THE HEPATICS OF THE UPPER PUIVA RIVER
(SUB-POLAR URAL, KHANTY-MANSI AUTONOMOUS DISTRICT)

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Abstract

An annotated list of hepatics of the Upper Puiva River basin (eastern slope of Subpolar Urals) was compiled based on identification of ca. 450 specimens collected by Elena Lapshina in 2015. It includes 104 species, two subspecies and two varieties, among which four species (Calycularia laxa, Jungermannia atrovirens, J. polaris, and Scapania tundrae), two subspecies and one variety are new for the Urals and 23 species and one variety are new for the Polar Urals. New localities for the worldwide rare hepatics (Biantheridion undulifolium, Protolophozia elongata, Lophoziopsis pellucida, and Cephaloziella arctogena) and very rare in the Urals Asterella lindenbergiana, Sauteria alpina, Odontoschisma macounii, and Cephaloziella varians are revealed. A world-wide distribution of the treated species and some morphological peculiarities are discussed. The described flora is compared with the previously studied neighboring flora of Mt. Ner-Oika.

KEYWORDS: hepatics, distribution, phytogeography, ecology, flora, Subpolar Urals, Russia

INTRODUCTION

The Subpolar Ural is the widest and highest part of the Ural mountains. The width of the mountain chain exceeds 150 km at 65° N and the highest summit (Mt. Narodnaya) reaches more than 1800 m of altitude. Hepatics of this part of the Urals as well as of the Polar Urals are poorly studied. Few publications deal with the hepatic flora of several territories on the western side of Northern and Middle Ural (Zinovjeva, 1973; Bakalin et al., 2001; Konstantinova & Bezgodov, 2006; Dulin, 2007; Konstantinova et al., 2010), and one area of the Polar Ural (Konstantinova & Czernyadjeva, 1995).

The first study of the hepatic flora on the eastern side of the Ural was of Mt. Ner-Oika in the territory of the Khaty-Mansi Autonomous District (Konstantinova & Lapshina, 2014). We here present the results of the study of the hepatic flora of the territory of the Upper Puiva River (Fig 1, 2) situated to the south of Mt. Ner-Oika. The area studied differs from that of Mt. Ner-Oika in the presence of carbonate rock outcrops. The distance between the two neighbouring areas is 10 km, the distance between the nearest collecting points is 4 km. In spite of this the hepatic floras of the areas differ strikingly.

Both areas mentioned above are situated near the watershed on the eastern slopes of the Ural mountains. Fragments of glaciers and permanent snow fields are common here. Mountain peaks with steep slopes alternate with deep trough valleys, narrow erosion canyons and high mountain plateaus. The upper parts of both Shshekurja and Puiva rivers and their tributaries (Koby-la-Yu, Shaitanka, Zhilnyi, Malaya Puiva) are ending in

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glacier valleys and cirques. The highest peaks of these areas are Mt. Ner-Oika (1649 m) and in upper Puiva River Mt. Khus'-Oika (1386 m) and Mt. Shatmaga (1088 m). The mountain ridges are composed of granitoides and quartzites. In the upper Puiva River shale strata of the intermontane spaces are broken by numerous dikes of intrusive rocks of basic, neutral and acid composition. A significant part of the territory of Puiva’s geosyncline is composed of interstratified calcareous shales and marbles. It defines the presence of carbonate outcrops and the wide development of karst sinkholes caves. There are four main vegetation zones in the mountains of the Subpolar Urals: forest zone (up to 400–450 m alt.), subgoltsy zone were larch low growth open forests, alder tickets and subalpine meadow are predominant (up to 500–600 alt.), and mountain tundra zone which at 900–1000 m alt. changes into a rock desert zone were rock fields are predominant. The upper forest border varies greatly. Particularly on steep slopes larch low growth open forests and alder tickets can reach 650 m alt.
**MATERIAL AND METHODS**

In 2015 Elena Lapshina gathered hepatics in the highlands on the eastern side of the Subpolar Ural mountains (Fig. 2) 20 km to the south of Mt. Ner-Oika, where the hepatic flora has been studied earlier (Konstantinova & Lapshina, 2014). In total 450 specimens were collected in the Upper Puiva River Basin (64°26′ – 64°31′N; 59°38′ – 59°46′E) from July 30 to August 10. Seventy five hepatic collection sites were visited at 380–1030 m alt. (Fig. 1). They represent all hepatic habitats present in the region. Some species easily recognized in the field (**Ptilidium ciliare**, **Tetraphis setiformis**, **Barbilophozia lycopodioides**, **Marchantia polymorpha** subsp. **montivagans**) were only collected at some sites and most of their localities were just marked in the notes. For all localities the coordinates and elevations were measured using GPS. The collected specimens were studied in the laboratory of the Polar-Alpine Botanical Garden-Institute (Kirovsk, Murmansk Province). The specimens are deposited in the Herbarium of Polar-Alpine Botanical Garden-Institute of the Kola Scientific Center, Russian Academy of Sciences (KPABG). Label data of duplicates are incorporated in the CRIS – Cryptogamic Russian Information System (kpabg.ru›cris/?q=node/16). ANNOTATED LIST OF SPECIES

The annotated list of hepatics includes 104 species, 2 subspecies and 2 varieties. The nomenclature generally follows Söderström et al. (2016) with changes for some *Lophozia* spp. in accordance with Bakalin (2016). We also treat *Plectocolea* as a separate genus following Konstantinova et al. (2009). Brief descriptions of each species is in accordance with what was applied for hepatics of Mr. Ner-Oika (Konstantinova & Lapshina, 2014). Some synonyms that are common in Russian publications are cited in square brackets. 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). The collecting sites are listed acc. Fig. 1. Table 1, followed by the number of localities where the species have been recorded, the altitudinal range (in m) is indicated after a colon. Habitat characteristics and accompanying species are given for sporadic and widespread species. The frequency is characterized as: sporadic (sp., 3–6 localities), frequent (fr., 7–13 localities) and common (com., more than 13 localities) and at least one reference to herbarium number in the Cryptogamic Russian Information System – CRIS (kpabg.ru›cris/?q=node/16) is cited. For species collected from 1–2(3) localities the labels are cited in full and the reference to the herbarium number in the Herbarium of Polar-Alpine Botanical Garden-Institute (KPABG) is given. For specimens that are deposited in Yugor State University (YSU) only the collecting number of Lapshina is cited. One asterisk before a species name means a new record for the District; two asterisks mean a new record for the Urals. If the species is new for both Urals and Khanty-Mansi Autonomous District then it was marked as two asterisks + one asterisk in brackets.

**Anthelia juratzkana** (Limpr.) Trevis.: – 3, 5, 8, 10, 11, 13, 17 (9: 680–1030 m), fr.: on moist loamy spots of bare soil in low bush-moss- and bushy herbaceous tundra with *Betula nana*, on fine earth between boulders in rock fields and on edges of snowfields, on soil in snowbed communities [121221]. The species occurs in pure mats or mixed with widespread, mostly acidophilous hepatics (*Pseudolophozia sudetica*, *Lophozia wenzelii*, *Fuscephaloziosis albescens*, *Cephalozia bicuspidata*, *Marsupella sprucei*, *Solenostoma confertissimum*, *Nardia geoscyphus*, *Plectocolea hyalina*). It was collected twice on carbonate cliffs covered by soil where it occurred with some mostly calciphilous bryophytes: *Preissia quadra*, *Blepharostoma trichophyllum* subsp. brevirete, *Mesoptichya heterocolpos*, *Cyrtonnium hymenophyloides* [121176].

**Asterella lindenbergiana** (Corda ex Nees) Arnell (gyn., spor.) – 2, 6, 8, 11, 12 (8: 633–973 m), sp.: tundra belt, on fine earth on sides of sinkholes and in shaded niches on carbonate cliffs and rocks [121150], in pure mats or mixed with *Mesoptichya gillmanti*, *Clevea hyalina*, *Sauteria alpina*, *Tritomaria scitula*, *Blepharostoma trichophyllum* subsp. brevirete, *Distichium capillaceum*. Occurs as well on soil and fine earth in mossy beds and on sides of temporary streams where it grows in pure mats or mixed with *Preissia quadra*, *Mnium spinosum*, *Philonotis fontana*, *Pohlia wahlbergii*. It is an almost circumpolar arctomontane calcilocus species. It has previously been reported for Russia from Caucasus, the Murmansk Province, the mountains of Yakutia and the Far East (Borovichev et al., 2015). Finding the species in Urals in areas with carbonate rocks fills in the huge gap in its distribution.

