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Additions to the checklist of lichenicolous fungi of Mongolia

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Abstract: Seventy-four species of lichenicolous fungi, including two species of lichenicolous lichens, are reported from Mongolia. *Arthonia xanthoparmeliarum, Katherinomyces cetrariae* s. lat. and *Lichenochora arctica* are newly reported for Asia. *Arthonia epiphyscia, A. excentrica, A. molendoi, Carbonea vitellinaria, Cercidospora xanthoriae, Didymocyrtis rhizoplacae, Endococcus propinquus, Intralichen christiansenii, Lichenochora caloplacae, L. rinodinae, Lichenodiplis lecanorae, Lichenostigma dimelaenae, L. triseptatum, Niesslia peltigericola, Polycoccum trypethelioides, Rhymbocarpus neglectus, Sphaerellothecium phaeorrhizae, S. propinquellum, Stigmidium xanthoparmeliarum, Taeniolella pertusariicola* and *Tetramelas phaeophysciae* are reported new to Mongolia. The occurrence of *Stigmidium psorae* in Mongolia is confirmed. *Flavocetraria* and *Rhizoplaca* are reported as new host genera for *Katherinomyces cetrariae* s. lat.

Keywords: lichen parasites, biodiversity, biogeography, Central Asia

INTRODUCTION

Recently, the first synopsis of lichenicolous fungi of Mongolia was published, which included data on 114 species, mainly collected in the Khubsugul Aimak (Zhurbenko et al., 2019). The present contribution presents the results of further studies of the lichenicolous mycobiota of Mongolia performed by the authors in 2019, mainly in the Mongolian Altai. Here, data on new finds of 74 species of lichenicolous fungi are presented, three of which are new to Asia and 21 are new to Mongolia, which increases the number of lichenicolous fungi species documented in Mongolia to 138.

MATERIAL AND METHODS

The study is based on 153 specimens of lichenicolous fungi collected by the authors from 8 to 27 July 2019 in 15 localities in Mongolia. Microscopical examination was carried out using a Stemi 2000-CS dissecting microscope and a Zeiss Axio Imager A1 compound microscope with interference contrast, fitted with an AxioCam MRc5 digital camera. Hand-cut, razor-blade sections of fruit bodies were studied in water, 10% KOH, Lugol's iodine, directly or after a KOH pre-treatment, or brilliant cresyl blue. For the identification of host lichens, commercial bleach and a solution of paraphenylenediamine in ethanol were used. The length and breadth of asci, ascospores and conidia are given (where n > 10) as (min–){X–SD}–{X+SD}(–max), where "min" and "max" are the extreme observed values, X the arithmetic mean and SD the corresponding standard deviation, followed by the number of measurements (n). The length/breadth ratio is indicated as L/B and given in the same way. Measurements were taken from water mounts. Geographical names mainly follow Enhbayaryn (2004). Voucher specimens are housed in the mycological herbarium of the V. L. Komarov Botanical Institute in St. Petersburg, Russia (LE).

Collecting localities

Visited localities in Mongolia are arranged in chronological order and referenced in the list by Latin numbers in bold.

I: Arkhangai Aimag, Tsenkher Somon, between Tsetserleg and Tsenkher settlements, Urd-Tamir River valley, 47°04'18"N, 100°59'25"E, elev. 2100 m, *Larix sibirica* forest with stones.

II: Arkhangai Aimag, Bulgan Somon, Khul Sayayn Davaa pass, 46°49'52"N, 100°48'45"E, elev. 2800 m, mountain tundra.

III: Khovd Aimag, Altai Somon, near Barlag settlement, 45°53'42"N, 93°12'24"E, elev. 1850 m, steppe with shale rock outcrops.

IV: Khovd Aimag, Must Somon, Bodonch Gol River valley, 46°31'53"N, 92°23'28"E, elev. 2400 m, sandstone boulders in steppe.

V: Khovd Aimag, Must Somon, Bodonch Gol River valley, Mt. Zurkh Uul, 46°30'44"N, 92°20'41"E, elev. 2600–3000 m, mountain tundra with stones and rocks.

VI: Khovd Aimag, Must Somon, Baga Ulaan Davaa pass, 46°41'38"N, 92°17'38"E, elev. 3000 m, steppe with sandstone boulders.

VII: Khovd Aimag, Mankhan Somon, 30 km SW of Mankhan settlement, Khoid Tsenkher Gol River valley, 47°20'26"N, 91°55'04"E, elev. 1700 m, steppe with shale rocks and stones.

VIII: Bayan-Ulgii Aimag, Tolbo Somon, 45 km E of Tolbo settlement, Khashaatyn Davaa pass, 48°30'30"N, 90°42'57"E, elev. 2630 m, steppe with shale rocks and stones.

IX: Bayan-Ulgii Aimag, Tolbo Somon, 15 km E of Tolbo settlement, Mt. Sairyn Uul, 48°22'39"N, 90°29'29"E, elev. 3050 m, mountain tundra with stones.

X: Bayan-Ulgii Aimag, Tolbo Somon, 15 km E of Tolbo settlement, Mt. Sairyn Uul, 48°21'48"N, 90°29'87"E, elev. 2600–2800 m, steppe and rocks on mountain slope.

XI: Bayan-Ulgii Aimag, Tsengel Somon, WNW of Zagastnuur settlement, Tsagaan Gol River valley, in the vicinities of Potanina glacier, 49°04'41"N, 88°05'16"E, elev. 2600 m, steppe.

XII: Bayan-Ulgii Aimag, Tsengel Somon, WNW of Zagastnuur settlement, Tsagaan Gol River valley, in the vicinities of Potanina glacier, 49°04'20"N, 88°03'57"E, elev. 2650 m, mountain tundra with *Betula rotundifolia* shrubs.

