

ON THE HEPATIC FLORA OF THE EASTERN SUBPOLAR URAL
(KHANTY-MANSI AUTONOMOUS DISTRICT)

К ФЛОРЕ ПЕЧЕНОЧНИКОВ ВОСТОЧНОГО МАКРОСКЛОНА ПРИПОЛЯИНОГО
УРАЛА (ХАНТЫ-МАНСИЙСКИЙ АВТОНОМНЫЙ ОКРУГ – ЮРГА)

NADEZHDA A. KONSTANTINOVA¹ & ELENA D. LAPSHINA²

НАДЕЖДА А. КОНСТАНТИНОВА¹, ЕЛЕНА Д. ЛАПШИНА²

Abstract

An annotated list of hepatics of the Ner-Oika mountain (eastern Subpolar Urals in the Khanty-Mansi Autonomous District – Yurga, 64°30' – 64°33' N; 59°35' – 59°38' E) was compiled based on identification of ca. 800 specimens collected by Lapshina. It includes 97 species, eight of them are newly recorded for Urals (*Hygrobiella laxifolia*, *Lophozopsis polaris*, *Saccobasis polymorpha*, *Scapania brevicaulis*, *S. crassiretis*, *S. degenii*, *S. spitsbergensis*, *Solenostoma gracillimum*) and 52 species are new for the district. New localities of hepatics rare in the Urals are revealed. A worldwide distribution of the treated species and some morphological peculiarities are discussed.

Резюме

Аннотированный список печеночников составлен на основе определения около 800 образцов, собранных в 2013 году в районе горы Нер-Ойка на Приполярном Урале, 64°30' – 64°33' N; 59°35' – 59°38' E, в пределах Ханты-Мансийского автономного округа – Югры. Список включает 97 видов, в том числе 8 видов, впервые найденных на Урале (*Hygrobiella laxifolia*, *Lophozopsis polaris*, *Saccobasis polymorpha*, *Scapania brevicaulis*, *S. crassiretis*, *S. degenii*, *S. spitsbergensis*, *Solenostoma gracillimum*) и 52 новых для округа, большинство из которых – широко распространенные арктомонтанные и монтанные печеночники.

KEYWORDS: Hepatics, distribution, phytogeography, reproduction, ecology, flora, Subpolar Urals, Russia.

INTRODUCTION

A diversity of hepatics, their ecology and distribution in the Urals still remain poorly understood. The first comprehensive list of hepatics of Polar and Northern Urals was compiled by Zinovjeva (1973). It includes 130 species, but some of them were given erroneously (Konstantinova & Potemkin, 1996; Konstantinova et al., 2009). An annotated lists of hepatics were subsequently published for several Strict Nature Reserves situated in the Middle and Northern Urals, *i.e.*, “Basegi” (Konstantinova et al., 2010), “Vishersky” (Konstantinova & Bezgodov, 2006), Pechora-Ilych Nature Reserve (Bakalin et al. 2001; Dulin, 2007), and for the Sob' River valley in the Polar Urals (Konstantinova & Czernyadjeva, 1995). As a whole 156 species were registered for Northern Urals (Konstantinova et al., 2009). Most territories mentioned above are restricted to the western macroslope of the Urals, whereas data on hepatics of its eastern part are very limited (practically absent).

The Subpolar Urals is the part of Urals within the limits of the northern taiga subzone that is bordered in the north by the sources of Khulga River (65°40'N) and in the south by Tel'posis mountain (1694 m, 64°N). The Ner-Oika mountain is situated in the eastern Urals in the westernmost part of the Khanty-Mansi Autonomous District – Yurga. It is a part of a watershed and one of the highest and quite isolated peaks of Subpolar Urals (1645 m alt.). The nearest peaks are Mount Telposis that is 80 km to the south and Mount Narodnaya (1895 m alt.), the highest peak in the Subpolar Urals situated ca. 100 km to the north from Ner-Oika Mt.

The study area includes spurs of Ner-Oika and Zeika mountains divided by deep valleys of the tributaries of the Shchekur'ya River (Fig. 1). The area is bordered in the east by the Shshekur'ya River valley, in the south by the Kobyla-Yu River valley and in the north by the Dovidis Stream valley.

Bedrocks consist of metamorphic rocks (crystalline

¹ – Polar-Alpine Botanical Garden-Institute of the Kola Science Center of RAS, Kirovsk, Murmansk Province, 184256, Russia – Россия, 184256, г. Кировск, Мурманская область, Полярно-альпийский ботанический сад-институт им. Н.А. Аврорина Кольского НЦ РАН. E-mail: nadya50@list.ru

² – Yugra State University, Khanty-Mansiysk, Khanty-Mansiysk Autonomous District, 628012 Russia – Россия 628012, Ханты-Мансийск, Ханты-Мансийский автономный округ, Югорский государственный университет; e-mail: e_lapshina@ugrasu.ru

schists and quartzites) and granites (Kemmerikh, 1970). Outcrops of schists are common at the bottom of steep slopes of stream valleys. Rock fields are quite common on slopes. There are no carbonate rocks in the area.

The climate is continental with long winters lasting about 7 months in the plains and about 9 months in mountains at height of 1000 m. The mean temperature of January is $-19-23^{\circ}\text{C}$, minimal values reach $-50-55^{\circ}\text{C}$. The mean temperature of July varies from $14-16^{\circ}\text{C}$ in submontane plains to 5° at height of 1300-1400 m. The Ural Mts stretch from north to south blocking movement of humid Atlantic air masses and making their eastern slopes much drier than the western ones. Precipitation does not exceed 800 mm per year in the uplands whereas it can be 1500 mm on the western slopes. There are large permanent snowfields on the leeward eastern slopes of the highest peaks (Kemmerikh, 1970).

Dark coniferous green moss forests with dominance of *Pinus sibirica*, *Larix sibirica* and *Betula pubescens* prevail in the forest belt. Secondary moss-herbs-birch forests with *Duschekia fruticosa* in the understory are widespread as well (names of vascular plants are given following Czerepanov, 1995). At 400-500 m dark coniferous forests are replaced by brighter larch and birch forests mixed with meadows and dwarf shrub formations with *Betula nana* (yerniks). Alder stands with rock outcrops and mossy rocks are widespread on steep north facing slopes. In the lower part of a mountain tundra belt dwarf shrub-green moss and moss-lichen tundra alternate with meadows, yerniks and willow stands depending on moisture, thickness of snow cover, etc. Chionophile bryophyte dominated communities are not rare in appropriate sites, whereas grass spots at melted snowbeds are rather rare. Above 800-850 m dry debris-lichen-moss tundra and rock fields prevail. Along a whole slope small patches of dwarf-shrub-*Sphagnum* bogs are not rare.

In 2013 E. Lapshina gathered 800 hepatic specimens on slopes of Mount Ner-Oika in the Subpolar Urals (Fig. 1-2). The studied area includes the upper part of the forest zone, subalpine and alpine (tundra) zones from 390 to 1035 m alt. Hepatics were not collected in the goltsty (polar desert belt).

SPECIES LIST

The nomenclature follows Konstantinova, Bakalin et al. (2009), with some changes adopted from newer publications. We accepted the genus *Neoorthocaulis* (Söderström & al. 2010), the family Endogemmataceae with the single species *Endogemma caespiticia* (Vilnet & al. 2011), the treatment of *Leiocolea* as *Mesoptychia* (Váňa & al., 2012), the treatment of *Cephalozia* and *Odontoschisma* in Vilnet & al. (2012) and Váňa & al. (2013).

In the list, after the species name the presence of reproductive structures is given in parentheses (and. – androecia; gyn. – gynoecia; per. – perianths or pseudoperianths; spor. – sporophytes; gem. – gemmae) and then collecting sites are enumerated. After them the number

of localities where the species has been found and altitudinal range are given in parentheses. Altogether 30 localities were studied, but in the map some of them are combined, thus the map includes only 16 points. Then the species frequency is provided with the following categories: sporadic (sp., 4-6 localities), frequent (fr., 7-13 localities) and common (com., more than 13 localities). For rare species collected from 1-3 localities labels are cited. Asterisks before species name mean: * – new record for the District; ** – new record for the North Urals region (as it is defined by Konstantinova, Bakalin et al., 2009); *** – new record for the Urals.

Specimens are kept in the Herbarium of Yugra State University (Khanty-Mansiysk, Russia), duplicates in KPABG.

Anthelia juratzkana* (Limpr.) Trevis. (per., and., spor.) – **2-6, 8, 11, 12 (12: 450-950 m alt.), fr.: in extensive mats in snowbed communities, on cryogenic clay spots in tundras, on bare soil along streams and on road sides. Sometimes abundant, in pure mats or mixed with *Fuscocephaloziopsis albescens*, *Marsupella sprucei* var. *ustulata*, *Gymnomitrium concinnatum*, *G. brevissimum*, *Nardia breidleri*, *Cephalozia bicuspidata*, *Nardia geoscyphus*, *Pseudolophozia sudetica*.

Barbilophozia barbata (Schmidel ex Schreb.) Loeske – **11**: at the base of rock in *Betula nana*-greenmoss tundra near timberline on north-eastern slope ($64^{\circ}33'47.5''\text{N}$; $59^{\circ}39'08.0''\text{E}$, 570 m alt.), some stems among *Lophozia wenzelii* var. *groenlandica* (13-325) and *Lophozia wenzelii* (13-327/1).

