Arctoa (2011) **20**: *153-174*

RARE SPECIES AND PRELIMINARY LIST OF MOSSES OF THE ANABAR PLATEAU (SUBARCTIC SIBERIA)

РЕДКИЕ ВИДЫ И ПРЕДВАРИТЕЛЬНЫЙ СПИСОК МХОВ АНАБАРСКОГО ПЛАТО (СИБИРСКАЯ СУБАРКТИКА)

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Abstract

A preliminaty list of mosses of Anabar Plateau and nearby areas (70-73°N and 100-111°E) includes 520 species. Rare species are highlighted and briefly discussed. With a mix of arctic, boreal, xeric, and even suboceanic species, the area is exceptionally rich for subarctic Siberia. The occurrence of numerous calciphytes, including 11 species of *Seligeria,* ultra-acidophytes such as *Tetrodontium brownianum*, and "metallophytes" in the genera *Mielichhoferia* and *Coscinodon*, can be explained by the complex bedrock geology.

Резюме

Рассмотрены редкие виды мхов Анабарского плато и сопредельных территорий, обсуждаются основные закономерности их распространения в регионе. Бриофлора территории необычно богата для континентальной части Азиатской Субарктики, характеризуясь высокой представленностью арктических, бореальных, аридных и даже субокеанических видов. Сложное геологическое строение региона обуславливает значительное число кальцефилов, в том числе одиннадцать видов рода *Seligeria*, ультраацидофилов, например *Tetrodontium brownianum*, а также металлофитов *Mielichhoferia* и *Coscinodon* и т.д. Приводится предварительный список бриофлоры Анабарского плато и сопредельных территорий, включающий характеристику встречаемости видов и их распространения по основным типам макроландшафтов региона; он включает 520 видов.

KEYWORDS: Taimyr, Anabar Plateau, moss flora, rare species, Taimyrsky State Reserve

Introduction

This paper considers mosses of the Anabar Plateau and some lowlands around it in the southeastern part of Taimyr Municipal District, 70-73°N and 100-111°E, (Figs. 1-2), occupying an area ca. 100 000 km^2. The area has a great diversity of moss habitats due to its position at border of arctic and boreal zones, complex geology, diversity of landscapes, numerous microclimates in a generally xeric condition, and lack of anthropogenic influence, as it remains totally unpopulated.

Until recently, only one locality of Ary-Mas (Fig. 1) at the plateau foothill was studied for its forest, the northernmost in the world. Afonina (1978) published its moss flora of 140 species, partially revised and supplemented recently by Fedosov & Afonina (2009). Otherwise only scat-

