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ON THE BRYOPHYTE FLORA OF "IREMEL" NATURE PARK (SOUTHERN URALS)
К ФЛОРЕ МОХООБРАЗНЫХ ПРИРОДНОГО ПАРКА "ИРЕМЕЛЬ" (ЮЖНЫЙ УРАЛ)

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Abstract

The preliminary list of bryophytes of "Iremel" Nature Park (Southern Urals Mts., Russia) includes 54 liverworts and 152 mosses. Distribution within the area and brief description of habitats is given.

Резюме

На настоящий момент на территории природного парка «Иремель» (Южный Урал, Россия) выявлено 54 вида печеночников и 152 вида мхов. Представлен аннотированный список мохообразных с указанием их распространения и краткой характеристикой местообитаний в районе исследования.

KEYWORDS: mosses, liverworts, Southern Urals, nature conservation

INTRODUCTION

The Ural Mountains are one of the Global 200 ecoregions, whose nature conservation is vital for the preservation of the planet's biodiversity (Olson & Dinerstein, 2002). This region represents a wide range of nature communities from mountain tundra to steppes. More than 80 % of the South Urals lies within the borders of the Republic of Bashkortostan (Russia).

Currently, 225 of the strictly protected natural areas with a total area 1064700 ha are located in the territory of Bashkortostan; they include 3 nature reserves, 1 national park, 4 natural parks, 29 reserves for conservation of certain species and more than 170 nature monuments (Muldashev, 2010). The Bashkir ecological network protects habitats of 68 % bryophytes and more than 80% vascular plants included in the Red Data Book of Bashkortostan (Mirkin, 2011). A low level of knowledge of bryophyte flora and consideration of chiefly vascular plants for nature protection in Bashkortostan caused a low representation of Bashkir ecological network for the bryophyte diversity conservation. The present paper continues the series of publications on the bryophyte flora of protected natural areas of Bashkortostan (Zolotov & Baisheva, 2003; Baisheva & Shirokikh, 2008; Baisheva, 2010; Baisheva *et al.*, 2014, *etc.*).

STUDY AREA

The "Iremel" National Park (INP) was established in 2010. Its area covers 49338 ha of the South Ural mountainous region with elevation ranging from 600 to 1580 m. It is located at 54°22'– 54°39' N and 58°33'– 59°07' E. The well-known Ural mountains Bol'shoy Iremel (1582 m a.s.l.) and Malyi Iremel (1449 m a.s.l.), and the mountain ridges Avalyak and Yagodnyi are situated there. The INP territory has a high diversity of nature communities and species, including rare and threatened ones. The complex relief and inaccessibility of the study area resulted in preservation of its nature (Tsvetaev, 1960).

The INP has a moderately cold and humid climate. The mean temperature of January is –15.7° C, the mean temperature of July is +12.10° C. The frost-free period is 90 days (near the Bol'shoy Iremel Mt. it is reduced to 40-50 days, due to the temperature inversion). The area is characterized by a wide daily temperature range (up to 20 degrees and more). The average annual precipitation is 800 mm and more (Yaparov, 2005). Snow cover increases with elevation (for 15-17 cm at every 100 m) due to heavier snowfalls and stronger frosts. As a result of strong winds, snow is swept from steep slopes and accumulated in depressions. Therefore, the thickness of snow

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cover in some places may reach up to 3 meters (Tsvetaev, 1960).

The relief of INP consists of mountain ranges and deep depressions. Rocks are represented by quartzites, sandstones, shales, crystalline limestone and amphibolites. Soils are diverse, comprising a wide range of soil types. The most widespread are mountain sod podzol soil, mountain forest soil and mountain meadow soil. Distribution of soils is associated with vegetation zones. Mountain tundra clay soil and subalpine mountain meadow soil are characteristic for alpine and subalpine belts. Brown and grey mountain forest soil types are typical for mountain taiga belt. All types of soil are characterized by high acidity, low content of calcium, magnesium and a high content of iron and aluminum. Some mineralogical properties of soils (siallitic type of weathering, hydromica-kaolinitic composition of the mineral part, constancy of the molecular binding of silica and iron in the whole soil profile) indicate the relict character of this complex, formed under the influence of a warm climate period (Mukatanov, 1992).

A lot of small rivers and streams, including the upper courses of the Belaya, Ai, Yuryuzan, Miass and Uy Rivers, run through the territory of INP. According to natural zonation of Bashkortostan (Muldashev, 2010), the study area belongs to the Yamantau district of dark coniferous forests and alpine vegetation. This is the one of the most elevated areas of the Southern Urals. Vegetation cover of INP is typical for the Southern Urals. There are clearly distinguished alpine belt (goltsy) with alpine tundra and bare rocks, subalpine belt (subgoltsy) with *Betula* shrublands, sparse pine-spruce forests and mesophytic tall-herb meadows, and forest belt with mountain taiga (Gorchakovskiy, 1966, 1975). The special element of landform, rock fields (accumulations of boulders with no finer material between them) are widespread in the middle and upper mountain belts. Rock fields consist of large blocks of quartzite or, rarely, black carbonaceous shale (Muldashev, 2010).

The alpine belt occurs at elevations of 1200-1582 m. Various types of mountain tundra communities predominated by lichens, mosses, grasses, sedges, *etc*., occur in uplands of Bol'shoy Iremel Mt., as well as on the saddle between Bol'shoy and Malyi Iremel Mts. In total, 52 species of bryophytes were revealed in alpine tundra communities. The most common are *Dicranum spadiceum, Rhytidium rugosum, Hylocomium splendens, Pleurozium schreberi, Polytrichum juniperinum, P. commune, Polytrichastrum alpinum, Paraleucobryum longifolium, Pohlia nutans, Dicranum fuscescens, Polytrichum piliferum, Hypnum cupressiforme* and *Sanionia uncinata.*

The subalpine belt is located at elevations of 1100-1200 m. The typical communities of this belt are *Betula czerepanovii* shrublands, park-like open forests of *Picea obovata,* tall-herb meadows dominated by *Bistorta major, Anemonastrum biarmense, Aconogonon alpinum, Veratrum lobelianum, Calamagrostis uralensis, Heracleum sibiricum*, *etc.* (hereafter the nomenclature of vascular plants follows Cherepanov, 1995). In open woodlands, 45 bryophyte species were recorded: *Pohlia nutans, Dicranum scoparium, Pleurozium schreberii, Sanionia uncinata, Dicranum fuscescens, Aulacomnium palustre, Sciuro-hypnum reflexum, Dicranum montanum, D. spadiceum, Hylocomium splendens*, *etc.* In mountain meadows, 43 species were found; *Sciuro-hypnum reflexum, Rhodobryum roseum, Brachythecium salebrosum, Dicranum scoparium, Plagiothecium denticulatum, Paraleucobryum longifolium, Pohlia nutans, Amblystegium serpens, Plagiomnium rostratum, Polytrichum longisetum,* and *Rhytidiadelphus subpinnatus* are the most common there. The timberline has a complex shape. It depends on a range of environmental factors (climate, orography, soil conditions, *etc.*). On gentle slopes of mountains and on ridges sheltered from the wind, forest vegetation can penetrate into subalpine and even alpine belt where isolated tree islands can spread across the tundra. Floristic composition of the herb layer of the high-altitude treeline ecotone communities depends on the composition of tree stand, density of trees, soil characteristics and can be represented by tall herbs, boreal short grasses, mosses, lichens and sedges. Due to the warming of the first half of 20th century, forests have expanded upwards for 60-80 m vertically into former tundra and for 500-600 m along the slope (Shiyatov, 1986).

