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

ПЕЧЕНОЧНИКИ ВЕРХОВЬЕВ РЕКИ ПУЙВА (ПРИПОЛЯРНЫЙ УРАЛ, ХАНТЫ-МАНСИЙСКИЙ АВТОНОМНЫЙ ОКРУГ)

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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 Khanty-Mansi Autonomous District – Yugra. New localities for the worldwide rare hepatics (*Biantheridion undulifolium, Protolophozia elongata, Lophoziopsis pellucida,* and *Cephaloziella arctogena*) and very rare the in Urals *Asterella lindenbergiana, Sauteria alpina, Odontoschisma macounii,* and *Cephaloziella varians* are revealed. A worldwide 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.

Резюме

Аннотированный список печеночников бассейна реки Пуйва в верхнем ее течении (восточный макросклон Урала), составленный на основе идентификации около 450 образцов, собранных Еленой Лапшиной в 2015 году, включает 104 вида, два подвида и две разновидности из которых четыре вида (*Calycularia laxa, Jungermannia atrovirens, J. polaris, Scapania tundrae*), два подвида и одна разновидность – новые для Урала и 23 вида и одна разновидность ранее не указывались для Ханты-Мансийского автономного округа (Югры). Выявлены новые местонахождения редких в мире (*Biantheridion undulifolium, Protolophozia elongata, Lophoziopsis pellucida, Cephaloziella arctogena*) и очень редких на Урале *Asterella lindenbergiana, Sauteria alpina, Odontoschisma macounii, Cephaloziella varians*) видов. Обсуждаются распространение и некоторые морфологические особенности ряда редких видов. Проведено сравнение изученной флоры с флорой расположенной вблизи горы Нер-Ойка.

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 Ural was of Mt. Ner-Oika in the territory of the Khanty-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 (Kobyla-Yu, Shaitanka, Zhilnyi, Malaya Puiva) are ending in

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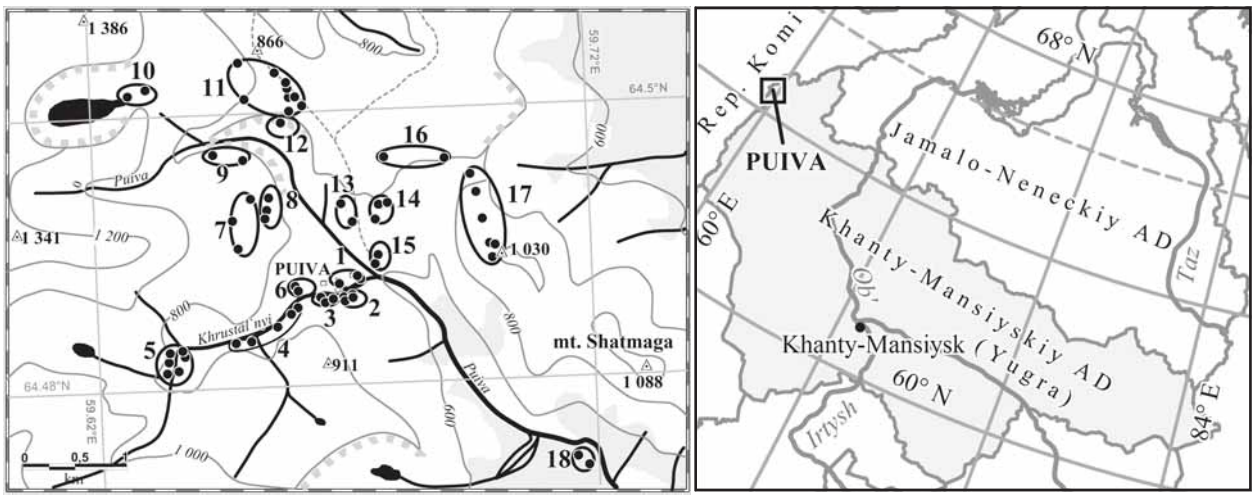

Fig. 1. Collecting sites – Рис. 1 Места сбора

1 – Abandoned settlement of geologists «Puiva» including rock field in subalpine meadow on bank of river and road sides – Заброшенный поселок геологов, в том числе зарастающий курумник среди субальпийского луга по берегу реки, обочина дороги

2 – Steep slope of quarzite ridge with carbonate rock outcrops on right bank of Zhilnyi Creek opposite Puiva Settlement – Крутой склон кварцитной гряды с карбонатными выходами на правом берегу ручья Жильный напротив поселка

