LIVERWORTS OF THE GEOLOGICAL RESERVE “SKALY KAMENKY” (KOMI REPUBLIC)
ПЕЧЕНОЧНИКИ ГЕОЛОГИЧЕСКОГО ЗАКАЗНИКА “СКАЛЫ КАМЕНКИ”
(РЕСПУБЛИКА КОМИ)

MICHAEL V. DULIN
МИХАИЛ В. ДУЛИН

Abstract

An annotated list of liverworts of the geological reserve “Skaly Kamenky” includes 61 species and one subspecies. This territory was not explored for liverwort flora before. Information on habitat, substrates, reproductive system and associated species is provided. Five new sites of rare species red-listed in the Komi Republic (Arnellia fennica, Heterogemma laxa, Lophoziopsis pellucida, Oleolophozia perssonii, Schistochilopsis hyperarctica) is presented. Some taxa (Jungermannia polaris, Moerckia flotoviana u Cephaloziella elegans, Cephaloziella arctogena) was recently found in the flora of the Komi Republic, so their distribution and ecology are still little known.

KEYWORDS: flora, liverworts, rare species, geological reserve, the Ydzhyd-Kamenka River, Komi Republic.

INTRODUCTION

Geological reserve “Skaly Kamenky” is located downstream the Ydzhyd-Kamenka River, a right tributary of the Kozhva River (the Pechora River basin) within the limits of Pechora administrative area in 40 km south-west from the town Pechora. The reserve includes 10 km zone along the Ydzhyd-Kamenka River from its mouth to the bridge (the road Izyayu - Berezovka). The width of the protected zone is 200 m on the both banks of the river. In the reserve, the Ydzhyd-Kamenka River forms canyon-like valley with rocky banks up to 30-40 m height.

Orographically, this region is a part of the Pechora ridge, which is situated in Kozhva area of the Pechora north-taiga province (Isachenko, 1964). Flat hilly moraine plains (50-100 m a.s.l.) with certain hills up to 250 m usually appear here.

From the regional geological point of view, the territory is located in south part of the Pechora-Kozhva swell. Paleozoic deposits form the Kamenskaya anticline structure in this place. The core of the fold is formed by lime-
basin, which include rock outcrops of the Upper Devon and Carbon age rich in organic residues with bitumen and oil signs and sulfur springs (Taskaev & Timonin, 1993).

**MATERIAL AND METHODS**

Our field work in the vicinities of the geological reserve “Skaly Kamenky” was conducted in 2012. Liverwort collections were made in 38 localities, they include 338 samples. All collections are deposited in the herbarium of the Institute of Biology, Syktyvkar (SYKO).

Species in the list are annotated by the presence of structures associated with reproduction (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 accom-
panying species. Taxa included in the Red Data Book of the Komi Republic (2009) are marked by *. The nomenclature of liverworts follows Konstantinova, Bakalin et al. (2009).

**SPECIES LIST**

*Aneura pinguis* (L.) Dumort. (andr., per., spor.) – 7B, 8A, 8B: on slightly matted loamy soil and concrete slabs in the settlement near the boiler-house; on slightly matted loamy soil of vertical surface of ground wall bordering with road ditch at base of steep slope afforested by schrublet-grass-moss birch-spruce forest; on vertical surface of ground wall of stream channel in the schrublet-moss mixed pine-birch-spruce forest. In pure patches.

*A. fennica* (Gottsche) Lindnb. – 3A: on ledges and cavities in the middle part of rock outcrops afforested by grass-moss spruce-birch community (NWW-faced slope). In pure patches and with *Leiocolea badensis* and *Lophozia pelliculosa*.

*Athalamia hyalina* (Sommerf.) S.Hatt. (andr.) – 7A, 8A: on ledges and cavities of rock outcrops (E-faced slope); on ledges of rock outcrops in ravine birch-spruce grass-moss community. In pure patches.

*Barbilophozia barbata* (Schmidt ex Schreb.) Loeske (gem., per.) – 3B, 5A, 7B: on decaying wood and on butts of trees (*Betula* L.) in the inundated schrublet-moss spruce forest; on decaying wood in grassy aspen forest; on decaying wood in the upper part of steep river slope afforested by grassy birch forest (W-faced slope). In pure patches and with *Barbilophozia hatcheri*, *Lophocholea minor*, *Lophozia pelliculosa*.

