

LIVERWORTS OF GLACIAL RELICT LAKES AND THEIR VICINITIES
IN THE KOMI REPUBLIC

ПЕЧЕНОЧНИКИ РЕЛИКТОВЫХ ОЗЕР И ИХ ОКРЕСТНОСТЕЙ
В РЕСПУБЛИКЕ КОМИ

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Abstract

The annotated list of liverworts from glacial relict lakes and their vicinities in the Komi Republic includes 81 species, two varieties, and one subspecies. Each species is provided with information on habitats, substrate, reproductive structures and associated species. The data of perennial studies have been summarized. *Fossombronia foveolata* has been found for the territory of the Komi Republic for the first time. Six rare species of liverworts included in the Red Data Book of the Komi Republic are reported (*Cephalozia macounii*, *Harpanthus scutatus*, *Kurzia pauciflora*, *Lophozia ascendens*, *Odontoschisma denudatum*, *Heterogemma laxa*). The distribution and ecology data of five taxa being understudied in the region (*Odontoschisma elongatum*, *Scapania apiculata*, *S. praetervisata*, *S. umbrosa*, *Tritomaria exsecta*) are given.

Резюме

Приводится аннотированный список печеночников реликтовых озер и их окрестностей в Республике Коми, включающий 81 вид, один из которых представлен двумя подвидами, и две разновидности. В списке для каждого вида указаны местообитания, субстрат, наличие органов размножения и сопутствующие виды. Обобщены данные, полученные в результате многолетних исследований. Сообщается о находке нового для Республики Коми вида печеночников – *Fossombronia foveolata*. Отмечаются местонахождения шести редких видов, включенных в Красную книгу Республики Коми: *Cephalozia macounii*, *Harpanthus scutatus*, *Kurzia pauciflora*, *Lophozia ascendens*, *Odontoschisma denudatum*, *Heterogemma laxa*. Приводятся данные по экологии и распространению пяти малоизвестных в регионе таксонов: *Odontoschisma elongatum*, *Scapania apiculata*, *S. praetervisata*, *S. umbrosa*, *Tritomaria exsecta*.

KEYWORDS: liverworts, flora, rare species, glacial relict lakes, Komi Republic.

INTRODUCTION

Glacial relict lakes are remnants of ancient spacious periglacial water-bodies. The biggest glacial relict lakes on the territory of the Komi Republic are four lakes (the Yamozero Lake, the Sindorskoe Lake, the Donty Lake, and the lake group of the Big Kadam) situated along the Timan Range, the north-eastern part of the East-European Plain (Table 1).

The Yamozero Lake is located in the low part of the Timan Range between the Chetlasskii and the Chaitsynskii Rocks (65°01'N; 50°14'E; ca. 212 m a.s.l.). It was formed as a result of filling up by water of a deep cup-shaped hollow at retreat of the Mid-Pleistocene glacier. The lake is surrounded by spacious low-level and transitional wetlands. There are wet spruce, spruce-birch, and seldom pine forest areas with *Sphagnum* and grass-sphagnum vegetation.

The Sindor Lake (the Sindorskoe) occupies the watershed of the Vym River and the Vishera River basins

being tributaries of the Vycheгда River (62°45'N; 51°57'E; ca. 132 m a.s.l.). It was formed by impounded waters of the Mid-Pleistocene glacier. Vegetation cover around the lake is dominated by wet *Polytrichum* and *Sphagnum* spruce and mixed forests, as well as upper *Sphagnum* bogs.

The Donty (Donskoe) Lake and the Kadam Lakes (the Big Kadam, the Middle Kadam, and the Small Kadam) are located at the north-western margin of the Vycheгда River valley (61°34'N; 54°00'E; ca. 105 m a.s.l.). They are glacial relicts of a spacious near-glacial water-body resulted from impounding of the Vycheгда River waters at the Mid-Pleistocene ice time. The vast low area around the lakes is mesotrophic to oligotrophic *Sphagnum* bogs covered with trees, dwarf shrubs. The neighboring sandy ranges are *Pleurozium-Hylocomium* and *Polytrichum* and *Sphagnum* pine forests.

All the lakes apart from the Yamozero Lake belong to the area with moderate-continental climate, the At-

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Fig. 1. The main collection sites around the glacial relict lakes of the Komi Republic: 1. Yamozero Lake; 2. Sindor Lake; 3. Donty Lake; 4. Kadam Lakes.

lantic-continental forest climatic region, the north-eastern sub-region. According to the botanical-geographical zone division of the European part of Russia, the above units are situated in the North-European taiga province within the Eurasian taiga area. By the regional geobotanical zone division, they belong to the middle taiga subzone. The Yamozero Lake belongs to the Atlantic-Arctic forest climatic region, the eastern sub-region; the north taiga subzone (Teteryuk, 2012).

MATERIALS AND METHODS

Field work was conducted in 1999 (Donty Lake, 34 localities / 212 specimens), 2000 (Sindor Lake, 15 / 538, Kadam Lakes – 9 / 98, Donty Lake – 4 / 41). Two specimens collected by B.Yu. Teteryuk in 2006 at the Yamozero Lake and in 2008 at the Sindor Lake were also identified. Totally 890 specimens from 64 floristic descriptions were studied. Collections were done along lake shores and their vicinities, at 2-5 km from lakes, covering all habitat types.

SPECIES LIST

Species in the list are annotated by the presence of reproductive structures (gem. – gemmae; per. – perianthia or pseudoperianthia; andr. – androecia; gyn. – gynoecia;

spor. – sporophytes; fem. re. – female receptacle; m. re. – male receptacle), collection points (numbers follow Fig. 1), habitat, substrate, and accompanying species. The label is given fully for the new-found liverwort and for the species collected at the Yamozero Lake as every species of this difficult accessible region has only one specimen. Taxa included in the Red Data Book of the Komi Republic (2009) are marked by * and new species for the region are marked by **. The nomenclature of liverworts follows Konstantinova, Bakalin et al. (2009). All the collections are deposited in SYKO.

Aneura pinguis (L.) Dumort. (andr., per., spor.) – 3: On slightly matted soil of steep loamy road slope and in sandpit. In pure patches and with *Cephaloziella rubella*, *Marchantia polymorpha* subsp. *ruderalis*.

Barbilophozia barbata (Schmidel ex Shreb.) Loeske – 2, 3, 4: On butts of trees (*Betula*), on decaying wood in wineberry-grass birch forest. On butts of trees (*Betula*) and on fine grained soil of turned out wood roots in cowberry-grass mixed forest. On sandy soil along bank of the Donty Lake. On the road edge soil and at the base of buildings in the Don Village. In pure patches and with *Barbilophozia hatcheri*, *Blepharostoma trichophyllum*, *Calypogeia neesiana*, *Lepidozia reptans*, *Lophozia silvicola*, *Lophozia longidens*, *Ptilidium pulcherrimum*.

B. hatcheri (A.Evans) Loeske (gem., per.) – 2, 3, 4: On butts of trees (*Betula*, *Pinus*, *Picea*), on decaying wood, on fine grained soil of turned out wood roots and on trails in herbal-*Sphagnum*, *Menyanthes-Sphagnum*, large herb, shrublet-grass mixed forests. On slightly matted sandy soil along bank of the Donty Lake and in waterside cowberry-greenmoss pine forest. On butts of trees (*Picea*) in *Oxalis*-grass spruce-abies forest. In pure patches and with *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *C. lunulifolia*, *Chiloscyphus polyanthos*, *Lepidozia reptans*, *Lophozia ventricosa* s.l., *Scapania irrigua*, *Plagiochila porelloides* and 5 other species.

