Turczaninowia 28, 3: 132–139 (2025)
https://www.doi.org/10.14258/turczaninowia.28.3.15
http://turczaninowia.asu.ru

ISSN 1560–7259 (print edition)
TURCZANINOWIA
ISSN 1560–7267 (online edition)

УДК 582.293.378:581.92(571.6)

Lichenicolous fungi growing on *Myelochroa* in the Far East of Russia

M. P. Zhurbenko[1, 4]*, S. V. Chesnokov[1, 2, 5], I. F. Skirina[3, 6], F. V. Skirin[3, 7]

[1] *Komarov Botanical Institute RAS, Prof. Popov St., 2, St Petersburg, 197022, Russian Federation*

[2] *Botanical Garden-Institute FEB RAS, Makovskogo St., 142, Vladivostok, 690024, Russian Federation*

[3] *Centre for Landscape and Environmental Researches of Pacific Institute of Geography FEB RAS, Radio St., 7, Vladivostok, 690041, Russian Federation*

[4] *E-mail: zhurb58@gmail.com; ORCID iD: https://orcid.org/0000-0002-9839-4698*

[5] *E-mail: lukinbrat@mail.ru; ORCID iD: https://orcid.org/0000-0001-9466-4534*

[6] *E-mail: SSkirin@yandex.ru; ORCID iD: https://orcid.org/0000-0003-2849-8608*

[7] *E-mail: Autumn.wayfarer@gmail.com; ORCID iD: https://orcid.org/0000-0003-2982-1729*

* *Corresponding author*

Keywords: *Arthonia*, biogeography, *Burgoa*, lichen-dwelling fungi, *Plectocarpon*, taxonomy.

Summary. An augmented species concept is proposed for *Arthonia pepei* s. l. based on its finding on the new host genus *Myelochroa*. A brief description of *Burgoa* cf. *angulosa*, first found on *Myelochroa* and characterized by erumpent and mainly orange grey instead of superficial and whitish bulbils, is given. *Plectocarpon diedertzianum*, previously known only from India, is recorded from Russia. *Lichenostigma alpinum* s. l. is first recorded on *Myelochroa*. To date, 11 species of lichenicolous fungi are known to grow on *Myelochroa*, one of which was documented only on this host genus. Lichenicolous fungi were detected on 1 % of herbarium specimens of *Myelochroa* from the south of the Russian Far East.

Лихенофильные грибы, растущие на *Myelochroa* на Дальнем Востоке России

М. П. Журбенко[1], С. В. Чесноков[1, 2], И. Ф. Скирина[3], Ф. В. Скирин[3]

[1] *Ботанический институт им. В. Л. Комарова РАН, ул. Проф. Попова, д. 2, г. Санкт-Петербург, 197022, Россия*

[2] *Ботанический сад-институт ДВО РАН, ул. Маковского, д. 142, г. Владивосток, 690024, Россия*

[3] *Тихоокеанский институт географии ДВО РАН, ул. Радио, д. 7, г. Владивосток, 690041, Россия*

Ключевые слова: биогеография, лихенофильные грибы, таксономия, *Arthonia*, *Burgoa*, *Plectocarpon*.

Аннотация. Расширенная видовая концепция предложена для *Arthonia pepei* s. l. на основании ее находки на новом роде хозяев *Myelochroa*. Дано краткое описание *Burgoa* cf. *angulosa*, впервые отмеченной на *Myelochroa* и отличающейся прорывающимися и в основном оранжево-серыми бульбилами, по сравнению с ранее описанными для нее поверхностными и беловатыми бульбилами. *Plectocarpon diedertzianum*, ранее известный только из Индии, найден в России. *Lichenostigma alpinum* s. l. впервые отмечена на *Myelochroa*. К настоящему времени на *Myelochroa* известно 11 видов лихенофильных грибов, один из которых отмечен только на этом роде хозяев. Лихенофильные грибы были обнаружены на 1 % гербарных образцов *Myelochroa* с юга Дальнего Востока России.

Поступило в редакцию 17.02.2025
Принято к публикации 03.09.2025

Submitted 17.02.2025
Accepted 03.09.2025

Introduction

The lichen genus *Myelochroa* (Asahina) Elix et Hale of the family Parmeliaceae was described by Elix and Hale (1987) and, according to Thell et al. (2012), comprises about 30 species of foliose lichens with a centre of distribution in eastern Asia. Eight species of this genus are known in the Russian Far East (Chesnokov, Konoreva, 2023), most of which are common there in broadleaf and mixed forests with *Pinus koraiensis* at elevations up to 1300 m. Some of the most common species there are *Myelochroa aurulenta* (Tuck.) Elix et Hale and *M. subaurulenta* (Nyl.) Elix et Hale, mostly growing on woody substrates but not infrequently inhabiting the surface of mossy rocks and cliffs beneath the forest canopy.