3 – Lower parts of steep slopes with mossy beds of temporary creeks along Zhilnyi Creek near the border of subalpine and tundra belts – Нижние части крутых склонов гор с замшелыми руслами временных водотоков вдоль руч. Жильного на границе подгольцового и тундрового пояса

4 – Upper Zhilnyi Creek – Верховья ручья Жильный

5 – Quarzite ridge on the left bank of Zhilnyi Creek – Кварцитная гряда по левому берегу ручья Жильный;

6 – Carbonate rock outcrops in upper part of mountain slope on the right bank of Puiva River – Выходы обветренных карбонатных скал в верхней части склона по правому берегу р. Пуйва

7 – Northern slope of quarzite ridge in contact zone with carbonate rock outcrops on right bank of Upper Puiva River – Северный склон кварцитной гряды на контакте с карбонатными породами по правому берегу в верховьях р. Пуйва

8 –Gentle slope of hollow of glacier lake in Upper Puiva River – Пологий склон котловины карового озера в верховьях р. Пуйвы

9 – Puiva Plateau with karst hollow and carbonate rock outcrops on left bank of Puiva River – Пуйвинское плато с карстовыми просадками и выходами карбонатных скал на примыкающем крутом склоне по левому берегу р. Пуйва

10 – South-west facing steep slope with carbonate rock outcrops on left bank of Puiva River – Крутой склон юго-западной экспозиции с карбонатными выходами останцов на левом берегу р. Пуйва

11 – Silicates rock outcrops at the bottom of mountain to the west from Shatmaga Mountain – Складка силикатных пород и нижняя часть примыкающего к ней склона к западу от г. Шатмага

12 – The nearest part of steep slope on left bank of Puiva River opposite Zhilnyi Creek Mouth – Нижняя часть крутого склона на левом берегу р. Пуйва напротив впадения в нее ручья Жильный

13 – The gentel south facing slope of plateau between Puiva and Small Pyiva rivers – Пологий склон южной экспозиции обширного плато между бассейнами рек Пуйва и Мал. Пуйва

14 – North-west spurs of Shatmaga Mountain – Северо-западные отроги горы Шатмага

15 – The gentel slope to valley of Puiva River near the upper border of forest belt – Пологий склон к долине р. Пуйва вблизи верхней границы леса (пояс березовых криволесий и лиственничных редколесий);

16 – Valley on left bank of Puiva River including the bottom of mountain slopes in upper part of forest belt – Левобережная долина р. Пуйвы и нижние части прилегающих склонов гор в верхней части лесного пояса

17 – Low terrace and bottoms of mountains on right bank of Puiva River, upper part of forest belt – Низкая терраса по правому берегу р. Пуйвы и нижние части прилегающих склонов гор в верхней части лесного пояса

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, Tetralophozia 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 Herbarium of Yugor State University (YSU), duplicates 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 Mt. 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, Fuscocephaloziopsis 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 quadrata, Blepharostoma trichophyllum* subsp. *brevirete, Mesoptychia heterocolpos, Cyrtomnium hymenophylloides* [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 *Mesoptychia gillmanii, 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 quadrata, Mnium spinosum, Philonotis fontana, Pohlia wahlenbergii*. It is an almost circumpolar arctomontane calcicolous 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 *Larix* open forest on a carbonate cliff as single stems in mats with *Lophocolea minor, Mnium thomsonii, Callicladium 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, Schljakovia kunzeana, 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 *Lophoziopsis longidens, Pleurozium schreberi, Lescuraea secunda, Hylocomiastrum pyrenaicum*.

B. sudetica (Nees ex Huebener) L. Söderstr., 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, Gymnomitrion concinnatum, Lophozia wenzelii, L. murmanica, Fuscocephaloziopsis albescens, Pohlia crudoides, Kiaeria falcata, Andreaea rupestris, Racomitrium lanuginosum*.

Biantheridion undulifolium (Nees) Konstant. & Vilnet (per.) – **9**: sedge-*Sphagnum* bog at the bottom of quartzite ridge [121187], mixed with *Polytrichum strictum* or *Schistochilopsis incisa, Lophozia wenzelii, Scapania parvifolia, Cephaloziella arctogena*. The species was previously known in the Urals from one locality in Polar Urals (Konstantinova & Chernyadjeva, 1995) and one site on Mt. Ner-Oika (Konstantinova & Lapshina, 2014). It is a world wide rare species that has status "disappeared" in Central and Western Europe (Schumacker & Matriny, 1995) and listed as rare in the Red Data Book of Russia (Bardunov, 2008). It has recently been found in many sites in Siberia (Konstantinova & Savchenko, 2008).