B. hatcheri (A. Evans) Loeske (per., gem.) – **3, 8, 10, 13-15** (7: 390-709 m alt.), fr.: in the ground layer and at the bottom of trees in dark coniferous and mixed *Vaccinium*-greenmoss and swampy forests, in alder bushes, as well as in dwarf shrub-greenmoss and moss-lichen tundras on humus-covered rocks and cliffs. Sometimes abundant. Without admixture of other liverworts or mixed with *Lophozia longidens*, *Lophozia cf. silvicola*, *L. ventricosa* var. *longiflora*, *Ptilidium pulcherrimum*.

B. lycopodioides* (Wallr.) Loeske – **3, 6, 10, 11, 14 (7: 390-650 m), sp.: in ground layer and at the bottom of trees in forests and light forests including swampy forests, on mossy rocks in rock fields, in *Betula nana* formations, dwarf shrub-moss-lichen and moss-lichen tundras. Mostly without admixture of other hepatics or mixed with *Neoorthocaulis floerkei*, *Ptilidium ciliare*.

** (*) *Biantheridion undulifolium* (Nees) Konstant. & Vilnet [*Jamesoniella undulifolia* (Nees) Müll. Frib.] (per.) – **9**: dwarf shrub-sedge-*Sphagnum* bog on gentle slope of mountain ($64^{\circ}33'54.1''\text{N}$; $59^{\circ}35'38.5''\text{E}$, 914 m alt.), among *Sphagnum* and green mosses (13-394/1); on dead *Sphagnum* among *Lophozia ventricosa* var. *longiflora* and admixture of *Ptilidium ciliare*, *Cephalozia bicuspidata* (13-393/1). This species was previously known from one locality in Polar Urals (Konstantinova & Czernyadjeva 1995). The species is red-listed for Europe (Schumacker & Matriny, 1995) and in the world.

Blasia pusilla L. (gem.) – **1, 2, 3, 10** (5: 168-620 m), fr.: on moist clayish soil on road sides and on alluvium on banks of streams. Without admixture of other species or mixed with *Pellia neesiana*, *Marchantia polymorpha* subsp. *montivagans*, *Scapania curta*, *Plectocolea hyalina*, *Solenostoma sphaerocarpon*, *Cephalozia bicuspidata*.

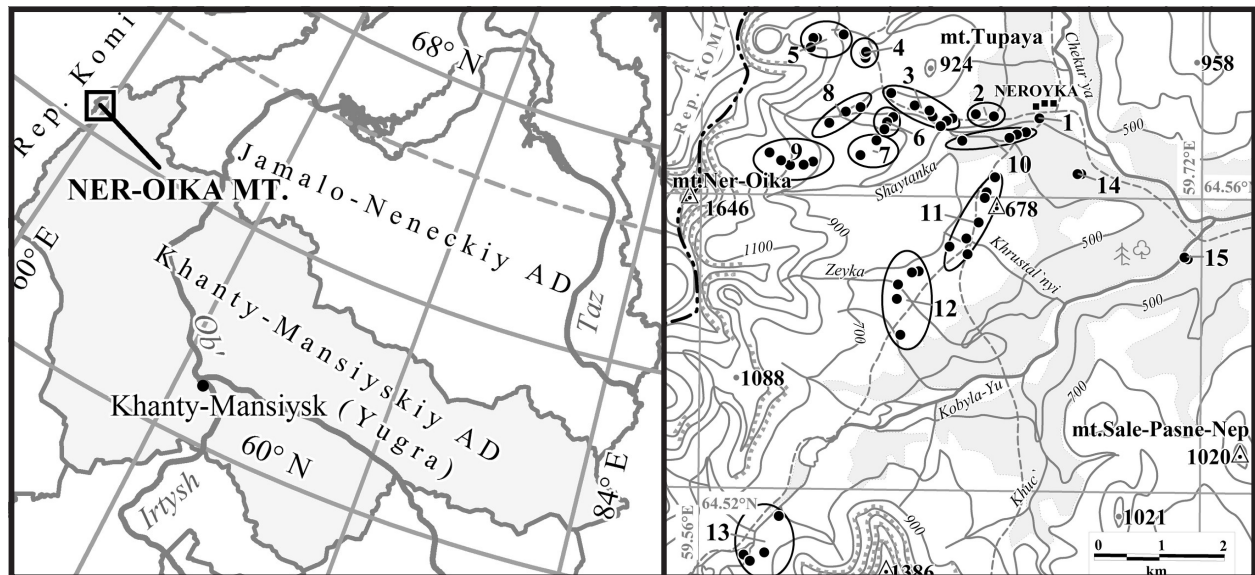


Fig. 1. Position of Ner-Oika Mountain and collecting localities:

- 1 – surroundings of geologist's settlement Ner-Oika, upper part of forest zone (64°34'16.6" N; 59°39'58.6" E; 400 m alt.);
- 2 – bottom of south-east slope of Tupaya Mt., upper part of forest zone (64°34'17.3"-64°34'18.3" N; 59°39'06.1"-59°38'45.3" E; 420-450 m alt.);
- 3 – south-east slope of Tupaya Mt., lower part of tundra belt (64°34'12.2"-64°34'28.2" N; 59°37'07.8"-59°38'18.5" E; 585-698 m alt.);
- 4 – top of mountain pass and concave northern slope of Tupaya Mt. to valley of Dodovis Stream (64°34'45.3"-64°34'48.2" N; 59°36'36.8"-59°36'38.5" E; 785-808 m alt.);
- 5 – eastern slope of northern spur of Ner-Oika Mt. (64°34'50.1"-64°34'56.6" N; 59°35'34.7"-59°36'12.5" E; 860-960 m alt.);
- 6 – valley of left tributary of Shaytanka River (64°34'10.4"-64°34'16.4" N; 59°37'00.3"-59°37'10.3" E; 640-665 m alt.);
- 7 – gentle north-eastern spur of Ner-Oika Mt. between two valleys that are sources of Shaytanka River (64°33'57.6"-64°34'04.9" N; 59°36'32.9"-59°36'51.2" E; 707-725 m alt.);
- 8 – headstream of left tributary of Shaytanka River (64°34'13.2"-64°34'21.1" N; 59°35'56.8"-59°36'32.6" E; 706-724 m alt.);
- 9 – eastern slope of Ner-Oika Mt. (64°33'52.3"-64°33'58.3" N; 59°34'48.4"-59°35'38.5" E; 914-1035 m alt.);
- 10 – valley of Shaitanka River, upper part of forest zone (64°34'05.2"-64°34'09.7" N; 59°38'30.0"-59°39'43.3" E; 450-512 m alt.);
- 11 – north-eastern slope of pass to Kobyla-Yu River including northern spur and valley Khrustal'nyi Stream (64°33'09.6"-64°33'47" N; 59°38'16.3"-59°39'08.0" E; 570-685 m alt.);
- 12 – southern and south-eastern slopes of the spur of Ner-Oika mountain (64°32'29.8"-64°33'01.0" N; 59°37'16.3"-59°37'41.1" E; 603-703 m alt.);
- 13 – headstream of Kobyla-Yu River, upper part of forest zone (64°30'38.1"-64°31'18.5" N; 59°34'22.7"-59°35'02.7" E; 521-575 m alt.);
- 14 – bottom of north-eastern slope to Shchekur'ya River, upper part of forest zone (64°33'49.5" N; 59°40'42.9" E; 406 m alt.);
- 15 – right bank of Kobyla-Yu River near mouth (64°33'08.3" N; 59°42'50.4" E; 393m alt.), upper part of forest zone;
- 16 – 20 km east from Ner-Oika settlement, along the road to Saranpul town, forest zone (64°28'22.9" N; 59°52'23.9" E; 325 m alt.).

Blepharostoma trichophyllum (L.) Dumort. (per.) – **5, 6, 10, 12, 14, 16** (8: 325-960 m), fr.: in forests and subalpine alder bushes (*Duschekia fruticosa*), on decaying wood, on soil under deadfall, on mossy cliffs, under rocks, on bare soil and fine earth on banks of streams. Often with *Fuscocephaloziopsis pleniceps*, *F. lunulifolia*, *Schistochilopsis opacifolia*, *Diplophyllum taxifolium*, *Lophozia ventricosa* var. *longiflora*. Collected once in a dwarf shrub-sedge-*Sphagnum* bog on *Sphagnum* mixed with *Tritomaria quinqueidentata*, *Schljakovia kunzeana*, *Scapania crassiretis*, *Sphenolobus minutus*, *Cephalozia bicuspidata*, *Gymnocolea inflata*.

Calypogeia integristipula Steph. (gem.) – **14**: in swampy birch-fir-*Calamagrostis-Sphagnum*-greenmoss forest (64°33'49.5" N; 59°40'42.9" E, 406 m alt), in niches between roots of trees (13-357) with *Lophozia* cf. *silvicola*, *Cephalozia bicuspidata* and on humus and fine earth (13-365, 13-366, 13-367, 13-369/1, 13-370), without any admixture of other hepatics or mixed with *Fuscocephaloziopsis pleniceps*, *F. lunulifolia*, *Blepharostoma trichophyllum*.

C. muelleriana (Schiffn.) Müll. Frib. – **10**: dwarf shrub-*Sphagnum* bog within subalpine alder bushes on steep slopes of river valleys (64°34'05.2" N; 59°38'30.0" E, 510 m alt.), on dead *Sphagnum* (13-317), mixed with *Mylia anomala*, *Calypogeia sphagnicola*, *Riccardia latifrons*, *Neoorthocaulis binsteadii*, *Cephalozia bicuspidata*, *Fuscocephaloziopsis pleniceps*.