**Barbilophozia barbata** (Schmidel ex Schreb.) Loeske – 2, 19, 21 (4: 380–636 m), sp.: on soil in moist mixed *Betula-Picea-Pinus sibirica* and *Betula-Picea* tall herbs–*Vaccinium myrtillus*-green moss forests on steep slopes of mountains [121240] and in wet *Picea-Betula* forests in valleys of brooks, both in mats without admixture of other bryophytes and mixed with *Barbilophozia hatcheri*, *Lophocolea minor*, *Lophozia cf. silvicola*, *Sanionia uncinata*. It was once collected in *Laris* open forest on a carbonate cliff as single stems in mats with *Lophocolea minor*, *Mnium thomsonii*, *Calliachium haldanianum*, *Pohlia cruda*, *Platydictya jungermannioides* (72/5).

**B. hatcheri** (A. Evans) Loeske (gem., and., per.) – 1, 2, 4, 8, 13, 11, 12, 14, 15, 16, 17, 18, 19, 20 (20: 380–840 m), com.: on soil and soil covered rocks in grass- and grass-moss tundras, on soil among herbs, between rocks and on fine earth covered rocks in rock fields, on soil at the bases of trees and on mossy rocks in alder thickets, larch and birch low growth open forests, mixed *Betula-Picea* and dark coniferous tall herb-moss forests [121118]. The species was gathered several times in sinkholes and on fine earth on ledges on carbonate cliffs in tundras. It occurs both in pure mats and mixed with *Barbilophozia barbata*, *Schljukovia kunziana*, *Ptilidium ciliare*, *Lophozia wenzelii*, *Lophoziopsis longidens*, etc.

**B. lycopodioides** (Wallr.) Loeske (per.) – 3, 8, 11, 15, 16, 17, 18, 19, 20, 21 (16: 380–850 m), com.: on soil in mixed birch-spruce and dark coniferous forests, in larch and birch low growth open forests, in swampy willow thickets along ground-
water seepages, on fine earth covered rocks and on soil in grass and grass-moss tundras [121125]. Often in pure mats, but sometimes mixed with Lophozia longidens, Pleuroziu
*m schreberi, Lecuraria secunda, Hylcomiostrum pyrenaicum.*

*B. sudetica* (Nees ex Huebener) L. Süderstr., De Roo & Hedd. [Lophozia sudetica (Nees ex Huebener) Grolle, Pseudolophozia sudetica (Nees ex Huebener) Konstant. & Vilnet] (gem., per.) – 4, 5, 7, 8, 11, 16, 19 (12: 676–980 m), fr.: on fine earth covered siliceous rocks, between boulders in rock fields on mountain slopes, on soil in snowbed communities, on edges of snowfields, on soil on the side of sinkholes, on road sides [121133]. In pure mats or mixed with Diplophyllum albicans Tetralophozia setiformis, Gymnornitrium cinnnatum, Lophozia wenzelii, L. murmanica, Fuscocephaloziopsis abescens, Pohlia crudeida, Kiaeria falcata, Andreeva rupestris, Racomitrium lanuginosum.

Biantheridion undulifolium* reported earlier for the western side of the Urals, particular-

eastern side of the Urals. The subspecies* brevirete* has previously been found in many sites in Siberia (Konstantinova & Mamontov, 2010). As opposed to the typical subspecies *B. trichophyllum* subsp. *brevirete* is restricted to calcareous areas and high latitudes and altitudes. It is much more common than subsp. *trichophyllum* in the high Arctic and at high altitudes in mountains.

**(*) Calyclaria laxa** Lindb. & Arnell – 4: rock field at the bottom of Zhilny brook (64.48296° N – 59.65805° E; 688 m alt.), on fine earth between rocks, some thalli in mats dominated by Lophozia wenzelii and admixture of Trilophozia quinuedentata, Sanionia uncinata (16/5). 9: on moist carbonate fine earth under boulders in rock field [121181, 121186] in pure mats and some thalli among Diplophyllum albicans, D. taxifolium, Pohlia crudiioides. C. laxa is an arctomontane spe-

cies with predominantly Asian – western North American dis-
tribution and a single locality in the European Arctic (Kon-
stantinova & Lavrinenko, 2002) and another in the subarctic (Borovichev, 2013), which presumably represent post-glacial invasion (Konstantinova & Mamontov, 2010).

Calypogea neesiana (C. Massal. & Caresta) Müll. Frib. – 19, 20, 21 (3: 380–433 m), sp.: on decaying wood in coniferous mountain forests [121285] in pure mats or mixed with Fuscocephaloziopsis lunulifolia, F. pleniceps, Blepharostoma trichophyllum.

C. sphagnicola (Arnell & J. Perss.) Warnst. & Loeske – 17: northern spur of Mt. Shatmaga, dwarf shrub-sedge green moss-Sphagnum bog at the bottom of mountain [121267], mixed with Riccardia latifrons, Blepharostoma trichophyllum, Neorthocaulis binsteadii, Scapania paludicola, Trilophozia quinuedentata, Dicranum laevidens, Warnstorfa sarmentosa. 22: upper part of the forest belt in the middle of Puiva River [121301], at the bottom of mountain, edge of bog, on base of tree mixed with Mylia anomala, Schljakovia kanzeana, Aulacomnium palustre.

Cephalozia ambigua C. Massal. – 5: rock field at the edge of snowfield in valley of a brook (64.47855° N – 59.63406° E; 783 m), on fine earth between boulders (24/3), single shoots in mats of Schistochilopsis opacifolia. 9: sedge-Sphagnum bog at the base of quartzite ridge (64.49596° N – 59.65054° E; 890 m alt.), small admixture in mats of Neorthocaulis binsteadii, on Lophozia longiflora and Cephalozia spinigeria (30/1).

C. bicuspisdata (L.) Dumort. (per. spor.) – 3, 4, 5, 7, 9, 11, 10, 19, 17 (12: 476–980 m), com.: on moist loamy spots in grav-
el lichen and dwarf-shrub-moss tundras, on fine earth be-
tween huge boulders in rock fields, in snowbeds, between mosses in dwarf-shrub-sedge-moss bogs, on sides of brooks [121166]. Usually mixed with Lophozia spp., Fuscocephaloziopsis pleniceps, F. abescens, Scapania curta, Nardia geoscyphus, Plectocolea hyalina, Harpanschia flavovians, Schistochilopsis opacifolia.

Cephalozziella arctogena (R.M. Schust.) Konstant. (and., gyn, per.) – 9, 10, 19, 20 (4: 433–994 m), sp.: on moist loamy spots in dwarf-sedge-moss tundras, in bryophyte mats in sedge-Sphagnum bog, on decaying wood and at bases of trees in birch-dark coniferous tall herbs–green moss forests [121297]. The species always occurs as small admixture in mats of bryophytes. For the Northern Urals it has previously been reported for Mt. Ner-Oika (Konstantinova & Lapshina, 2014).

C. divaricata (Sm.) Schiffn. – 8: on carbonate cliffs in tundra [121176], on fine earth between rocks, some stems in mats dominated by Preissia quadrata; 16: on soil in herbaceous tundra on gentle south facing slope (64.49586° N – 59.67885°
E. 810 m alt.), admixture in mats with dominated by *Pseudolophozia sudetica* (53/4-2-3) or mixed with *Lophozia wenzieli* and *Lophoziosis excisa*. 17: northern spur of Mt. Shatmaga [121265], dwarf-shrub-sedge-*Sphagnum* bog at the bottom of slope, admixture in mats with dominated by *Scapania tundracea*.

*C. rubella* (Nees) Warnst. (per., and.) – 18: *Betula-Vaccinium myrtillus*-green moss open forest [121239] on bare soil without admixture of other bryophytes.

*C. spinigera* (Lindb.) Jörg. (per.) – 9: *sedge-*Sphagnum bog at the base of quartzite ridge (64.4956° N – 59.65054° E; 890 m alt.), single shoots in mats dominated by *Neorthocaulis binsteadii* mixed with *Lophozia longiflora* and *Cephalozia ambigua* (30/1). 20: upper part of forest belt in the Middle Puiva River (64.48790° N – 59.69896°; 380 m alt.), seepage at the bottom of mountain at the edge of a bog, on base of trees in mat of *Dicranum* sp. (66/2).

*C. varians* (Gottsche) Steph. – 10: rock field impounded by water from lake (64.50243° N – 59.63124° E; 990 m alt.), on fine earth as admixture in mats with *Lophozia munrmanica*, *Gymnomitrion concinnatum*, *Sanionia uncinata*, *Onoclea phorus wahlenbergii*, *Hylocomium pyrenicum* (41/1-1).

