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New and rare lichens and allied fungi from Arkhangelsk Region, North-West Russia. II

Viktoria N. Tarasova, Vera I. Androsova, Angella V. Sonina

Department of Botany and Plant Physiology, Petrozavodsk State University, 33 Lenin str., 185910 Petrozavodsk, Russia.
E-mails: tarasova1873@gmail.com, vera.androsova28@gmail.com, angella_sonina@mail.ru

Abstract: Information about 38 species of lichens is presented. In total, 18 species are newly recorded for Arkhangelsk Region, 11 species are new for its mainland area. New localities for 9 rare species are presented. *Thalloidima physaroides* is new for the territory of Northwest Russia. The species *Calicium pinicola* is reported for the second time in the territory of European Russia, *Sclerophora peronella* and *Rhizocarpon simillimum* – in Northwest Russia. For *Vezdaea rheocarpa* and *Pilophorus robustus* the westernmost localities in Russia are reported. The new localities of 9 species included in the Red Data Book of Arkhangelsk Region are presented. Six species are added to the list of lichens of Vodlozersky National Park.

Keywords: Leshukonsky District, limestone outcrops, old-growth forest, rocky forest, Timan ridge

INTRODUCTION

This paper further supplements the knowledge on lichens and allied fungi of Arkhangelsk Region of Russia. Arkhangelsk Region is a vast territory (589,9 thousand km^2), which includes plains of northern and middle taiga (northern and middle boreal subzone) with a relatively high percentage of old-growth forests, seashores, limestone outcrops, as well as a large area of Arctic islands. Heterogeneity of geology, relief, landscapes and plant communities in the territory of Arkhangelsk Region leads to the presence of a rich lichen diversity. However, for this region there is still no checklist of lichens. Nonetheless, in the last decade, the lichen diversity of Arkhangelsk Region has attracted considerable interest. The detailed overview of history of lichenological studies in this territory as well as results of recent expeditions are represented in several previous papers (Tarasova et al., 2015, 2016, 2019, 2020c,d, 2021).

The present study focuses on new and rare species of lichens in Arkhangelsk Region which were found in the expeditions arranged in 2019–2020.

MATERIALS AND METHODS

Study area

The study is based on the materials collected during four expeditions in 2019–2020. Totally, 27 localities from three different districts of Arkhangelsk Region were investigated (Figs. 1 & 2; Appendix 1).

In June 2019 and 2020 the lichen diversity of plant communities in the basin of the Ileksa River (length of 155 km, catchment area 3950 km^2) and its tributaries in northwestern part of Arkhangelsk Region was investigated. Its basin is a flat, highly swampy moraine plain, with 407 reservoirs with a total area of 122 km^2 (Barsova, 2009). The territory is dominated by mostly intact feathermoss, bog-grass and floodplain spruce forests, as well as bogs (Fig. 2A).

In June 2020, the second study was carried out in the northeastern part of Arkhangelsk Region to provide the *justification for* the establishment of the planned protected area – the Timansky landscape nature reserve. This territory represents the most remote, poorly studied and inaccessible area of Arkhangelsk Region. It includes the basin of the Mezenskaya Pizhma River with its tributaries, located on the spurs of ancient geological formation – the Timan Ridge. The maximal altitudinal range of the Timan Ridge is 471 m a.s.l. (the Chetlassky Stone) (Spiridonov, 1978). It was not covered by a glacier of the Last Glacial Period and is formed mainly by sedimentary rocks, including limestones (Gafarov, 1963). The metamorphic formation consisting of schists and basalts is in the upper reaches of the Mezenskaya Pizhma River. This area is a part of the Intact Forest Landscapes identified for Europe (Potapov et al., 2008). The forest communities of the Timan Ridge are without significant signs of anthropogenic disturbances and mainly represented by old-growth spruce forests with larch, and at altitudes of more than

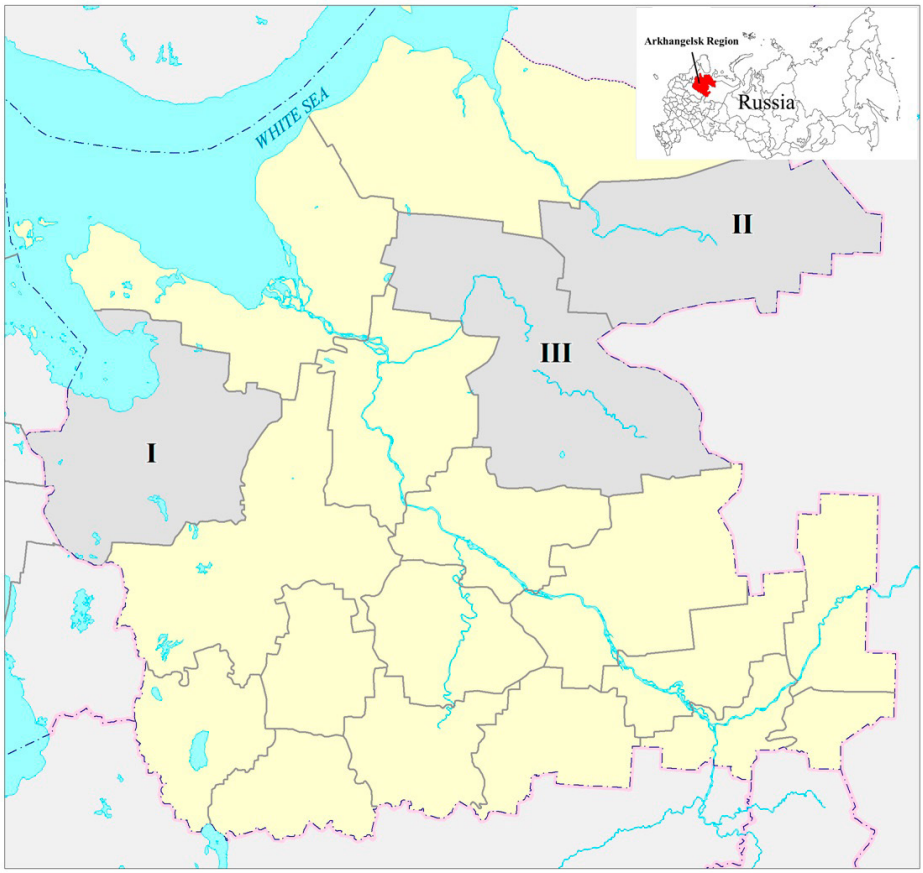

Fig. 1. Collection areas: I – Onezhsky District, Vodlozersky National park, the Ileksa River basin, II – Leshukonsky District, the Mezenskaja Pizhma River basin, III – Pinezhsky District, Javzora *River basin.*

200 m a.s.l. – sparse woodlands, mainly spruce or birch (Figs. 2B & 2C).

In September 2020, the third expedition was carried out in the Yavzora River basin located on the border of Arkhangelsk Region (eastern part) with the Republic of Komi near the territory of *Puchkomsky Nature* Landscape *Reserve*. The relief is a slightly hilly plain with an average elevation of 220 m above sea level. The territory is slightly boggy, the coverage of open bogs is about 15% of the area. Low hills among the bogs are covered with spruce forests. Pine and spruce forests with larch grow mainly on hills composed of sandy and loamy deposits (Fig. 2D).