Blasia pusilla L. (and., gyn.) – **1**: Puiva village, on soil on road side under *Alnus* (43/2-1) mixed with *Scapania curta, Pohlia filum*. **19**: valley of Puiva River [121260], road side, on soil, without admixture of other bryophytes or mixed with *Scapania curta, Pohlia filum, Dicranella subulata, Nardia japonica* (52/1-2). Widespread cosmopolitan species.

Blepharostoma trichophyllum (L.) Dumort. – **11, 19, 20, 21** (5: 433–890 m), sp.: on spots of loamy bare soil in *Betula nana* grass tundra, mixed with *Anthelia juratzkana, Nardia geoscyphus, Scapania curta, Cephalozia bicuspidata, Prasanthus suecica*, on fine earth between boulders in rock fields, often with *Cephalozia pleniceps*, among mosses in dwarf-sedge-moss bogs with *Scapania paludicola, Sphenolobus minutus var. grandis, Ptilidium ciliare, Warnstorfia sarmentosa, Aulacomnium turgidum, Loeskypnum badium*, in *Betula-Picea* tall-herb-moss forest, on decaying wood in thin pure mats with admixture of *Sciuro-hypnum reflexum* and other bryophytes on decaying wood [121266].

B. trichophyllum* subsp. *brevirete* (Bryhn & Kaal.) R.M. Schust. [*B. trichophyllum* var. *brevirete* Bryhn & Kaal.] – **2, 4, 6, 8, 9, 12, 17 (11: 630–926 m alt.), fr.: on carbonate cliffs in tundras, larch low growth open forests, in alder thickets, on humus and carbonate fine earth on ledges and in niches under rocks on cliffs and in rock fields, on sides of brooks near carbonate rocks [121312]. The species occurs both in pure mats and mixed with *Tritomaria scitula, Distichium capillaceum, Mesoptychia heterocolpos, M. gillmanii, M. collaris, Odontoschisma macounii, Saccobasis polita, Preissia quadrata, Clevea hyalina, Cyrtomnium hymenophylloides, Mnium thomsonii, Pohlia cruda, Platydictya jungermannioides*. This is the first record of the subspecies for the eastern side of the Urals. The subspecies *brevirete* has been reported earlier for the western side of the Urals, particularly the Vishera State Nature Reserve (Konstantinova & Bezgodov, 2006). 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.

***(*) Calycularia laxa* Lindb. & Arnell – **4**: rock field at the bottom of Zhilnyi 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 quinquedentata, 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 crudoides*. *C. laxa* is an arctomontane species with predominantly Asian – western North American distribution and a single locality in the European Arctic (Konstantinova & Lavrinenko, 2002) and another in the subarctic (Borovichev, 2013), which presumably represent post-glacial invasion (Konstantinova & Mamontov, 2010).

Calypogeia neesiana (C. Massal. & Carestia) 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, Neoorthocaulis binsteadii, Scapania paludicola, Trilophozia quinquedentata, Dicranum laevidens, Warnstorfia 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 kunzeana, 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 *Neoorthocaulis binsteadii*, with *Lophozia longiflora* and *Cephaloziella spinigera* (30/1).

C. bicuspidata (L.) Dumort. (per., spor.) – **3, 4, 5, 7, 9, 11, 10, 19, 17** (12: 476–980 m), com.: on moist loamy spots in gravel lichen and dwarf-shrub-moss tundras, on fine earth between 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. albescens, Scapania curta, Nardia geoscyphus, Plectocolea hyalina, Harpanthus flotovianus, Schistochilopsis opacifolia*.

Cephaloziella 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 tundra, 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 wenzelii* and *Lophoziopsis 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 tundrae*.

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 (64.49596° N – 59.65054° E; 890 m alt.), single shoots in mats dominated by *Neoorthocaulis binsteadii* mixed with *Lophozia longiflora* and *Cephalozia ambigua* (30/1). **20**: upper part of forest belt in the Middle Puiva River (64.48790° N – 59.69986°; 380 m alt.), seepage at the bottom of mountain at the edge of a bog, on base of tree in mats 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 murmanica, Gymnomitrion concinnatum, Sanionia uncinata, Oncophorus wahlenbergii, Hylocomiastrum pyrenaicum* (41/1-1). The species has previously been reported for the Urals from Mt. Ner-Oika. (Konstantinova & Lapshina, 2014).

Chiloscyphus polyanthos (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 *Mesoptychia gillmanii* and admixture of *Jungermannia atrovirens*, *Bryoerythrophyllum recurvirostre*, *Blepharostoma trichophyllum* subsp. *brevirete*, *Marchantia polymorpha* subsp. *montivagans* (46/4-1).