The species has previously been reported for the Urals from a single locality in the Vishera State Nature Reserve (Konstantinova & Bezgodov, 2006) and a single locality in the vicinity of Mt. Ner-Olka (Konstantinova & Lapshina, 2014).

*Chiloscyphus panthanthos* (L.) Corda – 6: mossy rocky bed of brook [121228], on rocks covered by fine earth, mixed with *Marchantia polymorpha* ssp. *montivagans*, *Pohlia wahlenbergii*, mossy rocky bed of temporary brook, on fine earth on rocks in mats dominated by *Mesopathyzia gillinmani* and admixture of *Jungermannia atrovirens*, *Bryoerythrophyllum recurvirostre*, *Blepharostoma trichophyllum* subsp. *brevirete*, *Marchantia polymorpha* subsp. *montivagans* (46/4-1).

*Blepharostoma trichophyllum* (L.) Corda [121229], on left bank of Puiva River [121219], on fine earth in shaded niche at the bottom of cliff, mixed with *Mesopathyzia gillinmani*, *Asterella lindenbergiana*, *Blepharostoma trichophyllum* subsp. *brevirete*, *Trichomma scitula*, *Mnium thomsonii*. 12: carbonate cliff on left bank of Puiva River [121219], on fine earth in shaded niche at the bottom of cliff, mixed with *Mesopathyzia gillinmani*, *Asterella lindenbergiana*, *Blepharostoma trichophyllum* subsp. *brevirete*, *Orthothecium strictum*, *Distichium capillaceum*, *Isothyriopsis pulchella*, *Encalypta cf. streptocarpa*. It is a widespread arctomontane species restricted to areas with calcareous bedrocks. This species was previously known in the North Urals from the western side in the Republic of Komi (Bakalin et al., 2001; Dulin, 2007).

*Conocephalum conicum* (L.) Dumort. – 19: on side of brook, on soil among tall herbaceous vegetation, in pure mats or mixed with *Pellia neesiana*, *Plagiothecium* sp. [121259]. It is mostly boreomontane species, but it occurs sporadically at high altitudes and latitudes.

*Diplophyllum albidum* (L.) Dumort. (gem., and.) – 4, 9, 17 (8: 888–1030 m), sp.: on fine earth between boulders in silicate rock fields [121277]. Occurs both in pure mats and mixed with *Pseudolophozia sudetica*, *Gymnomitrion concinnatum*, *Tetralophozia setiformis*, *Lophozia munrmanica*, *L. longiflora*, *Fuscocephaloziopsis albidum*, *Pohlia crudoides*, *Ra- comitrion lanuginosum*, *Andreaea rupestris*. It is a widespread arctomontane species, but it has previously only been reported from a few sites in the Urals (Zinovieva, 1973; Konstantinova & Lapshina, 2014)

*D. obtusifolium* (Hook.) Dumort. (and., gyn., spor.) – 3, 9, 17 (5: 644–1030 m), sp.: on fine earth between boulders in rock fields, on loamy fine earth in rocky dwarf-shrubs-lichen tundra, on bank of a temporary brook under a snowfield [121271]. Usually mixed with other hepatics: *Marsupella sprucei*, *Gymnomitrion concinnatum*, *Antheila juratzkana*, *Praesanthis suecica*, *Iosaphes bicornatus*. The species has previously been recorded in the Urals from a single locality in the Visha State Nature Reserve (Konstantinova & Bezgodov, 2006) and a single locality in the vicinity of Mt. Ner-Olka (Konstantinova & Lapshina, 2014).

*D. taxifolium* (Wahlenb.) Dumort. (gem., per.) – 3, 7, 9, 11, 17 (6: 644–946 m), sp.: on rocks and on fine earth between rocks in rock fields, on soil in snowbed along the temporary brook under snowfield [121180]. The species occurs both in pure mats and mixed with *Pseudolophozia sudetica*, *Diplophyllum albidum*, *Fuscocephaloziopsis albidum*, *Lophozia wenzieli*, *L. munrmanica*, *Gymnomitrion concinnatum*, *Pohlia crudia*, *P. crudoides*.

Endogenna caespiticia (Lindb.) Konstant., Vilnet & A.V. Troitsky [Solenostrongylus caespiticiu*um* (Lindb.) Steph.] (gem., per.) – 18: on road between tracks [121233], on sandy soil, in mats dominated by *Nardia japonica* and admixture of *Marsupella sprucei*, *Scapania obcordata*, *Iosaphes bicornatus*. Mountain circumbarreal species restricted to bare soil.

Fuscocephaloziopsis albidens (Hook.) Vaňa & L. Sőderstr. [*Pleurocladula albidens* (Hook.) Grolle] – 3, 5, 7, 9, 10, 17 (6: 680–994 m), fr.: between rocks at edges of snowfields, in moist shaded niches in rock fields, in snowbeds, sometimes on spots of loamy bare soil in dwarf-shrub-sedge-moss tundra [121159], usually mixed with *Antheila juratzkana*, *Cephalozia bicuspidata*, *Lophozia munrmanica*, *Diplophyllum albidum*, *D. taxifolium*, *Gymnomitrion concinnatum*, *Pohlia drummondii*.

*F. lunatifolia* (Dumort.) Vaňa & L. Sőderstr. [*Cephalozia lunatifolia* (Dumort.) Dumort.] (gem., and.) – 19, 20 (3: 380–433 m), sp.: on decaying wood in coniferous forests [121247], on base of a tree at the edge of a bog, in pure mats or mixed with *Lepidopteria repansa*, *Mylia anomala*, *Dicranum fasci- scens*, *Tetraphis pellucida*, etc.

*F. pleniceps* (Austin) Vaňa & L. Sőderstr. [*Cephalozia pleniceps* (Austin) Lindb.] (per., spor.) – 2, 3, 4, 5, 11, 19 (7: 433–830 m), fr.: tufted belt, on fine earth in niches on carbonate cliffs mixed with *Asterella lindenbergiana*, *Pohlia crudia*, *Bartramia tibiphylla*, on fine earth between boulders in rock fields, among mosses in sedge-moss bog, on bare soil in snowbeds and along temporary brooks under snowfields, as well on decaying wood in mountain coniferous forests [121150]. Occurs both in pure mats and mixed with *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Lophozia munrmanica*, *Schistochilopsis opacifolia*, *Mesopathyzia gillinmani*.

Gymnocolea inflata (Huds.) Dumort. (per., spor.) – 5, 7, 9 (3: 783–945 m), sp.: on fine earth between rocks in rock fields at the edge of snowfield, on soil in dwarf shrubs-sedge-green moss-*Sphagnum* bog and in pools in sedge-*Sphagnum* bogs mixed with *Schlakiovia kunzeana*, *Scapania irrigua*, *S. irri- gua* subsp. *rufescens*, *S. paludicola*, *Odontoschisma elonga*ta, *Cephalozia sudetica*, *Warnstorfia sarmentosa* [121190].

*Gymnomitrion concinnatum* (Lightf.) Corda (per.) – 9, 10, 17 (6: 840–1030 m), sp.: on fine earth-loamy cryogenic spots of bare soil in dwarf shrubs-licheny rocky tundra, on rocks in rock fields, on fine earth on silicate cliffs [121179]. Occurs in pure mats but more often mixed with *Diplophyllum albi-
Lophocolea heterophylla, Gymnomitrium coralloides, Sphenolobus minutus, S. nitidus var. grandis, Antheridium juratzkana, Pseudophylophyllum nuda, Lophozia longiflora, L. murmanica, Pohlia crudaoides, Andreaea rupetris.

G. corallioides Nees (per., spor.) – 8, 13, 17 (3: 788–980 m), sp.: on fine earth on ledges of carbonate cliffs and between boulders and on loamy spots in dwarf-shrub-lichens rocky tundra [121123], mixed with Sphenolobus nitidus, Trilophozia quinquedentata, Gymnomitrium coralloides, etc.

Harpanthus flotovianus (Nees) Nees – 5, 19 (3: 476–783 m), sp.: on soil and fine earth on sides of streams, in rock fields at the base of snowfields [121156], mixed with Pellia neesi-anana, Scapania paludosa, Lophozia longiflora, Cephalozia bicuspidata, Rhizomnium magnifolium, Sanionia uncinata, Pohlia drummondii, Bartramia ityphylla, etc.