XIII: Zavkhan Aimag, Ikh-Uul Somon, Solongotyn Davaa pass, 48°17'26"N, 98°57'31"E, elev. 2600 m, wet mountain tundra with *Betula rotundifolia* shrubs.

XIV: Arkhangai Aimag, Tsakhir Somon, near Tsagannuur settlement, 48°04'30"N, 99°25'33"E, elev. 2060 m, steppe.

XV: Arkhangai Aimag, Taryat Somon, NW of Taryat settlement, near Khorgo Uul volcano, 48°11'28"N, 99°49'47"E, elev. 2080 m, volcanic stone field with sparse *Larix sibirica* trees.

THE SPECIES

Taxa newly reported for Asia are denoted by '**', those new to Mongolia by '*'. Lichenicolous lichens are designated by 'L'.

Abrothallus caerulescens I. Kotte
All on thalli of *Xanthoparmelia stenophylla*. **III:** 13.07.2019, O. Enkhtuya (LE 309977); **XV:** 27.07.2019, M. P. Zhurbenko 19287 (LE 309979); 27.07.2019, M. P. Zhurbenko 19295c (LE 309978). – New to Arkhangai and Khovd Aimags of Mongolia.

Abrothallus parmeliarum (Sommerf.) Arnold
I: on *Parmelia omphalodes* (thallus), 8.07.2019, M. P. Zhurbenko 19311a (LE 309999a); **II:** on *P. saxatilis* (thallus), 9.07.2019, O. Enkhtuya (LE 310000a). – New to Arkhangai Aimag of Mongolia.

Arthonia clemens (Tul.) Th. Fr.
All on apothecia of *Rhizoplaca chrysoleuca*. **II:** 9.07.2019, M. P. Zhurbenko 19324a (LE 310065); **IV:** 14.07.2019, M. P. Zhurbenko 19351 (LE 310063); **VI:** 16.07.2019, M. P. Zhurbenko 19303 (LE 310061); **VII:** 17.07.2019, O. Enkhtuya (LE 310062); **XV:** 27.07.2019, M. P. Zhurbenko 19288 (LE 310064). – New to Arkhangai and Khovd Aimags of Mongolia.

*Arthonia epiphyscia Nyl.
XI: on *Physcia caesia* (thallus), 22.07.2019, O. Enkhtuya (LE 309998). – A common lichenicolous ascomycete with subcosmopolitan distribution (Brackel, 2014).

*Arthonia excentrica Th. Fr.
Both on thalli of *Lepraria neglecta* agg. **IX:** 19.07.2019, M. P. Zhurbenko 19299 (LE 309990); **XI:** 22.07.2019, O. Enkhtuya (LE 309989). – In our material the ascospores are larger than was reported in the protologue (Fries, 1867), viz. (12.1–)13.9–16.7(–18.5) × (5.2–)5.6–6.6(–7.6) µm, L/B = (2.1–)2.2–2.8(–3.1) (n = 34) vs. 11–13 × 4–5 µm. Kowalewska & Kukwa (2003) also reported for this species ascospores size similar to ours, viz. 13–16 × 5–6.5 µm. Known from scattered finds in Europe, Asia, North America and South America, mainly in the arctic-oreophytic environments (Alstrup & Hawksworth, 1990; Hafellner & Türk, 1995; Santesson, 1998; Diederich & Sérusiaux, 2000; Hafellner et al., 2002; Santesson et al.,

2004; Etayo & Sancho, 2008; Hafellner, 2008; Zhurbenko 2009a; Etayo, 2010).

*Arthonia molendoi (Frauenf.) R. Sant.
All on apothecia and thalli of *Rusavskia elegans*. **IV:** 14.07.2019, M. P. Zhurbenko 19353a (LE 310014a); **V:** 15.07.2019, O. Enkhtuya (LE 310017b); **VIII:** 18.07.2019, M. P. Zhurbenko 19300 (LE 310015). – A common lichenicolous ascomycete with subcosmopolitan distribution (Alstrup & Cole, 1998; Alstrup & Hawksworth, 1990; Etayo & Sancho, 2008; Hafellner & Muggia, 2006; Øvstedal & Lewis Smith, 2001; Zhurbenko, 2009b).

**Arthonia xanthoparmeliarum Etayo
XV: on *Xanthoparmelia stenophylla* (thallus), 27.07.2019, M. P. Zhurbenko 19282b (LE 309973b). – This species was described from South America (Chile: Etayo & Sancho, 2008) and subsequently also reported from North America (the U.S.A.: Kocourková, 2009) and Europe (Luxembourg: Eichler et al., 2010).

Bachmanniomyces punctum (A. Massal.) Diederich & Pino-Bodas
I: on *Cladonia amaurocraea* (podetia), 8.07.2019, M. P. Zhurbenko 19308 (LE 310021); **XIII:** on *C. arbuscula* (podetia), 26.07.2019, M. P. Zhurbenko 19355 (LE 310020); on *C. amaurocraea* (podetia), 26.07.2019, M. P. Zhurbenko 19339 (LE 310022). – New to Arkhangai and Zavkhan Aimags of Mongolia.

[L]Caloplaca epithallina Lynge
II: on *Rhizoplaca chrysoleuca* (thallus), 9.07.2019, M. P. Zhurbenko 19362 (LE 310068); **VII:** on *R. chrysoleuca* (thallus), 17.07.2019, O. Enkhtuya (LE 310067); **IX:** on *Psorinia conglomerata* (thallus), 19.07.2019, M. P. Zhurbenko 19280 (LE 309966). – A rather common lichenicolous lichen widely distributed in the arctic-oreophytic environments of the Holarctic, including Mongolia (Poelt, 1985).

