The lichens and allied fungi of the southern part of the Kenozersky National Park (Arkhangelsk Region, NW Russia)

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Abstract: The paper presents the first data on lichen diversity in the Kenozersky National Park (Arkhangelsk Region, Northwest Russia). As a result of the study, 263 species and 1 subspecies of lichens and allied fungi were found in the southern part of the national park. Seventeen lichen species are reported for the first time for Arkhangelsk Region. Biotura albidula is a new species for Northwest European Russia. Two recorded species are included in the Red Data Book of Russian Federation and 7 in the Red Data Book of Arkhangelsk Region. Pycnothelia papillaria can be recommended for inclusion to the Red Data Book of Arkhangelsk Region.

Keywords: middle boreal subzone, new records, protected area, taiga forests

INTRODUCTION

Currently, in the context of significant environmental transformation, the role of specially protected natural areas in the conservation and maintenance of the main types of natural landscapes, communities and biodiversity is becoming more and more important (Gray et al., 2016; Berteaux et al., 2018). Lichens are an integral component of boreal ecosystems known to be highly sensitive to habitat conditions (Nash, 2008). Lichenological studies of protected areas are traditionally of great interest due to the high preservation status of natural communities and their significant role in maintaining biodiversity and conservation of rare and protected species (Dymytrova et al., 2014). Lichen diversity can serve as an effective indicator for biomonitoring in natural ecosystems (Khashini et al., 2019). It is also used for assessing the scale of dynamic processes associated with both global and regional factors (McMullin et al., 2016; Brzeziecki, 2017), forecasting the state of ecosystems and developing effective measures for their conservation (Waser et al., 2007; Zhang et al., 2016).

The Kenozersky National Park (KNP) was established in 1991 with the purpose to conserve the natural, historical, and cultural heritage of the Russian North. It is located in Kargopolsky and Plesetsky districts of Arkhangelsk Region near the south-eastern border of the Republic of Karelia. The territory of the park has a long history of human use in the past and therefore differs from other protected areas in Northwest Russia by its high recreational attractiveness and the presence of vast anthropogenic landscapes formed over many centuries. There are a lot of monuments of wooden architecture. In 2004, the park was recognized by UNESCO as a biosphere reserve included in the World Network of Biosphere Reserves.

Lichen diversity of Arkhangelsk Region is still poorly studied compared to other regions of Russia (Tarasova et al., 2015, 2016). Similarly, the lichen biota of KNP is not properly studied. The aim of this study is to take an inventory of lichen diversity in the southern part of the Kenozersky National Park (Arkhangelsk Region, NW Russia).

MATERIALS AND METHODS

The study area is located in the south-western part of Arkhangelsk Region in the south of the Kenozersky National Park (Fig. 1). The total area of the park is 139.7 thousand hectares. Its territory extends from 61°40’ to 62°10’N and from 37°50’–38°00’ to 38°10’–38°30’E. The climate of the region is moderately continental. The average annual air temperature is 1.5°C in the south and 1.3°C in the north of the national park. The average annual precipitation is 597...
and 564 mm, respectively. The growing season lasts for about 130 days. Frost-free period is 108 days. A stable snow cover lasts for 160 days (Razumovskaja et al., 2012).

The territory of the national park is characterized by high natural heterogeneity. Two important natural boundaries run along it: between the Baltic Shield and the East European Platform (from southwest to northeast), and the watershed between the basins of the Atlantic and Arctic oceans (from north to south; Kulikova et al., 2012). The so-called “Maselga Point” from the southern part of park is particularly unique, cause its located in a place of intersection of two boundaries: the Atlantic-Arctic watershed and the water line between Fennoscandia and the Russian Plain (Kulikov et al., 2015).

The area of the national park stands out against the background of the plain environment with a complex geological structure and various forms of relief. The marginal part of the Baltic Shield, composed of Paleo- and Mesoarchean gneisses and granitoids, runs along the northern and northwestern sides of the national park. The south, east, and northeast of the national park are located within the East European Platform, in the area of Vendian and Paleozoic sedimentary rocks (limestones and dolomites; Kulikova et al., 2012; Razumovskaja et al., 2012). Crystalline rocks come to the surface in the form of eskers or are covered by a cover of quaternary deposits of the Valdai glaciation. The height differences rarely exceed 200 m; the average height above sea level is 100–120 m (Kalutskov, 2017; Kulikova & Kulikov, 2017). There are two large lakes in the Kenozersky National Park: Lake Lekshmozero in the south of the park and Lake Kenozero in the north (Razumovskaja et al., 2012). Podzolic soils, common for the middle taiga, occupy about 75% of the national park area. Boggy soils of various types spread on the rest 25% of the area (Kalutskov, 2017).

The vegetation in the Kenozersky National Park is typical for the middle taiga subzone. Forest
cover 76% of the park territory (Torkhov, 2012). Herb-rich spruce forests and their derivates such as birch and aspen forests dominate. Sphagnum raised and transitional bogs, as well as lowland bogs fed by springs are common. The Kenozero part of the park is characterized by the predominance of bilberry pine and spruce forests, as well as lingonberry pine forests. Herb-rich pine forests, spruce and aspen forests are confined to the steep slopes of moraine ridges, herb-rich spruce and aspen forests are located at their foot. Coastal vegetation is diverse along the shores of water bodies, and aquatic vegetation in shallow waters (Razumovskaja, 2018).

The vegetation of the park has been largely influenced by human activities in the past. The beginning of agricultural practices in the Kenozero region dates back to the 10th century. From that time until the middle of the 20th century the territory was densely, and most of the land presently covered by forests was used for agriculture (Razumovskaja et al., 2012). To a large extent, the forests of the national park are standing on previously burned areas resulted from slash-and-burn activities. It is evidenced by the pyrogenic origin of almost half of the forests. Thus, forests covering area of 49 thousand hectares are 80 to 100 years old. Intact forests older than 160 years occupy an area of only about 5.8 thousand hectares and have been preserved as fragments in low-lying wetlands unsuitable for agricultural activities (Torkhov, 2012). These forests are paludified spruce and pine forests with trees of age between 160 and 350 years (Byzova, 2016).

The field work was carried out by authors during 3 expeditions: in July 2011 (by V. Tarasova), in May 2018 (by A. Valekzhanin) and in August 2018 (by A. Pchelkin). Specimens were collected in the Kargopol sector of the national park in natural forest communities of different types and anthropogenic landscapes (Fig. 2).

The lichen diversity was studied on linear routes, which were developed based on forest plantation maps and satellite images to cover as many diverse habitat types as possible. To estimate the lichen species richness, various types of substrates were examined including 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 anthropogenic formations (buildings).

The collected material, a total of ~1230 lichen specimens, was identified using a standard microscopic technique and spot tests. The 22 specimens of the genus Cladonia and sterile crustose specimens were identified by a standard technique of thin-layer chromatography (TLC) in the Laboratory of Experimental Botany of Petrozavodsk State University (Petrozavodsk) using solvent systems A, B and C (Orange et al., 2001).

The cited specimens are deposited in the herbaria of Petrozavodsk State University (PZV), Institute of Geography RAS (IGRAS), Institute of Global Climate and Ecology (IGCE) and in the Kenozersky National Park.