Three studied areas have the different geographical locations, but nevertheless they are united by large coverage of old-growth forests of different types. Despite the long period of forest exploitation in Arkhangelsk Region, due to the inaccessibility of these watershed areas, the largest intact coniferous forests in Europe have survived to this day. Taiga forests are preserved in protected natural areas of Arkhangelsk Region. Indeed, in the north-east and east of the region along the border with the Republic of Komi large areas are covered by unprotected old-growth forest which are actively being cut down.

Data collection

The lichen diversity was studied on linear routes, which were developed on the basis of plantation maps and satellite images in order to cover as many diverse habitat types as possible. The

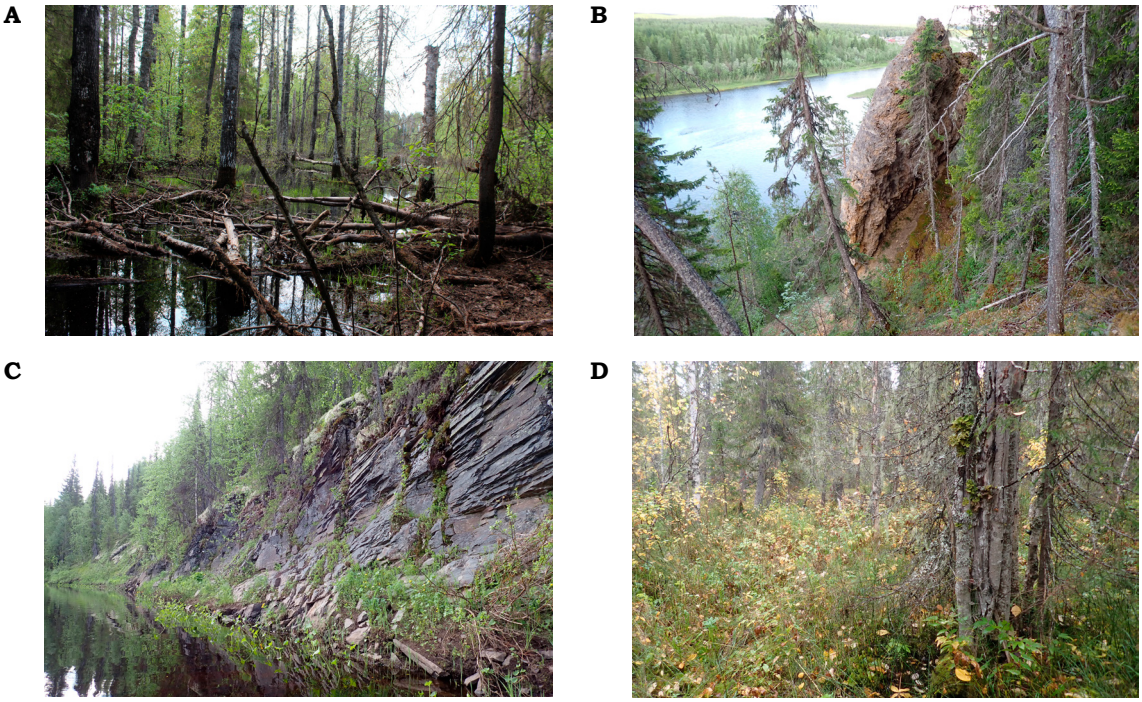

Fig. 2. Studied communities: A – paludified floodplain herb-rich spruce forest (locality I: 6), B – bilberry feathermoss spruce forest on limestone rocks (locality II: 2), C – bilberry feathermoss spruce forest on shale rocks (locality II: 6), D – paludified herb-rich spruce forest (locality III: 8).

lichen species were collected by the sample plots method. To estimate the total lichen species diversity, species occurring on all types of substrates were examined: trunks and branches of trees, shrubs, deadwood, mosses, soil and primitive soil covering the surface of the stones, rotting wood and stumps, dead trees, boulders and also buildings.

The collected material was identified using a standard microscopic technique and spot tests. The specimens of the crustose species *Calicium pinicola* were identified by a standard technique of thin-layer chromatography (TLC) in the Laboratory of Botany and Plant Physiology of Petrozavodsk State University (Petrozavodsk) using solvent systems A and B (Orange et al., 2001). The cited specimens are deposited in the Herbarium of Petrozavodsk State University (PZV).

RESULTS AND DISCUSSION

In total, 38 species of lichens are listed, among which, 18 species are recorded for the first time for the Arkhangelsk Region and 11 species are new for its mainland area (the species have earlier been recorded only from Arctic islands).

Species *Thalloidima physaroides* is new for the territory of Northwest Russia. For the species *Vezdaea rheocarpa* and *Pilophorus robustus* the westernmost localities in the territory of Russia are reported. From the world these three species are known from Northern and Central Europe and North America (Dobrysh, 2008; Nordin et al., 2011; Ahti & Stenroos, 2013). *Pilophorus robustus* occurs also in Azores, Asia and Colombia (Ahti & Stenroos, 2013).

The species *Sclerophora peronella* is reported for the second time in the territory of Northwest Russia and it is third finding of this species for the whole territory of Russia. In Europe it is a lichen of natural deciduous and mixed forests and stable microclimate of old-growth forests, the availability of old trees are the main factors for occurrence of this species (Liška et al., 2016). In the territory of Northwest Russia, the first

locality of this species (Kivach Nature Reserve, Southern Karelia) is mix spruce-aspen bilberry feathermoss forest (Hermansson et al., 2002), the second – paludified floodplain herb-rich spruce forest (180 km northeast of the first locality, in Arkhangelsk Region). This species was recently found in virgin forest of the Caucasus State Nature Biosphere Reserve (Urbanavichus et al., 2020). *Sclerophora peronella* is considered as a good indicator of ecological continuity of forest habitat (Tibell, 1992; Andersson et al., 2009). This lichen is included in the list of conservation species in several countries (Germany, Poland, Slovakia, Austria, Denmark, Finland, Great Britain, Sweden; Liška et al., 2016).

Schismatomma pericleum is also regarded as species of old-growth forests (Andersson et al., 2009) and included in the Red Data Book of the Republic of Karelia (Kuznetsov, 2020). *Xanthoparmelia conspersa* reported as new to Arkhangelsk Region is a common saxicolous species in neighboring Republic of Karelia while in the Murmansk region this species is in the Red Data Book (Konstantinova et al., 2014).

Based on new information about species occurrence, the *Bryoria nitidula*, *Pilophorus robustus*, *Sclerophora peronella* and *Thalloidima physaroides* might be recommended for inclusion to the list of the Red Data Book of Arkhangelsk Region. The species *Calicium pinicola*, *Xanthoparmelia conspersa* and *Schismatomma pericleum* should be included in the list of taxa of Arkhangelsk Region that need special attention to their state in the natural environment and are recommended for biological monitoring.