Isopaches bicrenatus (Schmidel ex Hoffm.) H. Buch (per.) – 17, 18 (3: 488–980 m), sp.: on sandy soil on roads between tracks, on fine earth-loamy cryogenic spots in dwarf-shrub-moss-lichen and dwarf-shrubs-lichens rocky tundra [121271], mixed with Antheridium juratzkana, Diplolophyllum obtusifolium, Gymnomitrium coralloides, Endogonium caspicastica, Marsupella spuria, Nardia japonica, Scapania obtusata, S. parvifolia, Prasanthus suecica.

**(*)** Jungermannia atrovirens Dumort. (and., gyn., per.) – 2, 6 (4: 633–634 m), sp.: on sides and in beds of mossy dry brooks [121321], on fine earth on rocks, in pure mats or mixed with Chiloscyphus polyanthos, Schistidium riparium, Hydrobrya ochracea, Pohlia wahlenbergii, Dichodontium pellucidum, Philonotis fontana, Mesopychia gillmanii, Bryoerythrophyllum recurvirostre. The species was collected once on the vertical wall of a carbonate cliff in larch light forest [121336], mixed with Mesopychia heterocolpos.

J. eucordifolia Schljakov [Jungermannia exsertifolia subsp. cordifolia (Dumort.) Vaňa] (per., spor.) – 2: in the mossy bed of a temporary brook, in pure mats, on moist rocks [121318].

**(*)** J. cf. polaris Lindb. – 11: herbaceous tundra (64.50132° N – 59.60066° E; 830 m alt.), on sides of a karst cave, on fine earth, single shoots mixed with Mesopychia gillmanii Pellia wahlenbergii, Philonotis sp., Asterella lindenbergiana (90/3). Widespread arecambra montane basiphilic or calcicolous hepatic restricted to high altitudes or high Arctic.

J. pumila With. (per., and.) – 13: Dwarf shrub (Betula nana, Vaccinium uliginosum)-herb-green moss tundra on steep south-east facing slope of mountain [121121], on bare soil, single shoots in mats dominated by Preissia quadrata and admixture of Lophocolea minor, Scapania cuspiduligera, Tritomaria scitula. 2: bed of mossy partly dry brook [121326], on moist vertical side of rock in pure mats or mixed with Pohlia wahlenbergii, Dichodontium pellucidum.

Lepidozia reptans (L.) Dumort. – 21: Betula-Picea-Pinus sibirica fern-Vaccinium myrtillus-green moss forest in the upper part of the forest belt [121284], on decaying wood in mats dominated by Dicranum sp. and admixture of Lophozia cf. silvicola or Sphenolobus minutus, Pohlia nutans, as well as on soil as admixture to Barbilophozia barbata. 19: birch-spruce tall herbs-green moss forest on south facing steep slope [121247], on decaying wood in mats dominated by Fuscocephaloziopsis lunulifolia and admixture of Tetrathis pellucida, Plagiothecium sp.

Lophostroma squamatum (Warnst.) R.M. Schust. (and., per., spor., gem.) – 20: sedge-Sphagnum bog with single trees of birch and spruce [121292], on decaying stump of wood, in pure mats. This species was previously recorded in the Urals from the western side in the Vishera State Nature Reserve (Konstantinova & Bezgodov, 2006).

L. longifolia (Nees) Schiff. [L. ventricosa var. longiflora (Nees) Macoun] (gem., per.) – 3, 4, 9, 10, 11, 13, 17, 18, 19, 20 (16: 390–994 m), com.: on sides of karst hollows [121130], on spots of bare loamy soil, on carbonate cliffs, in sedge-Sphagnum and dwarf shrub-moss bogs [121189], between boulders in rock fields, on rocks in birch-Vaccinium-green moss low growth open forests, on banks of brooks. In pure mats or mixed with Neothecula densifolia, Sphenilobus minutus, Pohlia nutans, as Dictamnus silvicola, Lophozia longiflora, Schistochilopsis opacifolia Harpanthus flotovianus, Fuscocephaloziopsis albescens, Diplolophyllum albicans, Gymnomitrium coralloides, Cephalozia bicuspidata, Lophozia murmanica, Harpanthus flotovianus. Cephalozia pleniceps.

L. murmanica KaaL. [Lophozia wenzeli var. groenlandica (Nees) Bakalin] (gem., per.) – 4, 5, 10, 11, 17, 19 (10: 476–980 m), fr.: on sides of karst hollow in herbaceous tundra, on fine earth between boulders in rock fields, under snowfield in sedge-moss bog at the bottom of mountain, on side of brook [121129], in pure mats or mixed with Pseudolophozia nuda, Lophozia longiflora, Schistochilopsis apopofila Harpanthus flotovianus, Fuscocephaloziopsis albescens, Gymnomitrium coralloides, Tetraphlebia setiformis, Sanionia uncinata, Pohlia crudaoides, P. drummondii.

L. silvicola H. Buch. (gem., per., spor.) – 3, 19, 20, 21 (6: 380–680 m), sp.: on bases of trees and decaying wood in mixed and dark coniferous forests, in sedge-Sphagnum with birch and spruce bog [121291], on soil in subalpine short grass-green moss-lichenowet meadow. Often in pure mats or mixed with Sciuro-hypnum reflexum, Sanionia uncinata, Dicranum fuscescens, D. montanum, Pohlia nutans, Plagiothecium spp., Lophocolea heterophylla, Lepidozia reptans, Ptilidium pulcherrimum.

L. ventricosa (Dicks.) Dumort. var. ventricosa (gem., per.) – 5, 14, 15, 19 (5: 610–783 m alt.), sp.: on fine earth between boulders in rock fields, on sides of brooks [121194], mixed with other bryophytes, on mossy rocks in birch and larch low growth open forests, in pure mats or mixed with Plectocolea hyalina, Barbilophozia barbata, Sciuro-hypnum reflexum.
L. wenzelii (Nees) Step. var. wenzelii (gem., per.) – 1, 3, 4, 5, 7, 9, 14, 10, 16 (11: 632–946 m), fr.: on soil and spots of bare loamy soil in tundras, in snowbed communities, between boulders in rock fields, in dwarf-shrub-sedge-Sphagnum bogs, in seepages, on banks of brooks and on road sides [121158], in pure mats or mixed with Pseudolophozia sudetica, Barbilophozia hatcheri, Pitulidium ciliare, Neoorthocaulis floerkei, Fuscoplechoziopsis albenscs, Anthelia juratzkana, Schljakovia kunzeana, Scapania irrigua, S. curta, Plectocolea subelliptica, Cephalozia bicuspidata, Polytrichasum sexangularum, Sanionia uncinata, Klaeria starkei.

**(*L. wenzelii var. massalarioides Balakín (gem.) – 5: on rocks in the bed and on sides of brook [121157]. This variety was described from Caucasus (Balakín, 2005) and was until now known from Caucasus only.**

Lophozia excisa (Dicks.) Konstant. & Vilnet (gem., and., gyn., per., spor.) – 1, 11, 16, 18, 20 (6: 390–890 m), sp.: on soil among mosses, on spots of bare soil in herbaceous tundras, on road sides [121127], always mixed with other bryophytes: Pseudolophozia sudetica, Lophozia wenzelii, L. longiflora, Cephalozia diversica, Scapania mucronata, Schistochilopsis opacifolia. L. longidens (Lindb.) Konstant. & Vilnet (gem., and., per., spor.) – 15, 19, 20, 21 (6: 390–610 m), fr.: on decaying wood and on bases of trees in mixed birch-spruce and birch dark coniferous forests, in mixed tall herbaceous-green moss and tall herbaceous-Vaccinium myrtillus-green moss forests and birch low growth open forests [121251], occurs both in pure mats or mixed with Barblilphozia lycopodioides, B. hatcheri, Lophocolea heterophylla, Lophozia cf. ventricosa, Tritomaria sectiformis, Pitulidium palcherrimum, Sanionia uncinata, Dicranum spp., Brachythecium salebrosum.

**L. pellucida (R.M. Schust.) Konstant. & Vilnet [Lophozia pellucida R.M. Schust.] (gem.) – 2 carbonate mossy cliffs in Láríx sibírica light forest, on ledges of rocks between rocks [121134], admixture in mats dominated by Mesopychya heterocolpos, mixed with Tritomaria sectula, Scapania gymnostomophila, Blepharostoma trichophyllum subst. brevirete, Cortymium hymenophyloides, Brachythecium cirrosum. This poorly known arctic species was previously reported in the Urals from single localities on the western side of mountains (Bergdov et al., 2003, Konstantinova & Bergdov, 2006).