*B. hatcheri* (A.Evans) Loeske (gem., andr., per.) – 3B, 5A, 7B, 8A: on decaying wood in an inundated schrublet-moss spruce forest, in *Schublet-Polytrichum-Sphagnum* mixed birch-spruce forest, in grassy aspen forest, in ravine grass-moss birch-spruce forest; on slightly matted loamy and sandy-loamy soil along roadside of dirt forest roads. In pure patches and with *Barbilophozia barbata*, *Isopaches bicrenatus*, *Lophozia pelliculosa* and *Lophozia excisa*, *Ptilidium ciliare*, *P. pulcherrimum*, *Schlajovia kunzeana*.

*Blasia pusilla* L. (gem.) – 1, 3B, 4: on slightly matted loamy soil at slope ledge between inundated schrublet-moss spruce forest and pebbly bar; on slightly matted soil of roadside wall of the forest road in schrublet-lichen-moss pine forest; on slightly matted loamy soil of vertical surface of ground wall between inundated meadow and pebbly bar along the river bank. In pure patches and with *Cephalozia pleniceps*, *Nardia geoscyphus*, *Plectocolea hyalina*, *Scapania curta*.

*Calypogeia integristipula* Steph. (gem.) – 3B, 4, 8A: on slightly matted loamy soil at slope ledge between inundated schrublet-moss spruce forest and pebbly bar; on decaying wood and on stones on rock scree (SEE-faced slope) afforested by spruce-birch-larch schrublet-moss community; on decaying wood in inundated schrublet-moss spruce forest; on vertical surface of ground wall of stream channel in the schrublet-moss mixed pine-birch-spruce forest. In pure patches and with *Cephalozia bicuspidata*, *C. lunulifolia*, *C. pleniceps*, *Lepidozia repans*, *Lophozia ventricosa*, *Nardia geoscyphus* and other.

*C. muelleriana* (Schiffn.) Müll.Frib. (gem.) – 3B, 8A: on slightly matted loamy soil at slope ledge between inundated schrublet-moss spruce forest and pebbly bar; on decaying wood in the inundated schrublet-moss spruce forest; on decaying wood in *Schublet-Polytrichum-Sphagnum* mixed birch-spruce forest; on vertical surface of ground wall of stream channel in the schrublet-moss mixed pine-birch-spruce forest. With *Cephalozia bicuspidata* and *Lepidozia repans*.


*Cephalozia bicuspidata* (L.) Dumort. (per., spor.) – 3B, 3C, 5A, 8A: on decaying wood in an inundated schrublet-moss spruce forest; on decaying pine wood on rock scree at base of cliff (SE-faced slope); on decaying wood in closed grass birch coppice; on slightly matted loamy soil of ruts of forest road in the schrublet- *Polytrichum-Sphagnum* mixed birch-spruce forest; on vertical surface of ground wall of stream channel in the schrublet-moss mixed pine-birch-spruce forest. In pure patches and with *Calypogeia integristipula*, *C. muelleriana*, *Lepidozia repans*, *Lophozia silvicola*, *Nardia geoscyphus*, *Ptilidium pulcherrimum*, *Scapania curta*, *Tritomaria exsectiformis*.

*C. leucantha* Spruce – 8A: on vertical surface of ground wall of stream channel in the schrublet-moss mixed pine-birch-spruce forest. With *Cephalozia bicuspidata*, *Lophozia ventricosa*.

*C. loitlesbergeri* Schiffn. (per.) – 9: on *Sphagnum* hummocks and in *Sphagnum* hollows on mesoooligotrophic schrublet- *Eriophorum-Sphagnum* mire with pine. In pure patches and with *Calypogeia cephagrica*, *Cephaloziella spinigeria*, *Mylia anomalisa*.

*Cephalozia lunulifolia* (Dumort.) Dumort. (per., spor.) – 3B, 4, 5A, 8A, 9: on decaying wood and on butts of trees (*Picea*) in the inundated schrublet-moss spruce forest, in grassy aspen forest, in inundated schrublet-moss spruce forest, in *Schublet-Polytrichum-Sphagnum* mixed birch-spruce forest, in ravine grass-moss birch-spruce forest; on decaying wood on mesoooligotrophic schrublet- *Eriophorum-Sphagnum* mire afforested by low pine; on peaty soil in *Carex*- *Sphagnum* mire afforested by low pine and birch; on vertical surface of ground wall of stream channel in the schrublet-moss mixed pine-birch-spruce forest. In pure patches and with *Calypogeia integristipula*, *Cephaloziella hellerianas*, *Lepidozia repans*, *Lophozia silvicola*, *L. ventricosa*, *Schlajovia kunzeana*, *Ptilidium pulcherrimum*.