C. sphagnicola (Arnell & J. Perss.) Warnst. & Loeske – **10**: dwarf shrub-*Sphagnum* bog in subalpine alder bushes, on steep slope of river valley (64°34'05.2" N; 59°38'30.0" E, 510 m alt.), on dead *Sphagnum* (13-315, 13-316/1, 13-317) mixed with *Mylia anomala*, *Neoorthocaulis binsteadii*, *Lophozia ventricosa* s.l., *Fuscocephaloziopsis lunulifolia*, *F. pleniceps*.

* *Cephalozia ambigua* C.Massal. (gem.) – **3, 4, 6** (4: 620-808 m), sp.: on permafrost spots in moss-lichen tundra, on moist clay and alluvium along stream, on road side. Usually mixed with *Scapania obcordata*, *Prasanthus suecicus*, *Anthelia juratzkana*, *Nardia breidlereri*, *Scapania curta*, *Cephalozia*

- bicuspidata*, *Pseudolophozia sudetica*, *Gymnomitrium concinnum*. The species mostly occurs with gemmae, sometimes very small plants (to 2-3 mm high) with numerous gemmae and underleaves are prevalent.
- C. bicuspidata* (L.) Dumort. (per., spor.) – **1-15** (27: 390-1035 m), com.: in forests, subalpine light forests and meadow-shrub communities, on clay spots in tundras, in dwarf shrub-sedge-*Sphagnum* bogs; on fine earth between rocks in rock fields and along streams. Usually mixed with other bryophytes. One of the most widespread hepatics in the studied area. The f. *amphigastriata* was collected on permafrost spots in dwarf shrub-lichen tundra (13-462/2) and on alluvium covered rock on bank of stream (13-389).
- Cephaloziella arctogena* (R.M. Schust.) Konstant. (per., and., spor., gem.) – **6, 11, 16** (4: 325-685 m), sp.: in cobble-moss-lichen and dwarf shrub-moss tundras, mixed with mosses and in *Salix*-grass stands on diluvium slope on bare soil. In pure mats (13-328), with admixture of *Scapania irrigua*, *Pseudolophozia sudetica* (13-377/3) or mixed with *Lophozia wenzelii* var. *groenlandica*, *Sphenobolus saxicola*, *Ptilidium ciliare*. Found once on decaying wood in *Picea*-dwarf shrub-herb-moss fen, mixed with *Blepharostoma trichophyllum*, *Fuscocephaloziopsis pleniceps*.
- C. divaricata* (Sm.) Schiffn. (and.) – **1**: on bank of stream (64°34'16.6" N; 59°39'58.6" E; 400 m alt.), on alluvium under herbs (13-211), mixed with *Scapania subalpina*, *S. irrigua*, *Schistochilopsis opacifolia*. **2**: herbs-*Vaccinium myrtillus*-greenmoss tundra near timberline (64°34'16.1" N; 59°38'18.5" E; 585 m alt.), at the bottom of a rock mixed with *Lophozia wenzelii* var. *groenlandica* (13-230) and at the edge of a clay spot (13-231), mixed with *Isopaches birenatus*, *Nardia geoscyphus*, *Marsupella sprucei*, *Solenostoma sphaerocarpum*. **10**: on rocky southfacing slope (64°34'06.3" N; 59°38'02.6" E; 537 m alt.), on rock near waterfall (13-324), in pure mats.
- * *C. grimsulana* (J.B. Jack ex Gottsche & Rabenh.) Lacout. – **1**: on bank of a stream (64°34'16.6" N; 59°39'58.6" E; 400 m alt.), on alluvium near trail (13-210), mixed with *Scapania curta*, *Lophozia ventricosa* s.l.
- C. spinigera* (Lindb.) Warnst. – **11**: dwarf shrub-cotton grass-sedge-*Sphagnum* bog (64°33'37.3" N; 59°38'56.4" E; 634 m alt.), mixed with *Lophozia silvicola*, *Ptilidium ciliare*, *Lophozia propagulifera* (13-335), and mixed with *Schljakovia kunzeana*, *Sphenobolus minutus*, *Ptilidium ciliare*, *Tritomaria quinqueidentata*, *Lophozia silvicola* (13-336).
- * *C. varians* (Gottsche) Steph. (per.) – **6**: seepage on cliffs on steep sides of valley of brook (64°32'47.3" N; 59°37'16.3" E; 636 m alt.), some plants mixed with *Pseudolophozia sudetica* (13-467/2). **9**: dwarf shrub (*Salix-Betula nana*)-sedge-*Sphagnum* bog (64°33'54.1" N; 59°35'38.5" E; 914 m alt.), at the bottom of rocks (13-395), mixed with *Scapania degenii* and *Gymnocolea inflata*. **13**: riffle (64°30'41.1" N – 59°34'22.7" E, 572 m alt.), on rock in running water, abundant (13-419).
- Chiloscyphus pallescens* (Ehrh. ex Hoffm.) Dumort. – **10**: on alluvium and rocks in the bed of a stream (64°34'08.5" N; 59°39'32.7" E; 460 m alt.), mixed with *Scapania subalpina* and *Pellia neesiana* (13-288).
- C. polyanthos* (L.) Corda – **14**: in swampy birch-fir-*Calamagrostis-Sphagnum*-green moss forest with numerous shallow brooks (64°33'49.5" N; 59°40'42.9" E; 406 m alt.), on sides of a temporary stream, on peaty soil (13-373/1), mixed with *Plectocolea obovata* var. *subelliptica*, *Cephalozia bicuspidata*.
- * *Conocephalum conicum* (L.) Dumort. – **10**: dense herbaceous-fern-greenmoss alder bushes, on steep slope of a river valley with mossy schistose cliffs (64°34'06.9" N; 59°39'24.2" E; 470 m alt.), on soil, mixed with *Cephalozia bicuspidata* and *Plectocolea obovata* var. *subelliptica* (13-299).
- * *Diplophyllum albicans* (L.) Dumort. – **9**: depression in rock field on slope of mountain (64°33'54.5" N; 59°35'01.8" E; 1013 m alt.), on fine earth between rocks, mixed with *Scapania spitsbergensis*, *Gymnomitrium concinnum* (13-402/1), *Marsupella emarginata* (13-401/1), *Lophozia wenzelii* (13-401/2).
- * *D. obtusifolium* (Hook.) Dumort. (per., and.) – **10**: dense herbaceous-fern-greenmoss alder bushes, on the steep slope of a river valley with mossy schistose cliffs (64°34'06.9" N; 59°39'24.2" E; 470 m alt.), on rock, mixed with *Pseudolophozia sudetica* var. *anomala* (13-305).
- * *D. taxifolium* (Wahlenb.) Dumort. (per., gem.) – **3, 5, 6, 10, 13, 15** (9: 390-950 m), fr: between rocks in rock fields, without any admixture or mixed with *Tetralophozia setiformis*, *Marsupella emarginata*, *Scapania spitsbergensis*. Frequent as well on cliffs and between mossy rocks in alder bushes, mixed with *Tritomaria quinqueidentata*, *Blepharostoma trichophyllum*, *Mesoptychia gillmanii*, *Lophozia ventricosa* s.l., less often on soil in herb-moss and moss-lichen tundras, mixed with *Neoorthocaulis floerkei*. The species was also collected in moist herbaceous forest in river valley, mixed with *Marsupella boeckii*, *Gymnocolea inflata*, *Cephalozia bicuspidata*, *Scapania irrigua* and on alluvium covered rocks and in stream beds, with *Solenostoma sphaerocarpum*, *Plectocolea hyalina*, *Lophozia* cf. *silvicola*, *Pseudolophozia sudetica*.
- Endogemma caespiticia* (Lindenb.) Konstant., Vilnet & A.V. Troitsky [*Solenostoma caespiticium* (Lindenb.) Steph.] (per.) – **2**: on road side near timberline (64°34'17.3" N; 59°39'06.1" E; 450 m alt.), mixed with *Solenostoma confertissima*, *Nardia japonica*, *Scapania curta*, *S. scandica*, *Plectocolea hyalina* (13-216/1).
- * *Fuscocephaloziopsis albescens* (Hook.) Váňa & L. Söderstr. [*Pleurocladula albescens* (Hook.) Grolle] (per., and., spor.) – **3, 4, 6, 8, 10, 11, 13** (8: 620-785 m), fr.: in snowbed communities where it sometimes is abundant, between rocks under snow fields and on rock fields, on banks of streams, in depressions near rocks in boggy tundra. Usually mixed with *Pseudolophozia sudetica*, *Anthelia juratzkana*, *Marsupella brevissima*, *M. sprucei*, *Schistochilopsis opacifolia*, *Diplophyllum taxifolium*, *Lophozia wenzelii* var. *groenlandica*, *L. ventricosa* var. *longiflora*, *Cephalozia bicuspidata*.
- F. lunulifolia* (Dumort.) Váňa & L. Söderstr. [*Cephalozia lunulifolia* (Dumort.) Dumort.] (per., and.) – **10, 13, 14, 15** (4: 390-527 m), sp.: in moist and swampy forests, on decaying wood as well as on humus and peaty soil. Without admixture of another hepatics or mixed with *Calypogeia integristipula*, *Barbilophozia hatcheri*, *Gymnocolea inflata*, *Diplophyllum taxifolium*. In dwarf shrub-*Sphagnum* bog among *Sphagnum*, mixed with *Mylia anomala*, *Neoorthocaulis binsteadii*, *Fuscocephaloziopsis pleniceps*, *Calypogeia sphaerocaulis*.
- F. pleniceps* (Austin) Váňa & L. Söderstr. [*Cephalozia pleniceps* (Austin) Lindb.] (per., spor.) – **3, 6, 10, 12-14, 16** (10: 390-703 m), fr.: on decaying wood and on humus in swampy forests and alder bushes, on rocks and fine earth in crevices of mossy cliffs, in snowbed communities and grass-moss tundra in subalpine belt. Usually mixed with *Blepharostoma*