Clevea hyalina* (Sommerf.) Lindb. [*Athalamia hyalina* (Sommerf.) S.Hatt.] (and.) – **9: under rocks in rock field (64.49653° N – 59.64451° E; 973 m alt.), on carbonate fine earth (29/4-3), some thalli mixed with *Blepharostoma trichophyllum* subsp. *brevirete*, *Tritomaria 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 *Mesoptychia gillmanii*,*Asterella lindenbergiana, Blepharostoma trichophyllum subsp. brevirete, Orthothecium strictum, Distichium capillaceum, Isopterygiopsis 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 albicans (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 murmanica, L. longiflora, Fuscocephaloziopsis albescens, Pohlia crudoides, Racomitrium lanuginosum, Andreaea rupestris*. It is a widespread arctomontane species, but it has previously only been reported from a few sites in the Urals (Zinovjeva, 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, Anthelia juratzkana, Prasanthus suecica, Isopaches bicrenatus*. The species has previously been recorded in 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-Oika (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 albicans, Fuscocephaloziopsis albescens, Lophozia wenzelii, L. murmanica, Gymnomitrion concinnatum, Pohlia cruda, P. crudoides*.

Endogemma caespiticia (Lindenb.) Konstant., Vilnet & A.V. Troitsky [*Solenostoma caespiticium* (Lindenb.) 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, Isopaches bicrenatus*. Mountain circumboreal species restricted to bare soil.

Fuscocephaloziopsis albescens (Hook.) Vaňa & L.Söderstr. [*Pleurocladula albescens* (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 *Anthelia juratzkana, Cephalozia bicuspidata, Lophozia murmanica, Diplophyllum albicans, D. taxifolium, Gymnomitrion concinnatum, Pohlia drummondii*.

F. lunulifolia (Dumort.) Váňa & L.Söderstr. [*Cephalozia lunulifolia* (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 *Lepidozia reptans, Mylia anomala, Dicranum fuscescens, Tetraphis pellucida, etc*.

F. pleniceps (Austin) Váňa & L.Söderstr. [*Cephalozia pleniceps* (Austin) Lindb.] (per., spor.) – **2, 3, 4, 5, 11,19** (7: 433–830 m), fr.: tundra belt, on fine earth in niches on carbonate cliffs mixed with *Asterella lindenbergiana, Pohlia cruda, Bartramia ithyphylla*, 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 murmanica, Schistochilopsis opacifolia, Mesoptychia gillmanii*.

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 *Schljakovia kunzeana, Scapania irrigua, S. irrigua* subsp. *rufescens, S. paludicola, Odontoschisma elongata, Pseudolophozia 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-lichens 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-*

cans, D. taxifolium, Tetralophozia setiformis, Marsupella sprucei, Gymnomitrion coralloides, Sphenolobus minutus, S minutus var. *grandis, Anthelia juratzkana, Pseudolophozia sudetica, Lophozia longiflora, L. murmanica, Pohlia crudoides, Andreaea rupestris*.

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 minutus, Trilophozia quinquedentata, Gymnomitrion concinnatum, 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 neesiana, Scapania paludosa, Lophozia longiflora, Cephalozia bicuspidata, Rhizomnium magnifolium, Sanionia uncinata, Pohlia drummondii, Bartramia ithyphylla, 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-lichen rocky tundras [121271], mixed with *Anthelia juratzkana, Diplophyllum obtusifolium, Gymnomitrion concinnatum, Endogemma caespiticia, Marsupella sprucei, Nardia japonica, Scapania obcordata, 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, Hygrohypnella ochracea, Pohlia wahlenbergii, Dichodontium pellucidum, Philonotis fontana, Mesoptychia gillmanii, Bryoerythrophyllum recurvirostre*. The species was collected once on the vertical wall of a carbonate cliff in larch light forest [121336], mixed with *Mesoptychia 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 – 59.66006° E; 830 m alt.), on sides of a karst cave, on fine earth, single shoots mixed with *Mesoptychia gillmanii Pohlia wahlenbergii, Philonotis* sp., *Asterella lindenbergiana* (09/3). Widespread arctomontane 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 *Tetraphis pellucida, Plagiothecium* sp.