*C. pleniceps* (Austin) Lindnb. (andr., per., spor.) – 3B, 4, 5A, 9: on decaying wood in the inundated schrublet-moss spruce forest and on soil in closed grass birch coppice; on slightly matted loamy soil at slope ledge between inundated schrublet-moss spruce forest and pebbly bar; on decaying wood on mesoooligotrophic schrublet- *Eriophorum-Sphagnum* mire afforested by low pine; on peaty soil in *Carex*- *Sphagnum* mire afforested by low pine and birch; on vertical surface of ground wall of stream channel in the schrublet-moss mixed pine-birch-spruce forest. With *Blasia pusilla*, *Calypogeia integristipula*, *Leiocolea heterocolpos*, *Lophozia ventricosa*, *Mylia anomalisa*.


*C. elegans* (Heeg) Schiffn. (gem., per.) – 8A: on decaying wood
in schrublet-Polytrichum-Sphagnum mixed birch-spruce forest. In pure patches.

*C. rubella* (Nees) Warnst. (gem., andr., per., spor.) – 4, 5B, 8A, 9: on decaying wood in schrublet-Polytrichum-Sphagnum mixed birch-spruce and in ravine birch-spruce grass-moss forests; on decaying wood and on stones in basal part of rocky scree often afforested by spruce and birch (SEE- and W-faced slopes); on Sphagnum hummocks and in Sphagnum hollows on mesooligotrophic schrublet-Eriophorum-Sphagnum mire afforested by low pine; on slightly matted sandy-loam soil of high roadside slope along forest road in the schrublet-mixed birch-spruce-pine forest. In pure patches and with Calypogea sphagnicola, Isopaches bicornatus, Lophozia ventricosa, Leploziopsis excisa.

*C. spinigera* (Lindb.) Warnst. (andr., per., spor.) – 9: in Sphagnum hollows on mesooligotrophic schrublet-Eriophorum-Sphagnum mire afforested by low pine. With Calypogea sphagnicola, Cephalozia loitlesbergeri, Cladopodiella flu-tans, Gymnocolea inflata, Mylia anomala. Chiloscyphus pallescens (Ehrh. ex Hoffm.) Dumort. – 2, 3C, 4, 7B: on stones shaded by bushes in basal part of rocky scree (S-faced slope); on wet humus soil in inundated tall herb-moss spruce forest; on slightly matted loamy soil of vertical surface of ground wall bordering with road ditch at base of steep slope afforested by schrublet-grass-moss birch-spruce forest; on slightly matted loamy soil of vertical surface of ground wall between inundated meadow and pebbly bar along the river bank. In pure patches and with Lophocolea minor.


H. heterocolpos (Thed. ex C.Hartm.) H.Buch (gem., per.) – 4, 5B, 7B, 8A: on ledges and cavities in basal part of rocky outcrops afforested by spruce and birch (SFW-faced slope); on decaying wood and on stones in basal part of rock scree (in the site of groundwater outputs) afforested by low spruce, larch (SEE- and W-faced slopes); on slightly matted loamy soil of vertical surface of ground wall bordering with road ditch at base of steep slope afforested by schrublet-grass-moss birch-spruce forest. In pure patches with and Calypogea integristipula, Cephalozia pleniceps, Leploziopsis excisa, Pitilidium ciliare. Lepidozia reptans (L.) Dumort. (per., spor.) – 3B, 3C, 4, 8A: on decaying wood in the inundated schrublet-moss spruce, in schrublet-Polytrichum-Sphagnum mixed birch-spruce, in ravine grass-moss birch-spruce forests; on decaying pine wood on rock scree at base of cliff (SE-faced slope). In pure patches and with Calypogea integristipula, C. muelleriana, Cephalozia lunulifolia, Lophozia silvicola, L. ventricosa. Lophocolea heterophylla (Schrad.) Dumort. (per.) – 5A: on decaying wood and on soil in closed coppice grass birch forest. With Cephalozia pleniceps, Lophozia silvicola, Leploziopsis excisa, Schljakovia kunzeana. L. minor Nees (gem.) – 2, 3B, 6, 7B: on fine grained soil of ledges and cavities and on stones of rocky outcrops and in basal part of rocky scree (NE and S-faced slopes); on decaying wood in the inundated schrublet-moss spruce and grass birch forests; on slightly matted loamy soil of vertical surface of ground wall bordering with road ditch at base of steep slope afforested by schrublet-grass-moss birch-spruce forest. In pure patches and with Barbilophozia bartbata, Chiloscyphus pallescens, Pitilidium pulcherrimum. Lophozia silvicola H.Buch (gem., andr., per., spor.) – 3B, 5A, 8A: on decaying wood, on soil in hollows and on butts of trees (Picea) in the inundated schrublet-moss spruce, in ravine grass-moss birch-spruce, in schrublet-Polytrichum-Sphagnum mixed birch-spruce, in closed coppice grass birch forests; on peaty soil in Carex-Sphagnum-moss mire afforested by low pine and birch. With Cephalozia bicuspidata, C. lunulifolia, Crossocalyx hellerianus, Gymnocolea infla-ta, Lepidozia reptans, Lophocolea heterophylla, Pitilidium pulcherrimum, Schljakovia kunzeana, Tritomaria exsectiformis.