Marchantia polymorpha L. subsp. montivagans Bischl. & Bois.-Dub. (gem., and., gyn., spor.) – 3, 5, 6, 8, 11, 20 (9: 380–890 m), fr.: on sides of lower side of karst hollows in pure tundras, in seepages and in snowbeds, on coarse-grained fluvial sediments on banks of streams [121151], often in pure mats or mixed with Chiloscyphus polyanthos, Jungermannia atrovirens, Mesopychia gillmanii, Polhia wahlenbergii, Philonotis fontana.

*Marasellioda condensata (Ångstr. ex C. Hartm.) Lindb. ex Kaal. – 9: rock field on quartzite ridge, on fine earth between boulders [121179], mixed with Fuscoplechoziopsis albenscs, Gymnomitriion concentatum, Diplophyllum taxifolium. This species was previously reported for the Urals by Zinovjeva (1973).

M. sprucei (Limp.) Bernet (per., spor.) – 17, 18 (4: 488–1030 m), sp.: on spots of fine-earth-loamy soil in rocky dwarf shrub-lichen tundra surrounded by rock fields [121270], mixed with Gymnomitriion concentatum, Diplophyllum obtusifolium, Prasanthus suecicus, Isopaches bicornatus. This species was collected once on a road on sandy soil between tracks mixed with Endogemina caespiticia, Nardia japonica (47/3).

*Mesopychia badensis (Gottsche ex Rabenh.) L. Söderstr. & Váňa [Leiocolea badensis (Gottsche) Jörg.] – 11: karst ledge in Dryas-herbaceous tundras, on fine earth in shaded moist niches [121136], mixed with Leiocolea gillmanii.

*M. collaris (Nees) L. Söderstr. & Váňa [Mesopychia collaris (Nees) Schljakov] (per. and.) – 2, 5, 8, 9, 12 (6: 634–926 m), sp.: carbonate rock outcrops in tundra, on fine earth at the bottom and between rocks, on rocks in the bed and on banks of dry mossy brook [121172], always mixed with other bryophytes, particularly Blepharostoma trichophyllum subst. brevirete, Tritomaria sectula, Odontoschisma macounii, Saccozphyllum polymorphum, Preissia quadrauta, Syntrichia norvegica, Distichium capillaceum. It was collected once in a herbs-moss-liverwort community in a snowbed, mixed with Neoorthocaulis floerkei and Lophozia wenzelii.

M. gillmanii (Austin) L. Söderstr. & Váňa [Leiocolea gillmanii (Austin) A.Evans] (and., gyn., per., spor.) – 2, 3, 6, 11, 12 (7: 633–855 m), sp.: the species is not rare on sides and in niches in karst hollows in tundra belt (usually in herbaceous and Dryas-herbaceous communities), it occurs as well on banks and mossy rocks in beds of temporary brooks [121136], both on soil and fine earth, in pure mats or mixed with Blepharostoma trichophyllum subst. brevirete, Mesopychia heterocolpos, M. badensis, Fuscoplechoziopsis pleniceps, Chiloscyphus polyanthos, Asterella lindenbergiana, Preissia quadrauta, Bryoerythrophyllum recurvirostre, Distichium capillaceum, Platydicya jungermannioides, Polhia wahlenbergii, P. cruda, Bratrarium ithyphylly, Dichodontium pelliculum, etc.

*M. heterocolpos (Thed. ex Hartm.) L. Söderstr. & Váňa [Leiocolea heterocolpos (Thed. ex C. Hartm.) H. Buch] (gem., and., gyn., per., spor.) – 3, 6, 9, 11, 12 (10: 636–973 m), fr.: on carbonate outcrops, on sides of karst hollows in herbaceous tundras, on fine carbonate earth in shaded niches between boulders in rock fields, on banks and on mossy rocks in beds of temporary streams [121172]. Always mixed with other bryophytes: Mesopychia gillmanii, M. collaris, Blepharostoma trichophyllum subst. brevirete, Tritomaria sectula, Preissia quadrauta, Jungermannia atrovirens, Distichium capillaceum, Drepanium recurvatum, Myurella tenerrina, Platydicya jungermannioides, Cortymium hymenophyloides, Mnium thomsonii, Encalypta sp., etc.

Mylia anomaly (Hook.) Gray (gem.) – 20: in seepage at the bottom of the slope on edge of a brook [121301], on base of tree, with admixture of Calypogea sphagnicola, Cephalozia spp., Schljakovia kunzeana, Aulacomnium palustre.

Nardia geoscyphus (De Not.) Lindb. (and., per., spor.) – 1, 3, 10, 17, 11, 17 (5: 644–994 m alt.), sp.: in tundra belt, on loamy cryogenic spots, on fine earth on bank of stream from snowfield, on soil on road sides [121221]. Always mixed with other bryophytes: Solenostoma confertissimum, Plectocolea hyalina, P. subelliptica, Anthelia juratzkana, Scapania curta, Cephalozia bicuspidata, Pilophyllum laevigatum, Pohlia drummondii.

*N. japonica Steph. (per.) – 18: on road between tracks, on sandy soil [121233], with admixture of Isopaches bicornatus, Gymnocolea borealis, Endogemina caespiticia, Scapania acerosata. 19: on road side [121261], mixed with Scapania curta, Solenostoma sphaerocarpum, Plectocolea hyalina, Neoorthocaulis binsteadii (Kaal.) L. Söderstr., De Roo & Hedd. (Orthocaulis binsteadii (Kaal.) H. Buch) – 9: seepage-Sphagnum bog at the base of quartzite ridge [121188], in mats with small admixture of Lophozia longiflora, Cephalozia ambigu, Cephalozia spiniger. 17: dwarf shrubs-sedge-Hypnum-Sphagnum bog at the bottom of mountain [121263]
in mat dominated by *Dicranum elongatum* and admixture of *Lophozia longiflora, Aulacomnium turgidum, or mixed with Sphagnum minitius, Riccardia latifrons, Cephalozia bicuspidata, Blepharostoma trichophyllum subsp. brevirete, Scapania tundra.*

*Neoorthocaulis floerkei* (F. Weber & D. Mohr) L. Söderstr., *De Roo & Hedd.* [Originalis floerkei (F. Weber & D. Mohr) H. Buch] (per.) – 5, 7, 11, 14 (4:775–946 m), sp.: on soil in herbaceous tundra on sides of karst hollows, in snowbed communities, in spring fen [121134]. Often in pure mats or mixed with *Lophozia wenzelii* and *Barbilocchioza hatcheri.*

*Sphenocolea elongata* (Lyell) Mitt. (Lindb.) A. Evans – 7: dwarf-shrub-sedge-green moss-Sphagnum bog on slope [121167], in small hollows, mixed with *Gymnocolea inflata Scapania irrigua* subsp. *reflexes, Warnstorfia sarmentosa.*

*O. macounii* (Austin) Underw. – 8: on carbonate cliffs in tundra [121174], on fine earth between rocks, mixed with *Mesotrichia heterocarpus, M. collaris, Blepharostoma trichophyllum subsp. brevirete, Tritomaria scitula, Schistochilopsis opaciocilia, Distichicum capitellum, Mnium thomsonii, Encalypta affinis.* This species has previously been recorded for the North Urals by Zinovjeva (1973).

*Peltinia neesiana* (Gottsch.) Limpr. (and., gyn., per.) – 1, 3, 5, 6, 19, 20 (9:390–787 m), fr.: on banks of streams, in seepages, in hollows in swampy forests [121156], in pure mats or mixed with *Plectocolea hyalina, P. obovata, Scapania subalpina, S. irrigua, S. paludosa, Pohlia wahlenbergii, P. filum, Calliergonella lindbergii.*

*Plectocolea hyalina* (Lyell) Mitt. [Solenostoma hyalina (Lyell) Mitt.] (per.) – 4, 5, 9, 10, 19 (6:476–973 m alt.), fr.: on bare soil on banks of streams and on road sides, on moist loamy spots in dwarf-shrub-sedge-moss tundra [121221].

1. This species has previously been known from the western side of the Urals in the Pechoro-Ilych Strict Nature Reserve (Bezgodov et al., 2003). Prisessia quadrata (Scop.) Nees (and., gyn., spor.) – 2, 6, 8, 13 (6:630–926 m), sp.: on fine earth and humus between boulders on carbonate rock outcrops in tundra, on soil on sides of karst hollows, on spots of bare soil in herbaceous tundra, on banks of mossy brooks, on fine earth between rocks in alder thickets [121121].