While examining *Myelochroa* specimens from the south of the Far East of Russia, S. V. Chesnokov found on them some lichenicolous fungi, which were subsequently identified by M. P. Zhurbenko. The aim of this paper is to provide new information on the taxonomy, hosts, and geography of these fungi.

Materials and methods

This study is based on 12 specimens of lichenicolous fungi from the Primorye Territory and Jewish Autonomous Region of Russia growing on lichens of the genus *Myelochroa*. Eleven of them were discovered during the revision under a stereomicroscope of 880 specimens of *Myelochroa* species from the south of the Russian Far East kept in the herbarium of the Pacific Institute of Geography in Vladivostok, Russia (VGEO). The study area represented by these specimens is approximately 250,000 km². An additional specimen collected by M. P. Zhurbenko in the Jewish Autonomous Region is also included in the study. Microscopy was carried out, and images were captured, using a Zeiss Axio Zoom.V16 stereomicroscope fitted with an AxioCam 712 colour digital camera and a Zeiss Axio Imager. A1 compound microscope equipped with Nomarski differential interference contrast optics and fitted with an AxioCam 807 colour digital camera. Microscopic characters were studied using sections hand-cut with a razor blade and mounted in water, 10 % potassium hydroxide (K), Lugol's iodine directly (I) or after K pretreatment (K/I), or 50 % aqueous solution of nitric acid (N). Measurements refer to water mounts unless otherwise indicated. When the number of measurements (n) > 10, the dimensions of microstructures, as well as the length/width ratio (l/w) of the ascospores, are given as (min–)($\bar{x}$ – SD)–($\bar{x}$ + SD)(–max), where min and max are the extreme values observed, $\bar{x}$ the arithmetic mean, and SD the corresponding standard deviation. Dimensions of microstructures, both newly obtained and those taken from the literature, are rounded to the nearest 0.5 μm. Colours are named according to Kornerup and Wanscher (1978). The examined specimens are deposited in the mycological herbarium of the V. L. Komarov Botanical Institute in St Petersburg, Russia (LE-F).

Results

The species

Arthonia pepei Etayo et Pérez-Ortega s. l. (Fig. 1).

Lichenicolous fungus on thalli (including soralia) of *Myelochroa aurulenta* and *Parmelina quercina* (Willd.) Hale (in LE F-355061 observed on both lichens growing nearby) producing slightly discoloured to medium grey infection spots up to 2.6 mm diam., consisting of up to at least 70 apothecia and conspicuous vegetative hyphae, sometimes surrounded by a diffuse to sharp, grey to black rim, 50–160 μm wide. *Vegetative hyphae* branched, septate, smooth, roughly of two types: 1) immersed, light brown, not or slightly constricted at the septa, composed of cells 7–11 × (1.5)2–3(4.5) μm (n = 14); 2) ± superficial and conspicuous under a stereomicroscope, brown, often markedly constricted at the septa (torulose), composed of cells (4)4.5–9.5(11.5) × (4–)5–7(–8) μm (n = 17). *Ascomata* apothecia, erumpent, soon superficial, dark brown to black (colour does not change when moistened), rather glossy, non-pruinose, with rough surface (apparently due to the protruding apices of paraphysoids), applanate-convex, emarginate, sometimes slightly constricted at the base, ± rounded or irregular in surface view, (30)55–95(130) μm diam. (n = 89), dispersed to aggregated, often merging into formations up to 450 μm diam. *Epihymenium* formed by apices of paraphysoids, 3.5–8 μm tall, medium brown or reddish brown, K+ brownish grey, N+ brownish orange or light brown, darker than hymenium, the same colour saturation as hypothecium, pigmentation uneven, with scattered dark speckles, distinct granules absent. *Paraphysoids* somewhat sinuous, branched, septate, better visible in K, 2–3 μm diam. in central part, 2.5–4 μm diam. near the apex, apices medium brown or reddish brown, K+ brownish grey, N+ brownish orange or light brown, sometimes with a