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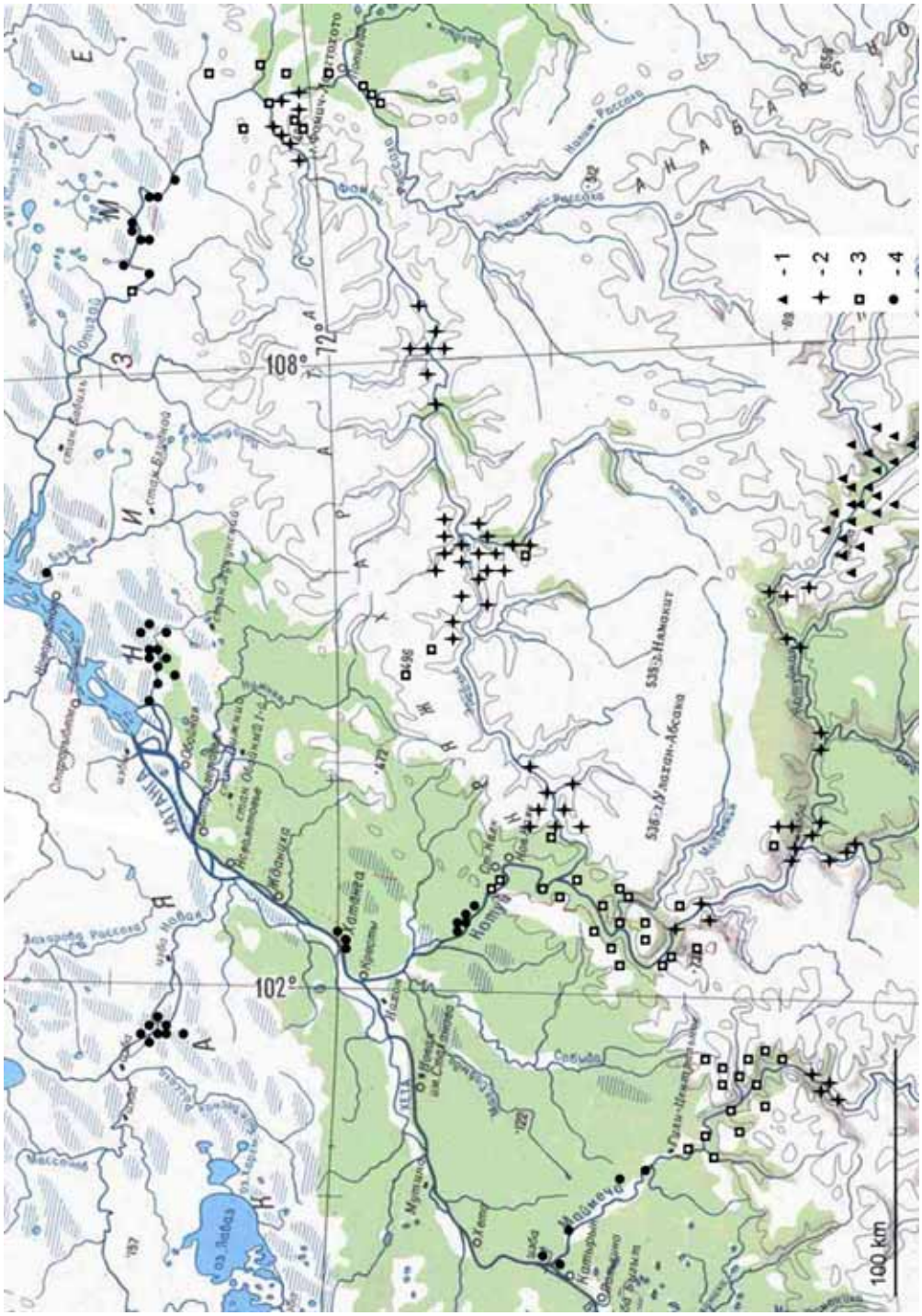


Fig. 1. Map showing bedrock types in the studied localities, grouped in four geologo-physiographic entities: 1. Anabar Crystalline Shield (gneiss, granite, quartzite sandstone, quartzite, schist, anorthosite, dolerite); 2. Calcareous NW Anabar Plateau periphery (dolomite, limestone, marble, argillite, dolerite); 3. Kotuyskoe Plateau (basalt, andesite, dolerite, trachydolerite, pycrite, sienite, ijolite, dunite, pyroxenite, calcareous sandstone, coal, salted loams etc.); 4. North-Siberian Lowland (quaternary sediments with rare outcrops of Jurassic clay).