1. Other species have previously been recorded in the Ural from one locality in the Vishera State Nature Reserve (Konstantinova & Bezgodov, 2006).

*Ptilidium ciliare* (L.) Hampe – 7, 9, 10, 11, 13, 14, 15, 16, 17 (13:790–973 m), com.: on soil in Dryas-herbaceous and dwarf-shrub-green moss tundras, in dwarf shrub-sedge-moss bogs, sometimes on fine earth between rocks in rock fields [121137]. In pure mats or mixed with *Barbilocchioza hatcheri, Schljakvia kunzeana, Lophozia wenzelii.*

*P. pulcherrimum* (Weber) Vain. (per.) – 19, 62 (380–433 m, sp.): on bases of trees and on decaying wood in mixed coniferous forests [121254], in pure mats or mixed with *Barbilocchioza bartbata, Lophozia heterophylla, Lophozia silvicola, Lophozia longidens, Brachythecium saleanosum, etc.*

*Riccardia latifrons* (Lindb.) Lindeg. – 17: dwarf shrub-sedge-Sphagnum bog at the bottom of slope [121263], mixed with *Sphenocolea minitius, Neoorthocaulis floerkei, Blepharostoma trichophyllum subsp. brevirete, Scapania subalpina, Philonetis fontana, Chiloscyphus polyanthos* (51/7-2).

*P. obovata* (Nees) Lindb. [Solenostoma obovatum (Nees) C. Massal.] – 5: willow (Salix lanata) thickets along stream, on fine earth covered stems of willow [121253], in pure mats (22/1-1) and mixed with *Scapania irrigua, S. paludosa, Peltia neesi-ana, Calliergonella lindbergii, Sciuro-hypnum latifolium, Warnstorfiella exannulata.*

1. This species has previously been recorded in the Ural from one locality on Mt. Ner-Oika (Konstantinova & Lapshina, 2014). *P. subelliptica* (Lindb. ex Kaal.) A. Evans: *Solenostoma subellipticum* (Lindb. ex Heeg) R.M. Schust., *Plectocolea obovata* (Nees) Mitt. var. *minor* (Carrington) Schljakov (and., per., spor.) – 1: under alder shrubs along road side (64.48391° N – 59.75020° E; 476 m alt.), on soil mixed with *Scapania subalpina, Philonetis fontana, Chiloscyphus polyanthos* (51/7-2).

1. This species has previously been reported for the Pechora-Ilych Strict Nature Reserve (Bezgodov et al., 2003). Saccobasis polita (Nees) H. Buch – 11: on sides of karst hollow in Dryas-herbaceous tundra [121138], on soil covered fine earth, mixed with *Mesosotrichia gilmannii, Asterella lindenbergiana.*

1. This species has previously been reported in the Ural from one locality on Mt. Ner-Oika (Konstantinova & Lapshina, 2014). *S. cf. polymorpha* (R.M. Schust.) Schljakov (per.) – 2: on rocks in bed of dry brook [121322] and on fine earth on banks of a brook [121232], mixed with *Mesosotrichia collaris, M. gilmannii, Scapania cupsiduligera, Tritomaria scitula, Blepharostoma trichophyllum subsp. brevirete, Distichicum capitellatum, Preissia quadrata.* This species has previously been reported for the Pechora-Ilych Strict Nature Reserve (Bezgodov et al., 2003).

1. This species has previously been reported for the Pechora-Ilych Strict Nature Reserve (Bezgodov et al., 2003). *Sauteria alpina* (Nees) Nees – 2: at the base of carbonate boulders in a subalpine meadow [121313], in shaded niches, on fine earth, mixed with *Blepharostoma trichophyllum subsp. brevirete, Tritomaria scitula, Distichicum capitellum, Mesosotrichia spp.*, *Encalypta spp.* 9: on carbonate fine earth under boulders in rock field (64.49635°N – 59.64451° E; 973 m alt.), mixed with *Blepharostoma trichophyllum subsp. brevirete, Tritomaria scitula, Mnium thomsonii* (29/4-3). The species was previously known from the western side of the Ural, in the Pechora-Ilych Strict Nature Reserve (Bezgodov et al., 2003).
Scapania curta (Mart.) Dumort. (gem., per.) – 1, 2, 11, 13, 19, 21 (7: 476–890 m), fr.: on bare soil on banks of streams, on road sides, on spots of moist clay spots in tundra [12123]. Sometimes in pure mats, but more often mixed with Nardia geocarpa, Plectocolea subelliptica, P. hyalina, Blasia pusilla, Nardia japonica, Scapania obcordata, Pohlia filum, Cephalozia bicuspidata.

*S. cuspiduligera* (Nees) Müll. Frib. (gem., and.) – 2, 12, 13 (4: 634–840 m), sp.: on ledges and under rocks on carbonate rock outcrops, at the bottom of carbonate cliffs, on bank of dry brook, on bare soil in dwarf shrub-herbaceous-green moss tundra near carbonate outcrops [12121]. In pure mats or mixed with Mesophtychia gillmannii, Tritomaria scutula, Sacocobia polymorpha, Scapania gymnostomaphila, Lophocolea minor, Preissia quadrata.

*S. gymnostomaphila* Kaal. (gem.) – 13: dwarf-shrub-herbaceous-green-moss tundra on steep slope of south-east facing slope [12121], on bare soil, some shoots in mats dominated by Preissia quadrata mixed with Scapania cuspiduligera, Lophocolea minor, Jungermannia pumila. 2: carbonate mossy rock outcrops in larch light forest, on fine earth, mixed with Scapania cuspiduligera [121335] and some shoots in mats dominated by Mesophtychia heterocolpos and admixture of Lophozopsis pellucida, Tritomaria scutula, Blepharostoma trichophyllum subsp. brevirete, Cyrtomium hymenophylloides, Brachythecium cirrosum [121334].

S. cf. hyperborea Jürg. – 5: rock field at the bottom of snowfield [121163], on fine earth between boulders, mixed with Anthelia juratzkana, Pseudolepidozyra seducta.

*S. irrigua* (Nees) Nees (gem.) – 1, 4, 5, 14, 16 (8: 295–810 m), fr.: in boggy willow stands in seepages, on banks of streams, between and under rocks in rock fields at edges of snowfields [121117]. In pure mats or mixed with Schljakovia kunzeana, Lophocolea wenzeli, Gymnocollea inflata, Straminergon stramineum, Sanionia uncinata, Aulacomnium palustre, Philonotis fontana.

*(*) S. irrigua subsp. rafescens (Loeske) R.M. Schust. [var. rafescens (Loeske) R.M. Schust.] (gem.) – 4, 7 (4: 713–946 m), sp.: in boggy willow thickets in seepages, on banks of streams, between and under rocks in rock fields at edges of snowfields. It has been collected in the same habitats as the typical subspecies [121147]. It has also been collected in hollows in dwarf shrub-sedge-moss bogs mixed with Gymnocollea inflata, Odontoschisma elongata, Warnstorfia sarmentosa (26/1) and in snowbeds mixed with Lophozia murmanica, Cephalozia bicuspidata (28/3-1). This subspecies differs from the typical subspecies in obtuse to rounded lobes and red pigmentation.

*S. mucronata* H. Buch (gem.) – 1: on mossy road side [121119], on soil, mixed with Schistochilopsis opacifolia, Lophozopsis excisa (03/1).

*S. obcordata* (Berggr.) S.W. Arnell (gem.) – 1, 13, 11 (3: 295–788 m), sp.: on bare soil on road sides and between tracks, on fine earth on ledge of carbonate outcrops in tundra [12123]. Usually mixed with Scapania curta, Nardia japonica, Gymnocollea borealis, Isopogon bicornutus, Solenostoma spp.

*S. paludicola* Loeske & Müll. Frib. (gem., per.) – 7, 9, 14, 17, 19, 20 (6: 390–890 m), sp.: in hollows in sedge-Sphagnum and dwarf-sedge-moss bogs, in seepages in dwarf shrub-green-moss tundra, on banks of brooks [121190]. In pure mats or mixed with Gymnocollea inflata, Warnstorfia exannulata, W. sarmentosa, Loeskynnum badium.

*S. paludosa* (Müll. Frib.) Müll. Frib. (per.) – 5, 6, 7, 14, 19, 20 (7: 380–874 m), fr.: on banks of streams, in boggy willow thickets, near seepages [121302]. Usually in pure mats or mixed with Scapania irrigua, Harpanthus flotovianus, Pellia neesiana, Cephalozia bicuspidata, Pohlia wahlenbergii, Philonotis fontana, Rhizomnium magnifolium, Calliergonella fimbriata, Warnstorfia exannulata.