*Carbonea vitellinaria (Nyl.) Hertel
IX: on *Candelariella* sp. (thallus), 19.07.2019, M. P. Zhurbenko 19281 (LE 310010). – A common lichenicolous ascomycete with cosmopolitan distribution (Brackel, 2014).

Cercidospora cf. macrospora (Uloth) Hafellner & Nav.-Ros.
X: on saxicolous *Lecanora* sp. (thallus), 19.07.2019, S. Javkhlan (LE 310152); **XV:** on *Rhizoplaca subdiscrepans* (thallus), 27.07.2019, S. Javkhlan (LE 310151). – The material examined differs from the species description in Calatayud et al. (2013) in its sometimes strongly heteropolar, somewhat longer and wider ascospores, (21.0–)23.9–29.3(–30.9) × (5.6–)6.0–7.0(–7.5) µm, L/B = (3.1–)3.7–4.5(–4.8) (n = 18) vs. (19–)20–25(–30) × 4–6(–7) µm, L/B = (3.0–)3.8–5.4(–6.7) (Calatayud et al., 2013). It is also similar to *C. crozalsiana* (H. Olivier) Nav.-Ros., Cl. Roux & Casares, growing on *Squamarina*, which differs in somewhat longer ascospores, (22–)24.5–32(–37) × (5–)5.5–7(–8) *µm*, L/B = (3.2–)3.7–5.5(–6.8) (Calatayud et al., 2013).

Cercidospora verrucosaria (Linds.) Arnold
II: on *Megaspora verrucosa* (thallus, thalline margins of apothecia), 9.07.2019, M. P. Zhurbenko 19328 (LE 309954). – New to Arkhangai Aimag of Mongolia.

*Cercidospora xanthoriae (Wedd.) R. Sant.
All on apothecia and thalli of *Rusavskia elegans*. **III:** 13.07.2019, O. Enkhtuya (LE 310016); **IV:** 14.07.2019, M. P. Zhurbenko 19353c (LE 310013); **V:** 15.07.2019, O. Enkhtuya (LE 310017a); **X:** 19.07.2019, O. Enkhtuya (LE 310018). – Known from scattered finds in Europe, Asia and North America (Alstrup & Hawksworth, 1990; Sérusiaux et al., 1999; Hafellner, 2002, 2018; Santesson et al., 2004; Knudsen & Lendemer, 2006; Zhurbenko, 2009b; Joshi et al., 2016).

Clypeococcum cetrariae Hafellner
II: on *Cetraria laevigata* (thallus), 9.07.2019, M. P. Zhurbenko 19323b (LE 310047); on *Flavocetraria cucullata* (thallus), 9.07.2019, E. Enkhtaivan (LE 310044); **XI:** on *F. cucullata* (thallus), 22.07.2019, O. Enkhtuya (LE 310046) **XIII:** on *Cetraria laevigata* (thallus), 26.07.2019, M. P. Zhurbenko 19335 (LE 310045). – New to Arkhangai, Bayan-Ulgii and Zavkhan Aimags of Mongolia.

Corticifraga peltigerae (Fuckel) D. Hawksw. & R. Sant.
XIII: on adjacent thalli of *Peltigera extenuata* and *P. rufescens*, 26.07.2019, M. P. Zhurbenko 19338 (LE 309965). – New to Zavkhan Aimag of Mongolia.

Didymocyrtis cladoniicola (Diederich, Kocourk. & Etayo) Ertz & Diederich
XIII: on *Cladonia amaurocraea* (podetia), 26.07.2019, M. P. Zhurbenko 19344 (LE 310027); **XV:** on *C. gracilis* (podetia), 27.07.2019, M. P. Zhurbenko 19291 (LE 310026). – New to Arkhangai and Zavkhan Aimags of Mongolia.

Didymocyrtis consimilis Vain.
V: on *Caloplaca cerina* (apothecia), 15.07.2019, O. Enkhtuya (LE 310004). – New to Khovd Aimag of Mongolia.

*Didymocyrtis rhizoplacae Y. Joshi & K. Bisht
XV: on *Rhizoplaca chrysoleuca* (apothecia), 27.07.2019, M. P. Zhurbenko 19363 (LE 310069). – The material examined differs from the species protologue (Joshi et al., 2018) in 1(rarely 2–3)-septate vs. 1-septate, larger ascospores, (7.5–)10.2–14.2(–17.0) × (4.7–)5.0–6.0(–6.6) µm vs. 10–12 × 4–5 µm, and orbicular, broadly oblong or broadly ellipsoid vs. ellipsoid, larger conidia, (4.1–)4.9–7.3(–9.2) × (3.7–)4.1–5.3(–6.5) µm vs. (4–)5 × 3 µm. This species has been reported from Mongolia as *Didymocyrtis* sp. in Zhurbenko et al. (2019). Previously it was known only from India (Joshi et al., 2018).

Echinothecium hypogymniae Zhurb.
II: on *Hypogymnia austerodes* (thallus), 9.07.2019, O. Enkhtuya (LE 309970). – New to Arkhangai Aimag of Mongolia.

Echinothecium reticulatum Zopf
II: on *Parmelia omphalodes* (thallus), 9.07.2019, O. Enkhtuya (LE 310000b); **IX:** on *P. saxatilis* (thallus), 19.07.2019, M. P. Zhurbenko 19272 (LE 310001). – New to Arkhangai and Bayan-Ulgii Aimags of Mongolia.