B. lycopodioides (Wallr.) Loeske (per.) – 3: On butts of trees (*Sorbus*) in fern-grass spruce forest and on soil in *Oxalis*-grass spruce-abies forest. In pure patches.

Blasia pusilla L. (gem.) – 2, 4: On slightly matted soil of railroad slope. On soil in hollows, on decaying wood, on trails soil in herbal-*Sphagnum* birch forest. On trails soil in cowberry-grass mixed forest. In pure patches and with *Calypogeia integrastipula*, *Cephalozia bicuspidata*, *Marchantia polymorpha* subsp. *ruderalis*, *P. neesiana*, *Scapania curta*, *Scapania irrigua* and 4 other species.

Blepharostoma trichophyllum (L.) Dumort. (per., spor.) – 2, 3, 4: On decaying wood, on butts of trees (*Betula*, *Pinus*, *Picea*), on soil, on fine grained soil of turned out wood roots in grass, herbal-*Sphagnum*, *Menyanthes-Sphagnum*, large herb, sphagnous and shrublet-greenmoss mixed, pine and birch forests. On soil, on decaying wood along bank of the Sindor

Table 1. The main parametric data of glacial relict lakes.

Lakes	Yamozero Lake	Sindor Lake	Donty Lake	B. Kadam Lake	M. Kadam Lake	S. Kadam Lake
Length, km	6.5	12.0	18.0	3.0	0.7	0.3
Width, km	6.2	3.0	0.2	2.5	0.9	0.2
Water area, km ²	31.0	28.4	4.6	3.5	0.5	0,05
Prevailing depths, m	1.0-1.2	1.0-1.5	1.2-1.5	1.0-1.5	1.0-1.5	1.0-1.5

- Lake and on slightly matted soil along bank of the Ugum River. On decaying wood, on butts of trees (*Betula*, *Picea*, *Sorbus*) in fen-grass spruce forest. On butts of trees (*Pinus*) on oligotrophic sphagnum mire afforested by low birch and dwarf birch. In pure patches and with *C. lunulifolia*, *Calypogeia integristipula*, *Lepidozia reptans*, *Lophocolea heterophylla*, *L. ventricosa* s.l., *Lophozia longidens*, *Ptilidium pulcherrimum* and 30 other species.
- Calypogeia* cf. *azurea* Stotler & Crotz (gem.) – 2: On fine grained soil of turned out wood roots in blueberry-greenmoss pine forest and on decaying wood in wineberry-grass birch forest. With *Cephalozia bicuspidata*, *Calypogeia integristipula*, *C. muelleriana*, *L. silvicola*. Unfortunately the specimens were studied in the laboratory after being dried. Oil-bodies in living plants were not observed.
- C. integristipula* Steph. (gem.) – 2, 4: On decaying wood, on butts of trees (*Betula*, *Pinus*, *Picea*), on soil, on fine grained soil of turned out wood roots in herbal-*Sphagnum*, *Menyanthes-Sphagnum*, large herb, greenmoss, grass and sphagnum mixed, pine and birch forests. On trails soil on the edge of bog whortleberry-cloudberry-*Sphagnum* mire afforested by low pine. On soil and on decaying wood along banks of the channel between the Podkadam'e and the B. Kadam Lakes. In pure patches and with *Cephalozia bicuspidata*, *C. lunulifolia*, *Gymnocolea inflata*, *Lophocolea heterophylla*, *L. ventricosa* s.l., *Ptilidium pulcherrimum*, *Scapania irrigua* and 17 other species.
- C. muelleriana* (Schiffn.) Müll.Frib. (gem., andr.) – 2, 3, 4: On decaying wood, on sites with disturbed vegetation, on soil along the forest roads, on fine grained soil of turned out wood roots in sphagnum, greenmoss, grass, shrublet-grass, large herb, grass-*Sphagnum*, *Menyanthes-Sphagnum* birch, pine mixed forests. On soil along roads at early stages successions. On decaying wood, on butts of trees (*Betula*, *Pinus*), on soil in windthrow hollows and on trails on the edges of mesooligotrophic *Oxycoccus-Sphagnum* mires afforested by low birch and dwarf birch. On decaying wood and soil along banks of the channel between the Podkadam'e and the B. Kadam Lakes. In pure patches and with *Blepharostoma trichophyllum*, *Cephalozia lunulifolia*, *Lepidozia reptans*, *Lophocolea heterophylla*, *L. ventricosa* s.l., *Mylia anomala*, *Riccardia latifrons* and 26 other species.
- C. neesiana* (C.Massal. & Carestia) Müll.Frib. (gem.) – 2, 4: On decaying wood in boggy shrublet-*Eriophorum-Sphagnum* pine forest and on butts of tree (*Picea*) in herbal-*Sphagnum* birch forest. On fine grained soil of turned out wood roots in waterside cowberry-grass mixed forest. With *Blepharostoma trichophyllum*, *Calypogeia muelleriana*, *Cephalozia lunulifolia*, *Geocalyx graveolens*, *Lepidozia reptans*, *Schljakovia kunzeana*, *Plagiochila porelloides* and 3 other species.