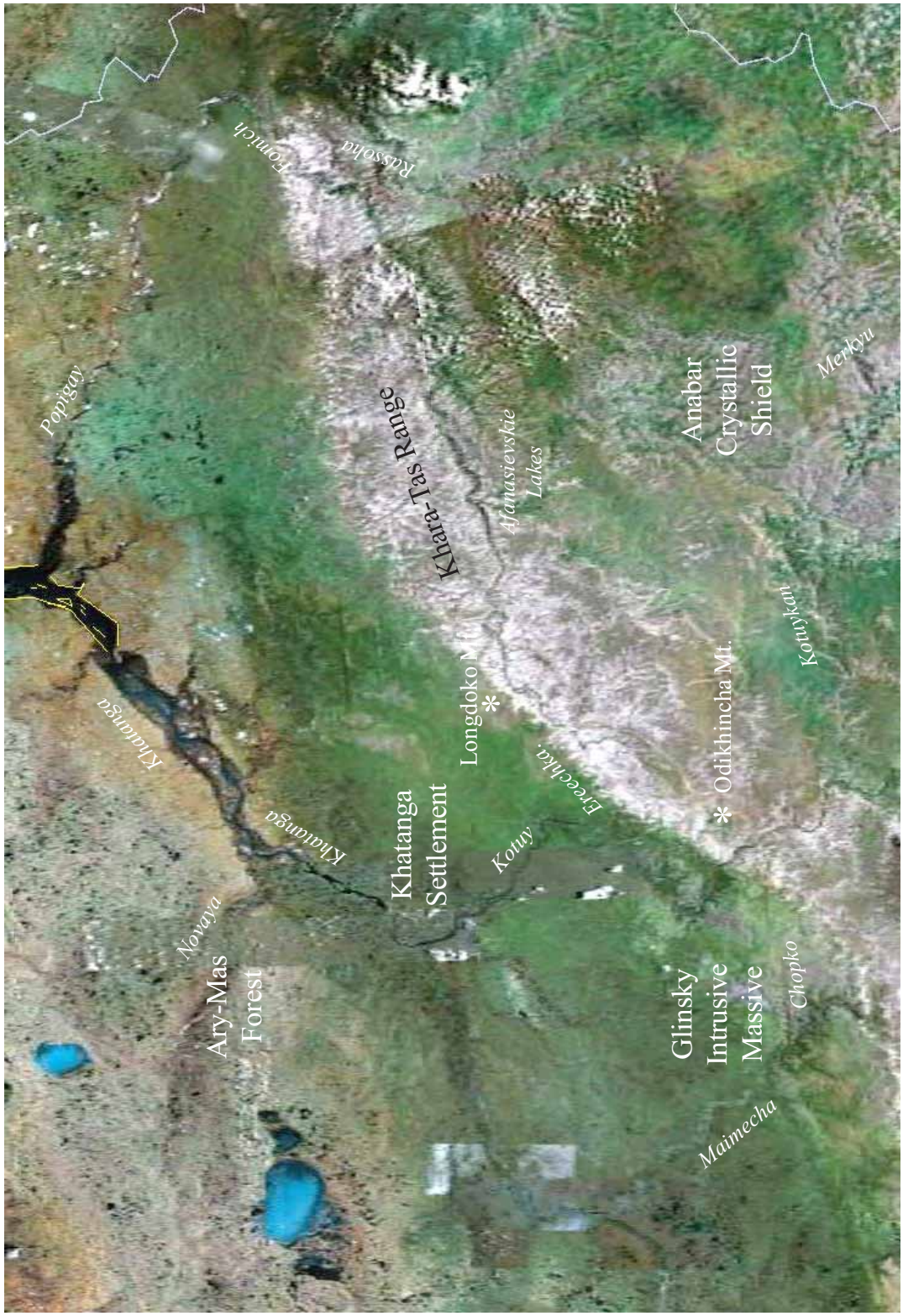


Fig. 2. Space Google map, showing limestone (white), and gneiss and crystalline schist (grey) areas.

tered data were published by Alexandrova (1937) in the tundra vegetation description, where 9 common mosses are mentioned, and Afonina & Andreeva (1993), who reported *Lyellia aspera* in the lower course of Kotuy River. The exploration of moss flora of the plateau itself started since 2003 by expeditions organized by the Taimyrsky State Reserve; some results were published by Fedosov (2006, 2007a,b, 2008a,b,c, 2009a,b, 2010), Fedosov & Ignatova (2006, 2008, 2009), Fedosov & Zolotov (2008), Fedosov et al. (2009). However within a rather short period of time, considering also a short time when the field work is possible, the moss flora of 520 species has been revealed, becoming thus the richest in Asiatic Subarctic, as well as in Asiatic Russia as a whole. Although numerous additions made in all last field trips indicate that the present knowledge of this moss flora is still incomplete, at least the main its features can be overviewed; they are discussed in the present paper.

STUDY AREA, GEOLOGY

The Anabar Plateau represents an elevated, 400-600(-905) m a.s.l., denudated plain with irregular geomorphological structure, exhibiting mainly concentric trends (Fig. 2). Its central part is formed by the Anabar Crystalline Shield, which is composed of the exposed Archaean crystalline bedrock mainly of gneiss and crystalline schist with local deposits of quartzite, ferriferous schist, marble and granitoid intrusions.

