (in Russian).
- SÉRUSIAUX E., DIEDERICH P., ERTZ D. & VAN DEN BOOM P. 2003. New or interesting lichens and lichenicolous fungi from Belgium, Luxembourg and France. IX. *Lejeunia* **173**: 1–48.
- SIPMAN H. J. M. 2002. Lichens. Checklist of Paramo plants. [July 2004]. <http://www.botanypages.org/neill/paramos/lichens.htm>
- ŠLIWA L. & WETMORE C. M. 2000. Notes on the *Lecanora varia* group in North America. *Bryologist* **103**(3): 475–492.
- TALBOT S. S., TALBOT S. L. & THOMSON J. W. 1992. Lichens of Tuxedni Wilderness Area, Alaska. *Bryologist* **95**(1): 20–30.
- TØNSBERG T. 1992. The sorediate and isidiate, corticolous, crustose lichens in Norway. *Sommerfeltia* **14**: 1–331.
- VÉZDA A. 1965. Flechten aus der NW-Mongolei. *Čas. Slez. Mus., Ser. A., Hist. Nat.* **14**: 187–190.
- VITIKAINEN O., AHTI T., KUUSINEN M., LOMMI S. & ULVINEN T. 1997. Checklist of lichens and allied fungi of Finland. *Norrinia* **6**: 1–123.
- WIRTH V. 1995. Die Flechten Baden-Württenbergs. Verlag E. Ulmer, Stuttgart.
- WIRTH V. 1997a. Additional lichen records from New Zealand 21. *Candelariella coralliza*, *Lepraria eburnea*, *Racodium rupestre*, *Rinodina olivaceobrunnea*, *Rinodina pyrina*, and *Trapeliopsis flexuosa*. *Australas. Lichenol. Newslett.* **40**: 11–13.
- WIRTH V. 1997b. Additional lichen records from Oceania 3. *Trapeliopsis flexuosa*. *Australas. Lichenol. Newslett.* **40**: 11.

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