- trichophyllum*, *Calypogeia integristipula*, *Schistochilopsis opacifolia*, *Diplophyllum taxifolium*, *Mesoptychia gillmanii*, *Plectocolea obovata*, *Harpanthus flotovianus*, *Scapania irrigua*. Collected once on dead *Sphagnum* in dwarf shrub-sedge-*Sphagnum* bog, mixed with *Mylia anomala*, *Calypogeia sphagnicola*, *C. muelleriana*, *Neoorthocaulis binsteadii*, *Fuscocephaloziopsis lunulifolia*, *Cephalozia bicuspidata*.
- Gymnocolea inflata* (Huds.) Dumort. (per., and.) – **5, 6, 9, 11, 12, 15** (6: 390-960 m), sp: in dwarf shrub-sedge-*Sphagnum* bogs, among *Sphagnum* and in small pools, in marshy tundras in shaded niches on peat near rocks, in temporary pools in moist forests, sometimes on rocks in rock fields. In pure mats or mixed with *Scapania paludicola*, *Odontoschisma elongatum*, *Fuscocephaloziopsis lunulifolia*, *F. albescens*, *Scapania degenii*, *Scapania irrigua*.
- * *Gymnomitrium brevissimum* (Schleich. ex Dumort.) Warnst. (spor.) – **3**: in snowbed community (64°34'14.4" N; 59°37'34'10.9" E; 597 m alt.), on ground floor (13-243), mixed with *Anthelia juratzkana*, *Pseudolophozia sudetica*, *Fuscocephaloziopsis albescens*. **4**: seepage at the bottom of slope of a stream valley (64°34'48.2" N; 59°36'38.5" E; 785 m alt.), mixed with *A. juratzkana*, *F. albescens* (13-270/2). **6**: on alluvium covered rocks along a stream (64°34'13.9" N; 59°37'03.2" E, 640 m alt.), single plants in mats of *Pseudolophozia* cf. *sudetica* (13-470/2) mixed with *Lophozia wenzelii*, *Isopaches bicrenatus*, *Anthelia juratzkana*.
- * *G. concinatum* (Lightf.) Corda (per., spor., gem.) – **4, 9, 11, 12** (4: 636-1013 m), sp.: on detritus-clay cryogenic spots in dwarf shrub-lichen-moss and lichen tundras, on rocks in rock fields, on fine earth on cliffs. Usually mixed with *Anthelia juratzkana*, *Prasanthus suecicus*, *Scapania obcordata*, *Cephalozia bicuspidata*, *Pseudolophozia sudetica*, *Lophozia wenzelii*, *Nardia geoscyphus*, *N. breidlerii*, *Sphenolobus minutus*, *Isopaches bicrenatus*.
- * *G. coralloides* Nees – **12**: cliffs in valley of a stream (64°32'47.3" N; 59°37'16.3" E; 636 m alt.), on fine earth between rocks (13-465/1), mixed with *Gymnomitrium concinatum*, *Pseudolophozia sudetica*.
- * *Harpanthus flotovianus* (Nees) Nees (per., spor.) – **4, 10, 11, 13-15** (7: 390-785 m), fr.: on banks of streams, in marshy forests, on moist meadow near seepages. Sometimes abundant. Without admixture of other hepatics or mixed with *Scapania paludosa*, *S. subalpina*, *Pellia neesiana*, *Plectocolea obovata*, *Fuscocephaloziopsis pleniceps*, *F. lunulifolia*, *Hygrobiella laxifolia*.
- *** (*) *Hygrobiella laxifolia* (Hook.) Spruce (per.) – **4**: seepages at the bottom of slope in valley of a stream (64°34'48.2" N; 59°36'38.5" E; 785 m alt.), on fine earth (13-262/2, 13-256/2) mixed with *Plectocolea obovata*, *Jungermannia borealis*, *Scapania subalpina*, *S. undulata*, *S. irrigua*, *Cephalozia bicuspidata*. **11**: on alluvium on bank of a stream (64°33'09.6" N; 59°38'37.1" E; 638 m alt.), rare in mats with dominance of *Plectocolea obovata* (13-346/2, 13-346/2, 13-347/2), mixed with *Cephalozia bicuspidata*, *Scapania undulata*, *Saccobasis polita*, *Harpanthus flotovianus*. **12**: seepage on cliffs on steep slope of valley of stream (64°32'47.3" N; 59°37'16.3" E; 636 m alt.), with *Jungermannia pumila* (13-463/3).
- Isopaches bicrenatus* (Schmidel ex Hoffm.) H. Buch (per., gem.) – **2, 3, 6, 11** (6: 420-700 m), sp.: on debris-clay spots in dwarf shrub-green-moss and lichen tundras, on alluvium covered rocks along bed of streams. Mostly mixed with *Pseudolophozia sudetica*, *Nardia geoscyphus*, *Cephalozia bicuspidata*, *C. ambigua*, *Lophozia wenzelii*, *Scapania parvifolia*, *Anthelia juratzkana*, *Marsupella sprucei* var. *ustulata*, *Gymnomitrium brevissimum*. Once found on road side with *Solenostoma sphaerocarpum*, *Nardia japonica*.
- *** (*) *Jungermannia borealis* Damsh. & Vána (per., and.) – **4**: seepages at the bottom of slope in valley of stream (64°34'48.2" N; 59°36'38.5" E; 785 m alt.), some stems among *Hygrobiella laxifolia*, *Plectocolea obovata*, *Scapania subalpina*, *Scapania undulata*, *Cephalozia bicuspidata*. **11**: bed of Khrustalnyi Stream (64°33'09.6" N; 59°38'37.1" E; 638 m alt.), on alluvium covered rocks in the bed and on steep banks, in pure mats (13-339) and mixed with *Scapania undulata*, *Plectocolea obovata* (13-347/1). **12**: seepages on schists cliffs on side of steep slope of valley of stream (64°32'47.3" N; 59°37'16.3" E; 636 m alt.), on fine earth, without admixture of other hepatics (13-464/1).
- * *J. pumila* With. (per., and.) – **12**: seepage at the bottom of slope in valley of stream (64°32'47.3" N; 59°37'16.3" E; 636 m alt.), on fine earth (13-463/2), with *Hygrobiella laxifolia*.
- *** (*) *Mesoptychia collaris* (Nees) L. Söderstr. & Vána [*Leiocolea collaris* (Nees) Schljakov] (per., and.) – **12**: seepage on schists on steep rocky slope to the valley of rivulet (64°32'47.3" N; 59°37'16.3" E; 636 m alt.), on fine earth (13-463/1, 13-463/3), with *Jungermannia pumila* and *Schljakovianthus quadrilobus*.
- * *M. gillmanii* (Austin) L. Söderstr. & Vána [*Leiocolea gillmanii* (Austin) A. Evans] – **10**: herb-fern-greenmoss alder communities on steep slope to the river, in niches between mossy cliffs (64°34'06.9" N; 59°39'24.2" E; 470 m alt.), on fine earth (13-313/3), with *Plectocolea obovata*, *Diplophyllum taxifolium*, *Scapania parviflora*.
- Lophocolea heterophylla* (Schrad.) Dumort. – **16**: *Picea-Equisetum*-herb-moss fen (64°28'22.9" N; 59°52'23.9" E; 325 m alt.), on decaying wood and peaty soil, with admixture of *Fuscocephaloziopsis pleniceps*, *Blepharostoma trichophyllum*, *Schljakovia kunzeana*, *Lophocolea minor*.
- L. minor* Nees (per., gem.) – **16**: *Picea-Equisetum*-herb-moss fen (64°28'22.9" N; 59°52'23.9" E; 325 m alt.), on decaying stump, as admixture to *Fuscocephaloziopsis pleniceps* and *Blepharostoma trichophyllum*.
- Lophozia silvicola* H. Buch (per., gem.) – **11**: dwarf shrub-cotton grass-sedge-*Sphagnum* bog (33'37.3" N; 59°38'56.4" E; 634 m alt.), in mats with admixture of *Cephalozia spinigera*, *Ptilidium ciliare*, *Lophozia propagulifera* (13-335). **13**: subalpine alder bushes (64°30'42.3" N; 59°34'46.5" E; 614 m alt.), on soil and fine earth, on mossy rocks, with *Barbilophozia hatcheri* (13-428). Identifying the species without oil bodies is problematic. We only referred two specimens to it, leaving 15 specimens as *Lophozia* cf. *silvicola*.
- L. ventricosa* (Dicks.) Dumort. s.l.
– var. *vernica* [var. *confusa* (Lindb. & H. Arnell) Evans] (gem.) – **10**: mossy cliffs in subalpine alder bushes (64°34'06.9" N; 59°39'24.2" E; 470 m alt.), in ground layer and between rocks, without any admixed species (13-301/2) or mixed with *Tritomaria quinquentata* (13-301/1). **8**: between rocks on bank of stream under snow field (64°34'13.2" N; 59°35'56.8" E; 709 m alt.), on alluvium (13-408).
– var. *longiflora* (Nees) Macoun (per., gem.) – **3, 5, 6, 8, 9, 10** (8: 460-914 m), fr.: mossy cliffs in subalpine alder bushes, on fine earth between rocks, in dwarf shrub-sedge-*Sphagnum* bogs, in snowbed communities, on fine earth on mossy

rocks and on alluvium covered rocks along rivulets. The species sometimes occurs in pure mats, but more often mixed with other hepatics, mainly *Tritomaria quinquedentata*, *Barbilophozia hatcheri*, *Fuscocephaloziopsis albescens*, *F. pleniceps*, *Cephalozia bicuspidata*, *Blepharostoma trichophyllum*, *Plectocolea obovata*, *Ptilidium ciliare*, *Schistochilopsis opacifolia*.