A number of different series of bedrocks were explored during the expeditions. The transect from the Anabar Crystalline Shield to the west was along Kotuykan Rivers (Figs. 1-2). In this direction the immediate periphery of the crystalline massif is bordered by quartzite sandstones that form table-like mountains surrounding the Anabar Crystalline Shield by a belt of ca. 30 km in width. Further to the west, the Proterozoic and Cambrian limestone, dolomites and argillites, interrupted at places by abundant dolerite intrusions, form a flattened plateau at 280-350(-400) m elev.; the plateau is dissected by river valleys enclosed in canyons. Still westward of this calcareous massif, the Kotuy Plateau (Parmuzin, 1964) is situated. It is formed by basalts with andesite layers. Its borders however have complicated geology due to ultrabasite intrusions, where Gulinsky, Odikhincha and others massifs occur. These ultrabasite intrusions are composed of many types of rocks, including dunite, peridotite, pyroxenite, carbonatite (Gulinsky massif), ijolite, sienite (Odikhincha Mt.). In the lower courses of Khatanga River tributaries, i.e. still northward from basalt area, the Ordovician to Carboniferous limestone and sandstone are exposed.

The northwestern edge of the Anabar Plateau is bordered by Khara-Tas Ridge, which is formed by extensive dolerite and trachydolerite intrusions (the highest one is Longdoko Mt., 524 m) with table-like tops, elevated over dolomite plateau. Northward and northwestward Khara-Tas Ridge gently descends to the North-Siberian Lowland. In its northern part, the Anabar Plateau adjoins with Popigajskaya astrobleme, a cryptoexplosion structure formed as a result of a giant meteorite fall. Here, in the valley of Rossokha River, extensive motley conglomerates are exposed. The northern and northwestern edge of mountainous terrain, at the border with the North-Siberian Lowland, is covered by moraine and sandy glacio-fluvial sediments with locally exposed Jurassic clays.

Numerous rock outcrops, rock-fields and screes, with rock pieces from few meter to several centimeter, are widespread throughout the territory.

CLIMATE

The region is characterized by continental climate with annual precipitation 251 mm, mean annual temperature –14°C, mean of January t= –34°C (t_{min}=-60°C), mean of July t=+12°C (t_{max}=+38.3°C); the data are from Khatanga meteorological station, 25 m a. s. l., the closest one to Anabar Plateau. There are no other meteorological data from the area, but obviously microclimates in different places are very diverse both in precipitation and temperature. The period with average daily temperature less than 0°C amounts to 260 days per year. Snow cover forms in September-October and melts in June, while late snow beds remain up to August and do not disappear every year. Permanent snow beds are abundant above 500 m elev. and in the deep valleys. Summer is generally cool, however some periods of certain years may be very hot, with daytime temperature over +35°C. The second half of summer is usually rainy.

Vegetation

All vegetation types are underlaid by permafrost. Most of the territory belongs to the subzone of northern taiga open forests (Yurtsev, 1966; Pospelova & Pospelov, 2007). The northern border of the study area roughly corresponds to the border between northern taiga and tundra. *Larix gmelinii* stands occur largely on valley slopes, usually up to 150 m and occasionally up to 500 m elev.; and more rarely larch forest grows within interfluve territories. The most common forest type is dwarf shrub-mossy taiga, where *Betula nana* s.l., *Ledum*, *Vaccinium*, *Hylocomium*, *Sphagnum,* are common. Alder shrub, *Duscheckia (Alnus) fruticosa* often forms dense understory in *Larix* forest on wetter steep slopes and also extend above tree line in wet depressions of rocky slopes near snow beds and in similar habitats. Dry steep S-facing slopes are mostly occupied by rocky steppe meadows. In flood plains larch forest alternates with mires, and in the southern part of the territory, sparse stands of *Picea obovata* occur. River flood plains are mostly occupied by willow shrub (*Salix viminalis, S. boganidensis, S. lanata*, *S. hastata, S. alaxensis,* etc.) and meadows, with ± silt-covered pebbly or sandy banks. Above tree-line, there are different tundra communities: fens, rock-fields, and meadows around snow beds. In calcareous areas open larch forest occurs only in river valleys and on their slopes, while interfluves are mostly occupied by tundra and "polar desert" vegetation. The northern part of the territory is situated in the South-Siberian Lowland, where tundra alternates with mires and numerous lakes, while larch forests are confined to slopes of big river valleys.