darker hood, more clearly visible in K, occasionally slightly enlarged, often bent, some apices partially to fully reclined on the surface of the epihymenium. *Hymenium* 30–40 µm tall (including epihymenium), subhyaline to medium greyish brown in thicker sections, K+ greyish brown, N+ brownish orange or light brown, I+ red, K/I+ blue (apparently due to the colouring of the periascal gel). *Exciple* and *subhymenium* not distinct. *Hypothecium* 35–55 µm tall, medium greyish brown or partly brown/reddish brown, K+ greyish brown, N+ brownish orange or light brown, pigmentation sometimes uneven, poorly delimited from the hymenium. *Asci* broadly clavate, stipe short or indistinct, upper wall thickened, with an apical beak, (25.5)27–32(33.5) × (10.5)12.5–16(18) µm (n = 17, in water or I) / (26.5)29.5–37(38) × (13)14–17.5(18.5) µm (n = 17, in K or K/I), wall K/I+ blue, ascoplasm K/I+ reddish/brownish orange, K/I+ blue apical ring distinct, 8-spored. *Ascospores* consistently hyaline, 1-septate, not constricted at the septum, clavate/skittle-shaped, with a slightly wider upper cell, with rounded ends, (9.5)10–12(12.5) × (3.5)4–5(5.5) µm, l/w = (2.2)2.3–2.5(2.7) (n = 31, mainly free spores, in water) / (9.5)10–12(14.5) × (3.5)4–5(5.5) µm, l/w = (1.9)2.2–2.8(3.1) (n = 86, in K or K/I), septum ± median [length of the upper cell/length of the lower cell = (0.8)1(1.2) (n = 22)], smooth, rarely with a rather indistinct gelatinous sheath 0.5–1 µm thick (as seen in K/I), with 1–7 conspicuous guttules (as seen in K), irregularly multi-seriate in the ascus. *Asexual morph* not observed.

Lichenicolous, non-lichenized species of the genus *Arthonia* Ach. s. l. are usually highly specific towards their hosts, with 127 out of 136 (93 %; Diederich et al., 2018) or 149 out of 162 (92 %; Hollinger et al., 2024) of their known species confined to one lichen genus. However, there are exceptions to this rule, e.g. *A. coronata* Etayo grows on lichens from different families, always being confined to their soredia, which may be a determining factor in the substrate choice for this species (Etayo, 1996; Lendemer, Harris, 2012).

According to the protologue (Etayo, Pérez-Ortega, 2016), *Arthonia pepei*, described from Spain growing on the thallus of epiphytic *Parmelina cryptotiliacea* A. Crespo et Núñez-Zapata, differs from the fungus presented here as follows. The host genus is different, although within the same family Parmeliaceae. Infection spots pinkish to cream coloured, somewhat smaller, up to 1.2 mm diam., without a black rim, consisting of a smaller number (up to 15) of ascomata. Vegetative hyphae not described. Apothecia sometimes with a distinct very thin margin. Epihymenium almost black in thick sections, K+ olivaceous green. Hymenium bluish grey vs. greyish brown, slightly lower, ca. 30 µm tall. Exciple sometimes distinct, though much reduced, composed of hyphae slightly different from paraphysoids. Subhymenium distinct. Asci and ascospores slightly smaller, 27–30 × 11–13 µm and (8)9.5–11 × 4–4.5 µm correspondingly. The most important (qualitative) differences of the examined fungus are the host genus, a slightly different pigmentation of the hymenium and the occurrence of ± superficial vegetative hyphae that are conspicuous under a stereomicroscope. The remaining differences are quantitative and were observed across many taxonomic characters.

The genera *Myelochroa* and *Parmelina* are morphologically similar and phylogenetically closely related; however, they differ in their lichen substances profiles and geographical distribution, sharing only a limited overlapping range (Thell et al., 2012; Núñez-Zapata et al., 2017). Considering these differences and the significant geographical separation between the type population of *Arthonia pepei* and the *Arthonia* population described here, it is reasonable to assume that they are not conspecific. Nevertheless, in the absence of molecular data, it is prudent to tentatively assign the described fungus to *Arthonia pepei* s. l., growing on a new host genus *Myelochroa*.

Specimens examined: "Russia, Jewish Autonomous Region, Bastak Nature Reserve, vicinity of Mt. Dubovaya Sopka, road along the Ikura River, 48°55'34"N, 132°52'51"E, elev. 210 m, *Quercus-Populus* dominated forest, on lobes (including soralia) of epiphytic *Myelochroa aurulenta*. 10 VIII 2002. I. F. Skirina, V. I. Skirin" (LE F-355060); same reserve, "Kirga River valley, near Polkovnikov's apiary, 48°59'13"N, 132°53'40"E, elev. 200 m, mixed forest, on lobes of growing nearby epiphytic *Myelochroa. subaurulenta* and *Parmelina quercina*. 10 VIII 2013. M. P. Zhurbenko 13179" (LE F-355061).

Burgoa cf. ***angulosa*** Diederich, Lawrey et Etayo (Fig. 2).

Colonies up to 2.5 mm diam., composed of dispersed to aggregated and sometimes confluent bulbils developing on the disc and thalline margin of *Myelochroa* apothecia without causing visible damage in them. Bulbils initially completely or partly immersed, with a greyish orange, opaque exposed part, then superficial, mainly orange grey, often whitish mottled, somewhat translucent, matt, isodiametric, ellipsoid or irregular (often somewhat

angular) in surface view, 60–300 × 50–210 µm, with a rough surface, without hairs.

The identification of this material is not entirely confident because in the protologue of *Burgoa angulosa* its bulbils are characterized as superficial and whitish (Diederich, Lawrey, 2007).