The new localities of nine species included in the Red Data Book of Arkhangelsk Region (Anufriev et al., 2020) were founded: *Bryoria bicolor*, *Chaenotheca laevigata*, *C. phaeocephala*, *C. sphaerocephala*, *Ramalina obtusata*, *R. roesleri*, *Ramboldia cinnabarina*, *Solorina saccata*. Three recorded species are included in the list of taxa of Arkhangelsk Region that need special attention to their state in the natural environment and are recommended for biological monitoring: *Chaenotheca stemonea*, *Nephroma expallidum*, *Toniniopsis aromatica*.

The study added six new species to the list of lichens and allied fungi of the Vodlozersky National Park (*Arthonia atra*, *Calicium pinicola*, *Psilolechia clavulifera*, *Sclerophora peronella*, *Vezdaea rheocarpa*, *Xylographa opegraphella*), one species – to its Arkhangelsk part (*Piccolia ochrophora*) (Tarasova et al., 2020b, 2021).

Nowadays, 996 species are listed for Arkhangelsk Region, among which 579 species – for its mainland area and 692 – for its arctic part (Tarasova et al., 2020a).

LIST OF SPECIES

Taxa are arranged in the alphabetical order; nomenclature of lichens and non-lichenized fungi mainly follows Nordin et al. (2011). For each species the localities, habitat types and substrates are listed (Appendix 1). The main phorophytes for the listed lichens were spruce (*Picea obovata* Ledeb. & *Picea abies* (L.) Karst.), birch (*Betula pubescens* Ehrh.), aspen (*Populus tremula* L.), willow (*Salix caprea* L.), pine (*Pinus sylvestris* L.) and larch (*Larix sibirica* Ledeb.). Lichen substances are given for TLC-analyzed species. Abbreviations and symbols: !! – new species for Arkhangelsk Region and ! – new species for the mainland area of Arkhangelsk Region (Tarasova et al., 2020a); RA – species included in the Red Data Book of Arkhangelsk Region (Anufriev et al., 2020); RA(bs) – species included in the list of taxa of Arkhangelsk Region which need special attention to their state in the natural environment and are recommended for biological monitoring; VNP! – new species for Vodlozersky National Park and VNP_AR! – new species for Arkhangelsk part of Vodlozersky National Park (Tarasova et al., 2020b).

!! Arthonia atra (Pers.) A. Schneid. – on bark of old willow, **I**: 2. VNP! – Common boreal species, widely distributed in different regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: Republic of Komi (Hermansson et al., 1998), Republic of Karelia (Fadeeva et al., 2007), and Leningrad Region (Longmire, 1823).

! Aspicilia indissimilis (H. Magn.) Räsänen – on stone, **II**: 8. – The species was previously reported from arctic territory of the Arkhangelsk Region (Andreev et al., 1996; Kristinsson et al., 2010). In the whole territory of Russia, it is known only from two arctic localities (Urbanavichus, 2010).

!! Aspicilia verrucigera Hue – on stone, **II**: 6. – This is an alpine species which is recorded for mountains of Europe (not arctic), Urals (not

arctic), Altai, Far East, Caucasus (Paukov et al., 2016). Distribution in neighboring territories: Republic of Karelia (Fadeeva et al., 2007), Murmansk Region (Urbanavichus et al., 2008), and Leningrad Region (Stepanchikova et al., 2017).

!! Bacidina egenula (Nyl.) Vězda – on bark of birch trunk, **III**: 13. – Boreal species widely distributed in the northern hemisphere (Golubkova, 2003), but scattered in Russia (Urbanavichus, 2010). Distribution in neighboring territories: Republic of Karelia (Fadeeva et al., 2007) and Leningrad Region (Himelbrant et al., 2017).

Bryoria bicolor (Ehrh.) Brodo & D. Hawksw. – on stone with thin soil layer, **II**: 17. RA. – In Arkhangelsk Region the species was previously known only from two localities of other districts (Golubkova, 1996; Tarasova et al., 2015, 2019).

! Bryoria nitidula (Th. Fr.) Brodo et D. Hawksw. – on stone with thin soil layer, **II**: 7. – The species was previously reported from arctic territory of Arkhangelsk Region (Lynge, 1928). This arctic-alpine species is very rare and scattered in northern Fennoscandia (Myllys et al., 2011). It is reported from different regions of Russia (Urbanavichus et al., 2008). Distribution in neighboring territories: Republic of Komi (Hermansson et al., 1998), Republic of Karelia (Fadeeva et al., 2007), and Murmansk Region (Urbanavichus et al., 2008). The species is included in the Red Data Book of the Republic of Karelia (Kuznetsov, 2020), and list of taxa of the Murmansk Region that need special attention to their state in the natural environment and are recommended for biological surveillance in the Red Data Book of the Murmansk Region (Konstantinova et al., 2014).

!! Calicium pinicola (Tibell) M. Prieto & Wedin. – on worked timber, wooden fence, **I**: 3. VNP! The specimens contain rhizocarpic acid. – This crustose species has verrucose, intensely yellowish green thallus, sessile ascomata 0.5–0.7 mm diam., cylindrical asci and ellipsoidal, slightly constricted at the septum spores 14–16 × 7–9 µm, which smooth when young and with ornamentation (irregular cracks or areolae) when mature (Tibell, 1999). This is rare species along the Scandinavian Mountain range and is widely distributed in cool temperate areas of Western Northern Hemisphere (Central and South Europe, North America) (Tibell, 1999). In the whole territory of Russia, it is known from three localities only including neighboring area (Murmansk region, eastern Siberia, north of Far East; Urbanavichus et al., 2008; Urbanavichus, 2010). This is the second finding of this species for the territory of European Russia.

Chaenotheca laevigata Nádvar. – on decorticated trunk of old aspen, **I**: 5; on wood of dead birch tree, **II**: 14. RA. – The species was previously reported only from single locality of another district of Arkhangelsk Region (Tarasova et al., 2019).

Chaenotheca phaeocephala (Turner) Th. Fr. – on bark of living and dead trees of birch and spruce, **II**: 2–4, 6–7, 9–10, 12, 14; on bark of living and dead trees of birch, spruce and larch, **III**: 1–4, 6–7, 10–12. RA. – The species was previously reported from two localities of other districts of Arkhangelsk Region (Tarasova et al., 2019).

Chaenotheca sphaerocephala Nádv. – on wood of dead standing and fallen spruce trees, **II**: 9, 11; on decaying wood of coniferous trees, **III**: 3, 8–9. RA. – The species was reported from other districts of Arkhangelsk Region only recently (Tarasova et al., 2020c,d).

Chaenotheca stemonea (Ach.) Müll. Arg. – on wood of fallen dead coniferous trees, **I**: 1; on decaying wood and fallen dead spruce, **II**: 15; on bark of spruce, **III**: 6, 14. RA(bs). – The species was previously reported from two localities of other districts of Arkhangelsk Region (Tarasova et al., 2019, 2020d).

! Cladonia pocillum (Ach.) Grognot – on primitive soil, **II**: 1. – The species was previously known from arctic territory of Arkhangelsk Region (Lynge, 1928). This is common species on calcareous and basic habitats in subarid, temperate to subtropical regions (Ahti & Stenroos, 2013). Distribution in neighboring territories: Republic of Komi (Hermansson et al., 1998), Republic of Karelia (Fadeeva et al., 2007), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

!! Cladonia symphycarpa (Flörke) Fr. – on primitive soil, **II**: 8, 13, 15–16. – The species is widespread on calcareous soil but mainly in calcareous area (Ahti & Stenroos, 2013), widely distributed in different regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: Republic of Komi (Hermansson et al., 1998), Republic of Karelia (Fadeeva et al., 2007), Leningrad Region

(Alexeeva & Himelbrant, 2007), and Murmansk Region (Urbanavichus et al., 2008).