RESULTS AND DISCUSSION

The 263 species and 1 subspecies of lichens and allied fungi (including 4 lichenicolous fungi and 3 non-lichenized fungi) belonging to 48 families and 101 genera were found in the southern part of the Kenozersky National Park. Crustose species were dominant (152 species), contributing to 59% to the total number of lichens. 53 fruticose (21%) and 51 foliose (20%) species were recorded.

Notes on new, rare or Red Data Book species

Among the recorded species 17 lichens are reported for Arkhangelsk Region for the first time: Absconditella lignicola, Arthonia apatetica, Biatora albidula, Biatora chrysantha, B. meio-carpa, Calicium tigillare, Candelariella lutella, Chaenotheca chlorella, Felipes leucopellaeus, Lecanora umbrina, Melanohalea exasperata, Peltigera hymenina, Phaeophyscia nigricans, P. orbicularis, Placynthiella dasaea, Pycnothelia papillaria, and Xylopsora caradocensis. Biatora albidula is a new species for Northwest Europe-an Russia. Four species (Candelariella aurella, Megaspora verrucosa, Myriolecis crenulata, M. dispersa) have been recorded earlier only from Arctic islands of Arkhangelsk Region.

Lobaria pulmonaria and Bryoria fremontii are included in the Red Data Book of Russian Federation. Seven recorded species (Acolium karelicum, Bryoria fremontii, Chaenotheca brachypoda, C. phaeocephala, Evernia divaricata, Lobaria
Fig. 2. Studied habitats: a – paludified peatmoss pine forest (locality № 5); b – paludified floodplain herb-rich spruce forest (locality № 7); c – bilberry feathermoss larch-spruce-pine forest (locality № 16); d – paludified herb-rich spruce forest (locality № 20); e – herb-rich aspen forest (locality № 22); f – individual boulders (locality № 25); g – the road along the route “Ancestral Trail” (locality № 35); h – roof of an abandoned house in Ivshinskaya village (locality № 47).
*Pulmonaria, Pseudevernia furfuracea* are included in the Red Data Book of Arkhangelsk Region (2020). Four species (*Acolium inquinans*, *Chaenotheca stemonea*, *Hypogymnia vittata*, *Rostania occultata*) are included in the list of taxa of Arkhangelsk Region that need special attention to their status in the natural environment and are recommended for biological monitoring (The Red Data Book of Arkhangelsk Region, 2020). *Pycnothelia papillaria* can be recommended for inclusion in the Red Data Book of Arkhangelsk Region. This species gravitates towards oceanic and suboceanic regions, is objectively rare in northwestern Russia, and is included in the Red Data Books of Leningrad Region (2000) and the Republic of Karelia (2020).

**Lichen substrates and habitats in study sites**

The substrate preferences analysis of lichens from studied communities revealed the predominance of the epiphytic group (corticolous and lignicolous) (185 species, 71%). Among the studied phorophytes, the richest lichen diversity (93 species, 36% of the lichen flora) was observed on the aspen trees. On the trunks and branches of spruce 68 species (26%) were found, on pine – 63 species (24%), on willow – 61 species (24%), on birch – 55 species (21%), on larch – 47 species (18%), on alder – 38 species (15%), on bird-cherry tree – 35 species (14%), on rowan – 34 species (13%), on juniper – 16 species (6%). On treated wood of buildings were presented 60 species, on dead wood – 41 species.

Terricolous lichens are the second dominant group (33 species, 13%). The saxicolous lichens are represented by the smallest number of species (30 species, 12%), but characterized by high substrate specificity (25 species were found on stones only). The largest number of lichen species was found on granite stones (23 species), and they were different from lichens found on the concrete walls (11 species). For example, species of the genera *Rhizocarpon*, *Porpidia*, *Tephromela* were found only on granite stones, while species *Calogaya decipiens*, *Myriolecis crenulata*, *M. dispersa* were observed on concrete walls. The *Protoparmeliopsis muralis* was found on limestone. Several species (17, 7%) were relatively nonspecific for substrates.

It should be noted that the identified species diversity of lichens and allied fungi for the Kenozersky National Park is still incomplete. For example, neighboring protected areas host significantly more species, than presently recorded for the territory of the Kenozersky National Park (Appendix 1). Further research of lichen diversity in the Kenozersky National Park is required, including its northern part, as well as earlier collections should be revised.

**LIST OF SPECIES**

Taxa are arranged in alphabetical order; nomenclature of lichens, lichenicolous and non-lichenized fungi follows Nordin et al. (2011). For each species the localities, habitat types and substrates are listed. Lichen substances are given for TLC-analyzed specimens.

Abbreviations and symbols: # – lichenicolous fungi; + – non-lichenized fungi; † – new species for mainland area of Arkhangelsk Region; †† – new species for Arkhangelsk Region (including arctic islands); RR – species included in the Red Data Book of Russian Federation (2008); RA – species included in the Red Data Book of Arkhangelsk Region (2020); RA(bs) – species 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 surveillance. Localities for species are marked by the numbers of sampling plots (1–68) according to Appendix 2.

†† Absconditella lignicola Vězda & Pišút – 45: on standing dead birch wood (*Betula pendula* Roth.). This is a common boreal species reported from most regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), Komi Republic (Hermansson et al., 1998), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

Acarospora moenium (Vain.) Räsänen – 35: on concrete wall; 36: on stone.

Acolium inquinans (Sm.) A. Massal. – 20: on snag of spruce (*Picea* sp.). RA(bs).

Acolium karelicum (Vain.) M. Prieto & Wedin – 7: on snags and trunk of spruce. RA.

Alectoria sarmentosa (Ach.) Ach. – 3, 39: on snags of spruce. RA.

Amandinea punctata (Hoffm.) Coppins & Scheid. – 13: on birch bark; 45: on aspen and birch bark.

!! Arthonia apatetica (A. Massal.) Th. Fr. – 61: on wood of standing dead spruce. This is a common boreal species reported from most regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), Komi Republic (Hermansson et al., 1998), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

Arthonia dispuncta Nyl. – 66: on bark of willow (Salix spp.).

Arthonia mediella Nyl. – 45: on bark of aspen.

Arthonia radiata (Pers.) Ach. – 49: on bark of aspen and old bird-cherry tree (Padus avium Mill.).

Aspicilia cinearea (L.) Körb. – 25, 35, 56: on stone.

Athallia holocarpa (Hoffm.) Arup et al. – 26: on concrete wall.

Athallia pyracea (Ach.) Arup et al. – 24, 54: on bark of aspen.

Baeomyces rufus (Huds.) Rebent. – 30: on sandy soil.

!! Biatora albidula Willey in Tuck. – 14: on bark of aspen. This species was previously known in Russia only from Republic of Altai, Chelyabinsk Region, Khabarovsk Territory, Trans-Baikal Territory (Palice et al., 2013), and Kostroma Region (Urbanavichus, 2019). Here it is reported first time for Northwest European part of Russia. So far it was reported from Germany, Norway, Sweden, and USA (Palice et al., 2013). Conf. D. Himelbrant.

Biatora albohyalina (Nyl.) Bagl. & Carestia – 28: on bark of aspen.