This species is optionally lichenicolous, however, it is included in the Flora of Lichenicolous Fungi (Diederich et al., 2022) and is therefore considered here. It has not been previously recorded on *Myelochroa*.

Specimen examined: "Russia, Jewish Autonomous Region, Bastak Nature Reserve, Kirga River valley, near Polkovnikov's apiary, 49°00'16"N, 132°51'33"E, elev. 200 m, mixed forest, on lobes of epiphytic *Myelochroa aurulenta*. 07 VIII 2002. I. F. Skirina and V. I. Skirin" (LE F-355062).

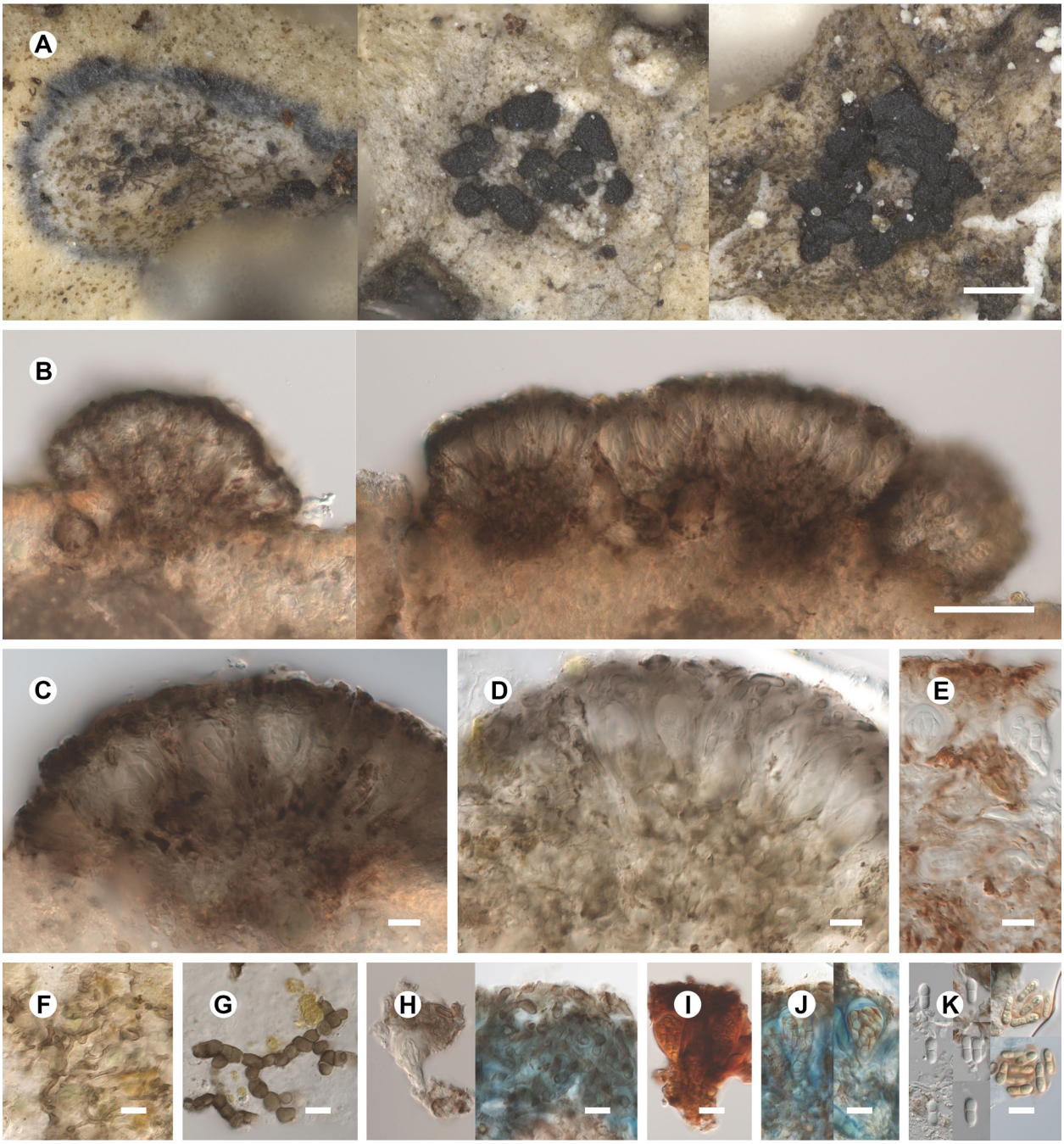

Fig. 1. *Arthonia pepei* s. l. (LE F-355060). A Habitus of infection spots and ascomata growing on lobes of *Myelochroa aurulenta*. B Single and merged ascomata in cross-section, in water. C Ascoma in cross-section, in water. D Ascoma in cross-section, in K. E Ascoma in cross-section, in N. F Immersed vegetative hyphae, in K. G ± superficial vegetative hyphae, in K. H Apices of paraphysoids, in water (left) and K/I (right). I Hymenium and asci with spores, in I. J Hymenium and asci with spores, in K/I. K Ascospores, in water (left) and K/I (right). Scale bars: A = 200 µm, B = 50 µm, C–K = 10 µm.