*S. parvifolia* Warnst. [Scapania scandica (Arnell & H. Buch) Macvicar f. parvifolia (Warnst.) Schljakov] (gem.) – 4, 6, 9, 10, 17 (6: 688–930 m), sp.: between rocks in rock fields, on bare soil on banks of brooks, on spots of bare soil in tundras [121145]. Usually mixed with other hepatics: Lophozopsis longidens, Cephalozia bicuspidata, Pseudolepidozyra sedetica, Diplophyllum albicans, Sphenolobus minutas, Mesophtychia spp., etc.

*(*) S. praetervis Meyl. [Scapania mucronata subsp. praetervis (Meyl.) R.M.Schust.] – 11: herbaceous tundra, on side of karst hollow (64.50132° N – 59.66006° E; 830 m alt.), on fine earth in niches, admixture in mats dominated by Mesophtychia gillmannii, M. heterocolpos (09/4).

*S. subalpina* (Nees ex Lindemb.) Dumort. (per.) – 4, 5, 6, 19 (6: 410–784 m), sp.: on soil and fine earth on banks and in beds of streams [121257]. Usually mixed with Pellia neesiana, Plectocolea obovata, Pohlia wahlenbergii, Calliergonella fimbriata, Rhizomnium magnifolium.

**(*) S. tundrae (Arnell) H. Buch [Scapania hyperborea var. tundrae (Arnell) Potemkin] – 3: short grass-green-moss subalpine meadow [121310], on soil, mixed with Kueeria starkei, Sanionia uncinata, Pohlia nutans. This is a mostly arctic species known from most sectors of the Arctic as well as from South Siberia (Damsholt, 2002; Konstantinova, Bakalin et al., 2009). This taxon is not recognized on the species level by some authors (Potemkin, 1999). Finding this species in Northern Ural fills up the gape in distribution in Eurasia and supports its circumpolar distribution. 17: dwarf shrub-sedge-Hypnum-Sphagnum bog at the bottom of slope [121265], mixed with Warnstorfia sarmentosa, Loeskynnum badium, Neoreothcaulis birsteadii, Sphenolobus minutas, Riccardia latifrons, Blepharostoma trichophyllum subsp. brevirete, etc.

*S. undulata* (L.) Dumort. – 19: on fine earth in pool on bank of brook [121256], in pure mats and mixed with Warnstorfia exannulata.

Schistochilopsis incisa (Schrad.) Konstant. (gem., per.) – 2, 9, 19, 21 (5: 380–980), sp.: on decaying wood in mixed birch-dark coniferous tall herbaceous-green moss forests [121245], in sedge-Sphagnum bogs, on bank of dry brook, on fine earth covered rocks, in pure mats or mixed with Tritomaria exseciformis, Pitrium cristatetraens, Sanionia uncinata, Dicranum spp., Lophozia spp., etc.

*S. opacifolia* (Culm. ex Meyl.) Konstant. (ant., per., spor.) – 1, 2, 3, 4, 5, 8 (8: 634–926 m), fr.: on soil between rocks in rock fields, on fine earth between rocks on banks of streams under snowfields [121145]. In pure mats or mixed with Lophozia spp., Cephalozia bicuspidata, C. ambiguus, Fuscocephalozia pleniceps, Lophozia murphyi, etc. It was once collected on fine earth between rocks on cliff [121174], mixed with Odontoschisma macounii, Blepharostoma trichophyllum subsp. brevirete, Mesophtychia heterocolpos, Distichium capillaceum, Mnium thomsonii, Encalypta affinis.
Schiaklovia kunzeana (Huebener) Konstant. & Vilnet (gem.) – 1, 4, 5, 14, 16, 17, 20 (7: 295–840 m), fr.: between boulders in rock fields at the edge of snowfields, among mosses on soil in grass tundras and boggy willow in seepages, on sides of bogs and on banks of streams [121117]. Occurs in pure mats but more often mixed with other bryophytes, more often with Barbilophozia hatcheri, B. lyco podioidei, Lophozia wenzeli, Scapania irrigua, Pohlia drummondii, Aulacomnium palustre, Paludella squarrosa, Rhizomnium pseudopunctatum, Sanionia uncinita, Sciurohypnum latifolium. Schlikovianthus quadrirubris (Lindb.) Konstant. & Vilnet (gem.) – 5: rock field near edge of snowfield [121159], on fine earth between boulders mixed with Fusc ocephaloziopsis albescens, Sanionia uncinita, Pohlia drummondii. 11: karst hollow in grass tundra [121215], on soil, mixed with Tritomaria scitu, Timmia austriaca, Distichium capillaceum.

Solenostoma confertissimum (Nees) Schliaklov (per., spor.) – 10: dwarf shrub-sedge-moss tundra on bank of lake [121221], on moist loamy spots of bare soil, mixed with Nardia geoscyphus, Plectocolea hyalina. *S. pusillum* (C.E.O. Jensen) Steph. (per., spor.) – 17: on fine-earth-loamy spots in dwarf-moss-lichen tundra on slope of mountain on flat area in rock field [121270], mixed with Marsupella sprucei, Prasanthus suecica, Scapania parvifo lia. This very small and poorly known species has previously been reported for Polar Urals (Konstantinova & Czernjadieva, 1995).

*S. sphaerocarpum* (Hook.) Steph. (and., per.) – 10: dwarf-sedge-moss tundra on bank of lake [121227], on moist loamy spots of bare soil in pure mats or mixed with Solenostoma confertissimum, Nardia geoscyphus. 19: on road side, on soil (64.45512 N° – 59.75020° E; 476 m alt.), several shoots among Scapania curta, Plectocolea hyalina, Nardia japonica (52/2-3).

Sphenolobus minutus (Schreb.) Berggr. (gem., per.) – 4, 8, 9, 15, 17, 21 (8: 380–926 m), fr.: on fine earth covered boulders in silicate rock fields, on ledges and in niches of carbonate cliffs, on soil in dwarf-shrub-sedge-moss- and dwarf-shrubs-Sphagnum bogs, on boulders and on soil in decaying wood in mixed forests. Occurs in pure mats or mixed with other bryophytes.

Sphenolobus minutus var. grandis (Gottsche ex Lindb.) Frye & L. Clark – 8, 17 (790–930 m), sp.: on carbonate cliffs, in rock fields, in dwarf-shrub-Hypnum-Sphagnum bog, [121267], usually mixed with other bryophytes.

*S. saxicola* (Schr.) Steph. – 4: in rock field at the bottom of mountain slope [121142], on fine earth on huge boulders mixed with Sphenolobus minutus, Sanionia uncinita, Pleurozium schreberi, Dicranum sp. 17: rock field on steep mountain slope [121268], on fine earth between rocks, in pure mats.

Tetraloophozia setiformis (Ehrh.). Schliaklov (per.) – 4, 9, 14, 17 (8: 930–1030 m), fr.: on siliceous rocks (quartzite, grani toid) in rock field [121182]. It often occurs in pure mats, more seldom mixed with Andreaea raperi, Pseudolopho zia sudetica, Diplophyllum albicans, Kiæeura falcata.

Tritomaria exsectiformis (Breid.) Loeske (gem.) – 19: Birch-spruce tall herbaceous-green moss forest on steep south facing slope [121245], on decaying wood, mixed with Sanionia uncinita, Plagiothecium laetum, Stereodon plicatulus, Dicranum montanum, Tetraphis pellucida. Trilophozia quinquedentata (Huds.) Bakalin [Tritomaria quin quedentata (Huds.) H. Buch] (and., per.) – 3, 4, 5, 8, 9, 10, 12, 13, 17 (11: 644–1030 m), fr.: between boulders in rock fields, on fine earth and soil both moist, shaded niches and illumi nated sites on carbonate cliffs, in dwarf shrubs-sedge-moss bogs, in willow thickets along temporary brooks [121181]. It occurs in pure mats or mixed with other bryophytes.

* T. scitula (Taylor) Jörg. (gem.) – 2, 8, 9, 11, 12, 13 (8: 636–926 m alt.), fr.: on fine earth and between rocks on ledges on mossy carbonate cliffs in tundra and low growth open forests on soil on sides of karst hollows in herbaceous tundra, along mossy brook near carbonate cliffs [121171]. It sometimes occurs in pure mats but more often mixed with Blepharostoma trichophyllum subsp. brevirete, Mesopytchia heterocolpos, M. gillmani, Scapania cuspiduligera, Tritomaria quinquedentata, Distichium capillaceum, Mnium thomsonii, Cyrtomium hy menophylloides, Platydicya juerganniioides, Sanionia uncinita.