!! Biatora chrysantha (Zahlbr.) Printzen – 8: on bark of standing dead alder (Alnus incana (L.) Moench). This is a common boreal species reported from most regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), the Komi Republic (Hermansson et al., 1998), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

Biatora efflorescens (Hedl.) Räsänen – 8: on bark of standing dead alder; 20: on bark of willow; 29: on bark of rowan (Sorbus aucuparia L.).

Biatora globulosa (Flörke) Fr. – 29: on bark of rowan.

Biatora helvola Körb. ex Hellb. – 5, 64: on bark of pine (Pinus sylvestris L.); 20: on bark of willow; 22, 24, 41: on bark of spruce and birch; 53: on bark of juniper (Juniperus communis L.).

!! Biatora meiocarpa (Nyl.) Arnold – 24: on bark of birch. This is a common boreal species reported from most regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), Komi Republic (Hermansson et al., 1998), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

Biatora ocelliformis (Nyl.) Arnold – 8, 49: on bark of standing dead alder; 20, 64: on bark of willow; 29: on bark of birch; 54: on bark of pine; 49, 52: on bark of bird-cherry tree.

Biatora pallens (Kullh.) Printzen – 8: on bark of standing dead alder.

Biatora vernalis (L.) Fr. – 28: on moss growing on bark of aspen.

Bilimbia microcarpa (Th. Fr.) Th. Fr. – 4: on bark of standing dead aspen.

Bilimbia sabuletorum (Schreb.) Arnold – 49, 61: on bark of aspen.

Bryoria fremontii (Tuck.) Brodo & D. Hawksw. – 5: on bark of pine; 44: on branches of spruce. RR, RA.


Bryoria nadvorenskiana (Gueln.) Brodo & D. Hawksw. – 3, 7, 10, 20, 54: on branches of spruce; 44: on branches of birch; 57: on decaying aspen; 60: on bark of larch (Larix sibirica Ledeb); 51, 53: on bark of pine.

Buellia disciformis (Fr.) Mudd – 15, 49, 56, 67: on bark of willow, alder, bird cherry tree and on wood.

Buellia erubescens Arnold – 20, 64: on bark of willow; 29: on bark of rowan; 49: on decaying wood.
**Buella griseovirens** (Turner & Borrer ex Sm.) Almb. – 53: on bark of old bird cherry tree.

**Calciurn adspersum** Pers. – 20: on bark of spruce.

**Calciurn denigratum** (Vain.) Tibell – 15, 51: on treated wood.

**Calciurn glauceum** Ach. – 2: on treated wood; 61: on wood of old pine.

**Calciurn parvum** Tibell – 51: on wood of old pine.

**!! Calciurn tigillare** (Ach.) Pers. – 44: on wood of old standing dead spruce. Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), Komi Republic (Hermansson et al., 1998), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008). Species included in the Red Data Book of the Republic of Karelia (2020).

**Calciurn trabinellum** (Ach.) Ach. – 2, 13, 15, 51, 53: on treated wood.

**Calciurn viride** Pers. – 1, 50: on bark of spruce; 15: on treated wood; 16: on bark of larch.

**!! Calogayia decipiens** (Arnold) Arup et al. – 26: on concrete wall. This species reported from most regions of Russia (Urbanavichus, 2010). Previously known in Arkhangelsk Region without exact location (Handbook., 2004). Species included in the Red Data Book of Komi Republic (2020).

**Caloplaaca cerina** (Hedw.) Th. Fr. – 24: on bark of aspen; 49: on bark of bird-cherry tree; 56: on bark of willow.

**!! Caloplaaca Candelariella aurella** (Hoffm.) Zahlbr. – 26: on concrete wall; 66: on bark of willow. This is a common boreal species reported from most regions of Russia (Urbanavichus, 2010). Previously known in Arkhangelsk Region only from its Arctic part (Deichmann-Branth, 1885; Heuglin, 1874).

**!! Caloplaaca Candelariella lutella** (Vain.) Räsänen – 24: on branches of aspen. This is a common boreal species reported from most regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), Komi Republic (Hermansson et al., 1998), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

**Candelariella vitellina** (Hoffm.) Müll. Arg. – 15: on treated wood; 24, 35, 46: on stones, treated wood and bark of aspen.

**Candelariella xanthostigma** (Ach.) Lettau – 13: on bark of birch; 18: on roofing paper.

**Catinaria atropurpurea** (Schaer.) Vézda & Poelt – 3: on branches of spruce; 57: on bark of fallen dead aspen.

**Cetraria islandica** (L.) Ach. – 30–32, 55: on soil.

**Cetraria septicola** (Ehrh.) Ach. – 15: on branches of spruce; 16: on branches of larch; 24: on branches of birch; 55: on treated wood.

**Chaenotheca brachypoda** (Ach.) Tibell – 4: on bark of standing dead aspen; 8: on bark of willow. RA.

**Chaenotheca bruneolla** (Ach.) Müll. Arg. – 2, 12–13: on treated wood.

**!! Chaenotheca chlorella** (Ach.) Müll. Arg. – 15: on treated wood. This is a boreal species reported from most regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: Republic of Karelia (Fadeeva et al., 2007), Komi Republic (Hermansson et al., 1998), Leningrad Region (Stepanchikova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008). Species included in the Red Data Book of Murmansk Region (2014).

**Chaenotheca chrysocephala** (Turner ex Ach.) Th. Fr. – 7, 15, 20: on bark of spruce; 9: on bark of larch; 15, 17: on treated wood; 50 – on bark of old spruce.

**Chaenotheca ferruginea** (Turner ex Sm.) Mig. – 5, 33, 40, 51, 54: on bark of pine; 7, 37: on bark of spruce and deadwood; 9, 16, 60: on bark of larch; 20: on bark of spruce; 54: on bark of old aspen.

**Chaenotheca furfuracea** (L.) Tibell – 4, 12: on soil on roots of fallen dead spruce trees.

**Chaenotheca phaeocephala** (Turner) Th. Fr. – 13: on treated wood. RA.

**Chaenotheca stemonea** (Ach.) Müll. Arg. – 43: on base trunk of spruce. RA(bs).

**Chaenotheca subroscida** (Eitner) Zahlbr. – 50: on bark of old spruce; 54: on bark of old pine.

**Chaenotheca trichialis** (Ach.) Th. Fr. – 12, 50: on bark of spruce; 16: on bark of larch; 20, 33: on bark of willow; 49: on treated wood; 61: on bark of old pine.

CHAENOTHECOPSIS EPITHALLINA Tibell – 16: on thalli of Chaenotheca trichialis on bark of larch; 20: on thalli of Chaenotheca trichialis on bark of willow.


CHAENOTHECOPSIS SAVONICA (Räsänen) Tibell – 9: on bark of larch.

CIRCINARIA CAESIOCINEREA (Nyl. ex Malbr.) A. Nordin et al. – 25, 36: on stone.

CLADONIA AMAUROCRAEA (Flörke) Schaer. – 30: on sandy soil.

CLADONIA ARBUSCULA (Wallr.) Flot. – 2, 46: on treated wood; 30: on sandy soil; 31, 55: on bare soil; 33, 34: on mossy stumps.

CLADONIA BACILLIFORMIS (Nyl.) Glück – 15, 24: on base of trunk of birch, 51; on base of trunk of pine; 49, 67: on treated wood.