Endococcus cf. macrosporus (Arnold) Nyl.
X: on *Rhizocarpon* sp. (thallus), 19.07.2019, O. Enkhtuya (LE 310137). – Ascomata 120–160 µm diam., mostly only slightly protruding, occasionally half erumpent, up to several tens per host areole, aggregated, host lobes sometimes slightly swollen and bleached under heavy infections. Ascospores pale brownish grey to finally medium brown, ellipsoid to narrowly ellipsoid, with rather acute apices, 1-septate, more or less homopolar, sometimes constricted at the septum, (14.7–)16.3–19.5(–22.7) × (6.2–)6.9–8.1(–8.9) µm, L/B = (1.8–)2.1–2.7(–3.1) (n = 55), wall smooth, sometimes apically slightly darker, guttulate, particularly when immature. According to Sérusiaux et al. (1999) *Endococcus macrosporus* is characterized by somewhat narrower ascospores, 16.5–19.5 × 5.5–7 µm. The material examined is also similar to *Endococcus sardous* Brackel, however, this species differs in having one or few ascomata per host areole, not inducing swellings of the host thallus, and often slightly heteropolar, somewhat narrower and more elongated ascospores, (14.0–)16.7–20.8(–23.0) × (5.0–)5.8–7.0 µm, L/B = (2.1–)2.5–3.4(–4.6), not constricted at the septum, without darkening of the apical wall (Brackel & Berger, 2019). So far *Endococcus macrosporus* has not been reported from Mongolia.

*Endococcus propinquus (Körb.) D. Hawksw. s. lat.
II: on a saxicolous crustose lichen (thallus), 9.07.2019, M. P. Zhurbenko 19331 (LE 310139). – A common lichenicolous ascomycete with cosmopolitan distribution (Brackel, 2014).

Endococcus cf. rugulosus (Leight.) Nyl. s. lat.
V: on *Rhizocarpon disporum* (thallus), 15.07.2019, O. Enkhtuya (LE 310138). – Ascomata 150–250 µm diam., mainly semi-immersed. Ascospores medium brown, homopolar, ends rounded, 1-septate, constricted at the septum, (12.3–)13.3–14.9(–15.2) × (7.1–)7.7–8.9(–9.6) µm, L/B = (1.5–)1.6–1.8(–2.0) (n = 25). The material examined corresponds to the broad species concept of *Endococcus rugulosus* presented by Triebel (1989), with the exception of somewhat narrower ascospores, (12–)13–16(–16.5) × (5.5–)6–7.5(–8) µm, cited by this author. So far *Endococcus rugulosus* has not been reported from Mongolia.

*Intralichen christiansenii (D. Hawksw.) D. Hawksw. & M.S. Cole
IV: on *Rusavskia elegans* (apothecia), 14.07.2019, M. P. Zhurbenko 19353b (LE 310014b); **IX:** on *Candelariella canadensis* (apothecia), 19.07.2019, M. P. Zhurbenko 19265 (LE 310012). – A common lichenicolous hyphomycete with cosmopolitan distribution (Brackel, 2014).

**Katherinomyces cetrariae Khodos. s. lat.
II: on *Cetraria laevigata* (thallus), 9.07.2019, M. P. Zhurbenko 19323c (LE 310049); on *Rhizoplaca chrysoleuca* (apothecia), 9.07.2019, M. P. Zhurbenko 19324c (LE 310054); on *Fla-*

vocetraria cucullata (thallus), 9.07.2019, M. P. Zhurbenko 19329a (LE 310051); **IV:** on *R. chrysoleuca* (apothecia, thallus), 14.07.2019, M. P. Zhurbenko 19357 (LE 310053); **IX:** on *Flavocetraria nivalis* (thallus), 19.07.2019, M. P. Zhurbenko 19268b (LE 310052); **XI:** on *Cetraria islandica* (thallus), 22.07.2019, M. P. Zhurbenko 19313 (LE 310050); **XIII:** on *F. cucullata* (thallus), 26.07.2019, M. P. Zhurbenko 19333a (LE 310048a). – The specimens examined differ from the species protologue (Khodosovtsev et al., 2016) in having 0(–1)-septate vs. aseptate, larger and less elongated conidia (Fig. 1), (5.2–)7.5–11.5(–17.2) × (3.4–)5.1–6.7(–7.6) µm, L/B = (1.0–)1.3–1.9(–3.0) (n = 282) vs. (4.3–)6.7–10.5(–16.3) × (2.8–)3.5–4.7(–6.0) µm, L/B = (1.1–)1.5–2.7(–5.0), and in inducing strong discoloration of the host lobes. Shape and size of conidia significantly vary in different specimens, even on the same host species. Vegetative hyphae are usually macroscopically conspicuous as a dense net of tiny dark hyphae. So far this species was known only from Ukraine, growing on *Cetraria aculeata* (type host) and *Lecidea fuscoatra* (Khodosovtsev et al., 2016; Darmostuk & Khodosovtsev, 2019), hence *Flavocetraria* and *Rhizoplaca* are new host genera.

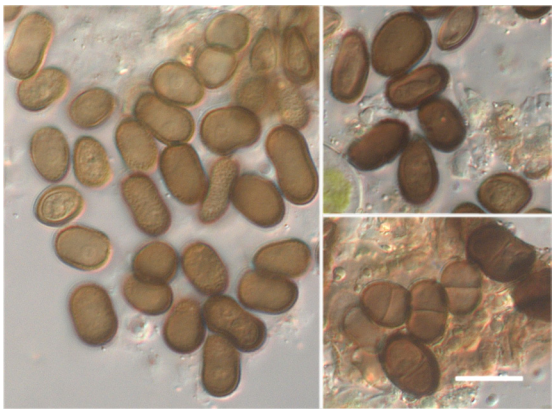

Fig. 1. Conidia of *Katherinomyces cetrariae* s. lat. growing on *Rhizoplaca chrysoleuca* (LE 310053; in water). Scale bar = 10 µm.