The forest belt is located at elevations below 1100 m. The forest stand of mountain taiga is characterized by dominance of *Picea obovata*, *Abies sibirica* and *Picea abies,* and a high constancy of *Betula pendula* and *B. pubescens*. *Larix sibirica* has a scattered distribution, but in some places may have high abundance. Two main types of dark coniferous forests are spread in INP territory. *Picea obovata-Abies sibirica* forests with tall herb layer (*Dryopteris assimilis, Calamagrostis arundinacea, C. obtusata, Aconitum lycoctonum, Cerastium pauciflorum, Stellaria bungeana*) belong to the association ***Cerastio pauciflori-Piceetum obovatae*** Solomeshch *et al.* ex Martynenko *et al.* 2008 (Martynenko, 2009). These communities are located on gentle slopes of ridges at the elevation of 700-1100 m. Eighty bryophyte species were revealed there. *Stereodon pallescens, Sanionia uncinata, Sciuro-hypnum reflexum, Dicranum montanum, Callicladium haldanianum, Chiloscyphus profundus, Brachythecium salebrosum, Ptilidium pulcherrimum, Plagiothecium denticulatum, P. laetum, Tetraphis pellucida, Blepharostoma trichophyllum, Lophozia longidens, L. ventricosa,* and *Sciuro-hypnum starkei* are most common on bark of living trees and rotten wood. *Plagiomnium cuspidatum, Sciuro-hypnum curtum, Pleurozium schreberi, Dicranum scoparium, Hylocomium splendens, Rhodobryum roseum, Cirriphyllum piliferum, Rhytidiadelphus triquetrus, R. subpinnatus, Plagiochila porelloides, Hylocomiastrum umbratum, H. pyrenaicum,* and *Mnium lycopodioides* grow on soil, rocks and boulders.

Fig. 1. Map of the study area. Collection sites are numbered as follow:

1. Malyi Iremel Mt., 2 km on southwest from top 1201 m. 54°32’58” N, 58°50’27” E, alt. 950 m.

2. Malyi Iremel Mt., 1 km to the west from top 1191 m. 54°32’24” N, 58°51’46” E, alt. 1100 m.

3. Malyi Iremel Mt., 1 km to the east from top 1310 m. 54°31’59” N, 58°52’41” E, alt. 1200 m.

4. Tygynskoe bog. 54°31’01” N, 58°53’00” E, alt. 990 m.

5. Northwest edge of Tygynskoe bog. 54°31’36” N, 58°52’56” E, alt. 1040 m.

6. Malyi Iremel Mt., southwest slope. 54°33’09” N, 58°52’13” E, alt. 1320 m.

7. Malyi Iremel Mt., the upper part of southwest slope. 54°33’05” N, 58°52’52” E, alt. 1350 m.

8. Malyi Iremel Mt., 1.8 km on southwest from main top. 54°33’04” N, 58°53’19” E, alt. 1390 m.

9. Malyi Iremel Mt., 1 km on southwest from main top. 54°32’48” N, 58°53’02” E, alt. 1340 m.

10. Malyi Iremel Mt., western slope near top 1201.6 m. 54°32’00” N, 58°51’33” E, alt. 1200 m.

11. Bol’shoy Iremel Mt., northeastern slope. 54°31’33” N, 58°50’47” E, alt. 1440 m.

12. Top of Zherebchik ridge. 54°31’ N, 58°50’ E, alt. 1450 m.

13. Top of Bol’shoy Iremel Mt. 54°31’12” N, 58°50’31” E, alt. 1580 m.

14. Riverhead of Tyuluk River. 54°34’ 47” N, 58°58’26” E, alt. 900 m.

15. Tyulyukskoe bog. 54°34’ N, 58°58’ E, alt. 890-920 m.

16. Yagodny Ridge, slope to Tyuluk River. 54°34’51” N, 58°57’39” E, alt. 920 m.

17. Yagodnyi Ridge. 54°36’ N, 59°00’ E, alt. 970-1065 m.

18. Valley of Bol’shoy Avnyar River. 54°26’ N, 58°44’ E, alt 580-630 m.

19. Malyi Iremel Mt. 54°34’ N, 58°55’ E, alt 800 m.

20. Bol’shoy Iremel Mt. North-Eastern slope. 54°32’ N, 58°49’ E, alt 1300 m.

21. Malyi Iremel Mt. 54°31’ N, 58°45’ E, alt 650 m.

22. Avalyak Ridge, Abarash-Tash Mt. 54°28’ N, 58°52’ E, alt 1290 m.

Green moss-tall herbs spruce-fir forests of the association ***Bistorto majoris-Piceetum obovatae*** Martynenko 2009 prov. are widespread in the central part of the Southern Urals at elevations 600-900 m, in the low and middle parts of slopes, as well as on the top of ridges near the boundary between forest and subalpine open woodland. These communities are present on wet, poor and acidic, imperfectly developed mountain forest soils. Rock outcrops are typical for these forest habitats which often verge with brooks and wetland sites (Martynenko, 2009). The communities of the association are very rich in bryophytes: 95 bryophyte species (including 17 liverworts) were found there. Epiphytic species (*Pylaisia polyantha, Pseudoleskeella nervosa, Orthotrichum obtusifolium, O. speciosum,* and *Frullania bolanderi*) have a low constancy due to the rarity of deciduous trees in these communities. Typically, the ground moss cover is well developed (80-90%), but in sites with large rock outcrops or near boundary with open woodlands it may reduce to 5-10 %. In ground cover of these forests, boreal mosses *Pleurozium schreberi, Hylocomium splendens, Dicranum scoparium,* and *Ptilium crista-castrensis* are most common, also *Rhytidiadelphus subpinnatus, Hylocomiastrum umbratum, H. pyrenaicum, Polytrichum* spp., *Sciuro-hypnum curtum, Rhodobryum roseum, Plagiomnium cuspidatum* and typical species of wet and swampy habitats, *i.e.*, *Plagiochila porelloides, Aulacomnium palustre, Brachythecium rivulare, Brachythecium mildeanum, Calliergon cordifolium, Sphagnum spp.* may occur with quite high constancy. Near the boundaries of INP, secondary forests with dominance of birch and aspen are present.