CLADONIA CHLOROPHAEA (Flörke ex Sommerf.) Spreng. – 24, 50, 55, 57–59, 65: on base of trunks of birch, on dead wood, on soil, on base of old spruce. The specimens contain fumarproteocetraric acid.


CLADONIA CRISPATA (Ach.) Flot. – 18: on treated wood; 30, 54: on sandy soil.

CLADONIA CYANIPES (Sommerf.) Nyl. – 67: on dead wood.


CLADONIA FIMBRIATA (L.) Fr. – 17: on sandy soil; 24, 32-34: on base of trunk of trees.

CLADONIA FURCATA (Huds.) Schrad. – 31: on soil.

CLADONIA GRACILIS subsp. TURBINATA (Ach.) Ahti – 17: on sandy soil; 49, 58, 67: on soil, deadwood and stone with thin soil layer.

CLADONIA GRAYI G. Merr. ex Sandst. – 56: on soil. The specimen contains grayanic acid.

CLADONIA MACILENTA Hoffm. – 2, 18: on treated wood.

CLADONIA MITIS Sandst. – 18: on treated wood; 27, 32, 55, 64: on soil, deadwood and stone with thin soil layer.

CLADONIA OCHROCHLORA Flörke – 2: on treated wood; 49: on deadwood.

CLADONIA PHYLLOPHORA Hoffm. – 15, 27, 30, 55: on soil.

CLADONIA PLEUROTA (Flörke) Schaer. – 24, 33, 53: on base of trunk of trees.

CLADONIA PYXIDATA (L.) Hoffm. – 27, 30: on soil and on base of pine trunk.


CLADONIA REI Schaer. – 24: on base of trunk of birch.

CLADONIA STELLARIS (Opiz) Pouzar & Vězda – 2, 9, 13, 17–18, 27, 40, 67: on soil, deadwood and treated wood.

CLADONIA STYGIA (Fr.) Ruoss – 68: on sphagnum.


CLADONIA SULPHURINA (Michx.) Fr. – 2–20, 27, 41, 45: on bases of trees, deadwood and treated wood.

Cladonia verticillata (Hoffm.) Schäer. – 30, 55: on soil.

Cladostromum leprosum (Räsänen) Holien & Tønsberg – 20: on bark of spruce.


Dermatocarpon minutum (L.) W. Mann – 35: on stone.

Dibaeis baemycetes (L. f.) Rambold & Hertel – 30: on soil.

Diplochistes scruposus (Schreb.) Norman – 25: on mossy stone.

Evernia divaricata (L.) Ach. – 3: on branches of spruce. RA.


Evernia prunastri (L.) Ach. – 14, 29, 49: on bark of alder.

Felipes leucopellaeus (Ach.) Frisch & G. Thor – 42: on bark of old alder. This is a species reported only from Northern European part of Russia (Urbanavichus, 2010). Distribution in neighboring territories: the Republic of Karelia (Hermannson et al., 2002), Komi Republic (Hermannson et al., 1998), and Leningrad Region (Kuznetsova et al., 2007).

Fuscideps pusilla Tønsberg – 8: on bark of standing dead alder; 43: on bark of spruce. The specimens contain divaricatic acid.

Graphis scripta (L.) Ach. – 49: on bark of aspen.

Gyalecta fagicola (Hepp ex Arnold) Kremp. – 11, 14: on bark of aspen; 21: on bark of birch; 20: on bark of willow.

Gyalecta truncigena (Ach.) Hepp – 22: on bark of aspen.

Gyalolechia flavorubescens (Huds.) Seichting et al. – 28: on bark of aspen.

Hypocenomyce scalaris (Ach.) M. Choisy – 2, 9, 13, 15–18, 24, 27, 45–46: on bases of trees of different species, treated wood and burnt wood, bark of pine and birch.

Hypogymnia physodes (L.) Nyl. – 1–67: on trunks, branches, decaying wood of trees of different species, treated wood and stones.

Hypogymnia tubulosa (Schäer.) Hav. – 1–47, 49, 67: on trunks, branches, decaying wood of trees of different species, treated wood.

Hypogymnia vittata (Ach.) Parrique – 7: on bark of birch. RA(bs).

Icamadophila ericetorum (L.) Zahlbr. – 7, 44: on deadwood of old stamps.


Japevia tornoenensis (Nyl.) Tønsberg – 42: on branches of spruce.

Lecania cyrteula (Ach.) Th. Fr. – 29: on bark of rowan; 67: on bark of willow.

Lecania naegelii (Hepp) Diederich & van den Boom – 1: on bark of standing dead aspen; 29: on bark of rowan; 64, 67: on bark of willow.

Lecanora aiterna (Ach.) Hepp – 65: on fallen dead tree.

Lecanora albellula (Nyl.) Th. Fr. var. albellula–56: on bark of willow.

Lecanora allophana Nyl. – 1, 11, 20–21: on bark of aspen; 24, 29, 49, 54: on bark of aspen, rowan, birch.

Lecanora argentata (Ach.) Malme – 24: on bark of aspen; 49: on bark of bird-cherry tree.

Lecanora carpinea (L.) Vain. – 24: on bark of aspen; 49: on bark of bird-cherry tree.

Lecanora cateilea (Ach.) A. Massal. – 24: on bark of aspen; 52: on bark of old bird-cherry tree.

Lecanora cenisia Ach. – 25, 36: on stones.

Lecanora chlorotera Nyl. – 14, 24: on bark of aspen.

Lecanora circumboreal is Brodo & Vitik. – 15, 17: on treated wood.

Lecanora hypopta (Ach.) Vain. – 5: on snags of pine; 44: on bark of standing dead birch.

Lecanora intricata (Ach.) Ach. – 25: on stones.


Lecanora polytropa (Ehrh. ex Hoffm.) Rabenh. – 25, 36: on stones.
Lecanora populicola (DC.) Duby – 20: on bark of willow; 24, 41: on bark of aspen.


Lecanora symmicta (Ach.) Ach. – 2, 65: on treated wood; 20, 56: on bark of willow; 24, 33: on bark and branches of birch; 49: on bark of alder; 54: on bark of old aspen.

Lecanora umbrina (Ach.) A. Massal. – 18: on roofing paper. Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

Lecanora varia (Hoffm.) Ach. – 15, 18, 47: on treated wood.

Lecidea erythrophaea Flörke ex Sommerf. – 20, 24, 49, 63: on bark of aspen; 49: on bark of alder.

Lecidea leprarioides Tønsberg – 16: on bark of larch.


Lecidella elaeochroma (Ach.) M. Choisy – 1, 11, 14, 20–21, 24, 49: on bark of aspen.

Lecidella euphora (Flörke) Hertel – 24, 28: on bark and branches of aspen.

Lepra albescens (Huds.) Hafellner – 28: on bark of aspen.

Lepra amara (Ach.) Hafellner – 3, 8, 10–11, 14, 16, 20, 22, 41–43, 52, 63: on bark and wood of trees of different species.

Lepra opthalmiza (Nyl.) Hafellner – 8: on standing dead alder; 20: on bark of willow.

Leprazoria elobata Tønsberg – 8: on standing dead alder; 42: on mossy base of trunk of aspen tree. The specimens contain atranorin, zeorin and stictic acid complex.