**Lichenochora arctica Zhurb.
VII: on *Candelariella aggregata* (growing on the prothallus between areoles and apothecia), 17.07.2019, O. Enkhtuya (LE 310008). – Formerly known only from the Canadian Arctic (Zhurbenko, 2013b).

*Lichenochora caloplacae Zhurb.
II: on *Athallia saxifragarum* (thallus), 9.07.2019, M. P. Zhurbenko 19322 (LE 310005). – Formerly known from Norway (Svalbard), Russia (the Caucasus and Severnaya Zemlya archipelago) and Ukraine (Zhurbenko & Brackel, 2013; Khodosovtsev & Darmostuk, 2017; Zhurbenko, 2017).

*Lichenochora rinodinae Zhurb.
IX: on *Rinodina mniaraea* (thallus), 19.07.2019, M. P. Zhurbenko 19273 (LE 309959). – Formerly known from the arctic parts of Canada, Norway (Svalbard), Russia and the U.S.A., as well as from the Russian Caucasus (Zhurbenko, 2013b; Zhurbenko & Kobzeva, 2014).

Lichenoconium erodens M.S. Christ. & D. Hawksw.
II: on *Cetraria laevigata* (thallus), 9.07.2019, M. P. Zhurbenko 19323d (LE 310041); **V:** on *Vulpicida juniperinus* (thallus), 15.07.2019, O. Enkhtuya (LE 310042); **IX:** on *V. juniperinus* (thallus), 19.07.2019, M. P. Zhurbenko 19278 (LE 310040). – New to Arkhangai and Bayan-Ulgii Aimags of Mongolia.

Lichenoconium lecanorae (Jaap) D. Hawksw.
All on apothecia, occasionally on thalli of *Rhizoplaca chrysoleuca*. **II:** 9.07.2019, M. P. Zhurbenko 19324b (LE 310074); **VI:** 16.07.2019, M. P. Zhurbenko 19368 (LE 310073); **VII:** 17.07.2019, O. Enkhtuya (LE 310071); **VIII:** 18.07.2019, M. P. Zhurbenko 19317b (LE 310072); **XV:** 27.07.2019, M. P. Zhurbenko 19368 (LE 310070). – New to Arkhangai, Bayan-Ulgii and Khovd Aimags of Mongolia.

Lichenoconium pyxidatae (Oudem.) Petr. & Syd.
V: on *Cladonia pyxidata* (basal squamules), 15.07.2019, O. Enkhtuya (LE 310025). – New to Khovd Aimag of Mongolia.

Lichenoconium usneae (Anzi) D. Hawksw.
IX: on *Evernia terrestris* (thallus), 19.07.2019, M. P. Zhurbenko 19270 (LE 309969); on *Flavocetraria nivalis* (thallus), 19.07.2019, M. P. Zhurbenko 19268a (LE 310039). – New to Bayan-Ulgii Aimag of Mongolia.

*Lichenodiplis lecanorae (Vouaux) Dyko & D. Hawksw.
V: on *Athallia saxifragarum* (apothecia), 15.07.2019, O. Enkhtuya (LE 310006). – A common lichenicolous coelomycete with cosmopolitan distribution (Brackel, 2014).

Lichenopeltella cetrariae (Bres.) Höhn.
II: on *Cetraria laevigata* (thallus), 9.07.2019, E. Enkhtaivan (LE 310038). – New to Arkhangai Aimag of Mongolia.

Lichenopeltella cladoniarum E.S. Hansen & Alstrup
II: on *Cladonia arbuscula* (podetia), 9.07.2019, E. Enkhtaivan (LE 310024). – New to Arkhangai Aimag of Mongolia.

Lichenostigma alpinum (R. Sant., Alstrup & D. Hawksw.) Ertz & Diederich
II: on *Ochrolechia frigida* (apothecia, thallus), 9.07.2019, O. Enkhtuya (LE 309971a); on *Flavocetraria cucullata* (thallus), 9.07.2019, M. P. Zhurbenko 19329c (LE 310043); **V:** on *Cladonia pocillum* (basal squamules, cups), 15.07.2019, O. Enkhtuya (LE 310023b). –

Mostly confined to *Lepra*, *Ochrolechia* and *Varicellaria* (Diederich et al., 2018), but was also reported from many other lichen genera (Brackel, 2014). New to Arkhangai and Khovd Aimags of Mongolia.

Lichenostigma chlaroterae (F. Berger & Brackel) Ertz & Diederich
X: on *Lecanora* sp. growing on fine earth deposits with plant remnants on rock (apothecia, thallus), 19.07.2019, O. Enkhtuya (LE 310154); on saxicolous *Lecanora* sp. (thallus), 19.07.2019, S. Javkhlan (LE 310155). – New to Bayan-Ulgii Aimag of Mongolia.

Lichenostigma cosmopolites Hafellner & Calat.
All on thalli of *Xanthoparmelia stenophylla*. **I:** 8.07.2019, M. P. Zhurbenko 19312 (LE 309974); **II:** 9.07.2019, O. Enkhtuya (LE 309975); **XV:** 27.07.2019, M. P. Zhurbenko 19295b (LE 309976b). – New to Arkhangai Aimag of Mongolia.

*Lichenostigma dimelaenae Calat. & Hafellner
X: on *Dimelaena oreina* (thallus), 19.07.2019, S. Javkhlan (LE 310164). – Previously known from scattered finds in Europe (Ukraine: Darmostuk et al., 2018), Asia (Turkey: Yazici & Etayo 2014) and North America (Arizona and California in the U.S.A.: Calatayud et al., 2004; Kocourková & Knudsen, 2015).