L. wenzelii (Nees) Steph. var. *wenzelii* (per., spor., gem.) – **1, 2, 4-6, 8, 9, 11, 13** (12: 390-1013 m), fr.: in tundras on soil at the bottom of rocks, in snowbed communities, on fine earth between rocks in rock fields and on banks of streams. Sometimes occurs without admixture of other hepatics but usually mixed with *Pseudolophozia sudetica*, *Neoorthocaulis floerkei*, *Schistochilopsis opacifolia*, *Anthelia juratzkana*, *Scapania parviflora*, *Gymnomitrium concinnatum*, *Diplophyllum albicans*, *Scapania spitsbergensis*, *S. subalpina*, *S. irrigua*.

– var. *groenlandica* (Nees) Bakalin (per., and, per., gem.) – **3, 5, 6, 9-11, 13-15** (14: 390-1013 m), fr.: in swampy forests, in tundras, on clay spots, at the bottom of rocks in snowbed communities, in dwarf shrub-cotton grass-sedge-moss bogs, between rocks in rock fields and in *Salix*-herb communities, on mossy rocks in valley and on banks of streams. Often mixed with *Pseudolophozia sudetica*, *Diplophyllum taxifolium*, *Fuscocephaloziopsis albescens*, *Schistochilopsis opacifolia*, *Gymnocolea inflata*, *Scapania irrigua*, *Cephalozia bicuspidata*, as well as *Marsupella apiculata*, *Prasanthus suecica*, *Nardia geoscyphus*, *Solenostoma sphaerocarpaceum*, *Marsupella sprucei*.

Lophozia excisa (Dicks.) Konstant. & Vilnet [*Lophozia excisa* (Dicks.) Dumort.] (per., and, gem.) – **1, 3, 12** (6: 400-665 m), sp.: in ground layer among bryophytes, at the bottom of rocks, on spots of bare soil, on seepages on cliffs, on bare soil on banks of streams. Always mixed with other hepatics, most often with *Pseudolophozia sudetica*, *Lophozia wenzelii*, *Neoorthocaulis floerkei*, *Isopaches bicrenatus*, *Scapania parvifolia*, *S. subalpina*, *S. irrigua*.

L. longidens (Lindb.) Konstant. & Vilnet [*Lophozia longidens* (Lindb.) Macoun] (per., spor., gem.) – **10, 11, 13, 14** (4: 390-614 m), sp.: on decaying wood and at the bottom of tree trunks in both drained and swampy forests, in subalpine alder communities, on mossy rocks on banks of streams, at the bottom of rocks in *Betula nana*-green moss tundras. Without admixture of other hepatics or mixed with *Barbilophozia hatcheri*, *Lophozia* cf. *silvicola*, *Ptilidium ciliare*.

*** (*) *L. polaris* (R.M. Schust.) Konstant. & Vilnet [*Lophozia polaris* (R.M. Schust.) R.M. Schust. & Damsh.] (gem.) – **12**: seepage on schist cliffs on side of steep slope of valley of stream (64°32'47.3" N; 59°37'16.3" E; 636 m alt.), some plants among *Anthelia juratzkana*, *Scapania* sp., *Jungermania* sp. (13-465/2).

** (*) *L. propagulifera* (Gottsche) Konstant. & Vilnet [*Lophozia propagulifera* (Gottsche) Steph.] (gem.) – **3**: snowbed meadow (64°34'12.2" N; 59°38'04.9" E; 610 m alt.), on fine earth at the bottom of rock (13-249), mixed with *Barbilophozia hatcheri*. **11**: dwarf shrub-cotton grass-sedge-*Sphagnum* bog (64°33'37.3" N; 59°38'56.4" E; 634 m alt.), with *Cephalozia spinigera* and *Ptilidium ciliare*, in mats with dominance of *Lophozia silvicola* (13-335). **12**: rock field (64°32'29.8" N; 59°37'20.5" E; 603 m alt.), on fine earth between rocks, with *Neoorthocaulis floerkei* (13-376, 13-375) and as few plants in mats with dominance of *Gymnocolea inflata* and admixture of *Tritomaria quinquedentata*.

This species was previously known from one locality in Polar Ural (Konstantinova & Czernyadjeva, 1995).

Marchantia polymorpha L. subsp. *ruderalis* Bischl. & Boissel.-Dub. [*M. latifolia* Gray, *M. polymorpha* auct. non L.] – **10**: on bank of stream (64°34'08.5" N; 59°39'32.7" E; 460 m alt.), on fine earth on mossy rock (13-293), mixed with *Harpanthus flotovianus*, *Schistochilopsis opacifolia*, *Fuscocephaloziopsis pleniceps*, *Pellia neesiana*, *Blepharostoma trichophyllum*, *Lophozia ventricosa* var. *longiflora*, *Plectocolea obovata*.

M. polymorpha subsp. *montivagans* Bischl. & Boissel.-Dub. [*M. alpestris* (Nees) Burgeff.] (per. and.) – **1, 8, 10, 15** (5: 390-709 m), fr.: on banks of streams on alluvium, in depression in flood plain forest, without admixture of other species or mixed with *Pellia neesiana*, *Blasia pusilla*, *Scapania curta*.

** (*) *Marsupella apiculata* Schiffn. [*Gymnomitrium apiculatum* (Schiffn.) Müll. Frib.] (per.) – **9, 11, 13** (4: 685-1013 m), sp.: in dwarf shrub-lichen-moss tundra, on cryogenic spots, with *Prasanthus suecicus*, *Nardia geoscyphus*, *Solenostoma sphaerocarpaceum*, *Lophozia wenzelii* var. *groenlandica*, *Marsupella sprucei*, *Pseudolophozia sudetica*, *Cephalozia bicuspidata*, *Sphenolobus minutus*, as well as on cliffs and on rocks in rock fields. Occurs both in pure turfs and mixed with *Marsupella emarginata*, *Tetralophozia setiformis*, *Pseudolophozia sudetica*. This species was previously known from one locality in Polar Ural (Zinovjeva, 1973).

* *M. boeckii* (Austin) Kaal. (per., and.) – **6, 9, 13, 15** (4: 390-1013 m), sp.: on fine earth between and under rocks in rock fields, in dwarf shrub-sedge-*Sphagnum* tundra, on peat in shaded niches of rocks, in river valley forest on side of small moist depression. Always mixed with other hepatics, mostly with *Cephalozia bicuspidata*, *Gymnocolea inflata*, *Diplophyllum taxifolium*, *Marsupella emarginata*, *Fuscocephaloziopsis albescens*, *Lophozia sudetica*, *Scapania irrigua*.

* *M. emarginata* (Ehrh.) Dumort. (per.) – **9, 13** (4: 575-1013 m), sp.: on fine earth on rocks and between rocks in rock fields. Usually mixed with *Marsupella apiculata*, *Lophozia sudetica*, *Cephalozia bicuspidata*, *Diplophyllum albicans*, *D. taxifolium*, *Scapania degenii*, *S. spitsbergensis*, *Tetralophozia setiformis*, *Marsupella boeckii*.

* *M. sprucei* (Limpr.) Bernet (per, spor.) – **3, 4, 6** (5: 585-808 m), sp.: in ground layer in snowbed community, on cryogenic clay spots in dwarf shrub-moss and moss-lichen tundras. Mixed with *Prasanthus suecicus*, *Anthelia juratzkana*, *Isopaches bicrenatus*, *Nardia geoscyphus*, *Solenostoma sphaerocarpaceum*, *Scapania obcordata*, *S. parviflora*. Rarely also occurs on rocks covered with fine earth along rivulets, as admixture to *Pseudolophozia* cf. *sudetica*, *Fuscocephaloziopsis albescens*, *Schistochilopsis opacifolia*.

Mylia anomala (Hook.) Gray (per. and., gem.) – **10**: dwarf shrub-*Sphagnum* bog in subalpine alder bushes, on steep slope to the river (64°34'05.2" N; 59°38'30.0" E; 505 m alt.), in *Sphagnum* turfs, mixed with *Neoorthocaulis binsteadii*, *Calypogeia sphagnicola*, *Fuscocephaloziopsis lunulifolia*, *F. pleniceps*, *Lophozia ventricosa* s.l. (13-315, 13-316/1, 13-317).