- C. sphagnicola* (Arnell & J.Perss.) Warnst. & Loeske (gem.) – 2, 3, 4: On soil among *Sphagnum*, on decaying wood and on sites with disturbed vegetation in boggy sphagnum pine forests. On sphagnum tussocks and in hollows, on trails soil, on decaying wood at oligotrophic shrublet-*Sphagnum* mires and on the edges of such mires afforested by low birch, pine and dwarf birch. In pure patches and with *Cephalozia connivens*, *C. loitlesbergeri*, *C. lunulifolia*, *C. spinigera*, *Cladopodiella fluitans*, *Heterogemma laxa*, *Mylia anomala* and 7 other species.
- C. suecica* (Arnell & J.Perss.) Müll.Frib. (gem.) – 2: On decaying wood in grass-*Sphagnum* and *Menyanthes-Comarum-Sphagnum* mixed forests. On decaying wood в *Ledum*-bog whortleberry-*Sphagnum* pine forest. With *Blepharostoma trichophyllum*, *Cephalozia lunulifolia*, *Lepidozia reptans*, *Crossocalyx hellerianus*, *Lophozia guttulata*, *Riccardia latifrons*, *Scapania mucronata* and 6 other species.
- Cephalozia bicuspidata* (L.) Dumort. (andr., per., spor.) – 2, 3, 4: On decaying wood, on butts of trees (*Betula*, *Picea*), on fine grained soil of turned out wood roots, on slightly matted soil, on trails soil in herbal-*Sphagnum*, *Menyanthes-Sphagnum*, sphagnum, greenmoss, shrublet-greenmoss, grass, large herb mixed, pine, birch forests. On slightly matted soil of forest roads. On soil, on decaying wood on the banks of lakes and rivers. On butts of trees (*Pinus*) and on soil on trails at the edges of sphagnum mires. In pure patches and with *Blasia pusilla*, *Calypogeia integristipula*, *Gymnocolea inflata*, *L. ventricosa* s.l., *Nardia geoscyphus*, *Scapania irrigua*, *S. curta* and 24 other species.
- C. connivens* (Dicks.) Lindb. (per., spor.) – 2: On decaying wood, on sites with disturbed vegetation in boggy sphagnum pine forests. On decaying wood in herbal-*Sphagnum* birch forest. With *Calypogeia integristipula*, *C. muelleriana*, *C. sphagnicola*, *Mylia anomala*.
- C. leucantha* Spruce (per.) – 2, 4: On decaying wood, on butts of trees (*Betula*, *Picea*), on soil in grass-*Sphagnum* mixed forest and on trails soil on the edge of oligotrophic *Chamaedaphne-Oxycoccus-Sphagnum* mire. With *Blepharostoma trichophyllum*, *Calypogeia integristipula*, *Cephalozia bicuspidata*, *Geocalyx graveolens*, *Lophozia ventricosa* var. *longiflora*, *Mylia anomala*, *Odontoschisma denudatum* and 3 other species.
- C. loitlesbergeri* Schiffn. (per., spor.) – 2, 3, 4: on *Sphagnum* hummocks and in hollows between *Sphagnum*, on trails, on decaying wood on the edges of shrublet-*Sphagnum* mires afforested by low birch, pine and dwarf birch. On decaying wood and on sites with disturbed vegetation in boggy shrublet-*Eriophorum-Sphagnum* pine forest. With *Calypogeia integristipula*, *C. sphagnicola*, *Cephalozia pleniceps*, *Cephalozia spinigera*, *Heterogemma laxa*, *Mylia anomala*, *Odontoschisma denudatum*.
- C. lunulifolia* (Dumort.) Dumort. (andr., per., spor.) – 2, 3, 4: On decaying wood, on butts of trees (*Betula*, *Pinus*, *Picea*), on slightly matted soil along the forest roads, on fine grained soil of turned out wood roots, along the forest roads in herbal-*Sphagnum*, *Menyanthes-Sphagnum*, large herb, grass, shrublet-grass, shrublet-greenmoss mixed, pine and birch forests. On decaying wood, on butts of trees (*Pinus*), in hollows between *Sphagnum*, on trails soil on the edges of shrublet-*Sphagnum* mires afforested by low birch and dwarf birch. On decaying wood in fern-grass spruce forest. On soil along bank of the Sindor Lake. In pure patches and with *Blepharostoma trichophyllum*, *Calypogeia* spp., *Lophocolea heterophylla*, *L. ventricosa* s.l., *Riccardia latifrons*, *Ptilidium pulcherrimum*, *Schistochilopsis incisa* and 28 other species.
- **C. macounii* (Austin) Austin (andr.) – 2: On decaying wood in boggy shrublet-*Eriophorum-Sphagnum* pine forest. With *Calypogeia neesiana*, *C. muelleriana*, *Cephalozia lunulifolia*, *Mylia anomala*.
- C. pleniceps* (Austin) Lindb. (andr., per., spor.) – 2, 3, 4: On decaying wood, on slightly matted soil, on trails in boggy herbal-*Sphagnum*, *Menyanthes-Sphagnum*, shrublet-grass, grass and large herb mixed, pine, birch forests. On decaying wood, on butts of trees (*Pinus*), in hollows between *Sphagnum*, on the edges of shrublet-*Sphagnum* mires afforested by low birch, pine and dwarf birch. In pure patches and with *Blepharosto-*