Lichenostigma maureri Hafellner
IX: on *Evernia terrestris* (thallus), 19.07.2019, M. P. Zhurbenko 19271 (LE 309968); **XV:** on *Ramalina pollinaria* (thallus), 27.07.2019, M. P. Zhurbenko 19289 (LE 309953). – New to Arkhangai and Bayan-Ulgii Aimags of Mongolia.

Lichenostigma cf. rouxii Nav.-Ros., Calat. & Hafellner
III: on *Lobothallia alphoplaca* (apothecia, thallus), 13.07.2019, O. Enkhtuya (LE 310160); **IV:** on *Aspicilia* sp. (thallus), 14.07.2019, M. P. Zhurbenko 19349a (LE 310163); **X:** on *L. alphoplaca* (apothecia, thallus), 19.07.2019, S. Javkhlan (LE 310158); on *Lecanora baicalensis* (thallus, occasionally apothecia), 19.07.2019, O. Enkhtuya (LE 310161). – The identification is somewhat uncertain because according to Calatayud et al. (2002) this species is confined to *Squamarina*; so far it has not been reported from Mongolia.

*Lichenostigma triseptatum Halıcı & D. Hawksw.
V: on *Aspicilia* sp. (thallus), 15.07.2019, O. Enkhtuya (LE 310162). – Previously known from scattered finds in Asia (India, Iran and Turkey: Halici & Hawksworth, 2007; Valadbeigi & Sipman, 2010; Yazici & Etayo, 2014; Joshi et al., 2016).

Lichenothelia rugosa (G. Thor) Ertz & Diederich
II: on *Diploschistes muscorum* (thallus, occasionally apothecia), 9.07.2019, O. Enkhtuya (LE 309984); **X:** on *D. scruposus* (thallus), 19.07.2019, O. Enkhtuya (LE 309983); **XV:** on *D. scruposus* (thallus, occasionally apothecia), 27.07.2019, M. P. Zhurbenko 19286 (LE 309982). – New to Arkhangai and Bayan-Ulgii Aimags of Mongolia.

Muellerella erratica (A. Massal.) Hafellner & V. John
II: on *Lecidea lapicida* var. *pantherina* (thallus), 9.07.2019, O. Enkhtuya (LE 310144); **IV:** on *L. lapicida* (thallus), 14.07.2019, S. Javkhlan (LE 310143); on saxicolous *Verrucaria* sp. (thallus), 14.07.2019, M. P. Zhurbenko 19347 (LE 310141); on a saxicolous crustose lichen (thallus), 14.07.2019, M. P. Zhurbenko 19346b (LE 310140b); **X:** on *Lecidea lapicida* (thallus), 19.07.2019, O. Enkhtuya & S. Javkhlan (LE 310147. – *Verrucaria* is a rarely reported host genus for this species (Brackel, 2014; Knudsen & Kocourkova, 2009). New to Arkhangai, Bayan-Ulgii and Khovd Aimags of Mongolia.

Muellerella lichenicola (Sommerf.) D. Hawksw.
II: on muscicolous sorediate *Biatora* sp. (thal-

lus), 9.07.2019, O. Enkhtuya (LE 310142a); **III:** on *Aspicilia* sp. (thallus), 13.07.2019, O. Enkhtuya (LE 310146). – New to Arkhangai and Khovd Aimags of Mongolia.

Muellerella pygmaea (Körb.) D. Hawksw. s. str.
V: on *Acarospora* sp. (thallus), 15.07.2019, O. Enkhtuya (LE 310145); **VI:** on *Rusavskia elegans* (thallus), 16.07.2019, M. P. Zhurbenko 19302 (LE 310003); **VIII:** on *R. elegans* (thallus), 18.07.2019, M. P. Zhurbenko 19318 (LE 310019); **XV:** on *Anamylopsora pulcherrima* (thallus), 27.07.2019, M. P. Zhurbenko 19290a (LE 309967). – New to Arkhangai, Bayan-Ulgii and Khovd Aimags of Mongolia.

Muellerella cf. ventosicola (Mudd) D. Hawksw.
IV: on *Aspicilia* sp. (thallus), 14.07.2019, M. P. Zhurbenko 19349b (LE 310135); **VIII:** on *Aspicilia* sp. (thallus), 18.07.2019, M. P. Zhurbenko 19320a (LE 310134a). – Ascospores are somewhat larger than was reported by Triebel (1989), viz. (6.2–)7.3–9.3(–10.3) × (4.2–)4.8–5.6(–6.3) µm, L/B = (1.2–)1.4–1.8(–2.0) (n = 62) vs. 6.5–8.5(–9) × 4–5.5(–6) µm. This species was described from *Ophioparma ventosa* (Mudd, 1861) and according to Triebel (1989) also grows on species of *Dimelaena*, *Protoparmelia* and *Rhizocarpon*. However, it has been already reported from *Aspicilia* (Kukwa & Flakus, 2009) and *Lecanora* (Etayo, 2010). It is characterized by subcosmopolitan distribution (Brackel, 2014), but so far has not been reported from Mongolia.

Nesolechia oxyspora (Tul.) A. Massal. var. fusca (Triebel & Rambold) Diederich
II: on *Xanthoparmelia stenophylla* (thallus), 9.07.2019, O. Enkhtuya (LE 309981); **XV:** on *X. conspersa* (thallus), 27.07.2019, M. P. Zhurbenko 19374 (LE 310168); on *X. stenophylla* (thallus), 27.07.2019, M. P. Zhurbenko 19295a (LE 309980). – New to Arkhangai Aimag of Mongolia.