** (*) *Nardia breidlerii* (Limpr.) Lindb. (per., spor.) – **3**: on clayish soil on road side in subalpine belt (13-476/2), mixed with *Scapania curta*, *Blasia pusilla*, *Cephalozia bicuspidata*, *C. ambigua*, *Plectocolea hyalina*, *Solenostoma sphaerocarpaceum*. **6**: on moist clay along the stream (13-381, 13-382), in mats without admixture of other hepatics or mixed with

- Anthelia juratzkana*, *Pseudolophozia sudetica*, *Cephalozia bicuspidata*. **12**: seepages at the bottom of slope in valley of stream, on clayish fine earth (13-481/1, 13-481/2, 13-483/3, 13-481/4, 13-483/4), mixed with *Anthelia juratzkana*, *Gymnomitrium concinatum*.
- N. geoscyphus* (De Not.) Lindb. (per., and., spor.) – **3, 6, 8, 10-12** (7: 512-709 m), fr.: in dwarf shrub-moss and moss-lichen tundras, on clayish soil on cryogenic spots, on soil in seepages in subalpine belt, on fine earth on cliffs and on sandy alluvium on banks of streams. Usually mixed with *Solenostoma sphaerocarpum*, *Cephalozia bicuspidata*, *Plectocolea hyalina*, *Anthelia juratzkana*, *Isopaches bicrenatus*, *Scapania subalpina*, *S. curta*, *Blasia pusilla*, *Gymnomitrium concinatum*.
- ** *N. japonica* Steph. (per., ant.) – **2**: on road side in upper part of forest belt (64°34'17.3" N; 59°39'06.1" E; 450 m alt.), (64°34'18.3" N; 59°38'45.3" E; 420 m alt.), mixed with *Solenostoma confertissima*, *Scapania curta*, *S. scandica* (13-216/2, 13-219/1, 13-222/2). **6**: on fine earth covered rocks along a rivulet (64°34'13.9" N; 59°37'03.2" E; alt. = 640 m alt.), single plants in mats dominated by *Lophozia* cf. *silvicola*, mixed with *Solenostoma sphaerocarpum*, *Diplophyllum taxifolium*, *Pseudolophozia sudetica* (13-472/1, 13-472/2). **11**: on sandy alluvium on bank of rivulet (64°33'13.3" N; 59°38'16.3" E; 669 m alt.), mixed with *Fuscocephaloziopsis albescens*, *Anthelia juratzkana*, *Pseudolophozia sudetica*, *Cephalozia bicuspidata* (13-416). This species was previously known from one locality in Polar Ural (Konstantinova & Czernyadjeva, 1995).
- * *Neoorthocaulis binsteadii* (Kaal.) L. Söderstr., De Roo & Hedd. [*Orthocaulis binsteadii* (Kaal.) H. Buch] (gem.) – **10**: steep slope of the river valley, dwarf shrub-*Sphagnum* bog in subalpine alder bushes (64°34'05.2" N; 59°38'30.0" E; 510 m alt.), in ground layer on dead *Sphagnum* (13-315, 13-316/2), mixed with *Mylia anomala*, *Fuscocephaloziopsis lunulifolia*, *Calypogeia sphagnicola*, *Fuscocephaloziopsis pleniceps*.
- * *N. floerkei* (F. Weber & D. Mohr) L. Söderstr., De Roo & Hedd. [*Orthocaulis floerkei* (F. Weber & D. Mohr) H. Buch] – **3-6, 11-13** (7: 527-860 m), fr.: on ground floor in dwarf shrub-herb-moss tundra, subalpine *Salix*-herb communities and light forests. Sometimes abundant. Mostly without admixture of other bryophytes or mixed with *Barbilophozia lycopodioides*, *Lophozia wenzelii*, *Pseudolophozia sudetica*, *Diplophyllum taxifolium*.
- Odontoschisma elongatum* (Lindb.) A. Evans – **7**: dwarf shrub (*Salix-Betula nana*)-sedge-*Sphagnum* tundra (64°34'10.4" N; 59°37'00.3" E; 665 m alt.), on dead *Sphagnum* turf (13-384/1), mixed with *Fuscocephaloziopsis albescens*, *Cephalozia bicuspidata*, *Gymnocolea inflata*, *Schistochilopsis opacifolia*, *Lophozia wenzelii* var. *groenlandica*, *Scapania paludicola*. **11**: on dwarf shrub-cotton grass-sedge-*Sphagnum* bog (64°33'37.3" N; 59°38'56.4" E; 634 m alt.), in small wet depression (13-337, 13-338), without admixture of other bryophytes or mixed with *Gymnocolea inflata*, *Scapania paludicola*.
- ** *O. francisci* (Hook.) L. Söderstr. & Váňa [*Cladopodiella francisci* (Hook.) Jørg.] (gem.) – **11**: dwarf shrub-lichen debris tundra (64°33'25.3" N; 59°38'49.5" E; 685 m alt.), on clay spots, mixed with *Marsupella apiculata*, *Prasanthus suecicus*, *Pseudolophozia sudetica*, *Cephalozia bicuspidata*, *Sphenolobus minutus*. This species was previously known from two localities in the Polar Ural (Zinovjeva, 1973).
- Pellia neesiana* (Gottsche) Limpr. (per., and.) – **1, 4, 6, 8, 10, 12-15** (12: 390-785 m), fr.: on banks of streams, on seepages, in depressions in boggy forests and on moist meadows. Often without admixture of other bryophytes or mixed with *Marchantia polymorpha* subsp. *montivagans*, *Harpanthus flotovianus*, *Scapania paludosa*, *S. subalpina*, *Cephalozia bicuspidata*.
- Plectocolea hyalina* (Lyell) Mitt. (per., and.) – **2, 3, 6** (6: 420-700 m), sp.: on banks of streams and on road sides on bare soil. Always mixed with other hepatics, more often with *Nardia geoscyphus*, *Solenostoma sphaerocarpum*, *Scapania curta*, *Cephalozia bicuspidata*. It was collected once on bare cryogenic spots in dwarf shrub-lichen-green-moss tundra, mixed with *Anthelia juratzkana*, *Nardia geoscyphus*, *Prasanthus suecicus*, *Marsupella sprucei*, *Scapania obcordata*.
- * *P. obovata* (Nees) Lindb. (per., spor., and.) – **4, 10, 11, 14** (5: 406-785 m), sp.: on fine earth and rocks on banks of streams, in seepages, at base of river valley slopes. Sometimes abundant. Without admixture of other hepatics or mixed with *Scapania subalpina*, *S. undulata*, *S. paludosa*, *Hygrobiella laxifolia*, *Jungermannia borealis*. Collected twice with numerous sporophytes (13-263, 13-267). The species was found once on fine earth in subalpine alder bushes in niches of mossy cliffs, mixed with *Fuscocephaloziopsis pleniceps*, *Mesoptychia gillmanii*, *Tritomaria quinquedentata*, *Blepharostoma trichophyllum*, *Diplophyllum taxifolium*, *Lophozia ventricosa* var. *longiflora*.
- * *Prasanthus suecicus* (Gottsche) Lindb. (per., spor.) – **3, 4, 11** (4: 685-808 m), sp.: in debris moss-lichen and dwarf shrub-green-moss tundra on debris-clay cryogenic spots. Usually mixed with *Nardia geoscyphus*, *Marsupella apiculata*, *M. sprucei*, *Gymnomitrium concinatum*, *Pseudolophozia sudetica*, *Scapania obcordata*, *Sphenolobus minutus*, *Cephalozia bicuspidata*.
- * *Preissia quadrata* (Scop.) Nees – **12**: seepage on schistose cliff at the bottom of steep slope of valley of stream, on fine earth (64°32'47.3" N; 59°37'16.3" E; 636 m alt.), some plants mixed with *Scapania* cf. *curta*, *Solenostoma confertissima*, *Pseudolophozia sudetica*, *Jungermannia* sp. (13-482/4).
- Pseudolophozia sudetica* (Nees ex Huebener) Konstant. & Vilnet [*Lophozia sudetica* (Nees ex Huebener) Grolle] (per., spor., gem.) – **3-13** (25: 460-1035 m), com.: in subalpine alder bushes, on ledges and in crevices of mossy cliffs, on rocks and fine earth on banks of streams. The species is common in different types of tundra, on cryogenic detritus-clay spots, in snowbed communities and in rock fields. Without admixture of other species or mixed with numerous hepatics, more often with *Lophozia wenzelii*, *Lophozia wenzelii* var. *groenlandica*, *Fuscocephaloziopsis albescens*, *Scapania obcordata*, *Marsupella brevissima*, *Tetralophozia setiformis*, *Diplophyllum taxifolium*, *Tritomaria quinquedentata*, *Scapania curta*. Large celled (up to 25 µm) plants referred to *P. sudetica* var. *anomala* were collected twice.
- Ptilidium ciliare* (L.) Hampe (per.) – **3, 5, 9, 11** (7: 570-960), fr.: in dwarf shrub-green-moss tundra, in dwarf shrub-cotton grass-sedge-*Sphagnum* bogs, more rarely in forests or subalpine *Duscheckia fruticosa* bushes on rocky slopes. In mats without any admixture of other hepatics or mixed with *Barbilophozia lycopodioides*, *Sphenolobus saxicola*, *Schljakovia kunzeana*, *L. silvicola*, *L. wenzelii* var. *groenlandica*.
- P. pulcherrimum* (Weber) Vain. – **13**: subalpine alder bushes (64°30'42.3" N; 59°34'46.5" E; 614 m alt.), on litter and decaying wood (13-429/2), mixed with *Lophozia longi-*