- ma trichophyllum*, *Calypogeia* spp., *Lepidozia reptans*, *Lophocolea* spp., *Lophozia silvicola*, *Plagiochila porelloides*, *Riccardia latifrons* and 20 other species.
- Cephaloziella divaricata* (Sm.) Schiffn. – 4: On trail soil in waterside cowberry-grass and on decaying wood in run-off hollow in herbal-*Sphagnum* mixed forests. On slightly matted soil in windthrow hollows and on trail on the edge of oligotrophic *Chamaedaphne-Oxycoccus-Sphagnum* mire. In pure patches and with *Blasia pusilla*, *Calypogeia muelleriana*, *Crossogyna autumnalis*, *Lophocolea minor*, *Lophozia silvicola*, *Mylia anomala*, *Scapania* spp. and 5 other species.
- C. hampeana* (Nees) Schiffn. – 2: On soil in sedge along bank of the Ugum River. With *Schljakovia kunzeana*, *Scapania irrigua*.
- C. rubella* (Nees) Warnst. (gem., andr., per., spor.) – 2, 3: On decaying wood, on tree waste, on fine grained soil of turned out wood roots, slightly matted soil, trail soil in forests communities with soil surface covered with dead wood leaves, grass, herbal-*Sphagnum*, *Menyanthes-Sphagnum*, shrublet-greenmoss, large herb mixed, birch, pine forests. On decaying wood, on butts of trees (*Pinus*) on the edges of shrublet-*Sphagnum* mires afforested by low birch, pine and dwarf birch. On slightly matted soil of forest roads and sandpits. On soil along bank of the Sindor Lake, on wooden beams at the base of the bridge over the Ugum River. In pure patches and with *Cephalozia pleniceps*, *Isopaches bicrenatus*, *Lophozia silvicola*, *Lophozopsis excisa*, *Nardia geoscyphus*, *Ptilidium pulcherrimum*, *Scapania* spp. and 14 other species.
- C. spinigera* (Lindb.) Warnst. (per., spor.) – 2, 3: On sites with disturbed vegetation in boggy shrublet-*Eriophorum-Sphagnum* pine forest and on decaying wood on the edge of mesooligotrophic *Oxycoccus-Sphagnum* mire afforested by low birch and dwarf birch. With *Calypogeia muelleriana*, *C. sphagnicola*, *Cephalozia lunulifolia*, *C. loitlesbergeri*, *Gymnocolea inflata*, *Heterogemma laxa*, *Mylia anomala*.
- Chiloscyphus pallescens* (Ehrh. ex Hoffm.) Dumort. (andr., per., spor.) – 2, 3: On soil in hollows, on butts of trees (*Salix*, *Alnus*), On decaying wood in wet forests communities with soil surface covered with dead wood leaves, grass, grass-greenmoss, *Menyanthes-Sphagnum*, herbal-*Menyanthes* birch forests. On decaying wood and soil in large herb and *Menyanthes-Sphagnum* mixed forests. On decaying wood, on butts of trees (*Salix*) in large herb and grass willow-tree communities. On decaying wood and soil in waterside boggy grass willow-birch communities. On butts of trees (*Betula*), in hollows, on soil on sphagnous mire afforested by low birch and dwarf birch. In pure patches and with *Pellia epiphylla*, *P. neesiana*, *Scapania mucronata*, *S. irrigua*, *Schljakovia kunzeana*.
- C. pallescens* var. *fragilis* (A.Roth) Müll.Frib. – 3: On butts of trees (*Salix*) in waterside *Equisetum*-large-herb willow-tree community and in boggy *Carex-Menyanthes* birch forest with willow-shrub. In pure patches.
- C. polyanthos* (L.) Corda (andr., per.) – 2, 3, 4: On decaying wood, on butts of trees (*Alnus*, *Betula*, *Picea*, *Salix*), on soil, on fine grained soil of turned out wood roots in herbal-*Sphagnum*, herbal-*Menyanthes*, *Menyanthes-Sphagnum*, in grass, large herb, shrublet-grass mixed, pine, birch forests. On butts of trees (*Betula*, *Salix*), on wet soil in grass willow communities. On decaying wood, on butts of trees (*Betula*, *Salix*) and soil in waterside boggy grass willow-birch communities. On butts of trees (*Pinus*), on soil in hollows on sphagnous mire afforested by low birch and dwarf birch. In pure patches and with *Blepharostoma trichophyllum*, *Cephalozia pleniceps*, *Lophocolea* spp., *Marchantia polymorpha* subsp. *ruderalis*, *Pellia* spp., *Plagiochila porelloides*, *Scapania* spp. and 6 other species.
- Cladopodiella fluitans* (Nees) H. Buch – 2, 3: On sites with disturbed vegetation in boggy shrublet-*Eriophorum-Sphagnum* pine forest and on soil in hollows on the edge of mesooligotrophic *Oxycoccus-Sphagnum* mire afforested by low birch and dwarf birch. With *Calypogeia sphagnicola*, *Cephalozia lunulifolia*, *C. pleniceps*, *Gymnocolea inflata*, *Heterogemma laxa*, *Mylia anomala*.
- Crossocalyx hellerianus* (Nees ex Lindenb.) Meyl. (gem., andr., per., spor.) – 2, 3, 4: On decaying wood in boggy herbal-*Sphagnum*, sphagnous, large herb and shrublet-grass mixed and pine forests. On decaying wood in herbal-*Sphagnum* birch forest and fen-grass spruce forest. With *Blepharostoma trichophyllum*, *Cephalozia* spp., *Lepidozia reptans*, *Lophocolea heterophylla*, *Lophozia* spp., *Ptilidium pulcherrimum*, *Scapania* spp. and 10 other species.
- Crossogyna autumnalis* (DC.) Schljakov (per.) – 4: On decaying wood in run-off hollow in mixed birch-pine herbal-*Sphagnum* forest and along banks of the channel between the Podkadam'e and the B. Kadam Lakes. In pure patches and with *Cephaloziella divaricata*, *Crossocalyx hellerianus*, *Lophozia silvicola*, *Ptilidium pulcherrimum*, *Scapania* spp., *Schljakovia kunzeana*, *Tritomaria* spp.
- Geocalyx graveolens* (Schrad.) Nees – 2, 3: On decaying wood, on butts of trees (*Betula*, *Picea*) in large herb, herbal-*Sphagnum*, sphagnous mixed, pine, birch forests. On butts of trees (*Pinus*) on sphagnous mire afforested by low birch and dwarf birch. On soil along bank of the Sindor Lake. In pure patches and with *Blepharostoma trichophyllum*, *Calypogeia integris-tipula*, *Cephalozia* spp., *Lophocolea* spp., *L. ventricosa* s.l., *Schljakovia kunzeana*, *Scapania mucronata* and 12 other species.
- Gymnocolea inflata* (Huds.) Dumort. (andr., per.) – 2, 3, 4: On soil among *Sphagnum*, on sites with disturbed vegetation, on butts of trees (*Betula*, *Pinus*), on decaying wood in grass, sphagnous, herbal-*Sphagnum*, pine, mixed, birch forests. On wet soil of forest roads. On decaying wood and soil along boggy banks of rivers and lakes. In pure patches and with *Calypogeia* spp., *Cephalozia* spp., *Lophozia* spp., *Mylia anomala*, *Nardia geoscyphus*, *Pellia* spp., *Scapania irrigua* and 12 other species.
- Harpanthus flotovianus* (Nees) Nees – 2: On decaying wood in herbal-*Sphagnum* mixed and birch forests. In pure patches and with *Blepharostoma trichophyllum*, *Cephalozia lunulifolia*, *Liochlaena lanceolata*, *L. ventricosa* s.l., *Riccardia latifrons*.
- **H. scutatus* (F. Weber & D. Mohr) Spruce (gem.) – 2: On decaying wood in boggy large herb mixed forest and on fine grained soil of turned out wood roots in *Menyanthes-Comarum-Sphagnum* mixed forest. In pure patches and with *Plagiochila porelloides*.
- **Heterogemma laxa* (Jørg.) Konstant. & Vilnet (gyn.) – 2, 3, 4: On sites with disturbed vegetation in boggy shrublet-*Eriophorum-Sphagnum* pine forest. On decaying wood and in hollows at the edge of mesooligotrophic *Oxycoccus-Sphagnum* mire afforested by low birch and dwarf birch. On sphagnous tussocks and in hollows at the edge of bog whortleberry-cloudberry-*Sphagnum* mire afforested by low pine. With *Calypogeia muelleriana*, *C. sphagnicola*, *Cephalozia lunulifolia*, *C. loitlesbergeri*, *C. pleniceps*, *Cephaloziella rubella*, *C. spinigera*, *Cladopodiella fluitans*, *Mylia anomala*.