Lophocolea heterophylla (Schrad.) Dumort. (per., spor.) – **6**: mossy rocky bed of dry brook [121286], on soil. **19**: birch-spruce tall herbs-green moss forest on south faced steep slope [121244], on decaying wood in pure mats and mixed with *Lophoziopsis longidens, Ptilidium pulcherrimum, Brachythecium salebrosum*. **21**: *Betula –Picea –Pinus sibirica*-fern-*Vaccinium myrtillus*-green moss forest in upper part of forest belt [121282], on decaying wood, mixed with *Sciurohypnum reflexum, Stereodon plicatulus, Lophocolea minor, Sanionia uncinata.*

L. minor Nees (gem.) – **2, 6,13, 19, 21**(5: 380–725 m), sp.: on spots of bare soil in dwarf shrubs-herbs-green-moss tundra, on mossy carbonate cliffs in larch light forest [121120], mixed with *Preissia quadrata, Tritomaria scitula, Scapania cuspiduligera, S. gymnostomophila, Mnium thomsonii, Pohlia cruda, Platydictya jungermannioides*, sometimes on fine earth along temperate brooks. In dark coniferous and in mixed tall herbs-green moss forests the species occurs mostly on decaying wood and at base of trees [121240], mixed with *Lophocolea heterophylla, Barbilophozia barbata, Ptilidium pulcherrimum*.

Lophozia ascendens (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. longiflora (Nees) Schiffn. [*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 *Neoorthocaulis binsteadii, Schistochilopsis incisa, Fuscocephaloziopsis albescens, Diplophyllum albicans, Gymnomitrion concinnatum, Cephalozia bicuspidata, Lophozia murmanica, Harpanthus flotovianus. Cephalozia pleniceps*.

L. murmanica Kaal. [*Lophozia wenzelii* 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 sudetica, Lophozia longiflora, Schistochilopsis opacifolia Harpanthus flotovianus, Fuscocephaloziopsis albescens, Gymnomitrion concinnatum, Tetralophozia setiformis, Sanionia uncinata, Pohlia crudoides, 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-liverwort 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 hatcheri, Sciuro-hypnum reflexum*.

L. wenzelii (Nees) Steph. 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, Ptilidium ciliare, Neoorthocaulis floerkei, Fuscocephaloziopsis albescens, Anthelia juratzkana, Schljakovia kunzeana, Scapania irrigua, S. curta, Plectocolea subelliptica, Cephalozia bicuspidata, Polytrichastrum sexangulare, Sanionia uncinata, Kiaeria starkei*.

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

Lophoziopsis excisa (Dicks.) Konstant. & Vilnet (gem., and., gyn., per., spor.) – **1, 11, 15, 16, 18, 20** (6: 390–890 m), sp.: on soil among mosses, on spots of bare soil in herbaceous tundras, on road sides [121237], always mixed with other bryophytes: *Pseudolophozia sudetica, Lophozia wenzelii, L. longiflora, Cephaloziella divaricata, 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 *Barbilophozia lycopodioides, B. hatcheri, Lophocolea heterophylla, Lophozia* cf. *ventricosa, Tritomaria exsectiformis, Ptilidium pulcherrimum, Sanionia uncinata, Dicranum* spp., *Brachythecium salebrosum*.

**L. pellucida* (R.M. Schust.) Konstant. & Vilnet [*Lophozia pellucida* R.M. Schust.] (gem.) – 2 carbonate mossy cliffs in *Larix sibirica* light forest, on ledges of rocks between rocks [121334], admixture in mats dominated by *Mesoptychia heterocolpos*, mixed with *Tritomaria scitula, Scapania gymnostomophila, Blepharostoma trichophyllum* subsp. *brevirete, Cyrtomnium hymenophylloides, Brachythecium cirrosum.* This poorly known arctic species was previously reported in the Urals from single localities on the western side of mountains (Bezgodov *et al*., 2003, Konstantinova & Bezgodov, 2006).

Marchantia polymorpha L. subsp. *montivagans* Bischl. & Boissel.-Dub. (gem., and., gyn., spor.) – **3, 5, 6, 8, 11, 20** (9: 380–890 m), fr.: on soil on sides of karst hollows in grass 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, Mesoptychia gillmanii, Pohlia wahlenbergii, Philonotis fontana*.

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

M. sprucei (Limpr.) 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 *Gymnomitrion concinnatum, Diplophyllum obtusifolium, Prasanthus suecicus, Isopaches bicrenatus*. This species was collected once on a road on sandy soil between tracks mixed with *Endogemma caespiticia, Nardia japonica* (47/3).