L. ventricosa (Dicks.) Dumort. (gem., andr., per., spor.) – 3B, 4, 8A, 9: on decaying wood and on butts of trees (Picea, Larix Hill) in schrublet-Polytrichum-Sphagnum mixed birch-spruce, in inundated schrublet-moss spruce forests; on verti-
Liverworts of the geological reserve “Skaly Kamenky” (Komi Republic) 67
cal surface of ground wall of stream channel in the schrub-
et-moss mixed pine-birch-spruce forest; on decaying wood, on Sphagnum hummocks and hollows on mesooligotrophic
schrublet-Eriophorum-Sphagnum mire afforessted by low
pine; slightly matted loamy soil of ruts of forest road in the
schrublet-Polytrichum-Sphagnum mixed birch-spruce forest.
In pure patches and with Calypogeia sphagnicola, Cephalo-
ziella spinigera, Gymnocolea infleta.

Lophoziaopsis excisa (Dicks.) Konstant. & Vilnet (gem., andr.,
per., spor.) – 2, 3C, 4, 5A, 8A: on decaying wood and among
bryophytes on stones on rock scree often afforessted by
spruce-birch-larch schrublett-moss communities (SE and SEE-
faced slopes); on decaying wood in closed coppice grass
bath and in schrublet-Polytrichum-Sphagnum mixed birch-spruce
forests; on slightly matted sandy-loam soil of high roadside
slope along forest road in the schrublet-moss mixed birch-
spruce-pine forest. In pure patches and with Barbilophozia
hatcheri, Cephalozia rubella, Crossocalyx hellerianus,
Isonopogon bicaudatus, Lopidozia heterophylla, Plagiochila
pulcherrimum, Tritium exsectiformis, Tritomaria exsectiformis.

L. longidens (Lindb.) Konstant. & Vilnet (gem., andr., per.,
spor.) – 3B, 4, 5A, 8A: on decaying wood and on butts of
trees (Picea) in the inundated schrublet-moss spruce, in grass
aspen, in schrublet-Polytrichum-Sphagnum mixed birch-
spruce, in raving grass-moss birch-spruce forests. In pure
patches and with Barbilophozia hatcheri, Plagiochila
pulcherrimum, Tritium exsectiformis.

Mannia pilosa (Hornem.) Frye & L.Clark (fem. re.) – 3C, 8A:
on ledges and cavities in middle part of rocky outcrops
afforessted by grass-moss spruce-birch community (NWW-
faced slope). In pure patches and with Arnetella femmica,
Scapania gymnostomophila.

Orthocaulis atlanticus (Kaal.) H.Buch (gem.) – 9: in Sphag-
um moss afforessted by mesooligotrophic schrublet-Eriophorum-
Sphagnum mire afforessted by low pine. In pure patches.
Pellia endivifolia (Dicks.) Dumort. (andr., per.) – 4, 5A, 8B:
on wet soil at grass-moss hollow with low Salix sp.; on slightly
matted loamy soil of vertical surface of ground wall between
inundated meadow and pebbly bar along the river bank;
on stony soil of forest road to the river. In pure patches.

P. neesiana (Gottsche) Limpr. (per.) – 7B: on humus soil in the
inundated large-herb willow forest; on humus soil on inun-
dated large-herb meadow. In pure patches.

Plagiochila poroides (Torr. ex Nees) Lindenb. – 3C: on wet
humus soil in inundated large-herb-moss spruce forest. In
pure patches.

Plectocoele hystrix (Lyell) Mitt. (andr., per., spor.) – 3B, 8B:
on wet soil at grass-moss hollow with low Salix sp.; on slightly
matted loamy soil at slope ledge between inundated schrub-
et-moss spruce forest and pebbly bar. In pure patches and with
Blasia pusilla, Isonopogon bicaudatus, Nardia geoscy-
phus.