The largest Southern Ural mires (Tyulyukskoe, Tygynskoe, Karaguzhinskoe and Septinskoe) are located in intermountain basins of INP. Generally, vegetation complexes of these mires are as follows: central part is covered by oligotrophic and mesotrophic ridge-hollow bog complexes, where ridges are covered by *Pinus sylvestris* stands, while in hollows communities with dominance of *Carex limosa* and *C. rostrata* are common; on the periphery of the bog, eutrophic riparian swamp forests with *Alnus incana, Picea obovata* and *Betula pubescens* occur, and also fens with dominance of *Carex juncella* and oligotrophic communities of quaking mire with dominance of *Carex rostrata* are present (Baisheva *et al.*, 2012). These communities neighbor green moss dark coniferous forests which are located in the lower parts of mountain slopes surrounding the depression with mire. It is worthy to note that Tygynskoe bog situated between Bol’shoy Iremel Mt. and Avalyak Ridge is the only mountain mire in the Southern Urals with permafrost and thermokarst processes (Tyulina, 1931; Makovskiy, 1973). Most common bryophytes of investigated bogs are *Sphagnum magellanicum, S. angustifolium, S. balticum, S. capillifolium, S. centrale, S. fallax, S. fuscum, S. girgensohnii, S. russowii, Aulacomnium palustre, Pleurozium schreberi,* and *Polytrichum strictum*. Totally, 108 bryophyte species were revealed in bog communities.

First data on bryophyte flora of Iremel Mts. were published in the middle of the 19th century (Bunge, 1854; Shell', 1883). However, bryophyte diversity of the contemporary territory of INP was hitherto insufficiently studied. Some scattered data are available in geobotanical publications or notes on interesting records (Tyulina, 1931; Gorchakovskiy, 1975; Sharafutdinov, 1983; Danilkiv *et al.*, 1984; Ignatova & Ignatov, 1993; Ishbirdin *et al.*, 1996; Baisheva & Potemkin, 1998; Shljakov, 1998; Baisheva, 2002; Potemkin & Kalinauskaite, 2008; Potemkin & Baisheva, 2009; Baisheva & Ignatova, 2009; Baisheva *et al.*, 2012). According to the literature data, 81 species of bryophytes were previously known in the territory of INP.

The present paper represents a review of literature data and the results of identification of more than 800 samples collected by E. Baisheva, E. Ignatova, N. Kalinauskaite and some other botanists in 1990-2013 in the study area. The nomenclature of bryophytes follows Ignatov, Afonina, Ignatova *et al.* (2006), Potemkin & Sofronova (2009), and Konstantinova *et al.* (2009). Species are annotated with: frequency (Un – unique; Rar – rare; Sp – sporadically, Fr – frequent, Com – common); elevation range of species habitats in meters (in brackets); occurrence in 22 collection sites (cited below); ecology; associated species (if they were noticed), sporophyte presence (S+), citing a publication in which the species was mentioned for the first time for the study area. Specimens are kept in UFA and partly in MHA and H.

LIST OF SPECIES

Hepatics

Barbilophozia barbata – Un; [650], 21, in nemoral-herb spruce-fir forest. On soil (Ishbirdin *et al.*, 1996).

B. hatcheri – Sp; [950-1100], 1, 6, 10, 11, in fir-birch forest and mountain tundra, on bare rocks and rock fields. On rock surface and rotten wood.

B. lycopodioides – Sp; [1000-1450], 5, 10, 11, in spruce-fir and spruce-birch forests, in mountain tundra. On soil (Baisheva & Potemkin, 1998).

B. sudetica – Rar; [1380-1580], 12, 13, in mountain tundra. On soil and rocks (Potemkin & Baisheva, 2009).

Blepharostoma trichophyllum – Sp; 15, 16, in spruce-fir forests and in spruce wooded bog. On rotten wood.

Calypogeia integristipula – Un; [922], 15, in sedge-*Sphagnum* spruce woodland. On peaty soil together with *Harpanthus flotovianus*.

C. muelleriana – Un; [913], 15, in bilberry-moss peatland forest dominated by *Pinus sylvestris*. On peaty soil among *Sphagnum*.

C. neesiana – Sp; [905-920], 15, on hummocks in sedge-*Sphagnum*, bilberry-moss and cloudberry peatland forests dominated by *Betula pubescens* and *Pinus sylvestris*. On peaty soil and decaying wood.

C. sphagnicola – Rar; [913-916], on hummocks of sedge-*Sphagnum* ridge-pool mire, in bilberry-moss pine forest. On peat among *Sphagnum.* With antheridium (Potemkin & Baisheva, 2009).

Cephalozia bicuspidata – Un; [915], 15, on sedge-*Sphagnum* bog. On peaty soil.

C. connivens – Un; [994], 4, on sedge-*Sphagnum* peatland forest dominated by *Pinus sylvestris*. On peaty soil with *Cephalozia lunulifolia* (Potemkin & Kalinauskaite, 2008).

C. loitlesbergeri – Rar; [917-919], on sedge-*Sphagnum* ridge-pool mire, in cloudberry peatland forest dominated by *Pinus sylvestris*. Among *Sphagnum* (Potemkin & Baisheva, 2009)

C. lunulifolia – Sp; [910-917], 15, on sedge-*Sphagnum* ridge-pool mire, in spruce-pine open woodland and sedge-*Sphagnum* birch forest. On rotten wood and among *Sphagnum.*

C. pleniceps – Sp; [912-922], 15, in sedge-*Sphagnum* and bilberry-moss spruce-pine open woodlands, sedge birch forests, in cloudberry peatland forest dominated by *Pinus sylvestris*. On peat and rotten wood.

Cephaloziella elachista – Rar; [913], 15, in bilberry-moss pine forests. On rotten wood (Potemkin & Baisheva, 2009).

C. varians – Un; [1338], 9, on sedge-moss mountain tundra. On soil with *Scapania irrigua* (Potemkin & Baisheva, 2009).

Chiloscyphus fragilis – Un; [916], 15, on open ridge-pool mire. On peaty hummock.

C. minor – Sp; [590-1038], 5, 15, 16, 18, 21, on sedge-*Sphagnum* birch woodlands, tallgrass birch forests, in nemoral-herb spruce-fir forest and pine forest with *Calamagrostis arundinaceae* and motley grass. On rotten wood.

C. polyanthos – Sp; [650-930], 1, 15, 16, 18, 21, in sedge-*Sphagnum* spruce and pine forests, sedge birch forest, nemoral-herb spruce-fir forest, on meadows dominated by sedge and *Filipendula ulmaria*. On peaty soil.