- dens*, *Lophozia* cf. *silvicola*. **14**: swampy birch-fir *Calamagrostis-Sphagnum*-green moss forest (64°33'49.5" N; 59°40'42.9" E; 406 m alt.), at base of tree trunk (13-361), as admixture in mats with dominance of *Barbilophozia hatcheri*.
- Riccardia latifrons* (Lindb.) Lindb. (and., per.) – **10**: dwarf shrub-*Sphagnum* bog among subalpine alder bushes, on steep slope of stream valley (64°34'05.2" N; 59°38'30.0" E; 510 m alt.), on dead *Sphagnum* (13-317), mixed with *Mylia anomala*, *Calypogeia sphagnicola*, *C. muelleriana*, *Neoorthocaulis binsteadii*, *Cephalozia bicuspidata*, *Fuscocephaloziopsis pleniceps*.
- * *Saccobasis polita* (Nees) H. Buch (per.) – **11**: bed of the Khrustalnyi Stream (64°33'09.6" N; 59°38'37.1" E; 640 m alt.), on alluvium covered rocks in the bed and on steep banks of a stream (13-343/1, 13-346/1), without admixture of other hepatics or mixed with *Harpanthus flotovianus*, *Plectocolea obovata*, *Scapania subalpina* *S. paludosa*. **12**: temporary stream near seepage in the subalpine belt (64°33'01.0" N; 59°37'41.1" E; 700 m alt.), on fine earth, pure mats without admixture of other species (13-348, 13-350).
- *** (*) *S. polymorpha* (R.M. Schust.) Schljakov – **7**: hellebore-tufted club-rush (*Veratrum lobelianum*, *Trichophorum caespitosum*) community among dwarf shrub-herbaceous tundra (64°33'57.6" N; 59°36'32.9" E; 710 m alt.), some plants mixed with *Nardia geoscyphus*, *Pseudolophozia sudetica* (13-392/1).
- * *Scapania brevicaulis* Taylor (gem.) – **8**: *Deschampsia*-herbaceous tundra with *Phyllodoce* on south facing slope (64°34'18.8" N; 59°36'15.7" E; 724 m alt.), co-dominant in ground layer with *Pseudolophozia sudetica* and admixture of *Cephalozia bicuspidata* (13-412, 13-413).
- *** *S. crassiretis* Bryhn (gem.) – **5**: dwarf shrub-sedge-*Sphagnum* bog on gentle ledge on slope of mountain (64°34'50.1" N; 59°35'34.7" E; 960 m alt.), among *Sphagnum* without any admixture (13-280/1, 13-283) or mixed with *Blepharostoma trichophyllum* (13-281), or *Sphenolobus minutus*, *Tritomaria quinqueidentata*, *Schljakovia kunzeana*, *Cephalozia bicuspidata*, *Gymnocolea inflata*, *Ptilidium ciliare* (13-282).
- S. curta* (Mart.) Dumort. (per., spor., gem.) – **1-3, 6, 10, 12** (7: 400-640 m), fr.: on bare soil on banks of streams, on road sides, in *Salix* stands in valley of river, on fine earth at the bottom of cliffs. Sometimes without admixture of other species or mixed with *Plectocolea hyalina*, *Solenostoma sphaerocarpum*, *S. confertissima*, *Cephalozia bicuspidata*, *Blasia pusilla*, *Nardia japonica*, *N. breidleri*.
- *** (*) *S. degenii* Schiffl. ex Müll. Frib. (per., spor., gem.) – **5, 8, 9, 13** (6: 575-1013 m), sp.: between rocks in shaded niches in rock fields. In pure mats or mixed with *Pseudolophozia sudetica*, *Marsupella emarginata*, *Gymnocolea inflata*, *Scapania brevicaulis*. *S. degenii* var. *dubia* (13-278), with mostly 2-celled gemmae was collected once.
- * *S. cf. hyperborea* Jørg. – **5**: rock field on gentle slope, on rocks (13-273, 13-274), several plants among *Schljakovia kunzeana*. **6**: dwarf shrub (*Salix-Betula nana*)-sedge-*Sphagnum* tundra (64°34'10.4" N; 59°37'00.3" E; 665 m alt.), on peaty soil (13-386), some plants mixed with *Fuscocephaloziopsis albescens*, *Lophozia wenzelii* var. *groenlandica*, *Gymnocolea inflata*, *Cephalozia bicuspidata*, *Scapania irrigua*, *Sphenolobus minutus*, *Schljakovia kunzeana*.
- S. irrigua* (Nees) Nees (per., and gem.) – **1, 4, 6, 7, 12, 13, 15** (8: 400-785 m), fr.: in moist swampy forests and tundra, on subalpine meadows, in seepages, on banks of streams, on moist road sides. Without admixture of other hepatics or mixed with *Scapania subalpina*, *Fuscocephaloziopsis pleniceps*, *Cephalozia bicuspidata*, *Gymnocolea inflata*, *Plectocolea obovata*, *Lophozia wenzelii* var. *groenlandica*, etc.
- * *S. kaurinii* Ryan (gem., and., per.) – **9**: deep depression in rock field (64°33'54.5" N; 59°35'01.8" E; 1013 m alt.), on fine earth between rocks (13-402/2), mixed with *Tetralophozia setiformis*.
- S. mucronata* H. Buch – **2**: road side near timberline (64°34'17.3" N; 59°39'06.1" E; 450 m alt.), on bare soil (13-219/2), some plants among *Solenostoma confertissima*, *Scapania curta*, *S. scandica*.
- * *S. obcordata* (Berggr.) S.W. Arnell (spor., gem.) – **3, 4, 6** (5: 620-808 m), sp.: on bare soil on cryogenic clay spots in lichen-green-moss and debris lichen tundra, more rarely in snowbed communities and clay alluvium along streams, always with other hepatics. Mostly with *Nardia geoscyphus*, *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Fuscocephaloziopsis pleniceps*.
- S. paludicola* Loeske & Müll. Frib. – **6, 7, 11, 15** (4: 390-800 m), sp.: in wet depressions in dwarf shrub-cotton-grass-sedge-*Sphagnum* bogs, in swampy and moist forests in river valleys. Without admixture of other hepatics or mixed with *Gymnocolea inflata*, *Odontoschisma elongatum*. The species was collected as single plants on dead *Sphagnum* in swampy tundra, mixed with *Fuscocephaloziopsis albescens*, *Cephalozia bicuspidata*, *Schistochilopsis opacifolia*, *Lophozia wenzelii* var. *groenlandica*.
- * *S. paludosa* (Müll. Frib.) Müll. Frib. (and., spor.) – **1, 2, 4, 10, 11, 13, 14** (7: 400-785 m), fr.: on banks and in beds of streams, in moist and swampy forests, willow stands, in seepages. Often in turfs without admixture of other hepatics or mixed with *Scapania subalpina*, *S. undulata*, *Harpanthus flotovianus*, *Pellia neesiana*, *Cephalozia bicuspidata*.
- * *S. parvifolia* Warnst. (gem.) – **1, 2, 6, 10** (5: 470-665 m), sp.: on bare soil along road sides, in dwarf shrub-green-moss and lichen tundra, at bottom of rocks, rare in subalpine alder bushes, on fine earth in crevices and on ledges of cliffs, on bank of rivulets, on alluvium covered rocks. Some plants among other hepatics: *Scapania curta*, *Pseudolophozia sudetica*, *Lophozia excisa*, *Schistochilopsis opacifolia*, *Solenostoma confertissima*, *Isopaches bicrenatus*, *Mesopotychia gillmanii*, *Plectocolea obovata*, *Blasia pusilla*.
- S. scandica* (Arnell & H. Buch) Macvicar (gem.) – **2**: on road side near timberline (64°34'17.3" N; 59°39'06.1" E; 450 m alt.), on bare soil, mixed with *Nardia japonica* (13-216/2) and *Solenostoma confertissima*, *Scapania curta*, *S. mucronata* (13-219/2).
- *** (*) *S. spitsbergensis* (Lindb.) Müll. Frib. (per., and., gem.) – **9**: in deep depression in huge rock field (64°33'54.5" N; 59°35'01.8" E; 1013 m alt.), on fine earth between rocks (13-402/1, 13-403). Without admixture of other hepatics or mixed with *Diplophyllum albicans*, *Gymnomitrium concinatum*, *Lophozia wenzelii*, *Cephalozia bicuspidata*.
- S. subalpina* (Nees ex Lindenb.) Dumort. (per, spor.) – **1, 4, 6, 8, 10, 12, 13** (10: 460-786 m), fr.: on alluvium and rocks on banks and in beds of streams. Usually without admixture of other hepatics or mixed with *Plectocolea obovata*, *Fuscocephaloziopsis albescens*, *Scapania irrigua*, *Pellia neesiana*.
- * *S. undulata* (L.) Dumort. (per., and.) – **1, 4, 8, 11** (4: 400-785 m), sp.: on rocks and alluvium on banks and in beds of streams. Usually without admixture of any other hepatics.
- *** (*) *Schistochilopsis opacifolia* (Culm. ex Meyl.) Konstant. (per., spor., gem.) – **1, 2, 6, 7, 9, 10** (8: 400-914 m), fr.: in