Preissia quadrata (Scop.) Nees (fem. re., m. re.) – 2, 3A, 5A,
6, 7B, 8A: on fine grained soil on ledges and cavities in base
part of rocky outcrops and scree often in afforessted by
spruce and birch (in the site of groundwater outputs) (S-
SW-., NWW- and NE-faced slopes); on slightly matted
loamy soil of vertical surface of ground wall bordering with
road ditch at base of steep slope afforessted by schrublet-grass-
moss birch-spruce forest; on stony soil of forest road to the
river. In pure patches and with Leiocolea badensis, Schis-
tochilopsis hyperarctica.

Ptilidium ciliare (L.) Hampe – 4, 5B, 8A: on decaying wood
and on stones on rock scree (SEE-faced slope) afforessted by
spruce-birch-larch schrublet-moss community; on decaying
wood and on stones in basal part of rock scree (in the site
of groundwater outputs) afforessted by low spruce with dryas-
lichen-moss cover (W-faced slope); on decaying wood in
schrublet-Polytrichum-Sphagnum mixed birch-spruce forest.
In pure patches and with Barbilophozia hatcheri, Leiocolea
heterocolpos, Lopidozia excisa, Schlafkova kunzeana.
P. pulcherrimum (Weber) Vain. (per., spor.) – 3B, 3C, 4, 5A,
5B, 7B, 8A: on decaying wood and on butts of trees (Betula,
Picea, Larix) in the inundated schrublet-moss spruce in
schrublet-Polytrichum-Sphagnum mixed birch-spruce, in
grass-moss birch-spruce, in grass birch, in grass aspen for-

Scapania curta (Mart.) Dumort. (gem.) – 1, 8A: on slightly matted soil of roadside wall of the forest road in schrublet-lichen-moss pine forest; on slightly matted loamy soil of ruts of forest road in the schrublet-Polytrichum-Sphagnum mixed birch-spruce forest. In pure patches and with Blasia pusilla, Cephalozia bicuspidata, Gymnocalceae inflata, Iso-paches bicornatus, Nardia geocyclus. S. gymnostomophila Kaal. (gem.) – 3A, 5B, 6, 7A, 7B, 8A: on ledges and cavities sometimes on decaying wood in basal and middle part of rocky outcrops afforested by spruce and birch often in the site of Carex-Sphagnum-moss mire afforested by low pine and birch. In pure patches and with Jungermannia polaris, Leiocolea badensis, Lophoziosis pellucida. S. irigga (Nees) Nees (gem., andr., per.) – 5A, 8A, 8B: on wet soil at grass-moss hollow with low Salix sp.; on soil in closed coppice grass birch forest; on slightly matted loamy soil of vertical surface of ground wall bordering with road ditch at base of steep slope afforested by schrublet-grass-moss birch-spruce forest. In pure patches and with Jungermannia polaris, Leiocolea badensis. S. nipponica. L. heterophylla, Lophoziopsis pellucida. S. verrucosa (Smikrovsky) Smikrovsky – 6: on fine grained soil of ledges and cavities of rocky outcrops in the inundated schrublet-moss spruce forest. In pure patches and with Gymnocoleae inflata.


RESULTS AND DISCUSSION

The liverwort flora of the vicinities of the geological reserve “Skaly Kamenny” includes 61 species and one subspecies of liverworts belonging to 37 genera, 22 families, 7 orders, and 2 classes. The majority of species is relatively widespread in the region and throughout the North Holarctic Region (Dulin, 2007). Among others, there are several species only recently discovered in the Komi Republic, i.e., Jungermannia polariis and Moerckia flotoviana, found near the Vorkuta City (Dulin, 2013a), as well as Cephalozziella elegans and Cephalozziella arctogena reported from the Ilych River basin (Dulin, 2013b). Orthocalalis atlanticus is relatively rarely rare in the region, it was previously found only in the Bolshezemelskaia Tundra near Yun-Yaga research station (Zheleznova, 1982). Five species are officially protected and included in the Red Data Book of the Komi Republic (Taskaev, 2009; Dulin, 2008): Arnelliis fennica, Heterogemma laxa, Lophoziosis pellucida, Oleopohzia perssonii, and Schistochilopsis hyperarctica. Three former species and Cephalozziella elegans are red-listed in Europe (Schumacker & Matriny, 1995). One species, Oleopohzia perssonii, is included in the Red Data Book of the Russian Federation (Trutnev, 2008).

ACKNOWLEDGEMENTS

The author is grateful to V.M. Schanov for help in creating maps and to Y.A. Dubrovsky for help in translation of the article. The study is supported by the Program of UD RAS “Living Nature”, project No. 12-2-P-4-1018 «Specific, cenotic and ecosystem diversity of landscapes in the UNESCO World Heritage Site “Virgin Komi Forests”» and by the RFBR grant № 12-04-01476.

LITERATURE CITED


[LITERATURE CITED]