C. profundus – Com; [610], throughout the territory of INP, in sedge-*Sphagnum* birch woodlands, in various types of pine and spruce-fir forests. On rotten wood, bases of tree trunks and soil.

C. rivularis – Un; [918], 14, on the stream bank. On soil, with *Pellia neesiana* (Potemkin & Baisheva, 2009).

Cladopodiella fluitans – Rar; [910-990], 4, 15, in sedge-*Sphagnum* mire with *Eriophorum vaginatum* (Baisheva & Potemkin, 1998).

Frullania bolanderi – Un; [950], 1, in mesophytic fir-birch forest. On the bark of *Sorbus aucuparia*.

Gymnocolea inflata – Sp; [916-1439], 9, 12, 13, 15, in open sedge-*Sphagnum* mires, in peatland forests and alpine tundra. In mire hollows and rocky pools, often among *Sphagnum* (Potemkin & Kalinauskaite, 2008).

Harpanthus flotovianus – Sp; [910-916], 15, 16, in sedge-*Sphagnum* peatland forest dominated by *Betula pubescens*. On peaty soil.

Jamesoniella undulifolia – Un; [1387], 8, in sedge-moss mountain tundra. On peaty soil among *Dicranum undulatum.* Female plants with unfertilized archegonium (Potemkin & Baisheva, 2009).

Jungermannia pumila – Un; [906], 14, in stream of Tyulyuk River. On rocks.

Lepidozia reptans – Sp; [650-916], 15, 16, 21, in sedge-*Sphagnum* birch woodland, in nemoral-herb spruce-fir forest. On rotten wood.

Lophozia longidens – Rar; [650], 21, in nemoral-herb spruce-fir forest. On rotten wood.

L. rufescens – Rar; [1318-1580], 6, 13, in mountain tundra and subalpine belt. On rocks (Potemkin & Kalinauskaite, 2008).

L. cf. *saviczae* – Un; [1338], 9, in mountain tundra. On soil (Potemkin & Kalinauskaite, 2008).

L. ventricosa – Sp; [650-916], 15, 16, 21, in sedge-*Sphagnum* birch woodland, nemoral-herb spruce-fir forest. On rotten wood.

Marsupella sprucei – Un; [1500], in sedge-moss mountain tundra. On soil. With perianthium (Potemkin & Baisheva, 2009).

Mylia anomala – Sp; [910-994], 4, 15. On sedge-*Sphagnum* raised bog. Among *Sphagnum* (Potemkin & Kalinauskaite, 2008).

Orthocaulis kunzeanus – Un; [921], 15, in sedge-*Sphagnum* peatland forest dominated by *Picea obovata*.

Pellia endiviifolia – Un; [927], 16, in cloudberry-*Sphagnum* peatland forest dominated by *Picea obovata*. On peaty soil.

P. neesiana – Rar; [910-915], on wet meadow dominated by sedge and *Filipendula ulmaria*, in sedge birch forest. On wet soil.

Plagiochila porelloides – Sp; [650-920], 15, 16, 21, in tallgrass-green moss spruce forest, sedge-*Sphagnum* birch woodland, along streams. On wet soil.

Ptilidium ciliare – Sp; [950-1580], 1, 8, 13, in fir-birch forest and alpine tundra. On rocks (Gorchakovskiy, 1975).

P. pulcherrimum – Com; [650-920], throughout the territory of INP, in cloudberry-*Sphagnum* and sedge-*Sphagnum* pine and birch woodlands, *Calamagrostis* spp. spruce forests. On bases of birch trunks and rotten wood.

Radula complanata – [650], 21, in nemoral-herb spruce-fir forest. On bark of fallen birch trunk. S+.

Riccardia cf. *chamedryfolia* – Rar; [910-916], 15, in sedge-*Sphagnum* mires and in boggy woodlands. In mire hollows (Potemkin & Baisheva, 2009).

R. multifida – Rar; [916], 15, in sedge-*Sphagnum* mire. In hollows. S+ (Potemkin & Baisheva, 2009).

Scapania irrigua – Rar; [910-1440], 11, 15, 16, in sedge-*Sphagnum* peatland forest dominated by *Pinus sylvestris*, in wooded bog dominated by birch, sedge and *Filipendula ulmaria*. On rocks, soil and peat.

S. mucronata – Un; [916], 16, in sedge-*Sphagnum* birch woodland. On decaying log.

S. obcordata – Un; [906], 14, in stream of Tyulyuk River. On rock.

S. paludicola – Un; [1387], 8, in mountain tundra. On soil (Potemkin & Kalinauskaite, 2008).

S. paludosa – Un; [1440], 11, in subalpine belt. On basalt rock.

S. praetervisa – Un; near the top of Malyi Iremel Mt., in spruce-fir open woodland (Shljakov, 1998).

S. subalpina – Sp; [1201-1439], 1, 11, subalpine belt, along forest trail, on the bank of the river. On sandy soil and basalt rocks. With gemmae (Potemkin & Kalinauskaite, 2008).

Schistochilopsis opacifolia – Un; [1439], 11, in mountain tundra. On soil (Potemkin & Kalinauskaite, 2008).

Sphenolobus saxicola – Un; [1580], 13, in rock crevice with fine-grained soil.

Tetralophozia setiformis – Rar; [1290-1580], 13, 22, in niche between rocks. On fine-grained soil (Baisheva & Potemkin, 1998).

Tritomaria quinquedentata – Un; [1500], 13, in sedge-moss mountain tundra. On soil.

Mosses

Abietinella abietina – Sp; [1580], 13, in sedge-moss mountain tundra (Tyulina, 1931).

Amblystegium serpens – Sp; [912], 16, 18, in sedge-*Sphagnum* and birch forests with *Calamagrostis obtusata* and *C. arundinacea*. On rotten wood and soil. S+.

Andreaea rupestris – Rar; [1380-1580], 8, 13, in mountain tundra and on cliffs. On basalts. S+.

Atrichum flavisetum – Un; [650], 21, in spruce-fir forest. On sandy soil. S+.

A. undulatum – Sp; [650-950], 1, 21, on the bank of brook in the spruce-fir forest. On soil. S+.

Aulacomnium palustre – Com; [610-1440], throughout the territory of INP, in dark coniferous forests, in mountain tundra with *Eriophorum vaginatum*, alpine meadows and mires. On soil (Shell', 1883).

A. turgidum – Rar; [1300-1390], 7, 8, 11, 20, in sedge-moss mountain tundra and on subalpine meadows. On soil (Sharafutdinov, 1983).

Brachytheciastrum velutinum – Sp; [650-930], 16, 21, in spruce and spruce-birch forests. On boulders and rotten wood.