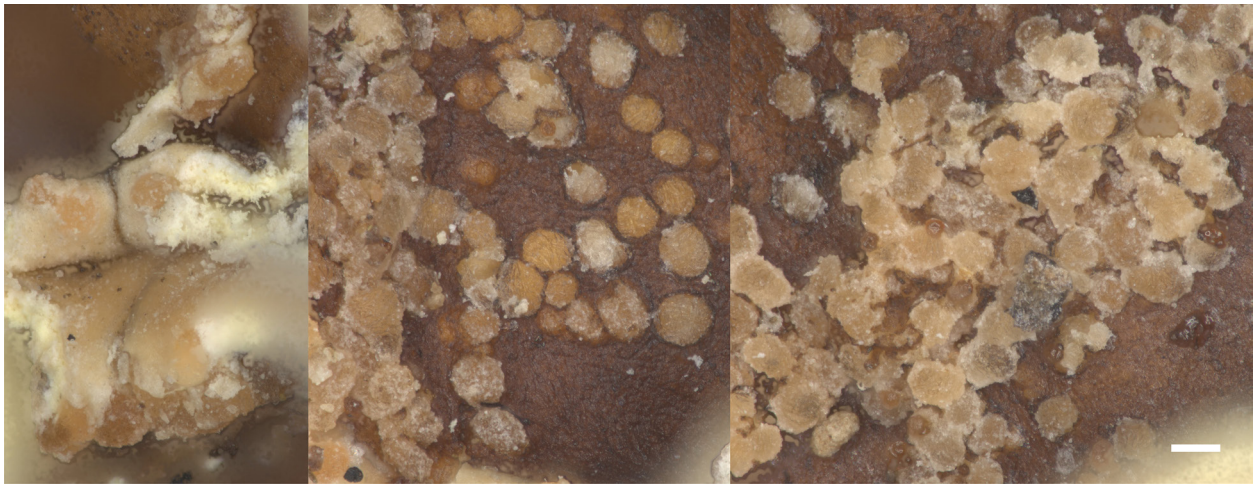

Fig. 2. *Burgoa* cf. *angulosa* (LE F-355062). Bulbils growing on the disc and thalline margin of apothecia of *Myelochroa aurulenta*. Scale bar = 100 µm.

Lichenostigma alpinum (R. Sant., Alstrup et D. Hawksw.) Ertz et Diederich s. l.

Conidiomata (22)24–68(107) µm diam. (n = 31). Conidia (7.5)8.5–13(17) µm diam. (n = 34), in optical section composed of (4)6–12(15) cells (n = 16), each 3–4.5(6) µm diam. (n = 20). Sexual morph not observed. The studied material generally fits the description of *Lichenostigma alpinum* presented by Ertz et al. (2014), except for the size of conidiomata, which are indicated by these authors as slightly larger, ca. (20)25–100(150) µm diam. This species has been described from *Ochrolechia frigida* (Sw.) Lynge and is rather common on terricolous and corticolous species of *Ochrolechia* A. Massal., *Pertusaria* DC., and *Varicellaria* Nyl. but has also been recorded on many other hosts suggesting a species complex comprising several cryptic taxa (Ertz et al., 2014). It is documented here for the first time on *Myelochroa*.

Specimens examined: "Russia, Primorye Territory, Partizanskii District, Postyshevka River valley, Mt. Skalistaya, 43°08'46"N, 132°58'05"E, elev. 564 m, *Pinus koraiensis*-broadleaf forest, on lobes of *Myelochroa aurulenta* growing on *Tilia amurensis*. 25 VIII 2012. F. V. Skirin and I. F. Skirina" (LE F-355063); same Territory, "Dal'negorskii District, Rudnaya River valley, Sadovyi spring, 44°28'37"N, 135°40'58"E, elev. 289 m, *Quercus* forest, on lobes of *Myelochroa entotheiochroa* growing on *Quercus*. 07 VIII 1980. I. F. Skirina" (LE F-355064).

Nesolechia oxyspora (Tul.) A. Massal. var. ***oxyspora***

We follow here the broad concept of this taxon, including all populations with reddish to dark brown apothecia and a hyaline to pale brown hypothecium growing on Parmeliaceae, adopted in Diederich et al. (2018). Ascospores ellipsoid, narrowly ellipsoid, reniform or lunate, ends usually more or less attenuated, very rarely rounded, (11.5)13–16(19) × 5.5–6.5(8) µm, l/w = (1.7)2.1–2.7(3.5) (n = 46).