- Isopaches bicrenatus* (Schmidel ex Hoffm.) H. Buch (gem., andr., per., spor.) – 2, 3, 4: On slightly matted soil of forest roads. On trail soil in blueberry-greenmoss birch forest and on the edge of oligotrophic *Chamaedaphne-Oxycoccus-Sphagnum* mire. In pure patches and with *Cephalozia* spp., *Cephalozia rubella*, *Gymnocolea inflata*, *Lophozia ventricosa* var. *longiflora*, *Lophozia excisa*, *Nardia* spp., *Solenostoma caespiticium* and 5 other species.
- ***Fossombronia foveolata* Lindb. (andr., per., juv. spor.) – 2: Knjazhpogostskij district, vicinity of Sindor Lake, become dry on the surface strand of the Sindor Lake near mouth of the Gudok Stream, (62°44'N – 51°54'E), in pure patche, 19.VIII.2008 Teteryuk B.Yu. # 44843a {SYKO}, det. M.V. Dulin.
- **Kurzia pauciflora* (Dicks.) Grolle – 3: On decaying wood on sphagnum mire afforested by low birch and dwarf birch. Several patches.
- Leiocolea heterocolpos* (Thed. ex C.Hartm.) H. Buch (gem., andr.) – 2: On decaying wood, on butts of trees (*Picea*) in boggy large herb mixed forest. With *Barbilophozia hatcheri*, *Blepharostoma trichophyllum*, *Calypogeia integristipula*, *Chiloscyphus polyanthos*, *Lepidozia reptans*, *Lophozia silvicola*, *Plagiochila porelloides*.
- Lepidozia reptans* (L.) Dumort. (per., spor.) – 2, 3, 4: On butts of trees (*Betula*, *Pinus*, *Picea*), on decaying wood, on fine grained soil of turned out wood roots, on slightly matted soil along the forest roads in herbal-*Sphagnum*, *Menyanthes-Sphagnum*, sphagnum, large herb, grass, grass-greenmoss, shrublet-greenmoss mixed, pine, birch forests. On butts of trees (*Betula*, *Pinus*), on decaying wood on the edges of shrublet-*Sphagnum* mires afforested by low birch and dwarf birch. On decaying wood, on butts of trees (*Betula*) in fen-grass spruce forest. On decaying wood along banks of the channel between the Podkadam'e and the B. Kadam Lakes. In pure patches and with *Blepharostoma trichophyllum*, *Calypogeia* spp., *Cephalozia* spp., *Lophocolea heterophylla*, *Lophozia* spp., *Plagiochila porelloides*, *Ptilidium pulcherrimum* and 19 other species.
- Liochlaena lanceolata* Nees (per., spor.) – 2: On decaying wood in boggy large herb mixed forest and in herbal-*Sphagnum* birch forest. With *Blepharostoma trichophyllum*, *Cephalozia* spp., *Chiloscyphus polyanthos*, *Crossocalyx hellerianus*, *Harpanthus flotovianus*, *Lepidozia reptans*, *Lophozia ventricosa* var. *longiflora*, *Scapania* spp., *Riccardia latifrons*, *Schljakovia kunzeana*.
- Lophocolea heterophylla* (Schrad.) Dumort. (andr., per., spor.) – 2, 3, 4: On decaying wood, on butts of trees (*Alnus*, *Betula*, *Picea*, *Pinus*, *Populus*, *Salix*, *Sorbus*), on wet soil in grass, herbal-*Menyanthes*, large herb, grass-greenmoss, shrublet-grass, shrublet-greenmoss, *Menyanthes-Sphagnum*, sphagnum birch, mixed, pine, spruce and spruce-abies forests. On soil, on decaying wood in waterside grass willow-shrub and willow-tree communities. On soil, on butts of trees (*Betula*) in waterside boggy grass willow-birch communities. On decaying wood at the mesooligotrophic *Oxycoccus-Sphagnum* mire afforested by low birch and dwarf birch. In pure patches and with *Blepharostoma trichophyllum*, *Calypogeia* spp., *Cephalozia* spp., *Lophozia* spp., *Lophozia longidens*, *Ptilidium pulcherrimum*, *Scapania* spp. and 17 other species.
- L. minor* Nees (gem., per.) – 2, 3, 4: On butts of trees (*Alnus*, *Betula*, *Pinus*, *Populus*, *Salix*), on decaying wood, on fine grained soil of turned out wood roots, on wet slightly matted soil, on trails in forests communities with soil surface covered with dead wood leaves, *Menyanthes-Sphagnum*, herbal-*Menyanthes*, large herb, grass, shrublet-grass mixed and birch forests. On butts of trees (*Pinus*) on sphagnum mire afforested by low birch and dwarf birch. On butts of trees (*Betula*) in boggy *Salix*-dwarf birch-*Sphagnum* pine forest. On decaying wood, on butts of trees (*Picea*) in *Oxalis*-grass spruce-abies forest. On decaying wood in *Equisetum-Carex* hollow along bank of the Donty Lake. In pure patches and with *Blepharostoma trichophyllum*, *Cephalozia* spp., *Chiloscyphus polyanthos*, *Geocalyx graveolens*, *Lophocolea heterophylla*, *Lophozia ventricosa* s.l., *Plagiochila porelloides*, *Scapania* spp. and 9 other species.
- **Lophozia ascendens* (Warnst.) R.M. Schust. (gem., per., spor.) – 2, 4: On decaying wood in *Menyanthes-Comarum-Sphagnum* and cowberry-grass mixed forests. With *Blepharostoma trichophyllum*, *Calypogeia muelleriana*, *Cephalozia pleniceps*, *Crossocalyx hellerianus*, *Lophocolea heterophylla*, *Lophozia ventricosa* s.l., *Ptilidium pulcherrimum*, *Scapania apiculata*.
- L. guttulata* (Lindb. & Arnell) A. Evans (andr., per., spor.) – 2, 3, 4: On decaying wood, on butts of trees (*Betula*, *Picea*) in herbal-*Sphagnum*, *Menyanthes-Sphagnum*, *Equisetum-Menyanthes*, large herb, shrublet-*Sphagnum*, shrublet-greenmoss, fen-grass mixed, pine, birch, spruce forests. On decaying wood along banks of the channel between the Podkadam'e and the B. Kadam Lakes. With *Blepharostoma trichophyllum*, *Calypogeia muelleriana*, *Cephalozia bicuspidata*, *C. lunulifolia*, *Crossocalyx hellerianus*, *Geocalyx graveolens*, *Lepidozia reptans*, *Lophocolea heterophylla*, *Lophozia longidens*, *Ptilidium pulcherrimum*, *Riccardia latifrons*, *Scapania umbrosa*, *Schistochilopsis incisa*, *Tritomaria exsectiformis*.
- L. silvicola* H. Buch (gem., andr., per., spor.) – 2, 3, 4: On decaying wood, on butts of trees (*Betula*, *Picea*), on soil, on fine grained soil of turned out wood roots, on trails and on soil along the forest roads in herbal-*Sphagnum*, *Menyanthes-Sphagnum*, sphagnum, large herb, grass, shrublet-grass mixed, pine, birch forests. On butts of trees (*Betula*) in waterside *Equisetum*-herbal willow-tree community. On decaying wood on the edge of mesooligotrophic *Oxycoccus-Sphagnum* mire afforested by low birch and dwarf birch. In pure patches and with *Barbilophozia hatcheri*, *Blepharostoma trichophyllum*, *Calypogeia* spp., *Cephalozia* spp., *Lophozia longidens*, *Ptilidium pulcherrimum*, *Tritomaria exsectiformis* and 21 other species.
- L. ventricosa* (Dicks.) Dumort. var. *ventricosa* (gem., andr., per., spor.) – 2, 4: On decaying wood, on butts of trees (*Betula*, *Picea*), on soil in shrublet-*Sphagnum*, herbal-*Sphagnum*, *Menyanthes-Sphagnum*, *Equisetum-Menyanthes*, large herb, shrublet-grass mixed, birch, pine forests. On soil at moss covered steep slope to the bank of the Ugum River. In pure patches and with *Blepharostoma trichophyllum*, *Calypogeia* spp., *Cephalozia* spp., *Geocalyx graveolens*, *Lepidozia reptans*, *Lophocolea minor*, *Schljakovia kunzeana* and 13 other species.
- L. ventricosa* var. *longiflora* (Nees) Macoun (gem., andr., per., spor.) – 2, 3, 4: On decaying wood, on butts of trees (*Betula*, *Picea*), on soil, on trails soil in grass, *Equisetum-Menyanthes*, shrublet-greenmoss, large herb, shrublet-grass, herbal-*Sphagnum*, *Menyanthes-Sphagnum*, shrublet-*Sphagnum* mixed, birch, pine forests. On slightly matted soil forest trails and roads. On soil, on decaying wood on the banks of lakes and rivers. On decaying wood in fen-grass spruce forest. In