Brachythecium cf. *capillaceum* – Un; [1580], 13, in fissure between rocks. On soil.

B. mildeanum – Com; [600-1038], 1, 5, 15, 16, 18, 21, in tallgrass and sedge dark coniferous forests, sedge-*Sphagnum* birch woodlands, wet meadows and banks of streams. On soil.

B. rivulare – Sp; [650-950], 1, 21, on brook banks in the spruce-fir and fir-birch forests. On soil.

B. salebrosum – Sp; [590-1318], 15, 16, 18, 21, on sedge-*Sphagnum* mires, in pine forest with *Calamagrostis* spp. On rotten wood and bases of tree trunks. S+.

Breidleria pratensis – Rar; [600-920], 15, 16, 18, in sedge-*Sphagnum* peatland forests dominated by *Betula pubescens*. On peaty soil.

Bryum caespiticium – Un; [1318], 6, in fissure between rocks. S+.

B. capillare – Sp; [1318-1440], 6, 11, subalpine belt. On gravelly slope.

B. creberrimum – Un; [1318], 6, on rock-field. On ground between blocks. S+.

B. elegans – Rar; [1318-1580], 6, 13, on rock-fields and in mountain tundra. On soil.

B. pallens – Un; [650], 21, in spruce-fir forest. On soil. S+.

B. pseudotriquetrum – Un; [650], 21, on bank of stream in spruce-fir forest. On soil.

B. weigelii – Un; [650], 21, on bank of brook in spruce-fir forest. On soil.

Bucklandiella microcarpa – Rar; [650 -1380], 1, 2, 8, in fir-birch forest, on rock field, in mountain tundra. On rocks.

Callicladium haldanianum – Sp; [620-917], 15, 18, in sedge-*Sphagnum* birch forests and pine forests with *Calamagrostis arundinacea* and motley grass. On bases of birch trunks and rotten wood. S+.

Calliergon cordifolium – Sp; [700-1038], 1, 5, 15, 21, on banks of brooks, in sedge-*Sphagnum* spruce and birch swampy forests. On soil.

C. giganteum – Com; [600-1038], 4, 5, 15, 16, 18, 21, on banks of brooks, fens, in sedge-*Sphagnum* swampy spruce and birch forests. On soil.

Calliegonella cuspidata – Un; Iremel Mt., in mountain meadow (Shell', 1883).

C. lindbergii – Sp; [650-950], 1, 15, on banks of brooks, in swampy woodlands. On soil.

Campylidium sommerfeltii – Rar; [624], 18, in sedge-*Sphagnum* birch and spruce bogs, pine forests with *Calamagrostis arundinacea* and motley grass. On bases of birch trunks and rotten wood. S+.

Campylium stellatum – Rar; [920-950], 1, 15, near pit with stagnant water, in sedge-*Sphagnum* mires. On soil.

Ceratodon purpureus – Sp; [900-1580], 1, 13, 21, subalpine belt, in mountain tundra. On soil and burnt rotten wood. S+ (Ishbirdin *et al.*, 1996).

Cirriphyllum piliferum – Rar; [650], 21, in dark coniferous nemoral-herb forest. On soil.

Climacium dendroides – Com; [600-1440], 5, 11, 15, 18, 21, in tall-herb and sedge-*Sphagnum* spruce-birch forests, in open sedge-*Sphagnum* mires, alpine meadows and mountain tundra. On soil.

Cynodontium strumiferum – Sp; [910-950], 1, 15, on rock field, in sedge-*Sphagnum* open pine woodland and mountain tundra. On rocks and rotten wood. S+.

C. tenellum (Schimp.) – Un; [1439], 11, subalpine belt. On bare rocks. S+.

Dichelyma falcatum – Rar; [906-1038], 5, 14, 21, in channels of mountain streams and rivers. On rocks (Czernyadjeva & Ignatova, 2013).

Dicranella crispa – Un; [1440], 11, subalpine belt. On basalt rock.

D. subulata – Un; [1440], 11, subalpine belt. On soil.

Dicranum acutifolium – Un; [1387], 8, in sedge-moss mountain tundra. On soil (Baisheva & Ignatova, 2009).

D. bonjeanii – Sp; [910-950], 1, 15, 16, in pine-spruce forest with *Calamagrostis arundinacea* and motley grass, sedge-*Sphagnum* birch and spruce woodlands, open sedge-*Sphagnum* mire, mountain tundra, edge of trail in the forest. On bases of tree trunks, rotten wood and soil.

D. flagellare – Un; [587], 18, in birch forest dominated by *Calamagrostis arundinacea* and *Aegopodium podagraria*. On decaying wood.

D. flexicaule – Sp; [890-1320], 1, 6, 15, in cloudberry-*Sphagnum* pine forest, mountain tundra, spruce elfin wood, on rock field. On rotten wood and rocks (Tyulina, 1931).

D. fuscescens Turner – Com; [920-994], 4, 15, 16 in sedge-*Sphagnum* birch, pine and spruce forests, and mountain tundra. On rotten wood and bases of tree trunks.

D. majus – Un; [950], 1, in spruce forest. On soil (Ishbirdin *et al.*, 1996).

D. montanum – Com; [910-1038],], throughout the territory of INP, in tall-grass fir-birch forests, green moss spruce forests, sedge-*Sphagnum* peatland forests dominated by birch, pine or spruce. On rotten wood and bases of birch and spruce tree trunks.

D. polysetum – Sp; [620-920], 15, 18, 21, in pine and spruce forests. On soil. On forest litter, rotten wood and bases of tree trunks.

D. scoparium – Com; [620-1440], 1, 5, 11, 15 in fir-birch, pine and spruce forests, birch-wooded bogs, mountain tundra and on rock field. On forest litter, rotten wood and bases of tree trunks. S+ (Shell', 1883).

D. spadiceum – Com; [1310-1450], 6, 8, 11, 12, 22, in mountain tundra and on rock field. On rocks (Ishbirdin *et al.*, 1996).

D. undulatum – Sp; [900-1387], 8, 15, in mountain tundra, cloudberry-*Sphagnum* and *Eriophorum vaginatum*-*Sphagnum* pine wooded bogs, sedge-*Sphagnum* birch woodland. On peaty soil.

Drepanium recurvatum – Un; [1580], 13, in mountain tundra. On soil between rocks.

Drepanocladus aduncus – Rar; [610-910], 15, 18, in sedge meadow by the lake and in boggy birch woodland. On wet soil.

Eurhynchiastrum pulchellum – Un; [650], 21, in tall-grass spruce forest. On boulder.

Fontinalis dalecarlica – Un; [906], 14, in mountain stream. On rock.

Grimmia elatior – Un; [1440], 11, subalpine belt. On basalt rock.