Leprazoria incana (L.) Ach. – 28–29, 59: on bases of trees, on mosses and stones. The specimens contain divaricatic acid, atranorin and zeorin.

Leptogium saturninum (Dicks.) Nyl. – 4: on standing dead aspen; 11, 28, 49: on bark of aspen; 20: on bark of willow; 49: on bark of bird-cherry tree.

Lobaria pulmonaria (L.) Hoffm. – 4: on standing dead aspen; 8, 22: on bark of aspen; 20: on bark of willow; 37–39, 41–44: on bark of aspen and willow. RR, RA.

Loxospora elatina (Ach.) A. Massal. – 6, 8, 16, 20, 39, 41–44, 53: on bark and wood of trees of different species.

Megasporea verrucosa (Ach.) Hafellner & V. Wirth – 21: on bark of aspen. This is a common species reported from most regions of Russia (Urbanavichus, 2010). Previously known in Arkhangelsk Region only from its Arctic part (Lynge, 1928).

Melanelixia subaurifera (Nyl.) O. Blanco et al. – 24: on bark and branches of aspen and birch; 53: on bark of bird-cherry tree.

Melanohalea exasperata (De Not.) O. Blanco et al. – 13: on treated wood and on bark of birch. This is a boreal species reported from most regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), Komi Republic (Hermansson et al., 1998), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008). Species included in the Red Data Book of Murmansk Region (2014).

Melanohalea exasperatula (Nyl.) O. Blanco et al. – 29: on bark of rowan and willow.


Micarea elachista (Körb.) Coppins & R. Sant. – 25: on mossy stump.

Micarea melaina (Nyl.) Hedl. – 6: on bark of pine; 8–9: on burnt stumps; 34, 40: on bark of pine, spruce, deadwood and mosses.
**Microcalicum Ahlneri** Tibell – 12: on stump; 15: on treated wood.

**Microcalicum Arenarium** (Hampe ex A. Massal.) Tibell – 12: on soil on roots of fallen dead spruce.

**Microcalicum Disseminatum** (Ach.) Vain. – 12, 20: on bark of spruce; 16: on bark of larch; 43: on thalli of *Loxospora elatina* on bark of spruce.


**Mycobilimbia Epixanthoides** (Nyl.) Vitik. et al. – 20, 22, 41: on mossy base of trunk of aspen.

**Mycoblastus Affinis** (Schaer.) T. Schauer – 59: on bark of old birch.

**Mycoblastus Sanguinarius** (L.) Norman – 3–10, 12, 16, 20–21, 40, 44, 53: on bark of deciduous and coniferous trees and deadwood.

**Mycocalicum Subtile** (Pers.) Szatala – 13, 15, 49: on treated wood; 54: on bark of pines.

**Myrolecisc Crenulata** (Hook.) Śliwa et al. – 26: on concrete wall. This is a common species reported from most regions of Russia (Urbanavichus, 2010). Previously known in Arkhangelsk Region only from its Arctic part (Deichmann-Branth, 1885).

**Myrolecisc Dispersa** (Pers.) Śliwa et al. – 26: on concrete wall. This is a common species reported from most regions of Russia (Urbanavichus, 2010). Previously known in Arkhangelsk Region only from its Arctic part (Blytt, 1872; Lyngje, 1928).

**Myrolecisc Hagenii** (Ach.) Śliwa et al. – 46–47: on bark of aspen and treated wood.

**Myrolecisc Sambuci** (Pers.) Clem. – 53: on bark of willow.


**Nephroma Bellum** (Spreng.) Tuck. – 20: on bark of willow; 22, 28, 63: on bark of aspen.

**Nephroma Parile** (Ach.) Ach. – 1, 8, 28, 63: on bark of aspen.

**Nephroma resupinatum** (L.) Ach. – 11, 38, 43: on bark of aspen; 20: on bark of willow.

**Ochrolechia Alboflavescens** (Wulfen) Zahlbr. – 53: on bark of pine, juniper and fallen dead pine.


**Ochrolechia Microsclerides** Räsänen – 10, 12: on bark of spruce; 16: on bark of larch.

**Ochrolechia Pallescens** (L.) A. Massal. – 20: on bark of willow; 29: on bark of rowan, 63: on bark of aspen.

**Palicella Filamentosa** (Stirt.) Rodr. Flakus & Printzen – 5: on snag of pine.


**Peltigera Apithosa** (L.) Willd. – 8: on mosses; 32: on soil, bases of trees.

**Peltigera Canina** (L.) Willd. – 1, 17: on soil; 42–43: on bases of old trees.

**Peltigera Didactyla** (With.) J. R. Laundon – 17, 30, 56: on sandy soil.

!! **Peltigera Hyemenina** (Ach.) Delise – 2: on soil. This *suboceanic* species is reported from most regions of Russia (Urbanavichus et al., 2007). Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), Leningrad Region (Alexeeva, 2005), and Murmansk Region (Urbanavichus et al., 2008).


**Peltigera Membranacea** (Ach.) Nyl. – 56: on soil.

**Peltigera Neckeri** Hepp ex Müll. Arg. – 20: on bark of aspen and willow.

**Peltigera Neopolydactyla** (Gyeln.) Gyeln. – 8: on mosses.
Peltigera polydactylon (Neck.) Hoffm. – 33–34: on bark of aspen, mosses.

Peltigera praetextata (Flörke ex Sommerf.) Zopf – 20, 49, 63: on bark of aspen; 30: on sandy soil; 65: on decaying tree.

Peltigera rufescens (Weiss) Humb. – 30: on sandy soil.

Pertusaria carneopallida (Nyl.) Anzi ex Nyl. – 49: on bark of alder.

Pertusaria leioplaca DC. – 22: on bark of aspen; 64: on bark of willow.

Phaeophyscia ciliata (Hoffm.) Moberg – 24: on bark of aspen.

Phaeophyscia nigricans (Flörke) Moberg – 26: on concrete wall. This is a species reported from most regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), Komi Republic (Hermansson et al., 1998), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

Phaeophyscia orbicularis (Neck.) Moberg – 1: on bark of standing dead aspen; 26: on concrete wall. This is a boreal species reported from most regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), Komi Republic (Hermansson et al., 1998), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).

Phaeophyscia sciastra (Ach.) Moberg – 18: on treated wood and roofing paper; 25: on stones.

Phlyctis argena (Spreng.) Flot. – 1, 3–4, 6–8, 11–12, 14, 16, 20–22, 28–29, 37–38, 49, 63: on bark of aspen and willow; 52: on bark of bird-cherry tree.

Physcia adscendens H. Olivier – 1, 21, 24: on bark of aspen.

Physcia aipolia (Ehrh. ex Humb.) Fürnr. – 24, 28: on bark of aspen.

Physcia alnophila (Vain.) Loht. et al. – 29; on bark of rowan; 56: on bark of willow.

Physcia caesia (Hoffm.) Fürnr. – 1: on bark of aspen; 18: on roofing paper; 26: on concrete wall.

Physcia stellaris (L.) Nyl. – 1, 21, 24: on bark of aspen.

Physcia tenella (Scop.) DC. – 26: on concrete wall; 29: on bark of rowan.

Physconia distorta (With.) J. R. Launon – 24; on bark of old aspen.