Specimens examined: (all on lobes of *Myelochroa aurulenta*) "Russia, Primorye Territory, Anuchinskii District, Tigrovaya River, near Tigrovyi settlement, *Pinus koraiensis*-broadleaf forest, 43°53'16"N, 132°46'20"E, elev. 390 m, on *Acer mono*. 27 VI 2008. I. F. Skirina and F. V. Skirin 22700" (LE F-355065); same Territory, "Spasskii District, 2 km W of Nikitovka settlement, 44°51'01"N, 133°18'23"E, elev. 134 m, *Quercus* forest, on *Quercus*. 23 V 2008. I. F. Skirina" (LE F-355066); same Territory, "Terneiskii District, Belimbe (Serokamenka) River, 45°35'03"N, 136°03'22"E, elev. 506 m, *Abies-Picea* dominated forest, on *Tilia amurensis*. 21 VI 1980. I. F. Skirina" (LE F-355067); same Territory, "Peter the Great Bay, De L'Ivrona Island, 42°41'40"N, 131°21'47"E, elev. 21 m, *Quercus* dominated forest, on *Tilia amurensis*. 14 VIII 1990. L. S. Stepanenko" (LE F-355068); same Territory, "Ussuriiskii Reserve, slope of Mt. Grabovaya, 43°37'23"N, 132°18'53"E, elev. 390 m, *Pinus koraiensis*-broadleaf forest. 1968. L. A. Knyazheva" (LE F-355069); same Reserve, "Komarovka River valley, 43°38'01"N, 132°17'43"E, elev. 137 m, *Pinus koraiensis*-broadleaf forest, on *Fraxinus mandshurica*. 14 VIII 1975. E. A. Semenova" (LE F-355070).

Plectocarpon diedertzianum Y. Joshi, Upadhyay et Chandra

The species was described by Joshi et al. (2016) based on a mixture of a species of *Plectocarpon* Fée

and *Opegrapha melanospila* Müll. Arg. growing on different genera of parmelioid lichens. Subsequently, Diederich and Ertz (2018) re-examined the holotype of *Plectocarpon diedertzianum*, lectotypified it on the lichenicolous fungus growing on *Myelochroa aurulenta*, and provided a new description. The examined material fits well the latter, including the ascospore dimensions, (15)16.5–19(20) × (4.5)5–6.5(7.5) μm, l/w = (2.5)2.8–3.5(3.8) (n = 41, in K or K/I). The species was previously known only from India and is herewith recorded as new for Russia.

Specimen examined: "Russia, Primorye Territory, Ussuriiskii Reserve, Koryavaya Pad' River valley, 43°38'50"N, 132°35'31"E, elev. 380 m, *Pinus koraiensis*-broadleaf forest, on lobes of epiphytic *Myelochroa aurulenta.* 19 VII 1975. E. A. Semenova" (LE F-355071).

Table 1. Lichenicolous fungi reported from *Myelochroa*

Lichenicolous fungi	Host genera	References
Arthonia pepei s. l.	*Myelochroa*, *Parmelina* (type genus)	Etayo, Pérez-Ortega, 2016; present paper
Burgoa cf. *angulosa* (optionally lichenicolous)	various lichen genera including *Myelochroa*, type genus *Physcia,* but also on mosses, algae or directly on bark	Diederich et al., 2022; present paper
Cladophialophora aff. *megalosporae* Diederich	*Hypotrachyna*, *Megalospora* (type genus), *Myelochroa*	Diederich et al., 2013; Sharma et al., 2022
Lichenostigma alpinum s. l.	mainly *Lepra*, *Ochrolechia* (type genus) and *Varicellaria*, but also *Coccotrema*, *Fuscidea*, *Myelochroa* and other lichen genera	Ertz et al., 2014; present paper
Nesolechia falcispora (Triebel et Rambold) Diederich	*Flavopunctelia*, *Hypotrachyna*, *Myelochroa*, *Punctelia* and *Usnea* (type genus)	Triebel et al., 1995; Sharma et al., 2022
Nesolechia oxyspora var. *oxyspora*	various genera of Parmeliaceae including *Myelochroa*, type genus *Platismatia*	Triebel et al., 1995; Zhurbenko, 2014; Kondratyuk et al., 2015; present paper
Opegrapha phaeophysciae R. Sant., Diederich, Ertz et Christnach	*Myelochroa* and *Phaeophyscia* (type genus)	Ertz et al., 2005; Kondratyuk et al., 2015
Ovicuculispora parmeliae (Berk. et Curt.) Etayo	various lichen genera including *Myelochroa*, type genus *Punctelia*	Etayo, 2010; Hafellner, 2012; Zhurbenko, 2014
Plectocarpon diedertzianum	*Myelochroa* (type genus)	Joshi et al., 2016; Diederich, Ertz, 2018; present paper
Trichonectria rubefaciens (Ellis et Everh.) Diederich et Schroers	various lichen genera mainly or exclusively of Parmeliaceae including *Myelochroa*, lectotype on sterile lichen growing on dead fallen maple limb	Lowen, 1995; Zhurbenko, 2014
Zwackhiomyces kantvilasii S. Y. Kondr.	*Myelochroa* and *Parmotrema* (type genus)	Kondratyuk, 1996; Sharma et al., 2022