- pure patches and with *Blepharostoma trichophyllum*, *Calypogeia integristipula*, *Cephalozia* spp., *Gymnocolea inflata*, *Nardia geoscyphus*, *Pellia epiphylla*, *Scapania* spp. and 15 other species.
- Lophozopsis excisa* (Dicks.) Konstant. & Vilnet (gem., andr., per., spor.) – 2, 3: On decaying wood and on slightly matted soil in *Ledum*-bog whortleberry-*Sphagnum* and cowberry-greenmoss pine forests. On soil in *Menyanthes-Comarum-Sphagnum* mixed forest. On slightly matted soil of road slopes. In pure patches and with *Cephaloziella rubella*, *Isopaches bicrenatus*, *Scapania curta*, *Scapania irrigua*, *Schljakovia kunzeana*.
- L. longidens* (Lindb.) Konstant. & Vilnet (gem., andr., per.) – 2, 3, 4: On decaying wood, on butts of trees (*Betula*, *Pinus*, *Picea*) in *Menyanthes-Sphagnum*, large herb, grass, grass-greenmoss, shrublet-greenmoss, shrublet-lichen mixed, birch, pine, spruce and spruce-abies forests. In pure patches and with *Barbilophozia barbata*, *Blepharostoma trichophyllum*, *Geocalyx graveolens*, *Lophocolea heterophylla*, *Lophozia silvicola*, *L. ventricosa* s.l., *Ptilidium pulcherrimum*, *Scapania mucronata*, *Schljakovia kunzeana*, *Tritomaria exsectiformis*.
- L. propagulifera* (Gottsche) Konstant. & Vilnet (gem.) – 4: on butts of tree (*Populus*) in cowberry-grass mixed forest. In pure patche.
- Marchantia polymorpha* L. subsp. *polymorpha* – 3: In the water along bank of the Donty Lake. In pure patch.
- M. polymorpha* L. subsp. *ruderalis* Bischl. & Boissel.-Dub. (gem., fem. re., m. re.) – 2, 3: On soil on the banks of streams and rivers. On slightly matted soil along the forest roads, road ditches, sandpits. On wet soil in hollows in in herbal-*Sphagnum* birch forest and boggy *Salix*-dwarf birch-*Sphagnum* pine forest. On soil at waterside *Carex*-large-herb meadow. In pure patches and with *Aneura pinguis*, *Blasia pusilla*, *Cephaloziella rubella*, *Chiloscyphus polyanthos*, *Pellia neesiana*.
- Mylia anomala* (Hook.) Gray (gem., andr.) – 2, 3, 4: On sphagnum tussocks and in hollows, on trails, on decaying woodne, on soil in windthrow hollows on the edges of shrublet-*Sphagnum* mires afforested by low birch, pine and dwarf birch. On sites with disturbed vegetation, on decaying wood in boggy sphagnum pine forests. On the road edge soil in lichen pine forest and on slightly matted soil in grass-*Sphagnum* mixed forest. In pure patches and with *Calypogeia* spp., *Cephalozia* spp., *Cephaloziella spinigera*, *Cladopodiella fluitans*, *Gymnocolea inflata*, *Odontoschisma denudatum* and 14 other species.
- Nardia geoscyphus* (De Not.) Lindb. (andr., per., spor.) – 2: On slightly matted soil of forest road. On sites with disturbed vegetation along bank of the Ugum River and in boggy shrublet-*Eriophorum-Sphagnum* pine forest. With *Calypogeia muelleriana*, *Cephalozia bicuspidata*, *Cephaloziella rubella*, *Gymnocolea inflata*, *Isopaches bicrenatus*, *Lophozia ventricosa* var. *longiflora*, *L. silvicola*, *Scapania curta*, *S. irrigua*, *S. scandica*, *S. paludicola*.
- N. insecta* Lindb. (per.) – 2, 4: On slightly matted soil of railroad slope and on trail soil on the edge of oligotrophic *Chamaedaphne-Oxycoccus-Sphagnum* mire. With *Calypogeia muelleriana*, *Cephalozia bicuspidata*, *Isopaches bicrenatus*, *Odontoschisma denudatum*, *Solenostoma caespiticium*.
- Obusifolium obtusum* (Lindb.) S.W.Arnell – 2: On butts of tree (*Picea*) in grass-*Sphagnum* mixed forest and on decaying wood in herbal-*Sphagnum* birch forest. With *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Cephalozia lunulifolia*, *Lophozia silvicola*, *Scapania irrigua*, *S. mucronata*.
- Odontoschisma denudatum* (Mart.) Dumort. (gem.) – 4: On trails soil on the edges of shrublet-*Sphagnum* mires afforested by low pine. On the road edge soil in lichen pine forest and on decaying wood in grass-*Sphagnum* mixed forest. With *Calypogeia muelleriana*, *C. sphagnicola*, *Cephalozia bicuspidata*, *C. leucantha*, *C. loitlesbergeri*, *C. lunulifolia*, *Isopaches bicrenatus*, *Lepidozia reptans*, *Mylia anomala*, *Nardia insecta*.
- O. elongatum* (Lindb.) A. Evans – 2: On slightly matted soil along bank of the Sindor Lake. With *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Lophozia ventricosa* var. *longiflora*, *Pellia epiphylla*, *Plagiochila porelloides*, *Scapania irrigua*.
- Orthocaulis attenuatus* (Mart.) A. Evans (gem.) – 4: On decaying wood in *Carex-Sphagnum* pine forest. In pure patch.
- Pellia epiphylla* (L.) Corda. (andr., per., gyn.) – 2, 3, 4: On soil along forest road. On soil along the banks of the lakes. On soil, on butts of trees (*Betula*) in shrublet-grass and herbal-*Sphagnum* birch forests. On soil in shrublet-grass mixed forest. On soil in hollows on the edge of sphagnum mire afforested by low birch and dwarf birch. In pure patches and with *Blasia pusilla*, *Blepharostoma trichophyllum*, *Cephalozia* spp., *Chiloscyphus* spp., *Gymnocolea inflata*, *Lophozia ventricosa* var. *longiflora*, *Scapania* spp. and 5 other species.
- P. neesiana* (Gottsche) Limpr. (andr., gyn.) – 1, 2, 3, 4: On soil in hollows, on butts of trees (*Betula*) in grass-*Sphagnum*, herbal-*Sphagnum*, large herb mixed and birch forests. On soil on the banks of lakes and rivers. On soil in waterside boggy grass willow-birch community. In pure patches and with *Blasia pusilla*, *Chiloscyphus pallescens*, *C. polyanthos*, *Marchantia polymorpha* subsp. *ruderalis*, *Pellia epiphylla*, *Scapania irrigua*. On raft of land vegetation along the west bank of the Jamozero Lake, with *Scapania irrigua*, (65°00'N – 50°15'E), 7.VII.2006 Teteryuk B.Yu. # 42020 {SYKO}, det. M.V. Dulin.
- Plagiochila porelloides* (Torr. ex Nees) Lindenb. (per.) – 2, 3, 4: On soil, on butts of trees (*Betula*, *Pinus*, *Picea*, *Salix*), on decaying wood, on fine grained soil of turned out wood roots, on soil in forests communities with soil surface covered with dead wood leaves, in herbal-*Sphagnum*, *Menyanthes-Sphagnum*, large herb, shrublet-grass, grass, mixed and birch forests. On soil in sedge and on sites with disturbed vegetation on the banks of lakes and rivers. On butts of trees (*Picea*) in fen-grass spruce forest. In pure patches and with *Blepharostoma trichophyllum*, *Calypogeia* spp., *Cephalozia lunulifolia*, *Chiloscyphus polyanthos*, *Lepidozia reptans*, *Lophocolea* spp., *Scapania* spp. and 12 other species.
- Plectocolea hyalina* (Lydell) Mitt. (andr.) – 3: On slightly matted soil of steep loamy road slope. In pure patch.
- Ptilidium ciliare* (L.) Hampe – 2: On decaying wood in boggy large herb mixed forest. In pure patch.
- P. pulcherrimum* (Weber) Vain. (per., spor.) – 2, 3, 4: On decaying wood, on butts of trees (*Betula*, *Pinus*, *Picea*, *Sorbus*) in in forests communities with soil surface covered with dead wood leaves, sphagnum, herbal-*Sphagnum*, *Menyanthes-Sphagnum*, large herb, shrublet-grass, grass, grass-greenmoss, shrublet-greenmoss, shrublet-lichen pine, mixed, birch, spruce, spruce-abies, aspen forests. On decaying wood, on butts of trees (*Betula*) at the edges of shrublet-*Sphagnum* mires afforested by low birch and dwarf birch. On decaying