!! Placynthiella dasaea (Stirt.) Tønsberg – 43: on soil on root of fallen dead spruce. This is a boreal species reported from most regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), Komi Republic (Hermansson et al., 1998), Leningrad Region (Kuznetsova et al., 2007), and Murmansk Region (Urbanavichus et al., 2008).


Polycauliona candelaria (L.) Frödén et al. – 13, 17: on treated wood; 23, 46: on bark of pine and treated wood.

Polycauliona polycarpa (Hoffm.) Frödén et al. – 23: on bark of pine.

Porpidia crustulata (Ach.) Hertel & Knoph – 35–36: on stones.


Porpidia tuberculosa (Sm.) Hertel & Knoph – 15: on stones.

Protoparmeliopsis muralis (Schreb.) M. Choisy – 25: on limestone.

Pseudevernia furfuracea (L.) Zopf – 5, 68: on branches of pine; 33, 44: on branches and trunks of pine, spruce, aspen. RA.

Pseudothelomma ocellatum (Körb.) M. Prieto & Wedin – 13, 17: on treated wood.

Psilolechia lucida (Ach.) M. Choisy – 43: on soil on roots of fallen dead spruce.

Pycnora sorophora (Vain.) Hafellner – 10: on bark of pine.
!! Pycnothelia papillaria (Ehrh.) Dufour – 17: on sandy soil; 30: on wood. This is a species reported from most regions of Russia (Urbanavichus, 2010). Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), and Leningrad Region (Brenner, 1886). Species included in the Red Data Books of Leningrad Region (2000) and the Republic of Karelia (2020).

!! Ramalina baltica Lettau – 21: on bark of willow. This is a species reported in Russia only from Northern part of European Russia (Urbanavichus, 2010). Previously known in Arkhangelsk Region only from Kozhzero Reserve (Fadeeva, 2006), but specimens have been redefined as Ramalina obtusata (by T. Ahti and V. Tarasova, in 2019). Distribution in neighboring territories: the Republic of Karelia (Fadeeva et al., 2007), and Leningrad Region (Kuznetsova et al., 2007).

Ramalina farinacea (L.) Ach. – 14, 37: on bark of aspen; 20: on bark of spruce and willow.

Ramalina pollinaria (Westr.) Ach. – 17: treated wood.

Ramalina sinensis Jatta – 11, 14, 24: on bark of aspen.

Rhizocarpon baiioatum (Flörke ex Spreng.) Th. Fr. – 25: on stone.

Rhizocarpon geographicum (L.) DC. – 25, 36: on stones.

Rhizocarpon grande (Flörke) Arnold – 25, 36: on stones.

Rhizocarpon hochstetteri (Körnb.) Vain. – 25: on stones.


Rinodina septentrionalis Malme – 29: on bark of rowan; 56, 67: on bark of willow; 63: on bark of aspen.

Rolalespora viridis (Tønsberg) Tønsberg – 49, 52: on trunk of bird-cherry tree. The specimens contain perlatolic acid.

Rostania occultata (Bagl.) Otálora et al. – 20: on bark of willow; 21: on bark of aspen. RA(bs).

+Sarea differmos (Fr.) Fr. – 44: on resin of spruce; 53: on bark of pines.

+Sarea resinae (Fr.: Fr.) Kuntze – 27, 53: on resin of pine; 60: on bark of larch.

Scoliciosporum chlorococcum (Graewe ex Stenh.) Vézda – 13: on branches of spruce; 15: on treated wood; 24: on bark of birch.

Scoliciosporum umbrinum (Ach.) Arnold – 58: on wood.

Scytinium teretiisculum (Wallr.) Otálora et al. – 4: on bark of standing dead aspen; 22: on bark of aspen.

+Stenocybe pullatula (Ach.) Stein – 8: on bark of standing dead alder; 49: on bark of alder.

Stereoaulon paschale (L.) Hoffm. – 27, 30: on soil.


Stereoaulon tomentosum Fr. – 27, 30, 33: on soil.

Strangospora moriformis (Ach.) Stein – 13, 17: on treated wood.

Tephromela atra (Huds.) Hafellner – 36: on stone.

Toensbergia leucococca (R. Sant.) Bendiksby & Timdal – 16: on branches of larch.

Toniniopsis subincompta (Nyl.) Kistenich et al. – 1, 41: on bark of aspen; 4: on bark of standing dead aspen; 20: on bark of willow.

Trapeliospis flexuosa (Fr.) Coppins & P. James – 2, 23: on treated wood.

Trapeliospis granulosa (Hoffm.) Lumbsch – 33: on wood of spruce.

Tuckermanniosis chlorophylla (Willd.) Hale – 1–67: on trunks, branches, decaying wood of different tree species and treated wood.

Usnea dasopoga (Ach.) Nyl. – 8, 12, 66: on branches of spruce; 16: on bark of larch; 20: on bark of willow and branches of spruce; 51: on bark of pine; 59: on bark of old birch.

Usnea glabrescens (Nyl. ex Vain.) Vain. ex Räsänen – 9: on bark of larch; 12, 48; on branches of spruce.


Usnea perplexans Stirt. – 20: on branches of spruce.

**ACKNOWLEDGEMENTS**

We would like to express our gratitude to the stuff of the Kenozersky National Park and Aleksey Kozykin for their help in organization of expedition to hard-to-reach areas. We are grateful to Elena Churakova, Viktor Juvanen and Matvei Juvanen for their assistance in the expedition work. The reported study was funded by RFBR (project number 20-04-00473). The work by Aleksey V. Pchelkin was carried out within the framework of the project “Lichenological survey of the territory of the Kenozersky National Park (Kargopol sector) and parts of the territory of the planned landscape reserve of regional significance “Lekshmokh”, justification for granting the status of protected area” (2018). We are grateful to reviewers for valuable corrections and recommendations, which have improved the quality of our work.

**REFERENCES**


### Appendix 1. Number of lichens and allied fungi in neighboring protected areas

<table>
<thead>
<tr>
<th>Protected area</th>
<th>Taiga subzone, region</th>
<th>Area, km²</th>
<th>Number of species</th>
<th>References</th>
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</thead>
<tbody>
<tr>
<td>Kivach Nature Reserve</td>
<td>middle boreal subzone, the Republic of Karelia</td>
<td>110</td>
<td>386</td>
<td>Hermansson et al., 2002; Tarasova &amp; Stepanchikova, 2016; Tarasova et al., 2017; Androsova et al., 2018</td>
</tr>
<tr>
<td>Lekshmokh Nature Reserve</td>
<td>middle boreal subzone, Arkhangelsk Region</td>
<td>250</td>
<td>96</td>
<td>Pchelkin, 2019</td>
</tr>
<tr>
<td>Paanajarvi-Oulanka National Park</td>
<td>northern boreal subzone, the Republic of Karelia, Finland</td>
<td>1045</td>
<td>443</td>
<td>Halonen, 1993</td>
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<tr>
<td>Pasvik Nature Reserve</td>
<td>northern boreal subzone, Murmansk Region</td>
<td>147</td>
<td>587</td>
<td>Urbanavichus &amp; Fadeeva, 2018</td>
</tr>
<tr>
<td>Pechoro-Ilych Nature Reserve</td>
<td>northern and middle boreal subzones, the Komi Republic</td>
<td>7213</td>
<td>866</td>
<td>Hermansson et al., 2006</td>
</tr>
<tr>
<td>Vodlozersky National Park</td>
<td>northern and middle boreal subzones, the Republic of Karelia, Arkhangelsk Region</td>
<td>4683</td>
<td>473</td>
<td>Tarasova et al., 2021</td>
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</tbody>
</table>
### Appendix 2. List of sampling plots