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

M. collaris* (Nees) L. Söderstr. & Váňa [*Mesoptychia 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* subsp. *brevirete, Tritomaria scitula, Odontoschisma macounii, Saccobasis polymorpha, Preissia quadrata, 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* subsp. *brevirete, Mesoptychia heterocolpos, M. badensis, Fuscocephaloziopsis pleniceps, Chiloscyphus polyanthos, Asterella lindenbergiana, Preissia quadrata, Bryoerythrophyllum recurvirostre, Distichium capillaceum, Platydictya jungermannioides, Pohlia wahlenbergii, P. cruda, Bartramia ithyphylla, Dichodontium pellucidum, etc.*

M. heterocolpos* (Thed. ex Hartm.) L. Söderstr. &Váňa [*Leiocolea heterocolpos* (Thed. ex C.Hartm.) H. Buch] (gem., and., gyn., per., spor.) – **2, 3, 6, 8, 9, 11, 12 (10: 633–973 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: *Mesoptychia gillmanii, M. collaris, Blepharostoma trichophyllum subsp. brevirete, Tritomaria scitula, Preissia quadrata, Jungermannia atrovirens, Distichium capillaceum, Drepanium recurvatum, Myurella tenerrima, Platydictya jungermannioides, Cyrtomnium hymenophylloides, Mnium thomsonii, Encalypta* ssp., *etc*.

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

Nardia geoscyphus (De Not.) Lindb. (and., per., spor.) – **1, 3, 10, 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, Psilopilum laevigatum, Pohlia drummondii.*

N. japonica Steph. (per.) – **18**: on road between tracks, on sandy soil [121233], with admixture of *Isopaches bicrenatus, Gymnocolea borealis, Endogemma caespiticia, Scapania obcordata*. **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**: sedge-*Sphagnum* bog at the base of quartzite ridge [121188], in mats with small admixture of *Lophozia longiflora, Cephalozia ambigua, Cephaloziella spinigera*. **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 *Sphenolobus minutus, Riccardia latifrons, Cephalozia bicuspidata, Blepharostoma trichophyllum* subsp. *brevirete, Scapania tundra*.

Neoorthocaulis floerkei (F. Weber & D. Mohr) L. Söderstr., De Roo & Hedd. [*Orthocaulis 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 hollow, in snowbed communities, in spring fen [121134]. Often in pure mats or mixed with *Lophozia wenzelii* and *Barbilophozia hatcheri*.

Obtusifolium obtusum* S.W. Arnell – **19: on bank of brook, on soil [121255], mixed with *Sanionia uncinata*.

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

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

Pellia neesiana (Gottsche) 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 hyalinum* (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]. Always mixed with other hepatics: *Nardia geoscyphus, N. japonica, Scapania curta, Solenostoma sphaerocarpum, S. confertissimum, Pellia neesiana, etc*.

P. obovata (Nees) Lindb. [*Solenostoma obovatum* (Nees) C. Massal.] – **5**: willow (*Salix lanata*) thickets along stream, on fine earth covered stems of willow [121153], in pure mats (22/1-1) and mixed with *Scapania irrigua, S. paludosa, Pellia neesiana, Calliergonella lindbergii, Sciuro-hypnum latifolium, Warnstorfia exannulata*. **19**: on bank of brook (64.45512° N – 59.75020° E; 476 m alt.), on soil, mixed with *Scapania subalpina, Philonotis fontana, Chiloscyphus polyanthos* (51/7-2).

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 – 59.66510° E; 632 m alt.), on soil, in pure mats (43/1-1) and mixed with *Scapania curta, Nardia geoscyphus* (43/1-3), *Lophozia wenzelii* (43/2-2). **2**: mossy dry brook (64.48383° N – 59.66943° E; 634 m alt.), on rocks in the bed and on fine earth on bank (71/15). This species has previously been reported for Polar Urals as *Plectocolea obovata* var. *minor* (Konstantinova & Czernjadieva, 1995).

Prasanthus suecicus (Gottsche) Lindb. (per., spor.): – **11, 17** (3: 840–980), sp.: on loamy spots of bare soil in *Betula nana*-herbaceous tundra, dwarf shrub-moss-lichen, dwarf shrub – lichen tundra [121271], mixed with *Anthelia juratzkana, Cephalozia bicuspidata, Blepharostoma trichophyllum, Nardia geoscyphus, Marsupella sprucei, Gymnomitrion concinnatum, Isopaches bicrenatus, Scapania parvifolia, Diplophyllum obtusifolium*.

Preissia 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]. Always mixed with other bryophytes, particularly with *Blepharostoma trichophyllum* subsp. *brevirete, Mesoptychia heterocolpos, M. gillmanii, M. collaris, Lophocolea minor, Scapania cuspiduligera, Asterella lindenbergiana*.