! Lecanora frustulosa (Dicks.) Ach. – on stone, **II**: 8. – The species was previously known only from arctic territory of Arkhangelsk Region (Lynge, 1928; Kristinsson et al., 2010). This is arctic-boreal species known in neighboring territories from: Republic of Komi (Hermansson et al., 1998), Republic of Karelia (Fadeeva et al., 2007), and Murmansk Region (Urbanavichus et al., 2008). The species is included in the list of taxa of the Murmansk Region that need special attention to their state in the natural environment and are recommended for biological surveillance in the Red Data Book of the Murmansk Region (Konstantinova et al., 2014).

! Lecidella stigmatea (Ach.) Hertel & Leuckert – on stone, **II**: 8. – The species was previously reported from arctic territory of Arkhangelsk Region (Andreev et al., 1996). This is a widely distributed common species on weakly calcareous or base-enriched siliceous rocks, on urban walls, concrete. Distribution in neighboring territories: Republic of Komi (Hermansson et al., 1998), Republic of Karelia (Fadeeva et al., 2007), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

! Nephroma expallidum (Nyl.) Nyl. – on primitive soil on stone, **II**: 8. RA(bs). – The species is previously known in Arkhangelsk Region only from arctic territories (Lynge, 1928). It is a circumpolar species with scattered distribution, northern boreal to arctic (Vitikainen, 2007). Distribution in neighboring territories: Republic of Komi (Hermansson et al., 1998), Republic of Karelia (Fadeeva et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

!! Physconia perisidiosa (Erichsen) Moberg – on bark of old willow, II: 5. – This is a common, widespread species occurring on different substrates. Distribution in neighboring territories: Republic of Komi (Hermansson et al., 1998), Republic of Karelia (Fadeeva et al., 2007), and Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

!! Piccolia ochrophora (Nyl.) Hafellner – on bark of old willow, **I**: 2. VNP_AR! – This is boreal species with very scattered distribution in Russia (Urbanavichus, 2010) while it is widespread in Europe and Noth America (Golubkova, 1978, Nordin et al., 2020). Probably, the species was apparently overlooked a long time. Distribution in neighboring territories: Republic of Karelia (Tarasova et al., 2015, 2017), Republic of Komi (Hermansson et al., 1998), Leningrad Region (Stepanchikova et al., 2010), and Murmansk Region (Urbanavichus et al., 2008). The species is included in the list of taxa of the Murmansk Region that need special attention to their state in the natural environment and are recommended for biological surveillance in the Red Data Book of the Murmansk Region (Konstantinova et al., 2014).

!! Pilophorus robustus Th. Fr. (Fig. 3) – on stone, **II**: 7. – This species is rare to scattered in low and middle alpine zones in mountains of Norway, northern Sweden and Finland, rarely in middle to northern boreal zones, both on coasts and inland (Ahti & Stenroos, 2013). The nearest locality in Fennoscandia is recorded from northern Finland (Kuusamo, Lapponia enontekiensis) (Ahti & Stenroos, 2013). In Russia this species is reported from Siberian and Far Eats (Urbanavichus, 2010). In neighboring territories, it occurred only in the Republic of Komi (Hermansson et al., 1998), Nenets Autonomous Okrug (Matveeva, 2020) and included in its Red Data Books of Republic of Komi (Degteva, 2019) and Nenets Autonomous Okrug (Matveeva, 2020). This is the westernmost locality of the species for the territory of Russia.

Fig. 3. The fertile thallus of *Pilophorus robustus* Th. Fr. on shale rocks

! Placynthium nigrum (Huds.) Gray – on stone, **II**: 1. – The species was previously known from

arctic territories of Arkhangelsk Region (Lynge, 1928). Common saxicolous species occurring in neighboring territories as well as in most regions of Russia (Urbanavichus, 2010).

! Protoblastenia rupestris (Scop.) J. Steiner – on stone, **II**: 1. – The species was previously known from arctic territory of Arkhangelsk Region (Lynge, 1928). Common saxicolous species occurring in neighboring territories as well as in most regions of Russia (Urbanavichus, 2010). Species is included in the list of taxa of the Murmansk Region that need special attention to their state in the natural environment and are recommended for biological surveillance in the Red Data Book of the Murmansk Region (Konstantinova et al., 2014).

!! Psilolechia clavulifera (Nyl.) Coppins – on roots of fallen dead aspen tree, **I**: 5. VNP! – This is boreal species with wide distribution in European territory, Australia and New Zealand (Kotlov, 1998). Distribution in neighboring territories: Republic of Karelia (Fadeeva et al., 2007), Republic of Komi (Hermansson et al., 1998), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008). The species is included in the Red Data Book of the Republic of Karelia (Kuznetsov, 2020).

Ramalina obtusata (Arnold) Bitter – on bark of spruce, larch, and birch, **II**: 1–2, 7, 12, 16. RA. – This species was known from one locality in Arkhangelsk Region (Kozhozerky Reserve, Onezhsky District) (Fadeeva, 2006). This is second record of this species in Arkhangelsk Region.

Ramalina roesleri (Hochst. ex Schaer.) Hue – on bark of spruce and willow trunks, rarely on decaying wood, **II**: 1, 11, 13; on branch of spruce, **III**: 4. RA. – This species was previously recorded from other districts of Arkhangelsk Region (Zakharchenko, 1994; Korotkov & Pchelkin, 2016).

Ramboldia cinnabarina (Sommerf.) Kalb et al. – on bark of juniper trunk and decaying wood, **II**: 1, 5; on trunk of spruce, **III**: 12. RA. – Species was previously recorded from other districts of Arkhangelsk Region (Andreev & Titov, 2008; Tarasova et al., 2019, 2020d).

! Rhizocarpon alpicola (Anzi) Rabenh. – on stone, **II**: 17. – The species was previously known from arctic territory of Arkhangelsk Region (Lynge, 1928). Distribution in neighboring territories: Republic of Komi (Hermansson et al., 1998), Republic of Karelia (Fadeeva et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

! Rhizocarpon eupetraeoides (Nyl.) Blomb. & Forssell – on stone, **II**: 6. – The species was previously known from arctic territory of Arkhangelsk Region (Andreev et al., 1996). Distribution in neighboring territories: Republic of Komi (Hermansson et al., 1998), Republic of Karelia (Fadeeva et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

!! Rhizocarpon simillimum (Anzi) Lettau – on stone, **II**: 6. – The species mainly occurs in Arctic regions (North America, Alps, Spitsbergen, Fennoscandia, Arctic Siberia) (Urbanavichus et al., 2008) and in Southern Siberia (Sedelnikova, 2013; Kharpukhaeva & Urbanavichus, 2015). In neighboring territories this species is known only from the Republic of Karelia (Himelbrant et al., 2001). This is the second finding of the species in the territory of Northwest Russia.