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<tr>
<th>No.</th>
<th>Locality</th>
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</thead>
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<td>1</td>
<td>Morshichinskaya village, near the church on the shore of Lekshmozero Lake</td>
</tr>
<tr>
<td>2</td>
<td>The Guzhevskaya Mill</td>
</tr>
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<td>3</td>
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<tr>
<td>4</td>
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<td>5</td>
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<tr>
<td>6</td>
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<tr>
<td>7</td>
<td>The route from the Guzhevskaya Mill to Bol’shoye Lebyazhiye Lake</td>
</tr>
<tr>
<td>8</td>
<td>--</td>
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<td>9</td>
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<td>11</td>
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<tr>
<td>12</td>
<td>--</td>
</tr>
<tr>
<td>13</td>
<td>Abandoned Guzhovo village</td>
</tr>
<tr>
<td>14</td>
<td>Near abandoned Guzhovo village</td>
</tr>
<tr>
<td>15</td>
<td>The church in Khizhgora</td>
</tr>
<tr>
<td>16</td>
<td>~0.8 km to the east from the Guzhevskaya Mill</td>
</tr>
<tr>
<td>17</td>
<td>Novoselovo village on the SE shore of Lekshmozero Lake</td>
</tr>
<tr>
<td>18</td>
<td>Kazarinovkaya village on the SE shore of Lekshmozero Lake</td>
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<tr>
<td>19</td>
<td>~2.5 km to the north from Novoselovo village</td>
</tr>
<tr>
<td>20</td>
<td>~3 km to the north from Novoselovo village</td>
</tr>
<tr>
<td>21</td>
<td>~2.5 km to the north from Novoselovo village</td>
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<tr>
<td>22</td>
<td>Southern shore of Lekshmozero Lake</td>
</tr>
<tr>
<td>23</td>
<td>Morshichinskaya village, near the pier and the visitor center</td>
</tr>
<tr>
<td>24</td>
<td>The edge of the forest near the west shore of Lekshmozero</td>
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<tr>
<td>25</td>
<td>West shore of Lekshmozero Lake</td>
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<td>26</td>
<td>North side of Morshichinskaya village</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coordinates</th>
<th>Community</th>
<th>Collector, identifier</th>
<th>Collection date</th>
</tr>
</thead>
<tbody>
<tr>
<td>63°45'58.9&quot;N, 38°03'02.6&quot;E</td>
<td>individual spruce and aspen trees</td>
<td>leg. &amp; det. VT</td>
<td>11 July 2011</td>
</tr>
<tr>
<td>63°49'29.3&quot;N, 37°56'20.5&quot;E</td>
<td>wooden buildings</td>
<td>leg. &amp; det. VT</td>
<td>11 July 2011</td>
</tr>
<tr>
<td>63°45'58.9&quot;N, 38°03'17.7&quot;E</td>
<td>individual pine trees</td>
<td>leg. &amp; det. AP</td>
<td>6 August 2018</td>
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<tr>
<td>63°45'59.4&quot;N, 38°03'32.7&quot;E</td>
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<tr>
<td>61°42'13.6&quot;N, 38°03'46.7&quot;E</td>
<td>individual boulders on the shore</td>
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<tr>
<td>61°46'29.7&quot;N, 38°02'33.4&quot;E</td>
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<td>leg. &amp; det. AP</td>
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<tr>
<td>61°49'29.3&quot;N, 37°56'20.5&quot;E</td>
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<td>leg. &amp; det. VT</td>
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<td>11 July 2011</td>
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<tr>
<td>61°49'29.1&quot;N, 37°56'12.9&quot;E</td>
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<td>61°49'11.0&quot;N, 37°56'20.3&quot;E</td>
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<td>61°43'52.8&quot;N, 38°08'52.4&quot;E</td>
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<td>herb-rich aspen forest</td>
<td>leg. &amp; det. VT</td>
<td>15 July 2011</td>
</tr>
<tr>
<td>No.</td>
<td>Locality</td>
<td>Coordinates</td>
<td>Community</td>
</tr>
<tr>
<td>-----</td>
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</tr>
<tr>
<td>27</td>
<td>Western slope near the road to Morshchinskaya village</td>
<td>61°44'54.0&quot;N 38°00'18.4&quot;E</td>
<td>bilberry lichen-feathermoss spruce-pine forest</td>
</tr>
<tr>
<td>28</td>
<td>The isthmus between Vilno Lake and Maselsko Lake</td>
<td>61°48'38.4&quot;N 38°03'39.2&quot;E</td>
<td>herb-rich aspen forest</td>
</tr>
<tr>
<td>29</td>
<td>Near the road from village of Maselga to Khizhgora</td>
<td>61°49'52.2&quot;N 38°01'22.8&quot;E</td>
<td>herb-rich spruce forest with birch and alder</td>
</tr>
<tr>
<td>30</td>
<td>Abandoned airfield -1 km to the south of Ilekinskaya village</td>
<td>61°41'20.4&quot;N 38°04'40.4&quot;E</td>
<td>moss and lichen cover on sandy soil</td>
</tr>
<tr>
<td>31</td>
<td>Southern shore of Lekshmozero Lake</td>
<td>61°40'45.0&quot;N 38°06'21.9&quot;E</td>
<td>bare soil</td>
</tr>
<tr>
<td>32</td>
<td>The trail from Morshchinskaya village to hay meadow</td>
<td>61°46'20.5&quot;N 38°04'27.2&quot;E</td>
<td>feathermoss-lichen pine forest with birch</td>
</tr>
<tr>
<td>33</td>
<td>The forest near the &quot;Trail of Anihulls&quot;</td>
<td>61°46'08.6&quot;N 38°04'02.2&quot;E</td>
<td>blueberry feathermoss birch-spruce-pine forest</td>
</tr>
<tr>
<td>34</td>
<td><em>.</em>._.</td>
<td>61°46'05.0&quot;N 38°03'26.1&quot;E</td>
<td>herb-rich pine forest with birch</td>
</tr>
<tr>
<td>35</td>
<td>The road along the route &quot;Ancestral Trail&quot;</td>