Protolophozia elongata* (Steph.) Schljakov – **2: on fine earth on bank of mossy dry brook [121327], in mats dominated by *Mesoptychia gillmanii, Scapania curta* and admixture *Schistochilopsis opacifolia, Pohlia cruda, Bartramia ithyphylla*. It is a rare hepatic that always occurs as admixture in mats of other hepatics. It is listed as rare in the Red Data Book of Russia (Bardunov, 2008) and in the Red Data Book of Europe (Schumacker & Martiny, 1995). The species has previously been recorded in the Urals 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 shrubs-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 *Barbilophozia hatcheri, Schljakovia 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 *Barbilophozia barbata, Lophocolea heterophylla, Lophozia silvicola, Lophoziopsis longidens, Brachythecium salebrosum, etc*.

Riccardia latifrons (Lindb.) Lindb. – **17**: dwarf shrub-sedge-*Hypnum-Sphagnum* bog at the bottom of slope [121263], mixed with *Sphenolobus minutus, Neoorthocaulis binsteadii, Cephalozia bicuspidata, Blepharostoma trichophyllum* subsp. *brevirete, Sphenolobus minutus* var. *grandis, Scapania tundrae, Loeskypnum badium.*

Saccobasis polita (Nees) H. Buch – **11**: on sides of karst hollow in *Dryas*-herbaceous tundra [121138], on soil covered fine earth, mixed with *Mesoptychia gillmanii, Asterella lindenbergiana*. **2**: on mossy rocks on bank and in the bed of a dry brook [121320], on fine earth, mixed with *Mesoptychia gillmanii, M. heterocolpos, Tritomaria scitula, Blepharostoma trichophyllum* subsp. *brevirete*.

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 [121323], mixed with *Mesoptychia collaris, M. gillmanii, Scapania cuspiduligera, Tritomaria scitula, Blepharostoma trichophyllum* subsp. *brevirete, Distichium capillaceum, Preissia quadrata*. This species has previously been reported in the Urals from one locality on Mt. Ner-Oika (Konstantinova & Lapshina, 2014).

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, Distichium capillaceum, Mesoptychia* spp., *Encalypta* spp. **9**: on carbonate fine earth under boulders in rock field (64.49653N° – 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 Urals, in the Pechoro-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 [121123]. Sometimes in pure mats, but more often mixed with *Nardia geoscyphus, 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 [121121]. In pure mats or mixed with *Mesoptychia gillmanii, Tritomaria scitula, Saccobasis polymorpha, Scapania gymnostomophila, Lophocolea minor, Preissia quadrata*.

* *S. gymnostomophila* Kaal. (gem.) – **13**: dwarf-shrub-herbs-green-moss tundra on steep slope of south-east facing slope [121121], 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 *Mesoptychia heterocolpos* and admixture of *Lophoziopsis pellucida, Tritomaria scitula, Blepharostoma trichophyllum* subsp. *brevirete, Cyrtomnium hymenophylloides, Brachythecium cirrosum* [121334].

S. cf. *hyperborea* Jörg. – **5**: rock field at the bottom of snowfield [121163], on fine earth between boulders, mixed with *Anthelia juratzkana, Pseudolophozia sudetica*.

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, Lophozia wenzelii, Gymnocolea inflata, Straminergon stramineum, Sanionia uncinata, Aulacomnium palustre, Philonotis fontana*.

(*) *S. irrigua* subsp. *rufescens* (Loeske) R.M. Schust. [var. *rufescens* (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 *Gymnocolea 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, Lophoziopsis 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 [121233]. Usually mixed with *Scapania curta, Nardia japonica, Gymnocolea borealis, Isopaches bicrenatus, 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 *Gymnocolea inflata, Warnstorfia exannulata, W. sarmentosa, Loeskypnum 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 lindbergii, 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: *Lophoziopsis longidens, Cephalozia bicuspidata, Pseudolophozia sudetica, Diplophyllum albicans, Sphenolobus minutus, Mesoptychia* spp., *etc.*

S. praetervisa* Meyl. [*Scapania mucronata* subsp. *praetervisa* (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 *Mesoptychia gillmanii, M. heterocolpos* (09/4).

S. subalpina (Nees ex Lindenb.) 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 lindbergii, 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 *Kiaeria 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, Loeskypnum badium, Neoorthocaulis binsteadii, Sphenolobus minutus, 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 exsectiformis, Ptilium cristacastrensis, 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. ambigua, Fuscocephaloziopsis pleniceps, Lophoziopsis excisa, Scapania mucronata, Harpanthus flotovianus, Bartramia ithyphylla, Pohlia drummondii*. It was once collected on fine earth between rocks on carbonate cliff [121174], mixed with *Odontoschisma macounii, Blepharostoma trichophyllum* subsp. *brevirete, Mesoptychia heterocolpos, Distichium capillaceum, Mnium thomsonii, Encalypta affinis*.