- wood in waterside boggy grass willow-birch community, on railway sleeper at the road ditch and along banks of the channel between the Podkadam'e and the B. Kadam Lakes. In pure patches and with *Barbilophozia barbata*, *Blepharostoma trichophyllum*, *Calypogeia* spp., *Cephalozia* spp., *Lepidozia reptans*, *Lophocolea heterophylla*, *Lophozia* spp., *Lophozioopsis longidens* and 16 other species.
- Radula complanata* (L.) Dumort. (andr., per., spor.) – 2, 3: On butts of trees (*Betula*) in *Menyanthes-Comarum-Sphagnum* mixed forest and on the bark of aspen in *Oxalis*-grass spruce-abies forest. In pure patches.
- Riccardia latifrons* (Lindb.) Lindb. (andr., per., spor.) – 2, 3: On decaying wood in *Menyanthes-Sphagnum*, sphagnous, large herb, grass, shrublet-greenmoss mixed, birch, pine forests. On slightly matted soil along bank of the Sindor Lake. With *Blepharostoma trichophyllum*, *Calypogeia* spp., *Cephalozia* spp., *Lepidozia reptans*, *Lophocolea heterophylla*, *Lophozia* spp., *Ptilidium pulcherrimum*, *Scapania* spp. and 8 other species.
- R. palmata* (Hedw.) Carruth. (per.) – 2: On decaying wood in herbal-*Sphagnum* birch forest. With *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *C. lunulifolia*, *Harpanthus flotovianus*, *Lepidozia reptans*, *Lophocolea heterophylla*, *Lophozia ventricosa* s.l., *Scapania mucronata*. Plants at the studied specimen has typical for the species size of dorsal epidermal cells (26-31 x 52-70 µm) in older parts with equally thick brownish walls. Oil-bodies were not observed.
- Scapania apiculata* Spruce (andr., per.) – 2, 4: On decaying wood in large herb, herbal-*Sphagnum*, shrublet-grass mixed forest, and also in *Ledum*-bog whortleberry-*Sphagnum* pine forest. With *Blepharostoma trichophyllum*, *Calypogeia muelleriana*, *Cephalozia* spp., *Crossocalyx hellerianus*, *Geocalyx graveolens*, *Lepidozia reptans*, *Lophocolea* spp., *Lophozia* spp., *Ptilidium pulcherrimum*, *Riccardia latifrons*, *Scapania* spp. and 7 other species.
- S. curta* (Mart.) Dumort. (gem., andr., per., spor.) – 2, 3: On slightly matted soil of road edges and slopes. On trails soil in shrublet-greenmoss birch forests. On sites with disturbed vegetation and on decaying wood in boggy sphagnous pine forests. In pure patches and with *Blasia pusilla*, *Cephalozia bicuspidata*, *Cephalozia muelleriana*, *Lophocolea heterophylla*, *Lophozia ventricosa* var. *longiflora*, *Nardia geoscyphus*, *Pellia epiphylla*, *Scapania irrigua*, *S. scandica*.
- S. irrigua* (Nees) Nees (gem., per.) – 1, 2, 3, 4: on slightly matted soil of forest roads. On soil in sedge and on sites with disturbed vegetation on the banks of lakes and rivers. On soil, on butts of trees (*Alnus*, *Betula*, *Picea*, *Pinus*), on decaying wood, on fine grained soil of turned out wood roots, on trails in forests communities with soil surface covered with dead wood leaves, herbal-*Sphagnum*, *Menyanthes-Sphagnum*, herbal-*Menyanthes*, large herb, shrublet-grass, grass mixed and birch forests. On decaying wood, on butts of trees (*Betula*, *Pinus*), on soil, in hollows on the edges of shrublet-*Sphagnum* mires afforested by low birch and dwarf birch. On soil, on decaying wood in grass willow-shrub and willow-tree communities. On decaying wood, on butts of trees (*Salix*) in waterside grass willow-birch communities. On wooden beams at the base of the bridge over the Ugum River and on decaying wood in *Ledum*-bog whortleberry-*Sphagnum* pine forest. In pure patches and with *Blasia pusilla*, *Blepharostoma trichophyllum*, *Cephalozia* spp., *Chiloscyphus polyanthos*, *Gymnocolea inflata*, *Lophocolea* spp., *Lophozia* spp., *Nardia geoscyphus*, *Scapania curta* and 22 other species. On raft of land vegetation along the west bank of the Jamozero Lake, with *Pellia neesiana*, (65°00'N – 50°15'E), 07.VII.2006 Teteryuk B.Yu. # 42020 {SYKO}, det. M.V. Dulin.
- S. mucronata* H.Buch (gem., andr., per.) – 2, 4: On decaying wood, on butts of trees (*Picea*), on soil, on fine grained soil of turned out wood roots in herbal-*Sphagnum*, *Menyanthes-Sphagnum*, large herb, shrublet-grass, grass-*Sphagnum* mixed forests. On sites with disturbed vegetation and on decaying wood on the banks of lakes and rivers. On decaying wood in *Carex-Sphagnum* and *Ledum*-bog whortleberry-*Sphagnum* pine forest. On decaying wood in herbal-*Sphagnum* birch forest. In pure patches and with *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Crossocalyx hellerianus*, *Geocalyx graveolens*, *Lophocolea heterophylla*, *Lophozia* spp., *Lophozioopsis longidens* and 14 other species.
- S. paludicola* Loeske & Müll. Frib. (andr.) – 2, 3: On soil, on butts of trees (*Betula*), on decaying wood in sphagnous, herbal-*Sphagnum*, *Menyanthes-Sphagnum* pine and mixed forests. On soil in hollows, on butts of trees (*Betula*) at the sphagnous mire afforested by low birch and dwarf birch. On soil in herbal-*Sphagnum* birch forest and in waterside boggy grass willow-birch community. In pure patches and with *Blepharostoma trichophyllum*, *Cephalozia* spp., *Chiloscyphus* spp., *L. ventricosa* s.l., *Scapania* spp., *Schljakovia kunzeana* and 5 other species.
- S. parvifolia* Warnst. – 3: On decaying wood in blueberry-greenmoss pine forest. In pure patch.
- S. praetervisiva* Meyl. (gem.) – 2: On decaying wood in boggy large herb mixed forest. With *Blepharostoma trichophyllum*, *Geocalyx graveolens*, *Scapania scandica*, *Schljakovia kunzeana*, *Tritomaria exsectiformis*.
- S. scandica* (Arnell & H.Buch) Macvicar (gem.) – 2, 3: On slightly matted soil of railroad slope and on decaying wood in boggy large herb mixed forest. With *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Geocalyx graveolens*, *Nardia geoscyphus*, *Scapania curta*, *S. irrigua*, *S. praetervisiva*, *Schljakovia kunzeana*, *Tritomaria exsectiformis*.
- S. umbrosa* (Schr.) Dumort. – 4: On decaying wood in water and along banks of the channel between the Podkadam'e and the B. Kadam Lakes. With *Calypogeia integrastipula*, *Cephalozia bicuspidata*, *Crossogyna autumnalis*, *Lepidozia reptans*, *Lophozia guttulata*.
- S. undulata* (L.) Dumort. – 4: On decaying wood in water along banks of the channel between the Podkadam'e and the B. Kadam Lakes. In pure patches.
- Schistochilopsis incisa* (Schr.) Konstant. (gem.) – 2: On decaying wood in boggy large herb mixed forest and herbal-*Sphagnum* birch forest. With *Blepharostoma trichophyllum*, *Calypogeia muelleriana*, *Cephalozia* spp., *Lepidozia reptans*, *Lophozia* spp., *Riccardia latifrons*, *Tritomaria exsectiformis* and 4 other species.
- Schljakovia kunzeana* (Huebener) Konstant. & Vilnet (gem., andr., per.) – 2, 3, 4: On decaying wood, on butts of trees (*Betula*, *Picea*), on soil, on trails soil, on fine grained soil of turned out wood roots in herbal-*Sphagnum*, *Menyanthes-Sphagnum*, sphagnous, large herb, grass mixed, birch, pine forests. On decaying wood on the edges of shrublet-*Sphagnum* mires afforested by low birch and dwarf birch. On soil in sedge and on sites with disturbed vegetation along bank of the Ugum River. In pure patches and with *Blepharostoma trichophyllum*, *Calypogeia* spp., *Cephalozia* spp., *Lophocolea heterophylla*, *Lophozia* spp., *Plagiochila porelloides*, *Scapania* spp. and 27 other species.