Discussion

An examination of 881 herbarium specimens of *Myelochroa* from the south of the Russian Far East revealed 12 (1 %) specimens infected by lichenicolous fungi. The frequency of occurrence of lichenicolous fungi on various lichen host genera and across different ecoregions worldwide remains poorly understood. One of the few available estimates for comparison is the infestation rate of specimens in the genus *Thamnolia* (primarily from the Arctic), which was found to be approximately 10 % (Zhurbenko, 2012).

To date, 11 species of lichenicolous fungi are known to grow on lichens of the genus *Myelochroa* (Table 1), three of which being documented on this host genus for the first time in this study. Of these 11 species, only *Plectocarpon diedertzianum* was not recorded on other lichen genera which may indicate the relatively low specificity of *Myelochroa* species as a substrate for lichenicolous fungi.

Acknowledgements

The research of M. P. Zhurbenko and S. V. Chesnokov was carried out within the framework of the research projects of the V. L. Komarov

Botanical Institute of the Russian Academy of Sciences "Taxonomic, ecological and structural-functional diversity of fungi and fungus-like protists" (124013100829-3) and "Flora and taxonomy of algae, lichens and bryophytes of Russia and phytogeographically important regions of the world" (121021600184-6) correspondingly. The study of M. P. Zhurbenko was carried out using the equipment of the Core Facility Center "Cell and Molecular Technologies in Plant Science" of the V. L. Komarov Botanical Institute. The study of S. V. Chesnokov was carried out in the frame of institutional research projects "Cryptogamic biota of Pacific Asia: taxonomy, biodiversity, species distribution" of the Botanical Garden-Institute FEB RAS. The research of I. F. Skirina and F. V. Skirin was carried out within the framework of the research topic № 122020900188-3 in accordance with the state assignment of the Pacific Geographical Institute of the Far Eastern Branch of the Russian Academy of Sciences. Jason Hollinger, Javier Etayo and Wolfgang von Brackel provided valuable discussion on *Arthonia pepei*; Paul Diederich is thanked for his comments on *Burgoa* cf. *angulosa*.

REFERENCES / ЛИТЕРАТУРА

Chesnokov S. V., Konoreva L. A. 2023. *Myelochroa* (Asahina) Elix et Hale. In: M. P. Andreev, T. Ahti, L. V. Gagarina, D. E. Himelbrant, I. S. Stepanchikova (eds.). *The Lichen Flora of Russia. Family Parmeliaceae II*. Moscow; St. Petersburg: KMK Scientific Press Ltd. Pp. 90–102. [In Russian] (***Чесноков С. В., Конорева Л. А.*** *Myelochroa* (Asahina) Elix et Hale. // Флора лишайников России: Семейство Parmeliaceae II. Под ред. М. П. Андреева и др. М.; СПб.: Тов-во науч. изд. КМК, 2023. С. 90–102).

Diederich P., Ertz D. 2018. Lectotypification of *Plectocarpon diedertzianum* (Arthoniales). *Herzogia* 31: 322–326. https://doi.org/10.13158/099.031.0127

Diederich P., Ertz D., Lawrey J. D., Sikaroodi M., Untereiner W. A. 2013. Molecular data place the hyphomycetous lichenicolous genus *Sclerococcum* close to *Dactylospora* (Eurotiomycetes) and *S. parmeliae* in *Cladophialophora* (Chaetothyriales). *Fungal Diversity* 58: 61–72. https://doi.org/10.1007/s13225-012-0179-4

Diederich P., Lawrey J. D. 2007. New lichenicolous, muscicolous, corticolous and lignicolous taxa of *Burgoa* s. l. and *Marchandiomyces* s. l. (anamorphic Basidiomycota), a new genus for *Omphalina foliacea*, and a catalogue and a key to the non-lichenized, bulbilliferous basidiomycetes. *Mycological Progress* 6: 61–80. https://doi.org/10.1007/s11557-007-0523-3

Diederich P., Lawrey J. D., Ertz D. 2018. The 2018 classification and checklist of lichenicolous fungi, with 2000 non-lichenized, obligately lichenicolous taxa. *The Bryologist* 121: 340–425. https://doi.org/10.1639/0007-2745-121.3.340

Diederich P., Millanes A. M., Wedin M., Lawrey J. D. 2022. *Flora of Lichenicolous Fungi, Vol. 1, Basidiomycota*. Luxembourg: National Museum of Natural History. 544 pp.