Schljakovia 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. lycopodioides, Lophozia wenzelii, Scapania irrigua, Pohlia drummondii, Aulacomnium palustre, Paludella squarrosa, Rhizomnium pseudopunctatum, Sanionia uncinata, Sciuro-hypnum latifolium*.

Schljakovianthus quadrilobus (Lindb.) Konstant. & Vilnet (gem.) – **5**: rock field near edge of snowfield [121159], on fine earth between boulders mixed with *Fuscocephaloziopsis albescens, Sanionia uncinata, Pohliadrummondii*. **11**: karst hollow in grass tundra [121215], on soil, mixed with *Tritomaria scitula, Timmia austriaca, Distichium capillaceum*.

Solenostoma confertissimum (Nees) Schljakov (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 parvifolia*. 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, on soil and on 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 (Schrad.) Steph. – **4**: in rock field at the bottom of mountain slope [121142], on fine earth on huge boulders mixed with *Sphenolobus minutus, Sanionia uncinata, Pleurozium schreberi, Dicranum* sp. **17:** rock field on steep mountain slope [121268], on fine earth between rocks, in pure mats.

Tetralophozia setiformis (Ehrh.) Schljakov (per.) – **4, 9, 14, 17** (8: 930–1030 m), fr.: on siliceous rocks (quartzite, granitoid) in rock field [121182]. It often occurs in pure mats, more seldom mixed with *Andreaea rupestris, Pseudolophozia sudetica, Diplophyllum albicans, Kiaeria falcata*.

Tritomaria exsectiformis (Breidl.) Loeske (gem.) – **19**: Birch-spruce tall herbaceous-green moss forest on steep south facing slope [121245], on decaying wood, mixed with *Sanionia uncinata, Plagiothecium laetum, Stereodon plicatulus, Dicranum montanum, Tetraphis pellucida*.

Trilophozia quinquedentata (Huds.) Bakalin [*Tritomaria quinquedentata* (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 illuminated 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, Mesoptychia heterocolpos, M. gillmanii, Scapania cuspiduligera, Tritomaria quinquedentata, Distichium capillaceum, Mnium thomsonii, Cyrtomnium hymenophylloides, Platydictya jungermannioides, Sanionia uncinata*.

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 calcicolous hepatic. *Jungermannia atrovirens* is also a calcicolous 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 wenzelii* 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, Mesoptychia badensis, M. collaris, M. heterocolpos, Odontoschisma macounii, Scapania cuspiduligera, S. gymnostomophila, Tritomaria scitula, Blepharostoma 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 (*Obtusifolium obtusum*) or montane (*Jungermannia eucordifolia*) 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, Neoorthocaulis binsteadii, 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 quinquedentata, 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, B. hatcheri, Mesoptychia gillmanii, Preissia quadrata,* and *Asterella lindenbergiana.* Four species (*Mesoptychia badensis, Scapania praetervisa, Solenostoma confertissimum,* and *Jungermannia polaris*) were collected in such 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 *Tetralophozia setiformis* is often the only and common species. In moist and shaded plots on fine earth *Gymnomitrion concinnatum, Pseudolophozia sudetica, Diplophyllum* spp., 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 albescens, Pseudolophozia sudetica, Orthocaulis floerkei* and *Anthelia juratzkana.* One species (*Scapania tundrae*) 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 binsteadii, 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 *Gymnocolea 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 *Ptilidium pulcherrimum* was found, whereas in moist forests many hepatics occur, including *Lophoziopsis longidens, Blepharostoma trichophyllum* and *Schistochilopsis incisa*. Five species (*Calypogeia neesiana, Lepidozia 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 paludicola* usually occur. *Marchantia polymorpha* ssp. *montivagans, Chiloscyphus polyanthos, Harpanthus flotovianus, Cephalozia* spp., *Scapania* spp., *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, Obtusifolium 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, Nardia* spp., *Lophoziopsis excisa, Pseudolophozia sudetica, Lophozia wenzelii*. The species mentioned above are also common on spots of loamy bare soil in tundra. More common species on sandy soil are *Blasia pusilla, Scapania obcordata, Isopaches bicrenatus, Endogemma sphaerocarpa,* and *Marsupella sprucei*.

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