Nesolechia oxyspora (Tul.) A. Massal. var. oxyspora
Both on thalli of *Parmelia omphalodes*. **I:** 8.07.2019, M. P. Zhurbenko 19311b (LE 309999b); **XV:** 27.07.2019, M. P. Zhurbenko 19294a (LE 310002a). – New to Arkhangai Aimag of Mongolia.

*Niesslia peltigericola (D. Hawksw.) Etayo
I: on *Peltigera aphthosa* (moribund parts of thallus), 8.07.2019, M. P. Zhurbenko 19309b (LE 309963b). – Known from scattered finds in Europe, Asia and North America (Hawksworth, 1980; Alstrup & Hawksworth, 1990; Hafellner & Türk, 1995; Alstrup & Cole, 1998; Diederich, 2003; Santesson et al., 2004; Sohrabi & Alstrup, 2007; Kukwa & Flakus 2009; Zhurbenko, 2009b).

*Polycoccum trypethelioides (Th. Fr.) R. Sant.
XV: on *Stereocaulon* sp. (thallus), 27.07.2019, S. Javkhlan (LE 309956). – Widely distributed in the Holarctic (Hafellner & Türk, 1995; Berger, 2000; Zhurbenko, 2010), but is also known from South America (Etayo & Sancho, 2008; Zhurbenko & Ohmura, 2019).

Polycoccum vermicularium (Linds.) D. Hawksw.
All on thalli of *Thamnolia vermicularis* (K+ pale yellow). **XI:** 22.07.2019, M. P. Zhurbenko 19314 (LE 309987); **XII:** 22.07.2019, M. P. Zhurbenko 19297 (LE 309988); **XIII:** 26.07.2019, M. P. Zhurbenko 19334 (LE 309986). – New to Bayan-Ulgii and Zavkhan Aimags of Mongolia.

Pronectria erythrinella (Nyl.) Lowen
XIII: on adjacent thalli of *Peltigera extenuata* (mainly) and *P. rufescens*, 26.07.2019, M. P. Zhurbenko 19342 (LE 309961). – New to Zavkhan Aimag of Mongolia.

Pyrenidium actinellum Nyl. s. lat.
XV: on *Diploschistes scruposus* (thallus), 27.07.2019, O. Enkhtuya (LE 309985). – New to Arkhangai Aimag of Mongolia.

*Rhymbocarpus neglectus (Vain.) Diederich & Etayo
Both on thalli of *Lepraria neglecta* agg. **IX:** 19.07.2019, M. P. Zhurbenko 19285 (LE 309991); **XI:** 22.07.2019, O. Enkhtuya (LE 309992). – Widely distributed in the Holarctic (Kümmerling et al., 1993; Diederich & Etayo, 2000).

Rosellinula frustulosae (Vouaux) R. Sant.
VII: on *Lecanora argopholis* (thallus), 17.07.2019, O. Enkhtuya (LE 310149). – New to Khovd Aimag of Mongolia.

[L]Sarcogyne sphaeospora J. Steiner
All on thalli of sterile *Candelariella* species growing on boulders or on fine earth deposits on boulders. **IV:** 14.07.2019, M. P. Zhurbenko 19352 (LE 310007); **VI:** 16.07.2019, M. P. Zhur-

benko 19305 (LE 310009); **VIII:** 18.07.2019, M. P. Zhurbenko 19319 (LE 310011); M. P. Zhurbenko 19320b (LE 310134b). – This scarcely lichenized lichenicolous fungus growing on *Candelariella* is so far known from scattered finds in Asia (India, Mongolia, Tajikistan and Turkey: Huneck et al., 1992; Kudratov & Mayrhofer, 2002; Zhurbenko, 2013a) and North America (California in the U.S.A.: Lendemer et al., 2009).

Sclerococcum deminutum (Th.Fr.) Ertz & Diederich
IX: on a muscicolous crustose lichen (thallus), 19.07.2019, M. P. Zhurbenko 19373 (LE 310148); **XIII:** on *Psoroma hypnorum* (apothecia, thallus), 26.07.2019, M. P. Zhurbenko 19335 (LE 309955). – New to Bayan-Ulgii and Zavkhan Aimags of Mongolia.

Sphaerellothecium araneosum (Arnold) Zopf
II: on *Ochrolechia frigida* (apothecia, thallus), 9.07.2019, O. Enkhtuya (LE 309971b). – New to Arkhangai Aimag of Mongolia.

Sphaerellothecium cladoniae (Alstrup & Zhurb.) Hafellner
Both on basal squamules of *Cladonia pyxidata*. **II:** 9.07.2019, M. P. Zhurbenko 19330 (LE 310031); **IX:** 19.07.2019, M. P. Zhurbenko 19283 (LE 310029). – New to Arkhangai and Bayan-Ulgii Aimags of Mongolia.

Sphaerellothecium cladoniicola E. S. Hansen & Alstrup
II: on *Cladonia arbuscula* (podetia), 9.07.2019, M. P. Zhurbenko 19356 (LE 310032); on *C. stellaris* (podetia), 9.07.2019, O. Enkhtuya (LE 310028); **XIII:** on *C. arbuscula* (podetia), 26.07.2019, M. P. Zhurbenko 19340 (LE 310033); **XV:** on *C. rangiferina* (podetia), 27.07.2019, S. Javkhlan (LE 310030). – New to Arkhangai and Zavkhan Aimags of Mongolia.

Sphaerellothecium cf. parmeliae Diederich & Etayo
Both on thalli of *Parmelia omphalodes*. **I:** 8.07.2019, M. P. Zhurbenko 19311c (LE 309999c); **XV:** 27.07.2019, M. P. Zhurbenko 19294b (LE 310002b). – The taxonomy of this fungus and its differences from the species protologue (Etayo & Diederich, 1998) have been discussed in Zhurbenko & Zheludeva (2015) and Zhurbenko et al. (2019). New to Arkhangai Aimag of Mongolia.