<td>61°46'35.0&quot;N 38°01'58.3&quot;E</td>
<td>isolated stones on the road</td>
</tr>
<tr>
<td>36</td>
<td>The Nikolin Stone</td>
<td>61°46'34.8&quot;N 38°01'48.6&quot;E</td>
<td>isolated big stone</td>
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<tr>
<td>37</td>
<td><em>.</em>._.</td>
<td>61°46'59.9&quot;N 38°00'33.4&quot;E</td>
<td>herb-rich aspen forest with birch and spruce</td>
</tr>
<tr>
<td>38</td>
<td><em>.</em>._.</td>
<td>61°47'04.7&quot;N 38°00'06.7&quot;E</td>
<td>herb-rich aspen forest with birch and spruce</td>
</tr>
<tr>
<td>39</td>
<td><em>.</em>._.</td>
<td>61°47'04.7&quot;N 37°59'20.3&quot;E</td>
<td>herb-rich aspen forest with birch and spruce</td>
</tr>
<tr>
<td>40</td>
<td><em>.</em>._.</td>
<td>61°47'10.2&quot;N 37°58'33.7&quot;E</td>
<td>herb-rich pine forest with birch and spruce</td>
</tr>
<tr>
<td>41</td>
<td>-1 km to the south from Ivshinskaya village</td>
<td>61°41'13.3&quot;N 38°11'25.1&quot;E</td>
<td>herb-rich aspen forest with birch and spruce</td>
</tr>
<tr>
<td>42</td>
<td>-1,5 km to the south from Ivshinskaya village</td>
<td>61°41'06.9&quot;N 38°12'17.8&quot;E</td>
<td>herb-rich aspen forest with birch and spruce</td>
</tr>
<tr>
<td>43</td>
<td>-2 km to the south-east from Ivshinskaya village</td>
<td>61°40'56.9&quot;N 38°12'47.5&quot;E</td>
<td>herb-rich aspen forest with birch and spruce</td>
</tr>
<tr>
<td>44</td>
<td>6 km to the south-east from Ivshinskaya village</td>
<td>61°40'50.0&quot;N 38°13'58.4&quot;E</td>
<td>swampy spruce forest with birch</td>
</tr>
<tr>
<td>45</td>
<td>Near Ivshinskaya village</td>
<td>61°41'37.3&quot;N 38°10'41.9&quot;E</td>
<td>wood of standing dead birch</td>
</tr>
<tr>
<td>46</td>
<td>Old barns on the shore of Lekshmozero Lake</td>
<td>61°45'57.2&quot;N 38°03'06.8&quot;E</td>
<td>on treated wood</td>
</tr>
<tr>
<td>47</td>
<td>The roof of abandoned house in Ivshinskaya village</td>
<td>61°41'40.0&quot;N 38°10'31.4&quot;E</td>
<td>on treated wood</td>
</tr>
<tr>
<td>48</td>
<td>The road from the Porzhensky churchyard to Vidyagino village</td>
<td>61°56'43.7&quot;N 38°07'32.7&quot;E</td>
<td>bilberry feathermoss aspen-pine-spruce forest</td>
</tr>
<tr>
<td>49</td>
<td>Hilly plain between Maloe Porzhensky Lake and Saremoh mire</td>
<td>61°54'8.53&quot;N 38°08'11.81&quot;E</td>
<td>bilberry feathermoss spruce-birch-aspen forest</td>
</tr>
<tr>
<td>50</td>
<td>Near the Saremoh mire</td>
<td>61°53'44.8&quot;N 38°09'12.40&quot;E</td>
<td>bilberry feathermoss birch-aspen forest</td>
</tr>
<tr>
<td>51</td>
<td>The Saremoh mire</td>
<td>61°53'33.13&quot;N 38°09'17.89&quot;E</td>
<td>padutified peatmoss pine forest</td>
</tr>
<tr>
<td>52</td>
<td>Floodplain of the Vilenka River</td>
<td>61°53'25.50&quot;N 38°06'41.7&quot;E</td>
<td>herb-rich willow-bird-cherry forest</td>
</tr>
<tr>
<td>53</td>
<td>Surroundings of Zheldozo Lake</td>
<td>61°53'22.32&quot;N 37°56'32.24&quot;E</td>
<td>cowberry feathermoss pine forest</td>
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<tr>
<td>No.</td>
<td>Locality</td>
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</tr>
<tr>
<td>54</td>
<td>The slope to the shore of Novgozero Lake</td>
<td>61°53'6.27&quot;N, 37°59'6.49&quot;E</td>
<td>herb-rich aspen-spruce forest</td>
</tr>
<tr>
<td>55</td>
<td>Steep slope to Maselgskoe Lake</td>
<td>61°49'50.72&quot;N, 37°59'6.49&quot;E</td>
<td>heathery feather moss-lichen pine forest</td>
</tr>
<tr>
<td>56</td>
<td>The foot of a large ridge near Khizhgora</td>
<td>61°49'51.03&quot;N, 38°0'27.82&quot;E</td>
<td>bare sandy soil</td>
</tr>
<tr>
<td>57</td>
<td>The bank of the Cholma River</td>
<td>61°39'54.10&quot;N, 38°11'26.67&quot;E</td>
<td>bilberry feather moss pine forest</td>
</tr>
<tr>
<td>58</td>
<td>The bridge over the Cholma River</td>
<td>61°40'14.30&quot;N, 38°11'8.79&quot;E</td>
<td>sedge thickets</td>
</tr>
<tr>
<td>59</td>
<td>Western shore of Naglimozero Lake</td>
<td>61°46'15.73&quot;N, 38°11'8.79&quot;E</td>
<td>bilberry feather moss aspen-spruce forest</td>
</tr>
<tr>
<td>60</td>
<td>Monastyrsky Island</td>
<td>61°46'38.30&quot;N, 37°57'0.44&quot;E</td>
<td>bilberry feather moss aspen-spruce-larch forest</td>
</tr>
<tr>
<td>61</td>
<td>Creek valley near Naglimozero Lake</td>
<td>61°46'13.59&quot;N, 37°55'36.93&quot;E</td>
<td>paludified herb-rich aspen forest</td>
</tr>
<tr>
<td>62</td>
<td>West bank of Naglimozero Lake</td>
<td>61°46'15.36&quot;N, 37°55'40.87&quot;E</td>
<td>bilberry feather moss spruce-pine forest</td>
</tr>
<tr>
<td>63</td>
<td>Naglimozero Lake shore</td>
<td>61°46'18.49&quot;N, 37°55'41.86&quot;E</td>
<td>herb-rich aspen-spruce forest</td>
</tr>
<tr>
<td>64</td>
<td>Creek valley near Naglimozero Lake</td>
<td>61°46'12.98&quot;N, 37°55'40.88&quot;E</td>
<td>paludified herb-rich willow forest</td>
</tr>
<tr>
<td>65</td>
<td>Kaskozero Lake shore</td>
<td>61°40'44.51&quot;N, 38°2'42.31&quot;E</td>
<td>paludified floodplain herb-rich birch-spruce forest</td>
</tr>
<tr>
<td>66</td>
<td>The Kulgom brook</td>
<td>61°49'28.66&quot;N, 37°56'20.96&quot;E</td>
<td>paludified floodplain herb-rich willow-birch forest</td>
</tr>
<tr>
<td>67</td>
<td>Near the Water Mill</td>
<td>61°49'27.46&quot;N, 37°56'25.63&quot;E</td>
<td>tourist parking area</td>
</tr>
<tr>
<td>68</td>
<td>Near the Lekshmokh nature reserve</td>
<td>61°48'49.4&quot;N, 38°14'01.7&quot;E</td>
<td>paludified peat moss pine forest</td>
</tr>
</tbody>
</table>

Notes. The names of the collectors are abbreviated as follows: AP – Alexey Pchelkin, AV – Andrei Valekzhanin, VT – Viktoria Tarasova.