Taxonomical Specificity

Pottiaceae have the greatest species diversity, being represented by 61 species. Xeric conditions, characteristic of many Pottiaceae, are also represented in tundra-steppe areas of adjacent Yakutia; many rare ultra-xeric species of Pottiaceae were found there in isolated northern localities, e. g. *Syntrichia caninervis* and *Pterygoneurum kozlovii*. The territory of Yakutia occupies 3.1 million square km, and is 20-30 times larger than area discussed in present paper; however, the whole moss flora of Yakutia includes only 51 species of the Pottiaceae (Ivanova, 2011). The occurrence of as much as 12 species of *Tortula* in the Anabar Plateau is especially noteworthy, moreover 3 of them were never found in any other arctic and subarctic region of Russia.

The diversity of *Encalypta*, 12 species, is higher than in any other regional flora of Russia. This is attributable the high diversity of basic, ultrabasic and calcareous rocks, as well as with xeric conditions. Interestingly, *E. brevipes, E. longicolla* and *E. mutica*, which are usually considered to be rare, occur here in a wide range of habitats, and latter two species are not rare but are locally fairly abundant. At the same time, the generally widespread *E. ciliata* is rare in the area.

The presence of eleven species of *Seligeria* is also interesting, this number is the highest in the Subarctic Russia and is even higher than in any other region of Russia (even considering much larger 19 subdivisions in the recent checklist of Ignatov, Afonina, Ignatova et al., 2006). Among them, *Seligeria acutifolia* is recorded for the first time in Russia; the locality of *S. trifaria* is the third record in Russia and first in Asiatic Russia; this species was recorded in the Western Sayan Mts. by Bardunov (1974), but subsequently this collection was re-identified by Gos & Ochyra (1994) as *S. subimmersa*; for the latter species Anabar locality is the second in Asiatic Russia and third in Russia as a whole. *Seligeria diversifolia* is rare in Russia; this species was reported in Asiatic Russia only from Sayan Mts. by Bardunov (1974). *Seligeria brevifolia* and *S. pusilla* are also rare species, previously known in Asiatic Russia only from the southern Siberia. In Russia the highest number of *Seligeria* species (8) was reported from Karelia, while most subarctic territories include only up to 3-4 species.

Obviously, the high number of *Seligeria* species is caused by the wide distribution and high diversity of calcareous rocks. Especially rich in *Seligeria* are the valleys of Kotuykan and Kotuy Rivers: eight species were recorded here along ca. 150 km. The difference in their ecology in this area is as follows. Small-sized *Seligeria acutifolia, S. brevifolia, S. diversifolia* and *S. pusilla* grow usually in small quantity on shaded rock outcrops and big block surfaces, always with *Fissidens* cf. *bryoides*. Two species, *Seligeria*

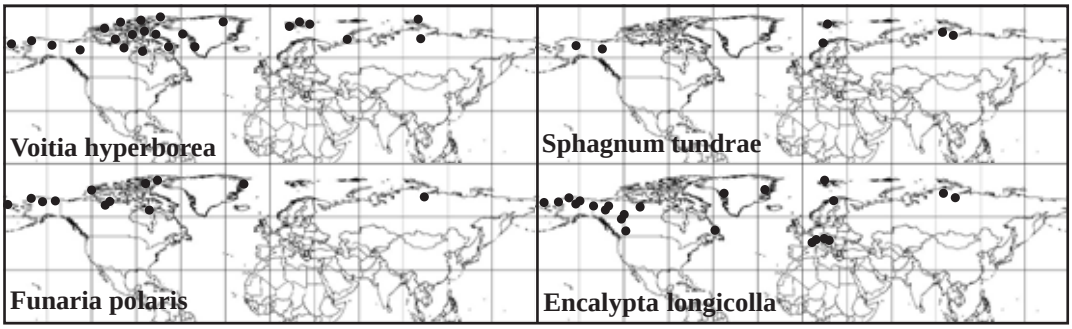


Fig. 3. Examples of Arctic distribution for species occurring in Anabar Plateau[1].

campylopoda and *S. tristichoides,* were found on rocks shortly above soil level, in niches, etc., sometimes being abundant, and the former species occurs occasionally also on well exposed rock faces. Larger plants of *S. subimmersa* and *S. trifaria* occur on moist calcareous silty sediments at creek bank; both of them were found only in one place, but in a number of groups forming dense extensive mats.