!! Sclerophora peronella (Ach.) Tibell – on bark of fallen dead spruce tree, **I**: 5. VNP! – This is crustose calicioid lichen with immersed thallus. Ascomata short, 0.5–0.8 high, with dull grayish, epruinose stalk. Capitulum hemispherical, 0.2–0.3 mm wide; pruina of capitulum faint lemon yellow when young, white when mature (Tibell, 1999). The species is known from Europe (Poelt & Vězda, 1981; Tibell, 1999) and North America (Esslinger, 1997). Relatively high number of recent localities from the territory of Czech Republic was discovered (Liška et al., 2016). This species occurs rarely in Fennoscandia (Tibell, 1999). In Russia it is know from Republic of Karelia (Hermansson et al., 2002), from Russian Caucasus (Urbanavichus et al., 2020) and is listed in the Red Data Book of Republic of Karelia (Kuznetsov, 2020). This is the third record of the species in Russia.

!! Schismatomma pericleum (Ach.) Branth & Rostr. – on bark of birch, **II**: 2; on bark of spruce, **III**: 2. – This is common species in Europe but records in Russia are scattered (Urbanavichus, 2010). Distribution in neighboring territories: Republic of Karelia (Fadeeva et al., 2007), Republic of Komi (Hermansson et al., 1998), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

!! Scytinium intermedium (Arnold) Otálora et al. – on mosses over soil layer on calcareous rock, II: 1. – In Russia it is known from Northwest Russia, Caucasis, Northern Ural southern Siberia, and the Far East (Urbanavichus, 2010). Distribution in neighboring territories: Republic of Karelia (Fadeeva et al., 2007), Republic of Komi (Hermansson et al., 1998), and Murmansk Region (Urbanavichus et al., 2008).

Solorina saccata (L.) Ach. – on soil, **II**: 1. RA. – This calcareous species was previously recorded from three localities of other districts of Arkhangelsk Region (Zakharchenko & Sokolova, 1989).

!! Stereocaulon cumulatum (Sommerf.) Timdal – on stone, **II**: 15. – In Scandinavia, the species is rather common in the mountains, especially along footpaths and on wind eroded sites. It is rare in the boreal region, but occurs at low altitude localities at sea level in northern and central Scandinavia (Timdal, 2002). The Russian distribution ranges of *S. cumulatum* from the Norwegian border to Far East (Urbanavichus, 2010). Distribution in neighboring territories: Republic of Karelia (Fadeeva et al., 2007), Republic of Komi (Hermansson et al., 1998), Leningrad Region (Himelbrant et al., 2018), and Murmansk Region (Urbanavichus et al., 2008).

!! Thalloidima physaroides (Opiz) Kistenich et al. (Fig. 4) – on soil, II: 1. – This crustose species with thallus which consists of squamules to 2 mm diam., the squamules scattered or contiguous, hemispherical when young, later bullate to columnar. Upper side of squamules dark greysh green with pseudocyphellae, densely bluish pruinose. Ascomata to 5 mm wide, flat, black, epithecium and exciple K+violet, N+ violet; hypothecium pale brown to colorless. Spores 12–18 × 3.5–5 µm, 1-septate, fusiform (Bredkina et al., 2003). This species is sporadically found in Russia (central part of European Russia, Southern part of Ural Mountains, Eastern Siberia, Caucasus) (Gabibova et al., 2009; Urbanavichus & Urbanavichene, 2015, 2018; Muchnik & Konoreva, 2017) and is widespread in the central Europe and Fennoscandia with exception Denmark (Nordin et al., 2011). This is the first record for the territory of Northwest Russia.

Fig. 4. The thallus of *Thalloidima physaroides* (Opiz) Kistenich et al. on quartzite-sandstone outcrops

! Toniniopsis aromatica (Sm.) Kistenich et al. – on stone, II: 1. RA(bs). – This is a commom calcareous species which is known from several regions of Russia (Urbanavichus, 2010). The species was previously known from arctic territory of Arkhangelsk Region (Lynge, 1928). Species is included in the list of taxa of the Murmansk Region that need special attention to their state in the natural environment and are recommended for biological surveillance in the Red Data Book of the Murmansk Region (Konstantinova et al., 2014).

!! Vezdaea rheocarpa Poelt & Döbbeler – on bark of fallen dead spruce tree, **I**: 6. VNP! – This is a rarely reported lichen. It is known from few localities of Northern Europe (Scandinavia, Scotland, England), central and eastern Europe, North America (Dobrish, 2008). In neighboring territories, it occurred only in Republic of Komi (Hermansson et al., 1998, Zhurbenko, 2004). This species was recently found in Russian Caucasus (Urbanavichus et al., 2020). This is fourth finding of this species for the territory of Russia and the westernmost locality for of Russia.

!! Xanthoparmelia conspersa (Ehrh. Ex Ach.) Hale – on stone, **II**: 6. – This is a common species in Nordic countries (Fennoscandia) (Elix & Thell, 2011), but absent from the northernmost parts. Distribution in neighboring territories: Republic of Karelia (Fadeeva et al., 2007), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008). The species is included in the Red Data Book of the Murmansk Region (Konstantinova et al., 2014).

!! Xylographa opegraphella Nyl. ex Rothr. – on timber and roots of fallen tree, **I**: 4, 7. VNP! – The species with scattered distribution in the northern hemisphere: Northern America, Northern Europe and Asia (Urbanavichus, 2010; Spribille et al., 2014). Distribution in neighboring territories: Republic of Karelia (Fadeeva et al., 2007), Leningrad Region (Stepanchikova et al., 2019), and Murmansk Region (Urbanavichus et al., 2008).

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REFERENCES

Ahti, T. & Stenroos, S. 2013. *Cladoniaceae*. In: Ahti, T, Stenroos, S. & Moberg, R (eds). *Nordic Lichen Flora*. Vol. 5. Uppsala. Pp. 1–117.

Alexeeva, N. M. & Himelbrant, D. E. 2007. Lichens. In: Tzvelev, N. N. (executive ed.). Environment and biological diversity of Berezovye Islands Archipelago (The Gulf of Finland) (in Russian, English summary). St. Petersburg. Pp. 213–229.

Andersson, L., Alexeeva, N. & Kuznetsova, E. (eds). 2009. Survey of biologically valuable forests in North-Western European Russia. Vol. 2. *Identification manual of species to be used during survey at stand level* (in Russian). St. Petersburg. 258 pp.

Andreev, M., Kotlov, Yu. & Makarova, I. 1996. Checklist of Lichens and Lichenicolous Fungi of the Russian Arctic. *The Bryologist* 99(2): 137–169.

Andreev, M. P. & Titov, A. N. 2008. Genus *Pyrrospora* Körb. (in Russian). In: *Keys to lichens in Russia* 10: 91–95.

Anufriev, V. V., Bespalaya, Yu. V., Bolotov, I. N., Ezhov, O. N., Mamontov, V. N., Mizin, I. A., Potapov, G. S., Puchnina, L. V., Pystina, T. N., Svetochev, V. N., Chemeris, E. V. & Churakova, E. Yu. (eds). 2020. *Red Data Book of the Arkhangelsk region.* Arkhangelsk. 478 pp. (in Russian).