G. incurva – Sp; [1387-1580], 2, 8, 13, in mountain tundra, on cliffs. On rocks.

G. longirostris – Rar; [800-1100], 1, 2, on cliffs. S+.

Hedwigia ciliata – Un; [1580], 13, on cliffs.

Helodium blandowii – Rar; [920-930], 15, in sedge-*Sphagnum* spruce and birch woodlands. On peaty soil.

Hygroamblystegium humile – Rar; [905-920], 15, 16, in sedge-*Sphagnum* birch woodland. On wet soil and rotten wood.

Hygrohypnella ochracea – Sp; [906-1387], 1, 8, 14, in stream of mountain brooks and rivers. On rocks.

Hylocomiastrum pyrenaicum – Sp; [650-1387], 1, 8, 21, in spruce-fir and fir-birch forests, sedge-moss mountain tundra. On rocks and forest litter.

H. umbratum – Rar; [650-920], 15, 21, in nemoral-herb spruce-fir forest. On forest litter.

Hylocomium splendens – Com; [910-1440], throughout the territory of INP, in dark coniferous forests, sedge-*Sphagnum* birch and spruce woodlands, mountain tundra, alpine meadows dominated by *Deschampsia cespitosa* and *Veratrum lobelianum*, in pine forest with *Calamagrostis obtusata* and *C. arundinacea*, and in spruce elfin wood. On forest litter and rotten wood (Bunge, 1854).

Hymenoloma crispulum – Un; Bol'shoy Iremel Mt. (Danilkiv *et al.*, 1984).

Hypnum cupressiforme – Un; [950-1450], 1, 12, in sedge-moss mountain tundra and spruce-fir forest. On rocks and cliffs.

Iwatsukiella leucotricha – Rar; [950-110], 1, 2, 21, in fir-birch forest and spruce open woodland. On boulders and fallen trunk of birch (Ignatova & Ignatov, 1993).

Kiaeria blyttii – Un; Bol'shoy Iremel Mt. (Danilkiv *et al.*, 1984).

Lescuraea incurvata – Rar; [800-1242], 2, 19, in spruce-fir forest. On rock near the brook and soil of trail.

L. saxicola – Sp; [900-1387], 1, 6, 8, 10, on rock fields, in forests, on banks of brooks, in open woodlands, and mountain tundra. On boulders and rocks.

Mnium lycopodioides – Rar; [950-970], 1, 16, in nemoral-herb spruce-fir forest and larch forest. On forest litter.

M. marginatum – Un; [650], 21, in nemoral-herb spruce-fir forest. On fine-grained soil in crevices of shady rocks.

M. spinosum – Sp; [950-1030], 1, 5, 11, 15, in alpine meadows and tall-grass spruce forest. On wet soil (Baisheva, 2002).

Neckera pennata – Un; [650], 21, in nemoral-herb spruce-fir forest. On bark of *Populus tremula.*

Oncophorus virens – Un; [650], 21, in nemoral-herb spruce-fir forest. On rock near the brook.

Orthotrichum affine – Un, [650], 21, in nemoral-herb spruce-fir forest. On bark of fallen birch trunk. S+.

O. obtusifolium – Un; [950], 1, in nemoral-herb spruce-fir forest. On bark of *Sorbus aucuparia*.

O. speciosum – Un; [950], 1, in nemoral-herb spruce-fir forest. On bark of *Sorbus aucuparia*. S+.

Oxystegus tenuirostris – Un; [1038], 5, in spruce wooded bog. On boulder.

Palustriella commutata – Un; [921], 15, in spruce forest with *Calamagrostis arundinacea* and motley grass. On wet soil near brook.

Paraleucobryum longifolium – Com; [650-1318], 1, 6, 15, 21, in alpine meadows, dark coniferous and larch forests, on rock fields. On boulders, cliffs and rocks (Ishbirdin *et al.*, 1996).

Plagiomnium cuspidatum – Rar; [650-950], 1, 21, in nemoral-herb spruce-fir forests. On rotten wood, bases of tree trunks and soil near of trail. S+.

P. ellipticum – Sp; [650-1038], 4, 5, 15, 21, in dark coniferous

forest, sedge-*Sphagnum* spruce and birch woodlands, on banks of brooks. On wet soil.

P. medium – Rar; [950-990], 1, 16, in spruce-fir and motley grass larch-birch forest. On soil.

P. rostratum – Sp; [910-1038], 5, 15, on banks of brooks, in sedge-*Sphagnum* birch and spruce wooded bogs. On wet soil.

Plagiothecium denticulatum – Com; [650-1318], 1, 6, 15, 16, 21, on rock fields, in fir-birch forests, sedge-*Sphagnum* birch woodland and mountain tundra. On rotten wood, bases of tree trunks, peaty soil and fine-grained soil between rocks.

P. laetum – Com; 5, 15, 16, in dark coniferous forests, sedge-*Sphagnum* birch and spruce woodlands. On rotten wood.

P. latebricola – Un; [800], 1, in spruce-fir forest. On bark of fallen birch trunk.

Platygyrium repens – Un; [950], 1, in fir-birch forest. On boulder.

Pleurozium schreberi – Com; [910-1440],], throughout the territory of INP, in dark coniferous and pine forests, mountain tundra, rock field, sedge-*Sphagnum* mires, alpine meadows and spruce elfin woods. On forest litter, rotten wood, cliffs, boulders and bases of tree trunks (Tyulina, 1931).

Pogonatum urnigerum – Sp; [950-1240], 1, 2, 10, near roads and trails in dark coniferous forests. On bare soil (Shell', 1883).

Pohlia andalusica – Un; [950], 1, near trail in spruce-fir forest. On bare soil (Baisheva & Ignatova, 2009).

P. annotina – Un; [1242], 10, 21, near brook and trail in spruce-fir woodland. On bare soil (Ignatova & Ignatov, 1993).

P. bulbifera – Un; [1038], 5, in tall-grass wet spruce woodland. On soil (Baisheva & Ignatova, 2009).

P. cruda – Rar; [650-1038], 1, 5, 21, near brook in spruce-fir forest, in tall-grass spruce wooded bog. On soil.

P. drummondii – Un; [1242], 10, near trail in spruce-fir forest. On bare soil (Baisheva & Ignatova, 2009).

P. melanodon – Un; [950], 1, near trail in spruce-fir forest. On bare soil. S+.

P. nutans – Com; [590-1440], throughout the territory of INP, in different types of forests, mires, in mountain tundra, on rock fields. On rotten wood, bases of tree trunks and soil. S+ (Ishbirdin *et al.*, 1996).