Solenostoma caespiticium (Lindenb.) Steph. – 2, 3: On slightly matted soil of railroad slope and on the road edge soil in cowberry-greenmoss pine forest. On decaying wood on the edge of mesooligotrophic *Oxycoccus-Sphagnum* mire afforested by low birch and dwarf birch. With *Cephalozia pleniceps*, *Isopaches bicrenatus*, *Nardia insecta*.

Sphenolobus minutus (Schreb.) Berggr. (gem., per.) – 2: On decaying wood, on butts of trees (*Picea*) in herbal-*Sphagnum*, *Menyanthes-Sphagnum*, large herb mixed forests. On slightly matted soil along bank of the Ugum River and on decaying wood in *Ledum*-bog whortleberry-*Sphagnum* pine forest. In pure patches and with *Blepharostoma trichophyllum*, *Calypogeia* spp., *Cephalozia* spp., *Lepidozia reptans*, *Lophozia ventricosa* s.l., *Scapania* spp., *Tritomaria exsectiformis* and 6 other species.

Tritomaria exsecta (Schmidel) Loeske (gem.) – 2, 4: On decaying wood, on butts of trees (*Picea*) in grass-*Sphagnum* mixed forests. On decaying wood in *Carex-Sphagnum* pine forest and also on soil, on decaying wood along bank of the Sindor Lake. With *Blepharostoma trichophyllum*, *Calypogeia suecica*, *Cephalozia bicuspidata*, *C. lunulifolia*, *Cephaloziella divaricata*, *Crossocalyx hellerianus*, *Crossogyna autumnalis*, *Lepidozia reptans*, *Lophozia silvicola*, *Lophozia ventricosa* s.l., *Ptilidium pulcherrimum*, *Riccardia latifrons*, *Scapania irrigua*, *S. mucronata*, *Schljakovia kunzeana*, *Tritomaria exsectiformis*.

T. exsectiformis (Breidl.) Loeske (gem.) – 2, 4: On decaying wood, on butts of trees (*Picea*) in herbal-*Sphagnum*, *Menyanthes-Sphagnum*, large herb, shrublet-grass mixed forests. On slightly matted soil, on decaying wood on the banks of lakes and rivers. On decaying wood in *Carex-Sphagnum* pine forest. In pure patches and with *Cephalozia* spp., *Crossocalyx hellerianus*, *Lepidozia reptans*, *Lophocolea* spp., *Lophozia* spp., *Lophozopsis longidens*, *Scapania mucronata*, *Schistochilopsis incisa* and 12 other species.

DISCUSSION

The present list includes 81 species and two varieties and one subspecies of liverworts belonging to 42 genera, 23 families. The highest taxonomic diversity was discovered for the liverwort flora of the Sindor Lake. It hosts 70 species of 37 genera and 22 families. The Kadam Lakes count 46 species of liverworts of 26 genera and 16 families. The adjacent Donty Lake was identified for a similar amount of liverwort species, particularly 45 species, 1 variety, and 1 subspecies of 29 genera and 18 families. The majority of species is relatively widespread in the region and throughout the North Holarctic Region (Dulin, 2007).

The temperate Euro-American *Fossombronia foveolata* Lindb. has been found for the first time for the flora of Komi Republic. This species is widely spread in Europe, common in North America and practically unknown in Asia (Konstantinova, 2000). For the European part of Russia, it was found in Karelia, the Leningrad Region, the Novgorod Region, the Vologda Region, the Volgograd Region, the Nizhnii Novgorod Region (Konstantinova et al., 2009; Philippov, Dulin, 2013). The finding of this species in the Komi Republic seriously widens the knowledge on its distribution in Europe and extends its areal north-eastwards.

Cephaloziella elachista was reported for the Sindor Lake (Dulin, 2006, 2008; Taskaev, 2009), but later re-identified as *Cephaloziella spinigera*, a morphologically similar and more widespread species, comparatively with *C. elachista*, which is considered to be diploid derivative of *C. spinigera*.

Six species are officially protected and included in the Red Data Book of the Komi Republic (Taskaev, 2009; Dulin, 2008): *Cephalozia macounii*, *Harpanthus scutatus*, *Kurzia pauciflora*, *Lophozia ascendens*, *Odontoschisma denudatum*, *Heterogemma laxa*. Among them three species (*Cephalozia macounii*, *Lophozia ascendens* and *Heterogemma laxa*) are red-listed in Europe (Schumacker & Matryny, 1995).

Some identified taxa are still understudied in the region (2-5 localities). They are as follows. *Odontoschisma elongatum* is an arctic-mountain, circumpolar liverwort, it was known earlier only from the Northern Urals (Bakalin et al., 2001). Its distribution in European Russia is normally associated with the Baltic crystalline shield and the Ural Region, so its findings on the Russian Plain are very poor; it was found only in Novgorod Region (Konstantinova et al., 2009). *Scapania praetervisa* is an arctic-montane, circumpolar liverwort, earlier found only several times in the Northern Urals and its foothills (Bakalin et al., 2001; Dulin, 2007), and also in the Timan Range (Zheleznova, 1985). Similarly to the previous species, it is normally distributed in mountain regions; only several findings (the Pinega Reserve, the Yaksha settlement) belong to lowland (Konstantinova et al., 2009). *Scapania apiculata* is a boreal, circumpolar species, earlier known from few localities in the southern part of the republic, i.e., the Mezhador village, the Nizhnyaya Omra settlement, and the Yaksha settlement vicinities. *Scapania umbrosa* is a boreal, nearly circumpolar species, known earlier from the vicinities of the Nombur, the Porub-Kepovskaya, and the Yaksha villages (Zheleznova, 1985). *Tritomaria exsecta* is a boreal, circumpolar species, known earlier from the vicinities of the Glotovo and the Yaksha settlements. Distribution of the above mentioned boreal liverworts is sporadic in spite of abundant appropriate habitats (decaying wood of coniferous trees). Possible explanation of their low frequency is the position of the study area at the northern limits of their distribution areas.

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