Barsova, A. V. 2009. Water diversity of the National Park "Vodlozersky" (in Russian). *Samarskaya Luka: problems of regional and global ecology* 18(4): 70–77.

Degteva, S. V. (ed.) 2019. *Red Data Book of the Republic of Komi.* Syktyvkar. 768 pp. (in Russian).

Dobrysh, A. A. 2008. Vezdaeaceae (in Russian). In: *Keys to lichens in Russia* 10: 464–466.

Elix, J. A. 2011. Xanthoparmelia. In: Thell, A. & Moberg, R. (eds). *Nordic Lichen Flora. Vol. 4. Göteborg. Pp. 1*31–138.

Esslinger, T. L. 1997. *A cumulative checklist for the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada.* North Dakota State University: http:/www.ndsu.nodak.edu/instruct/esslinge/chcklst/chcklst7.htm

Fadeeva, M. A. 2006. Lichens. In: *Nature and historical and cultural heritage of Kozhozerye* (in Russian). Arkhangelsk. Pp. 75–102.

Fadeeva, M. A., Golubkova, N. S., Vitikainen, O. & Ahti, T. 2007. *Conspectus of lichens and lichenicolous fungi of the Republic of Karelia* (in Russian, English summary). Petrozavodsk: Karelian Research Center of the Russian Academy of Sciences. 194 pp.

Gafarov, R. A. 1963. *Structure of the Precambrian basement in the North of the Russian platform* (in Russian). Moscow. 220 pp.

Gabibova, A. R., Ismailov, A. B. & Urbanavichus, G. P. 2009. Species of the genus *Toninia* A. Massal. on the Ganib plateau (Dagestan) (in Russian). *South of Russia: ecology, development* 4: 50–55.

Golubkova, N. S. 1978. Genus *Biatorella* De Not. (in Russian). In: *Keys to lichens in U.S.S.R.* 5: 143–155.

Golubkova, N. S. 1996. Genus *Bryoria* Brodo et D. Hawksw. (in Russian). In: *Keys to lichens in Russia* 6: 18–32.

Golubkova, N. S. 2003. Genus *Bacidia* De Not. (in Russian). In: *Keys to lichens in Russia* 8: 12–39.

Hermansson, J., Pystina, N. T. & Kudrejasheva, D. I. 1998. *Previous list of lichens of the Republic of Komi* (in Russian). Syktyvkar. 136 pp.

Hermansson, J., Tarasova, V. N., Stepanova, V. I. & Sonina, A. V. 2002. Lichens of the Kivach Reserve. *Flora and fauna zapovednikov* 101: 1–35. (In Russian, English summary).

Himelbrant, D. E., Musyakova, V. V. & Titov, A. N. 2001. On some interesting finds from Keret Karelia (Karelia keretina) (in Russian). In: *Proceedings of the 1st Russian lichenological school (Apatity, August 6–12, 2000).* Petrozavodsk. Pp. 27–40.

Himelbrant, D. E., Stepanchikova, I. S., Motiejūnaitė, J., Gerasimova, J. V., Kuznetsova, E. S., Dyomina, A. V. & Tsurykau, A. G. 2017. New records of lichens and allied fungi from the Leningrad Region, Russia. VIII. *Folia Cryptogamica Estonica 54:* 63–70. https://doi.org/10.12697/fce.2017.54.11

Himelbrant, D. E., Stepanchikova, I. S., Kuznetsova, E. S., Motiejūnaitė, J. & Konoreva, L. A. 2018. Konevets Island (Leningrad Region, Russia) – a historical refuge of lichen diversity in Lake Ladoga. *Folia Cryptogamica Estonica* 55*:* 51–78.

Kharpukhaeva, T. M. & Urbanavichus, G. P. *2015.* Finds of new and rare species of lichens for the Republic of Buryatia (in Russian). *Botanicheskii Zhurnal* 100(8): 850–854.

Konstantinova, N. A., Koryakin, A. S., Makarova, O. A. & Bianki, V. V. (eds). 2014. *Red data Book of the Murmansk region.* Kemerovo. 584 pp. (in Russian).

Korotkov, V. N. & Pchelkin, A. V. 2016. Primary information about the lichen biota of the Onega Pomorie national park (In Russian). *Bulletin of the Northern (Arctic) Federal University. Natural science* 3: 35–44. doi: 10.17238/issn2227-6572.2016.3.35

Kotlov, Ju. V. 1998. Genus *Psilolechia* Massal. (in Russian). In: *Keys to lichens in Russia 7*: 117–118.

Kristinsson, H., Zhurbenko, M. & Hansen, E. S. 2010. Panarctic checklist of lichens and lichenicolous fungi. In: Barry, T. (ed.). *CAFF Technical Report* 20: 1–120.

Kuznetsov, O. L. (ed.) 2020. *Red Data Book of the Republic of Karelia.* Belgorod. 448 pp. (in Russian).

Kuznetsova, E., Ahti, T. & Himelbrant, D. 2007. Lichens and allied fungi of the Eastern Leningrad Region. *Norrlinia* 16: 1–62.

Liška, J. P. Z., Dětinský, R. & Vondrák, J. 2006. Changes in distribution of rare and threatened lichens in the Czech Republic II. In: Lackovičová A., Guttová A., Lisická E. & Lizoň, P. (eds). *Central European lichens – diversity and threat, Mycotaxon Ltd., Ithaca.* Pp. 241–258.

Longmire, J. B. 1823. List of the plants found in the neighbourhood of St. Petersburg, taken from the works of the Petropolitan botanists. *Annals of Philosophy* 6(3): 191–197.

Lynge, B. 1928. Lichens from Novaya Zemlya (excl. Acarospora and Lecanora). *Report of the Scientific Results of the Norwegian Expedition to Novaya Zemlya 1921* 43: 1–299.

Matveeva, N. V. (ed.) 2020. *Red Data Book of the Nenets Autonomous Okrug.* Naryan-Mar. 456 pp. (In Russian).

Muchnik, E. E. & Konoreva, L. A. 2017. Materials for the second edition of the Red Book of the Belgorod Region. Plants, lichens, fungi and animals recommended for inclusion in the lists of protected species. 3. Section Lichens (in Russian). *Scientific Bulletin of BelSU. Series Natural Sciences* 4 (253), 38: 39–45.

Myllys, L., Velmala, S. & Holien, H. 2011. Bryoria. In: Thell, A. & Moberg, R. (eds). *Nordic Lichen Flora Vol. 4. Göteborg. Pp. 26–36.*

Nordin, A., Moberg, R., Tønsberg, T., Vitikainen, O., Dalsätt, Å., Myrdal, M., Snitting, D. & Ekman, S. 2011. *Santesson's Checklist of Fennoscandian Lichen-forming and Lichenicolous Fungi.* http://130.238.83.220/santesson/home.php (Accessed 25 March 2020.

Orange, A., James, P. W. & White, F. J. 2001. *Microchemical methods for the identification of lichens.* British Lichen Society, London. 101 pp.