P. proligera – Un; [650], 21, near brook in spruce-fir forest. On bare soil.

P. sphagnicola – Un; [994], 4, in sedge-*Sphagnum* mire. On peaty soil (Baisheva & Ignatova, 2009).

P. wahlenbergii – Un; [950], 1, near brook in spruce-birch forest. On rocks.

Polytrichastrum alpinum – Sp; [950-1440], 1, 11, 12, on rock field, in subalpine belt, mountain tundra, in alpine meadows dominated by *Deschampsia cespitosa* and *Veratrum lobelianum*, in spruce elfin wood. On soil and rocks (Tyulina, 1931).

P. formosum – Un; [1150], 11, in peatland forest fominated by *Picea obovata*. On peaty soil.

P. longisetum – Rar; [908-930], 15, in spruce forests and open sedge-*Sphagnum* mire. On forest litter and peaty soil.

P. pallidisetum – Un; [800], 21, in spruce-fir forest. On rotten wood of fir.

Polytrichum commune – Com; [650-1440], 1, 6-8, 11, 12, 15, 16, 21, on rock fields, in mountain tundra, subalpine belt, dark coniferous forests, sedge-*Sphagnum* mires, alpine meadow dominated by *Deschampsia cespitosa* and *Veratrum lobelianum*. On litter and soil (Shell', 1883).

P. juniperinum – Com; [910-1450], 1, 5, 6, 12, 15, 16, 22, on rock field, in dark coniferous forests and mountain tundra. On forest litter, rocks and soil (Tyulina, 1931).

P. piliferum – Sp; [950-1380], 1, 8, on rock fields, in mountain tundra. On rocks (Ishbirdin *et al.*, 1996).

P. strictum – Com; [910-1300], 4, 11, 15, 16, 20, in sedge-*Sphagnum* mires and alpine meadows. On peat and humus soil (Tyulina, 1931).

Pseudobryum cinclidioides – Rar; [910-994], 4, 15, in open sedge-*Sphagnum* mires. On peaty soil (Ishbirdin *et al.*, 1996).

Ptilium crista-castrensis – Com; [910-1038], 1, 5, 12, 18, 15, on rock fields, in dark coniferous forests, sedge-*Sphagnum* peatland forests dominated by spruce, birch and pine, in mountain tundra. On forest litter, peaty soil and rocks (Tyulina, 1931).

Pylaisia polyantha – Rar; [950], 1, in fir-birch forest. On the bark of birch. S+.

P. selwynii – Un; [600], 21, in spruce-fir forest. On bark of aspen. S+.

Rhizomnium pseudopunctatum – Sp; [650-950], 1, 15, 16, 21, on brook banks, in sedge-*Sphagnum* birch and spruce bog woodlands. On wet soil.

R. punctatum – Sp; [910-1387], 1, 8, 15, 14, on banks of rivers and brooks, rock fields, in motley grass spruce forest, sedge-*Sphagnum* spruce and birch woodlands. On rocks and soil.

Rhodobryum roseum – Sp; [620-950], 1, 15, 18, 21, in alpine meadow, sedge-*Sphagnum* birch woodland, pine forest with *Calamagrostis obtusata* and *C. arundinacea*, nemoral-herb spruce-fir forest. On soil.

Rhytidiadelphus subpinnatus – Rar; [910-950], 1, 15, near brook bank and trail in spruce-fir forest, in sedge-*Sphagnum* birch woodlands, alpine meadow dominated by *Deschampsia cespitosa* and *Veratrum lobelianum*. On soil (Tyulina, 1931).

R. triquetrus – Sp; [620-950], 1, 5, 15, 18, 21, on rock field, in fir-birch, spruce-fir and pine forests, sedge-*Sphagnum* or sedge-*Filipendula ulmaria* birch woodlands, in mountain tundra. On soil (Tyulina, 1931).

Rhytidium rugosum – Com; [1310-1450], 6, 8, 11, 12, on rock field, in mountain tundra and spruce elfin woods. On soil (Shell', 1883).

Sanionia uncinata – Com; [620-1318], throughout the territory of INP, on rock fields, in dark coniferous forests, juniper bush, sedge-*Sphagnum* mires, alpine meadows, mountain tundra. On soil, rocks, rotten wood and bases of tree trunks (Tyulina, 1931).

Sciuro-hypnum curtum – Com; [620-1038], 1, 5, 15, 16, 18, 21, in dark coniferous, pine and fire-birch forests, in sedge-*Sphagnum* birch woodland. On soil (Ishbirdin *et al.*, 1996).

S. reflexum – Com; [650-1318], 1, 6, 10, 15, 21, on rock-field, bank of stream, near trail, in sedge-*Sphagnum* birch woodlands, motley grass spruce forest, pine open woodlands. On forest litter, bare soil, fine-grained soil in crevices of boulders, rotten wood, bases of tree trunks. S+ (Ishbirdin *et al.*, 1996).

S. starkei – Sp; [650-1318], 1, 6, 15, 16, 21, on rock field, mountain meadows, in spruce-fir forest and sedge-*Sphagnum* spruce-birch woodlands. On rocks, soil, bases of spruce and birch trunks, rotten wood.

Serpoleskea confervoides – Un; [800], 21, in spruce-fir forest. On boulder. S+.

Sphagnum angustifolium – Com; [897-995], 4, 12, 15, 16, in sedge-*Sphagnum* birch, pine and spruce wooded bogs, bilberry-*Sphagnum* spruce woodland, in mountain tundra. On peaty soil (Tyulina, 1931).

S. balticum – Sp; , [910-995], 4, 16, in open and wooded sedge-*Sphagnum* mires. In ditches and hollows (Ignatova & Ignatov, 1993).