*Sphaerellothecium phaeorrhizae Diederich & Zhurb.
XV: on *Phaeorrhiza* sp. (thallus), 27.07.2019, M. P. Zhurbenko 19292 (LE 309993). – In our material the ascospores are slightly longer than reported in the protologue (Diederich & Zhurbenko, 2009), viz. (10.0–)10.8–12.2(–12.7) × (4.6–)4.9–5.5(–5.9) µm, L/B = (1.9–)2.1–2.3(–2.6) (n = 44) vs. 9–11.5 × 4–5(–5.5) µm. Previously known from a few finds in Russian Asia (Diederich & Zhurbenko, 2009; Zhurbenko, 2009a).

*Sphaerellothecium propinquellum (Nyl.) Cl. Roux & Triebel
XV: on *Lecanora albella* (apothecia), 27.07.2019, S. Javkhlan (LE 310150). – Widely distributed in the Holarctic (Brackel, 2014).

Sphaerellothecium pumilum (Lettau) Nav.-Ros., Cl. Roux & Hafellner
I: on *Physcia phaea* (thallus), 8.07.2019, O. Enkhtuya (LE 309997). – New to Arkhangai Aimag of Mongolia.

Stigmidium microcarpum Alstrup & J. C. David
II: on *Flavocetraria cucullata* (thallus), 9.07.2019, E. Enkhtaivan (LE 310037b). – Known from scattered finds in Europe, Asia (China, Japan, Mongolia, Russia) and North America, often in the arctic-oreophytic environments (Alstrup, 1993; Zhurbenko, 2009a; Brackel, 2014; Zhurbenko & Ohmura, 2019).

Stigmidium psorae (Anzi) Hafellner
Both on thalli of *Psorula rufonigra*. **I:** 8.07.2019, M. P. Zhurbenko 19310a (LE 309958a); **XV:** 27.07.2019, M. P. Zhurbenko 19293a (LE 309957a). – *Stigmidium* cf. *psorae* was formerly reported from Khuvsugul Aimag of Mongolia growing on *Psora testacea* (Zhurbenko et al., 2019). Here we confirm the occurrence of this species in Mongolia.

Stigmidium solorinarium (Vain.) D. Hawksw.
IX: on *Solorina octospora* (moribund thallus), 19.07.2019, M. P. Zhurbenko 19262 (LE 309960). – New to Bayan-Ulgii Aimag of Mongolia.

*Stigmidium xanthoparmeliarum Hafellner
XV: on *Xanthoparmelia stenophylla* (thallus), 27.07.2019, M. P. Zhurbenko 19282a (LE 309973a). – Known from scattered finds in Eu-

rope (Hafellner, 1994, 1999, 2018; Calatayud & Triebel, 1999; Hawksworth, 2003; Suija, 2005; Diederich et al., 2012; Brackel, 2014; Naumovych & Darmostuk, 2015), Asia (India, Iran, Russia, Turkey: Sohrabi & Alstrup, 2007; Halici et al., 2009; Zhurbenko & Kobzeva, 2014; Joshi et al., 2016), North America (Kocourkova & Knudsen 2008), but also in New Zealand (Hafellner & Mayrhofer, 2007).

*Taeniolella pertusariicola D. Hawksw. & H. Mayrhofer
II: on *Pertusaria bryontha* (apothecia, thallus), 9.07.2019, M. P. Zhurbenko 19326 (LE 309962). – Known from many finds in Greenland, Europe and Asia, but also from Australia (Heuchert et al., 2018).

Taeniolella rolfii Diederich & Zhurb.
IX: on *Cetrariella delisei* (thallus), 19.07.2019, M. P. Zhurbenko 19267 (LE 310035); **XI:** on *Cetraria aculeata* (thallus), 22.07.2019, O. Enkhtuya (LE 310034). – New to Bayan-Ulgii Aimag of Mongolia.

*Tetramelas phaeophysciae A. Nordin & Tibell
II: on *Physcia caesia* (thallus), 9.07.2019, O. Enkhtuya (LE 309996). – Known from scattered finds in Greenland, Europe and Asia, mainly in the arctic-oreophytic environments (Nordin & Tibell, 2005; Zhurbenko, 2009b; Zhurbenko & Brackel, 2013; Zhurbenko et al., 2016; Zhurbenko, 2017).

Tetramelas pulverulentus (Anzi) A. Nordin & Tibell
Both on thalli of *Physconia muscigena*. **V:** 15.07.2019, O. Enkhtuya (LE 309994); **IX:** 19.07.2019, M. P. Zhurbenko 19264 (LE 309995). – New to Bayan-Ulgii and Khovd Aimags of Mongolia.

Thelocarpon epibolum Nyl. var. epithallinum (Leight.) G. Salisb.
I: on *Peltigera aphthosa* (moribund parts of thallus), 8.07.2019, M. P. Zhurbenko 19309a (LE 309963a); **IX:** on *Solorina octospora* (moribund parts of thallus), 19.07.2019, M. P. Zhurbenko 19275b (LE 309964b). – Facultatively lichenicolous on *Arthrorhaphis*, *Baeomyces*, *Catapyrenium*, *Peltigera*, *Protopannaria* and *Solorina* (Diederich et al., 2018). New to Arkhangai and Bayan-Ulgii Aimags of Mongolia.

Trematosphaeriopsis parmeliana (Jacz.) Elenkin
XIV: on *Xanthoparmelia vagans* (both sides of lobes), 26.07.2019, M. P. Zhurbenko 19307 (LE 309972). – New to Arkhangai Aimag of Mongolia.

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