Paukov, A., Nordin, A., Tibell, L., Frolov, I. & Vondrák, J. 2016. *Aspicilia goettweigensis* (Megasporaceae, lichenized Ascomycetes) – a poorly known and overlooked species in Europe and Russia. *Nordic Journal of Botany* 35(5): 595–610. doi: 10.1111/njb.01222, ISSN 1756-1051

Poelt, J. & Vězda, A. 1981. Bestimmungschlüssel europäischer Flechten. II (in German). *Bibl. Lichenol.* 16: 1–390.

Potapov, P. A., Yaroshenko, S., Turubanova, M., Dubinin, L., Laestadius, C., Thies, D., Aksenov, A. et al. 2008. Mapping the world's intact forest landscapes by remote sensing. *Ecology and Society* 13(2): 51. http://www.ecologyandsociety.org/vol13/iss2/art51/

Sedelnikova, N. V. 2013. Species diversity of lichen biota of the Altai-Sayan ecoregion. *Rastitelnyi Mir Aziatskoy Rossii* 2(12): 12—54.

Spiridonov, A. I. 1978. *Geomorphology of the European part of the USSR* (in Russian). Moscow. 335 pp.

Spribille T., Resl P., Ahti T., Pérez-Ortega S., Tønsberg T., Mayrhofer H. & Lumbsch H. T. 2014. Molecular systematics of the wood-inhabiting, lichen-forming genus *Xylographa* (Baeomycetales, Ostropomycetidae) with eight new species. *Acta Univ. Ups. Symb. Bot. Ups* 37: 1.

Stepanchikova, I. S., Andreev, M. P., Himelbrant, D. E., Motiejūnaitė, J., Schiefelbein, U., Konoreva, L. A. & Ahti, T. 2017. The lichens of Bolshoy Tuters Island (Tytärsaari), Leningrad Region, Russia. *Folia Cryptogamica Estonica* 54: 95–116. http://dx.doi.org/10.12697/fce.2017.54.14

Stepanchikova, I. S., Himelbrant, D. E., Schiefelbein, U., Motiejūnaitė, J., Ahti, T., & Andreev, M. P. 2019. The lichens of Moshchny Island (Lavansaari) – one of the remote islands in the Gulf of Finland. *Folia Cryptogamica Estonica* 56: 31–52. https://doi.org/10.12697/fce.2019.56.05

Stepanchikova, I. S., Kukwa, M., Kuznetsova, E. S., Motiejūnaitė, J. & Himelbrant, D. E. 2010. New records of lichens and allied fungi from the Leningrad Region, Russia. *Folia Cryptogamica Estonica* 47: 77–84.

Tarasova, V. N., Androsova, V. I., Konoreva, L. A., Chesnokov, S. V. & Sonina, A. V. 2020a. *Database: Lichens of the Arkhangelsk region.* Certificate No. 2020621715 dated 09/18/2020 https://elibrary.ru/item.asp?id=43964343

Tarasova, V. N., Androsova, V. I. & Sonina, A. V. 2020b. *Database: Lichens of Vodlozersky National Park*. Certificate No. 2020622311 dated 11/18/2020 https://elibrary.ru/item.asp?id=44242100

Tarasova, V. N., Androsova, V. I. & Sonina, A. V. 2021. Lichens of the Vodlozersky National Park (Russia) (In Russian, English summary). *Nature Conservation Research. Zapovednaya Nauka* 6(1): 32–46. https://dx.doi.org/10.24189/ncr.2021.003

Tarasova, V. N., Konoreva, L. A., Zhurbenko, M. P., Pystina, T. N., Chesnokov, S. V., Androsova, V. I., Sonina, A. V., Semenova, N. A. & Valekzhanin, A. A. 2020c. New and rare species of lichens and allied fungi from Arkhangelsk region, North-West Russia. *Folia Cryptogamica Estonica* 57: 85–100. https://doi.org/10.12697/fce.2020.57.10.

Tarasova, V. N., Obabko, R. P., Himelbrant, D. E., Boychuk, M. A., Stepanchikova, I. S., & Borovichev, E. A. 2017. Diversity and distribution of epiphytic lichens and bryophytes on aspen (*Populus tremula*) in the middle boreal forests of Republic of Karelia (Russia). *Folia Cryptogamica Estonica* 54: 125–141. https://doi.org/10.12697/fce.2017.54.16

Tarasova, V. N., Pystina, T. N., Androsova, V. I., Sonina, A. V., Valekzhanin, A. A. & Konoreva, L. A. 2019. New records of lichens and allied fungi from Vodlozersky National Park within Arkhangelsk Region (NW Russia). *Folia Cryptogamica Estonica* 56: 87–98. https://doi.org/10.12697/fce.2019.56.09

Tarasova, V. N., Sonina, A. V., Androsova, V. I. & Stepanchikova, I. S. 2015. The lichens of forest rocky communities of Olovgora mountain (Arkhangelsk Region, North-Western Russia). *Folia Cryptogamica Estonica* 52: 51–62.

Tarasova, V. N., Sonina, A. V., Androsova, V. I. & Stepanchikova, I. S. 2016. The lichens of forest rocky communities of the hill Muroigora (Arkhangelsk Region, Northwest Russia). *Folia Cryptogamica Estonica* 53: 111–121.

Tarasova, V. N., Sonina, A. V., Androsova, V. I., Valekzhanin, A. A. & Konoreva, L. A. 2020 d. The lichens and allied fungi of forest rocky communities of the Vysokaya (Volda) Mountain (Windy Belt Ridge, Arkhangelsk Region, NW Russia). *Folia Cryptogamica Estonica* 57: 133–146. https://doi.org/10.12697/fce.2020.57.12

Tibell, L. 1999. Caliciales. In: Ahti, T., Jørgensen, P. M., Krisninsson, H., Moberg, R., Søchting, U. & Thor, G. (eds) *Nordic Lichen Flora. Vol. 1. Uddevalla. Pp. 20–71*.

Timdal, E. 2002. *Stereocaulon cumulatum* comb. nov., another crustose species in the genus. *Lichenologist* 34(1): 7–11. doi:10.1006/lich.2001.0368.

Urbanavichus, G. P. 2010. *A checklist of the lichen flora of Russia* (in Russian). St. Petersburg. 194 pp.

Urbanavichus, G., Ahti, T. & Urbanavichene, I. 2008. Catalogue of lichens and allied fungi of Murmansk Region, Russia. *Norrlinia* 17: 1–80.

Urbanavichus, G., Vondrák, J., Urbanavichene, I., Palice, Z. & Malíček, J. 2020. Lichens and allied non-lichenized fungi of virgin forests in the Caucasus State Nature Biosphere Reserve (Western Caucasus, Russia). *Herzogia* 33: 90–138.

Urbanavichus, G. P. & Urbanavichene, I. N. 2015. Materials for the lichen flora of the Utrish reserve. *Turczaninowia* 18(2): 86–95.https://doi.org/10.14258/turczaninowia.18.2.9

Urbanavichus, G. & Urbanavichene, I. 2018. New records of lichens and allied fungi from Lapponia-petsamoënsis, Murmansk Region, Russia. *Folia Cryptogamica Estonica* 55: 1–5. https://doi.org/10.12697/fce.2018.55.01

Vitikainen, O. 2007. Nephromataceae. In: Ahti, T., Jørgensen, P. M., Krisninsson, H., Moberg, R., Søchting, U. & Thor, G. (eds) *Nordic Lichen Flora. Vol. 3. Uddevalla. Pp. 91–95*.