**DISCUSSION**

The studied flora is in general relatively rich taken into account a quite restricted area and short period of study. It is composed mainly of more or less common and widely distributed species. Twenty three species reported in this study are new for Khanty Mansi Autonomous District. Four of them were collected for the first time in the Urals. One of these is Scapania tundrae. It is often not separated from the closely allied S. hyperborea and like the latter has circumarctic distribution. So finding it in highlands of the Urals was quite predictable. The arctomontane Jungermannia polaris restricted basically to bare soil is not a rare species in the Arctic. It is a basiphilic or calcilucious hepatic. Jungermannia atrovirens is also a calcilucious hepatic for the first time found in the Urals. It is a widespread species with mainly temperate distribution. Finding Calycularia laxa is entirely to be expected. It is an arctomontane species with mainly Asian-western North American distribution and single localities in the European Arctic (Konstantinova & Mamontov, 2010). To the east it is quite common in the adjacent Jamal Peninsula (Potemkin, 1993). Lophozia wenzeli var. massularioides was recently described from the highlands of Caucasus (Bakalin, 2005) and then was collected in these mountains many times (Konstantinova et al., 2009). The record of this variety from the Urals is the first one outside of Caucasus.

Among the species that are new records for the Khanty-Mansi National District, the largest group are widespread arctomontane calciphiles (Clevea hyalina, Jungermannia polaris, Mesopytchia badensis, M. collaris, M. heterocolpos, Odontoschisma macounii, Scapania cuspiduligera, S. gymnatomphila, Tritomaria scitula, Ble pharostoma trichophyllum subsp. brevirete). Most of these species occur sporadically in the Urals reflecting both the poor knowledge of the hepatic flora of the highlands of the Urals and the scattered distribution of calcareous bed rocks and rock outcrops. One species (Protolophozia elongata) is a rare hepatic listed in Red Data Book of Russia (Bardunov, 2008). The rest of the species new for the Khanty-Mansi Autonomous District are more or less widespread arctomontane (Marsupella condensata, S. praetervisa), arctoboreomontane (Obtaisulifolium obtusum) or montane (Jungermannia eudorticis) species.
The number of species found in Upper Puiva river area is a little bit higher than that of neighboring studied area of Mt. Ner-Oika, but the species composition of both areas are quite different. Twenty four species gathered in Mt. Ner-Oika were not collected during this study. Most of them are not rare arctomontane species (Gymnomitrion brevissimum, Hygrobiella laxifolia, Jungermannia borealis, Marsupella boeckii, Neorthocaulis binstadii, Scapania scandica, S. crassiretis, S. spitsbergensis, arctoboreomontane (Marsupella emarginata, Nardia breidleri). Some are poorly known and relatively rare arctomontane hepatics (Scapania brevicaulis, S. degenii, S. kaurinii). Except for S. spitsbergensis, all species mentioned above are acidophiles that explains their absence in studied area where calcareous rocks predominate.

The diversity of habitats of hepatics of area studied can be classified as follow: 1 – weathered carbonate rocks; 2 – karst sinkholes and caves; 3 – silicate rock outcrops and rock fields; 4 – lichen, herbs and dwarf shrubs – green moss tundras on skeleton soil; 5 – snowbed communities; 6 – dwarf shrub-sedge-Sphagnum mountain bogs; 7 – fens and boggy willow thickets near seepages; 8 – larch low growth open forests and secondary birch shrub forest; 9 – mountain forests and boggy forests in valley of rivers; 10 – banks of streams; 11 – road sides.

**Carbonate rock outcrops and karst sinkholes.** This type of habitats occupies less than 0.1% of the area, but specific of its flora and the diversity of hepatics is high. The most common hepatics on carbonate rock outcrops are Mesoptychia heterocolpos, Tritomaria scitula and Blepharostoma trichophyllum subsp. brevirete. Less frequent but not rare species are Tritomaria quinqueductata, Mesoptychia collaris, Barbilophozia hatcheri, etc. Two species (Clevea hyalina and Sauteria alpina) were collected in this habitats only. The diversity of hepatics in more humid and often shaded karst sinkholes is not as high as on rock outcrops and is quite variable. The commonest species here are Barbilophozia lycopodioides, Barbilophozia hatcheri, Mesoptychia gillmanii, Preissia quadrata, Averrhoa ciliata, Mesoptychia heterocolpos, Tritomaria scitula spp., and Memplea cinerea. This type of habitats only.

**Silicate cliffs and rock fields.** This type of rocks is widespread in the area studied and dominates at a height of 800–900 m rock fields. On dry cliffs and rocks Tetrarhaphozia setiformis is often the only and common species. In moist and shaded plots on fine earth Gymnomitrion concinnatum, Pseudolophozia sudetica, Diplophyllum sp., and Lophozia longiflora are not rare. In deep and more moist and shaded niches Sphenolobus saxicola and Anthelia juratzkana grow. It is the only habitat were Marsupella condensata was collected.

**Tundras.** Mountain tundras occupy ca. 50% of area studied. Common species on soil in tundra communities are Barbilophozia hatcheri, B. lycopodioides, Ptilidium ciliare and Lophozia murmanica. The majority of the species is restricted to the spots of bare soil and the bottom of boulders were Nardia geoscyphus, Anthelia juratzkana, Prasanthus suecicus, Isopaches bicrenatus, Scapania curta, and Cephalozia bicuspidata are the most common species.

**Snowbed communities.** It is the only type of habitats were hepatics dominate on soil ground. The diversity of species is not high. The more common species here are Lophozia wenzelii, Fuscocephaloziopsis albscens, Pseudolophozia sudetica, Orthocaulis flerkei and Anthelia juratzkana. One species (Scapania tundrana) was found in this type of habitats only.

**Wetlands.** Peat bogs comprise less than 1% of area studied. In high mountain bogs the most common species are Orthocaulis binstadii, Sphenolobus minutus, Calypogeia sphagnicola, and Cephalozia spp. Three species (Biantheridion undulifolium, Riccardia latifrons, Mylia anomala) were found in such bogs only. In pools pure mats of Gymnocolia inflata are quite common and Odontoschisma elongata, Scapania paludicola, S. irrigua subsp. rufescens occur scattered. The hepatic flora of fens and boggy alder thickets near seepages is not diverse and unique. The most common species here are Schljakovia kunzeana, Scapania paludosa and S. irrigua.

**Forests and low growth open forests.** Ca 10% of area studied are occupied by forest zone. Dominant communities here are mixed forests with Betula pubescens, Picea obovata and Pinus sibirica, more seldom dark coniferous green moss forests with Vaccinium myrtillus, ferns and forest grasses occur. The most common hepatic soil cover in such forests consists of Barbilophozia spp., Lophozia spp. and Pellia neesiana. On decaying wood in relatively dry places only Pilidium pulcherrimum was found, whereas in moist forests many hepatics occur, including Lophoziaopsis longidens, Blepharostoma trichophyllum and Schistochilopsis incisa. Five species (Calypogeia neesiana, Lepidoptea reptans, Lophocolea heterophylla, Tritomaria exsectiformis and Lophozia ascendens) were gathered in the forest zone only. The diversity of hepatics in open forests dominated by Larix sibirica is very low.

**Banks of streams.** The diversity of hepatics in these habitats is very high. It can be explained by diversity of substrates as well as pH of water. On peat banks Pellia neesiana and Scapania paludicula usually occur. Marchantia polymorpha sp. montivagans, Chiloscypus polyanthos, Harpanthus flootianus, Cephalozia sp., Scapania sp., Schistochilopsis opacifolia, and Plectocolea hyalina are frequent on mineral soil and fine earth.

Near areas with carbonate rocks on mossy stones Mesoptychia gillmanii, Jungermannia atrovirens, J. exsertifolia, and Asterella lindenbergiana occur. Some species (Protolophozia elongata, Ochthisfollium obtusum, Saccobasis polymorpha) were collected on banks of streams only.
Road sides. The diversity of hepatics restricted to bare soil on road sides and between tracks is also very high. The more common species here are Scapania curta, Nar-
dia spp., Lophoziozi excisa, Pseudolophzia sudetica, Lophizia wenzelli. The species mentioned above are also common on spots of loamy bare soil in tundra. More com-
mon species on sandy soil are Blasia pusilla, Scapania obcordata, Isopaches bicornatus, Endaugeoma sphaero-
carpa, and Marsupella sprucei.

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