- subalpine alder bushes, on fine earth in crevices of mossy cliffs, on alluvium covered rocks on banks of streams, on bare soil near rocks in dwarf shrub-*Sphagnum*-green-moss boggy tundra and on dead *Sphagnum* turf in dwarf shrub-sedge-*Sphagnum* bogs. Without admixture of other hepatics or more often mixed with *Fuscocephaloziopsis albescens*, *Plectocolea hyalina*, *Nardia geoscyphus*, *Blepharostoma trichophyllum*, *Pseudolophozia sudetica*, *Lophozia ventricosa* var. *longiflora*, *Diplophyllum taxifolium*, *Cephalozia bicuspidata*. The species was only cited previously for Polar (Konstantinova & Czernyadjeva, 1995) and South Urals (Potemkin & Kalinauskaite, 2008).
- Schljakovia kunzeana* (Huebener) Konstant. & Vilnet (per., gem.) – **5-7, 11, 16** (7: 325-960 m), fr.: on fine earth on rocks in rock fields, in sedge-moss-tundra. In pure mats without admixture of other hepatics or, more often, mixed with *Ptilidium ciliare*, *Tritomaria quinquedentata*, *Lophozia ventricosa* s.l., *Sphenolobus minutus*, *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*.
- * *Schljakovianthus quadrilobus* (Lindb.) Konstant. & Vilnet – **12**: *Betula nana*-herbaceous-green moss tundra on south facing slope (64°33'00.4"N; 59°37'33.4" E; 680 m alt.), abundant in ground layer, with some admixture of *Tritomaria quinquedentata* (13-355). On seepage on schistose cliffs on side of valley of stream, (64°32'47.3" N; 59°37'16.3" E; 636 m alt.), some plants with *Mesoptychia collaris* (13-463/4).
- * *Solenostoma confertissimum* (Nees) Schljakov (per., and., spor.) – **2**: road side near timberline (64°34'18.3" N; 59°38'45.3" E; 420 m alt.) and (64°34'17.3" N; 59°39'06.1" E; 450 m alt.), mixed with *Nardia japonica*, *Scapania curta*, *S. scandica*, *S. mucronata* (13-219/2, 13-221). **13**: on diluvium slope to a rivulet, on fine earth (64°32'47.3" N; 59°37'16.3" E; 636 m alt.), mixed with *Scapania* cf. *curta* (13-482/2).
- *** (*) *S. gracillimum* (Sm.) R.M. Schust. (per.) – **3**: dwarf shrub-green-moss tundra (64°34'28.2" N; 59°37'07.8" E; 698 m alt.), on bare clay spot (13-238), mixed with *Anthelia juratzkana*, *Marsupella sprucei* var. *ustulata*, *Isopaches bicrenatus*, *Pseudolophozia sudetica*, *Nardia geoscyphus*, *Cephalozia ambigua*.
- ** (*) *S. cf. pusillum* (C.E.O. Jensen) Steph. – **8**: between rocks on bank of rivulet under snow field (64°34'13.2" N; 59°35'56.8" E; 709 m alt.), mixed with *Lophozia* cf. *wenzelii*, *Cephalozia bicuspidata*, *Scapania* spp., *Anthelia juratzkana* (13-485). This species was previously known from one locality in Polar Ural (Konstantinova & Czernyadjeva, 1995).
- S. sphaerocarpum* (Hook.) Steph. (per., and., spor.) – **2-4, 6, 11, 12** (8: 420-785 m), fr.: on partly grass- and moss covered soil on road side, under willow on diluvium in valley of stream, on fine earth covered rocks along a rivulet, rarely on bare soil in tundra. Always mixed with other hepatics: *Plectocolea hyalina*, *Isopaches bicrenatus*, *Scapania curta*, *Lophozia* cf. *silvicola*, *L. wenzelii* var. *groenlandica*, *Diplophyllum taxifolium*, *Pseudolophozia sudetica*, *Nardia japonica*, *Cephalozia bicuspidata*, *Prasanthus suecicus*, *Marsupella apiculata*.
- ** (*) – var. *nanum* (Nees) R.M. Schust. (per.) – **6**: on alluvium covered rocks along a rivulet (64°34'13.9" N; 59°37'03.2" E; 640 m alt.), mixed with *Schistochilopsis opacifolia*, *Cephalozia bicuspidata*, *Fuscocephaloziopsis albescens*, *Scapania curta* (13-473/2). This variety was previously known from one locality in Polar Ural (Konstantinova & Czernyadjeva, 1995).
- Sphenolobus minutus* (Schreb.) Berggr. (per., gem.) – **4-6, 9-11** (8: 470-960 m), fr.: between mosses in ground layer or on clay spots in debris lichen and dwarf shrub-lichen-moss tundra; in crevices on mossy cliffs and on dwarf shrub-sedge-*Sphagnum* bogs. Sometimes without admixture of other hepatics but more often in bryophyte turfs. On the edge of debris-clay spots in dwarf shrub-lichen tundra. *F. grandis* (Lindb.) Schljakov was collected once (13-462/1), mixed with *Cephalozia bicuspidata* and *Lophozia wenzelii*.
- * *S. saxicola* (Schrud.) Steph. – **2, 4, 11, 13** (4: 450-808 m), sp.: in debris dwarf shrub-lichen and green moss-lichen tundra, among rocks in overgrown rock field. Usually mixed with *Ptilidium ciliare*, *Tetralophozia setiformis*, *Tritomaria quinquedentata*. Collected once on a huge rock on a road side near timberline.
- * *Tetralophozia setiformis* (Ehrh.) Schljakov – **2, 9, 11, 13** (7: 450-1035 m), fr.: on rocks in rock fields, sometimes on small rocks in debris lichen and dwarf shrub-moss-lichen tundra. Often without admixture of other hepatics. Collected once on a huge rock on a roadside near timberline.
- * *Tritomaria quinquedentata* (Huds.) H. Buch (per.) – **5, 6, 10-13** (10: 450-960 m), fr.: on litter in subalpine alders, on ledges and in crevices of mossy cliffs, in *Betula nana* and herb-green moss tundra, on sedge-*Sphagnum* bogs. Frequent, sometimes abundant. Occurs without admixture of other species or mixed with *Barbilophozia hatcheri*, *Ptilidium ciliare*, *Schljakovia kunzeana*, *Neoorthocaulis floerkei*, etc.

DISCUSSION

In our previous study on hepatics of the Khanty-Mansi Autonomous District we reported 83 species from plain regions that are prevalent in the district (Lapshina & Konstantinova, 2012). The present list counts 97 species collected in its mountain part; it includes 52 species new for the district, reaching the total number to 135. This study enriched the hepatic mainly by arcticmontane, arcticboreomontane and montane species.

Nine species are new for the Urals. The most impressive finding is *Hygrobiella laxifolia*. The species is known as having an oceanic distribution (Konstantinova, 2000). It had been reported in Russia from Murmansk Province and Karelia in the West as well as from Kamchatka and the South Kurils in the East (Konstantinova et al., 2009). Finding the species on the eastern slopes of the Urals changes the knowledge about its distribution. The discovery of arcto-montane (*Lophozia polaris*, *Saccobasis polymorpha*, *Scapania brevicaulis*, *S. crassiretis*, *S. degenii*, *S. spitsbergensis*) and montane hepatics (*Solenostoma gracillimum*) in the Urals was quite predictable. It was recently shown that these hepatics are not rare in the arctic and northern mountains of Russia (Konstantinova et al., 2009).

The majority of hepatics new for the district are widespread arcto-montane species that are usually frequent (*Anthelia juratzkana*) or sporadic in many region (*Cephalozia ambigua*, *Gymnomitrium concinnatum*, *Marsupella apiculata*, *M. boeckii*, *M. sprucei*, *Prasanthus suecicus*), but in the studied area they are rare (*Gymnomitrium brevisimum*, *G. corallioides*, *Neoorthocaulis binsteadii*, *Scapania brevicaulis*). The second largest group of hepatics

that were found for the first time in Khanty-Mansi Autonomous District are arcto-boreomontane species. This group includes a number of calciphilous species (*Mesoptychia collaris*, *M. gillmanii*, *Preissia quadrata*, *Schljakovianthus quadrilobus*) that are rare in the area because of the rarity of suitable habitats; some are not rare in the Arctic and mountains (*Tritomaria quinquedentata*, *Conocephalum conicum*, *Diplophyllum taxifolium*, *Lophoziaopsis propagulifera*) or in suboceanic regions (*Odontoschisma francisci*, *Nardia breidleri*, *Nardia japonica*, *Saccobasis polita*) but are generally rare in the studied region. Montane species are the third largest group among the species collected for the first time in the district. Most of them are rather common worldwide (*Diplophyllum albicans*, *Marsupella emarginata*, *Neorothocaulis floerkei*, *Scapania paludosa*, *Scapania undulata*, etc.) and occur sporadically in the studied area.

Rarity of arcto-montane, arcto-boreomontane and montane species can be explained mainly by the relatively small area studied in the upper mountain belts.

One of an interesting characters of the flora is the presence of species that are known as predominantly oceanic and suboceanic (*Diplophyllum albicans*, *Endogemma caespiticia*, *Harpanthus flotovianus*, *Hygrobiella laxifolia*, *Nardia breidleri*, *Odontoschisma francisci*, *Saccobasis polita*). All of them, apart from *Harpanthus flotovianus*, are rare in the studied area. These species are restricted to permanently moist microhabitats or habitats with high humidity that are abundant in high mountains and particularly on Ner-Oika Mt.

A low amount of boreal species and almost total absence of temperate species is explained mostly by undercollecting in lower part of forest belt. As a result, many widespread boreal hepatics (e.g., *Geocalyx graveolens* (Schrad.) Nees, *Lepidozia reptans* (L.) Dumort., *Neorothocaulis attenuatus* (Mart.) L. Söderstr., De Roo & Hedd., *Riccardia palmata* (Hedw.) Carruth. etc.) and sporadic species (*Calypogeia suecica* (Arnell & J. Perss.) Müll. Frib., *Lophozia ascendens* (Warnst.) R.M. Schust., *Scapania apiculata* Spruce, etc.) were not gathered.

Two species, *Biantheridion undulifolium* and *Nardia breidleri*, which are red-listed in Russia (Bardunov, 2008) were found in studied area. *Biantheridion undulifolium* is worldwide endangered species that is extremely rare in Europe, but probably not rare in Siberia (Konstantinova & Savchenko, 2008). It was collected earlier in Polar Urals in one locality in the Sob River valley (Konstantinova & Czernyadjeva, 1995). *Nardia breidleri* is a mainly oceanic disjunctive arcticmontane species that is not rare in Murmansk Province and occurs sporadically in the mountains of South Siberia and in the Far East (Konstantinova et al., 2009). The species is probably overlooked because of its very small size and some difficulties in identification.

Apart from species red-listed in Russia, several species rare in Europe were collected (*Scapania brevicau-*

lis, *S. degenii*, and *S. spitsbergensis*). These species are red-listed in Europe (Schumacker & Váňa, 2005). All of them are rare in the studied area.

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