Zakharchenko, Yu. V. 1994. *Study of the baseline state and some anthropogenic changes in the epiphytic lichen flora of spruce forests in the southeast of the White Sea-Kuloi plateau* (in Russian). Moscow. 116 pp.

Zakharchenko, Yu. V. & Sokolova, S. V. 1989. Supplement to the list of lichens of the Pinezhsky Reserve (in Russian). In: *Algae, lichens, mushrooms and bryophytes in the reserves of the RSFSR. Collection of scientific papers of the Central Research Laboratory of Glavokhota RSFSR.* Moscow-St.-Petersburg. Pp. 60–70.

Zhurbenko, M. P. 2004. Lichenicolous and some interesting lichenized fungi from the Northern Ural, Komi Republic of Russia. *Herzogia* 17: 77–86.

Appendix 1. List of study sites in the Arkhangelsk Region. Abbreviations of collectors: AS – Angella Sonina, AV – Andrey Valekzhanin, VA – Vera Androsova, VT – Viktoria Tarasova.

No.		Locality	Coordinates	Altitude	Community	Collector	Collection date
I	1	Onezhsky District, Vodlozersky National park, the Ileksa River basin	63°10'52.8"N, 36°30'33.0"E	206 m	bilberry feathermoss spruce forest on rock	VA & VT	1 June 2019
	2		62°55'12.8"N, 37°02'47.8"E	164 m	natural and anthropogenic communities of abandoned Nosovka villiage	VA & VT	7 June 2019
	3		62°55'21.1"N, 37°03'48.2"E	160 m	natural and anthropogenic communities of abandoned Korkola villiage	VA &VT	7 June 2019
	4		62°53'20.5"N, 37°03'49.6"E	164 m	natural and anthropogenic communities of cordon «Monastyrskoe»	VA & VT	8 June 2019
	5		63°02'01.9"N, 36°56'42.7"E	172 m	paludified floodplain herb-rich spruce forest	VA & VT	9 June 2019
	6		63°15'16.1"N, 36°37'32.9"E	176 m	paludified floodplain herb-rich spruce forest	VA & VT	7 June 2019
	7		62°58'06.0"N, 36°52'44.2"E	171 m	paludified floodplain herb-rich spruce forest	AS, VA, VT	11 June 2020
II	1	Leshukonsky District, the Mezenskaja Pizhma River basin	64°41'08.8"N, 49°16'26.6"E	136 m	bilberry feathermoss spruce forest on limestone rocks	VT	10 June 2020
	2		64°43'1.4"N, 49°17'4.6"E	131 m	herbal-rich feathermoss spruce forest	VT	11 June 2020
	3		64°43'06.8"N, 49°16'32.5"E	166 m	bilberry feathermoss spruce forest	VT	12 June 2020
	4		64°42'25.0"N, 49°16'22.1"E	114 m	paludified floodplain herb-rich spruce forest	VT	12 June 2020
	5		64°47'19.7"N, 49°40'01.5"E	185 m	herb-rich spruce-pine forest on recently burned sites, on shale rocks	VT	14 June 2020
	6		64°46'37.8"N, 49°40'43.6"E	192 m	bilberry feathermoss spruce forest on shale rocks	VT	15 June 2020
	7		64°46'43.4"N, 49°40'01.3"E	221 m	bilberry feathermoss spruce forest on shale rocks	VT	15 June 2020
	8		64°46'59.2"N, 49°39'48.6"E	185 m	vertical shale rocks on the river bank	VT	16 June 2020
	9		64°46'58.1"N, 49°39'40.4"E	227 m	bilberry feathermoss spruce forest on shale rocks	VT	17 June 2020
	10		64°46'30.6"N, 49°38'26.5"E	246 m	bilberry feathermoss spruce forest	VT	17 June 2020
	11		64°52'18.3"N, 49°36'15.8"E	173 m	paludified peatmoss spruce forest	VT	18 June 2020
	12		64°51'49.7"N, 49°35'20"E	176 m	paludified floodplain herb-rich spruce forest	VT	19 June 2020
	13		64°51'54.7"N, 49°36'22.6"E	181 m	paludified floodplain herb-rich spruce forest	VT	19 June 2020
	14		64°51'46.0"N, 49°35'40.3"E	164 m	paludified floodplain herb-rich spruce forest	VT	19 June 2020
	15		64°57'29.2"N, 49°20'06.7"E	159 m	cowberry lichen pine forest on quartzite-sandstone outcrops	VT	20 June 2020
	16		64°56'45.5"N, 49°18'56.2"E	181 m	bilberry feathermoss spruce forest on shale rocks	VT	21 June 2020
	17		64°49'53.2"N, 49°16'35.0"E	175 m	cowberry lichen pine forest on rock	VT	22 June 2020

No.		Locality	Coordinates	Altitude	Community	Collector	Collection date
III	1	Pinezhsky District, Javzora *River basin*	63°52’52.7”N, 46°10’17.9”E	205 m	bilberry peatmoss spruce forest	VT	6 September 2020
	2		63°52’28.1”N, 46°10’43.2”E	187 m	floodplain herb-rich spruce forest	VT	6 September 2020
	3		63°50’02.5”N, 46°10’38.3”E	191 m	cowberry- bilberry lichen-feathermoss pine-spruce forest	VT	7 September 2020
	4		63°50’12.6”N, 46°10’57.1”E	169 m	paludified herb-rich spruce forest	VT	7 September 2020
	5		63°49’39.4”N, 46°11’59.2”E	163 m	paludified bilberry peatmoss birch-spruce forest	VT	8 September 2020
	6		63°49’46.4”N, 46°11’43.3”E	183 m	paludified bilberry peatmoss spruce forest	VT	8 September 2020
	7		63°49’50.3”N, 46°11’17.3”E	193 m	bilberry feathermoss spruce forest	VT	8 September 2020
	8		63°51’19.4”N, 46°09’27.8”E	196 m	paludified herb-rich spruce forest	VT	9 September 2020
	9		63°50’37.3”N, 46°11’56.8”E	170 m	floodplain paludified herb-rich spruce forest	VT	10 September 2020
	10		63°52’18.1”N, 46°06’21.6”E	191 m	bilberry feathermoss larch forest	AV, det. VT	11 August 2020
	11		63°53’16.3”N, 46°06’42.8”E	226 m	cowberry lichen-feathermoss spruce-larch-spruce forest	AV, det. VT	12 August 2020
	12		63°52’58”N, 46°09’30.8”E	193 m	paludified peatmoss spruce forest	AV, det. VT	13 August 2020
	13		63°53’15.5”N, 46°10’23.9”E	196 m	paludified herb-rich spruce forest	AV, det. VT	13 August 2020
	14		63°53’49.6”N, 46°15’24.1”E	202 m	paludified peatmoss birch forest	AV, det. VT	14 August 2020
	15		63°53’18.6”N, 46°17’20.2”E	226 m	bilberry feathermoss birch-spruce forest	AV, det. VT	14 August 2020