Elix J. A., Hale M. E. 1987. *Canomaculina*, *Myelochroa*, *Parmelinella*, *Parmelinopsis* and *Parmotremopsis*, five new genera in the Parmeliaceae (lichenized Ascomycotina). *Mycotaxon* 29: 233–244.

Ertz D., Christnach C., Wedin M., Diederich P. 2005. A world monograph of the genus *Plectocarpon* (Roccellacreae, Arthoniales). *Biblioth. Lichenol.* 91: 1–155.

Ertz D., Lawrey J. D., Common R. S., Diederich P. 2014. Molecular data resolve a new order of Arthoniomycetes sister to the primarily lichenized Arthoniales and composed of black yeasts, lichenicolous and rock-inhabiting species. *Fungal Diversity* 66: 113–137. https://doi.org/10.1007/s13225-013-0250-9

Etayo J. 1996. Aportación a la flora liquénica de las Islas Canarias. I. Hongos liquenícolas de Gomera. *Bull. Soc. Linn. Provence* 47: 93–110.

Etayo J. 2010. Hongos liquenícolas de Perú Homenaje a Rolf Santesson. *Bull. Soc. Linn. Provence* 61: 83–128.

Etayo J., Pérez-Ortega S. 2016. Lichenicolous lichens and fungi from Monfragüe National Park (western Spain). *Herzogia* 29: 315–328. https://doi.org/10.13158/heia.29.2.2016.315

Hafellner J. 2012. Lichenicolous Biota (Nos 121–150). *Fritschiana (Graz)* 74: 19–41.

Hollinger J. P., Scott P. A., Lendemer J. C. 2024. Two new species of lichenicolous *Arthonia* (Arthoniaceae) from southeastern North America highlight the need for comparative studies of lichen parasites and their hosts. *The Bryologist* 127: 2–21. https://doi.org/10.1639/0007-2745-127.1.001

Joshi Y., Upadhyay S., Chandra K., Bisht K., Falswal A. 2016. A new species of *Plectocarpon* (Roccellaceae, lichenised Ascomycetes) from India. *Acta Bot. Hung.* 58(3–4): 257–264. https://doi.org/10.1556/ABot.58.2016.3-4.3

Kondratyuk S. Y. 1996. New species of *Pronectria*, *Vouauxiomyces*, *Wentiomyces* and *Zwackhiomyces* from Australasia. *Muelleria* 9: 93–104. https://doi.org/10.5962/p.198439

Kondratyuk S., Lökös L., Farkas E., Oh S.-O., Hur J.-S. 2015. New and noteworthy lichen-forming and lichenicolous fungi 2. *Acta Bot. Hung.* 57(1–2): 77–141. https://doi.org/10.1556/ABot.57.2015.1-2.10

Kornerup A., Wanscher J. H. 1978. *Methuen handbook of colour. 3rd ed., reprinted*. London: Eyre Methuem Ltd. 252 pp.

Lendemer J. C., Harris R. C. 2012. Studies in lichens and lichenicolous fungi – no. 16. *Opusc. Philolichenum* 11: 313–321. https://doi.org/10.12697/fce.2014.51.13

Lowen R. 1995. *Acremonium* section *Lichenoidea* section nov. and *Pronectria oligospora* species nov. *Mycotaxon* 53: 81–95.

Nuñez-Zapata J., Alors D., Cubas P., Divakar P. K. et al. 2017. Understanding disjunct distribution patterns in lichen-forming fungi: insights from *Parmelina* (Parmeliaceae: Ascomycota). *Bot. Journal Linn. Soc.* 184(2): 238–253. https://doi.org/10.1093/botlinnean/box022

Sharma S., Joseph S., Nayaka S. 2022. New records and hosts of lichenicolous fungi from India. *Mycotaxon* 137: 603–614. https://doi.org/10.5248/137.603

Thell A., Crespo A., Divakar P. K., Kärnefelt I. et al. 2012. A review of the lichen family Parmeliaceae. *Nordic J. Bot.* 30: 641–664. https://doi.org/10.1111/j.1756-1051.2012.00008.x

Triebel D., Rambold G., Elix J. A. 1995. A conspectus of the genus *Phacopsis* (Lecanorales). *The Bryologist* 98: 71–83. https://doi.org/10.2307/3243643

Zhurbenko M. P. 2012. Lichenicolous fungi growing on *Thamnolia*, mainly from the Holarctic, with a worldwide key to the known species. *The Lichenologist* 44: 147–177. https://doi.org/10.1017/S0024282911000739

Zhurbenko M. P. 2014. Lichenicolous fungi from Far East of Russia. *Folia Cryptog. Estonica* 51: 113–120. https://doi.org/10.12697/fce.2014.51.13