S. capillifolium – Sp; [610-920], 15, 16, 18, in *Calamagrostis-Sphagnum* peatland forest dominated by spruce and birch, open mires with *Eriophorum vaginatum*. On peat (Shell', 1883).
S. centrale – [908-915], 15, in open and wooded sedge-*Sphagnum* mires. On peat.
S. compactum – Un; [918], 15, in oligotrophic ridge-pool mire. On peat.
S. fallax – Sp; [910-920], 15, 16, in sedge-*Sphagnum* pine woodlands (Ishbirdin *et al.*, 1996).
S. flexuosum – Rar; [910-995], 4, 15, in sedge community of quagmire (Ignatova & Ignatov, 1993).
S. fuscum – Com; [910-995], 4, 15, 16, on hummocks in oligotrophic open ridge-pool mires, in sedge-*Sphagnum* pine and birch woodlands. On peat (Tyulina, 1931).
S. girgensohnii – Com; [897-1300], 4, 15, 16, 20, in sedge-*Sphagnum* and cloudberry-*Sphagnum* pine, birch and spruce woodlands, in mountain tundra dominated by sedges and *Eriophorum vaginatum*. On peat (Tyulina, 1931).
S. jensenii – Rar; [890-995], 4, 15, in ridge-pool mire. In hollow (Ignatova & Ignatov, 1993).
S. lindbergii – Rar; [915-995], 4, 15, in sedge-*Sphagnum* and *Eriophorum vaginatum-Sphagnum* communities on ridges of ridge-pool mire. On peat (Ignatova & Ignatov, 1993).
S. magellanicum – Com; [910-1380], 4, 8, 15, 16, in sedge-*Sphagnum* mires and sedge-moss mountain tundra (Ishbirdin *et al.*, 1996).
S. majus – Rar; [916-995], 4, 15, in *Eriophorum vaginatum* community on ridge of ridge-pool mire. On peat (Ignatova & Ignatov, 1993).
S. palustre – Un; [910], 15, in watered sedge-*Sphagnum-Menyanthes trifoliata* community on ridge-pool mire.
S. papillosum – Rar; [910-995], 4, 15, in *Baeothryon cespitosum*+ *Empetrum hermaphroditum* community on ridges of ridge-pool mire, in cloudberry and bilberry pine wooded bogs. On peat (Ignatova & Ignatov, 1993).
S. platyphyllum – Un; [920], 15, on cloudberry-pine community on ridges of hummock-ridge bog. On peat.
S. riparium – Rar; [930-990], 4, 15, 16, in sedge-*Sphagnum* pine and birch woodlands, on cloudberry-*Sphagnum* spruce woodland. On peat (Tyulina, 1931).
S. rubellum – Rar; [920-995], 4, 15, in sedge-*Sphagnum* spruce, birch and pine woodlands (Ignatova & Ignatov, 1993).
S. russowii – Com; [890-995], 4, 15, 16, in open and wooded sedge-*Sphagnum* mires (Tyulina, 1931).
S. squarrosum – Sp; [890-1038], 5, 15, 16, in tall-herb peatland forest. On peat.
S. subsecundum – Sp; [890-995], 4, 15, in sedge-*Sphagnum* mires (Ignatova & Ignatov, 1993).
S. warnstorfii – Sp; [890-930], 4, 15, 16, in sedge-*Sphagnum* mires (Tyulina, 1931).
S. wulfianum – Rar; [890-990], 4, 7, 15, in sedge-*Sphagnum* mire and sedge-moss mountain tundra (Tyulina, 1931).
Stereodon pallescens – Com; [620-950], throughout the territory of INP, in dark coniferous, birch, pine and spruce forests and open woodlands, in mountain tundra. On rotten wood and bases of tree trunks, rarely on rocks. S+.
S. plicatulus – Un; [1535], 13, in mountain tundra. On rocks and soil.
Straminergon stramineum – Sp; [890-995], 4, 15, 16, in open and wooded sedge-*Sphagnum* mires.
Tayloria splachnoides – Un; [1100], 2, in wet tall-herb spruce forest. On soil. S+ (Baisheva & Ignatova, 2009).
Tetraplodon angustatus – Rar; [600-650], 21, in spruce-fir forest. On fallen aspen and birch trunks. S+.
Tetraphis pellucida – Sp; [650-1030], 1, 5, 15, 16, 21, in fir-birch and spruce-fire forests. On rotten wood.
Thuidium recognitum – Un; [612], 18, in boggy birch forest. On soil.
Tortula hoppeana – on bank of stream (Shell', 1883).
Warnstorfia exannulata – Sp; [890-995], 4, 15, 16, in sedge-*Sphagnum* mire.
W. fluitans – Sp; [890-930], 15, 16, in sedge-*Sphagnum* mire.

The bryophyte flora revealed in the study area includes 54 liverworts from 19 families and 27 genera and 152 moss species from 32 families and 71 genera. The richest in species families and genera of mosses are *Sphagnaceae* (23 species), *Dicranaceae* (12), *Polytrichaceae* (11), *Mniaceae* (10), *Mielichhoferiaceae* (10), *Pylaisiaceae* (9), *Bryaceae* (8), *Amblystegiaceae* (8) and *Sphagnum* (23 species), *Dicranum* (11), *Pohlia* (10), *Bryum* (7), *Polytrichastrum* (4), *Polytrichum* (4), *Plagiomnium* (4), *Brachythecium* (4). The richest in species families and genera of liverworts are *Scapaniaceae* s.l. (21 species), *Cephaloziaceae* (5), *Lophocoleaceae* (5) and *Scapania* (7 species), *Cephalozia* (5), *Chiloscyphus* (5), *Barbilophozia* (4), *Calypogeia* (4), *Lophozia* (4). The number of species allocated to each floristic elements (latitudinal types) and area types (longitudinal types) is given in table 1.

Table 1. Geolements of bryophyte flora of "Iremel" National Park. M – Multiregional, C – Circumpolar, E-A – Euroasian, Am – Amphioceanic.

Floristic elements	**Areals** M	C	E-A	Am	**number of species/ %**
		Mosses			
Multi Zone	30	16	–	–	46/30.3
Arctic-montane	1	5	–	–	6/3.9
Boreo-arctic Montane	8	57	1	–	66/43.4
Boreal	2	9	–	–	11/7.2
Boreo-temperate	1	18	–	–	19/12.5
Temperate	–	1	–	–	1/0.7
Montane	–	2	–	–	2/1.3
Species with unsufficienly known distribution	–	1	–	–	1 / 0.7
In total:	42	109	1	–	152 / 100
		Liverworts			
Multi Zone	1	–	-	-	1 / 1.9
Arctic-montane	-	13		-	13 / 24.1
Boreo-arctic Montane	-	20	-	1	21 / 38.9
Boreal	-	17	-	1	18 / 33.3
Temperate	-	1	-	-	1 / 1.9
In total:	1	51	-	2	54 / 100

When considering the geographical relationships of bryophyte flora as a whole, it is apparent that a high proportion of Boreo-arctic Montane element is characteristic of both mosses and liverworts. The proportion of Multi Zone element is greater in the moss flora, the proportion of Boreal and Arctic-montane element is higher in the hepatic flora. Most species are circumpolar, *Harpantus*

flotovianus and *Cephaloziella elachista* are amphioceanic, *Serpoleskea confervoides* has European-North American distribution. More high proportion of multizonal and multiregional species among mosses (in comparison with liverworts) reflects wide ecological amplitude of some species. The analysis of liverwort flora may better reflect the climatic conditions and vegetation history of the region because the distribution of liverworts is restricted to narrower range of habitat types and plant communities.

In the study area, the species included into the Red Data Book of Bashkortostan (Mirkin, 2011) were found, *i.e.*, *Sphagnum platyphyllum, S. lindbergii, Tayloria splachnoides, Pylaisia selwynii, Jamesoniella undulifolia,* and *Riccardia multifida*. In Bashkortostan, *Tayloria splachnoides* and *Jamesoniella undulifolia* are known only from the territory of INP. *Dicranella subulata* and *D. crispa* are new for the territory of the Republic of Bashkortostan.

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