Another interesting feature of Anabar moss flora is the prominence of the genus *Bryum,* the genus with the highest number of species, 33, in the flora. At the same time, most subarctic moss floras have the highest number of species in the genus *Sphagnum*, while in the Anabar Plateau only 27 species of this genus are known. However, the Murmansk Province and Yakutia, another well-studied northern area, have about the same proportion of these genera as in Anabar.

The third position in terms of number of species is held by the genus *Schistidium*, 23 species, while most subarctic moss floras are usually more rich in species of *Dicranum* (in Anabar flora 16). This diversity of *Schistidium* obviously corresponds with abundance of rocky substrates. However even this high number of species probably under-represents the real diversity of the genus considering the rather short time of study of the area, as well as taxonomical difficulties of the genus. Anyway, a comparison with the three times larger and much better studied territory of Sweden with 33 species of *Schistidium* (Hallingbäck et al., 2008) indicates approximately the same level of inventory of the general species diversity.

PHYTOGEOGRAPHIC SPECIFICITY

Some species found in Anabar Plateau have almost strictly **Arctic distribution** (cf. Fig. 3). They occur usually above tree-line in the study area, in tundra, at brook banks, fens, etc. Four of them are rather evenly distributed in the area, while others are concentrated along the northern periphery of the territory. In the evenly distributed group, *Schistidium andreaeopsis* dominates in rocky tundras on dolomitic bedrock, *Seligeria polaris* occurs in moist calcareous habitats, *Aplodon wormskjoldii* and *Plagiothecium berggrenianum* are scattered in various habitats. Taxa along the northern edge include *Bryoerythrophyllum rotundatum, Bryum calophyllum, Campylium longicuspis, Ceratodon heterophyllus, Funaria arctica, F. polaris, Pterygoneurum lamellatum, Rhizomnium andrewsianum, Tetraplodon paradoxus, Sphagnum arcticum, S. tundrae, Splachnum vasculosum,* etc. Four species, *Funaria polaris, Voitia hyperborea, Sphagnum arcticum* and *S. tundrae,* were previously known in the Russian Arctic only or mostly in Chukotka, so these new records indicate a circumpolar distribution.

Species with generally more **southern distribution** (cf. Fig. 4) are also well represented. The unexpectedly high number of species of this group north of 70° latitude can be explained by the fact that being strongly emergent into Arctic Ocean, Taimyr Peninsula is a big land mass and its area protects inland territories from the immediate impact of the severe climate of the Arctic Ocean. Being preserved from the Atlantic cyclonal impact by Putorana Plateau, the Anabar Plateau and

[1] – maps are based mostly on numerous literature records and checklists, and built in many cases with an accuracy to country, state or province level

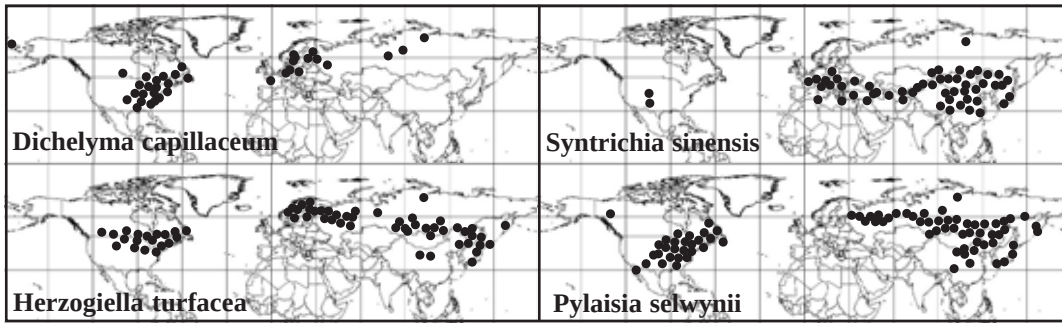
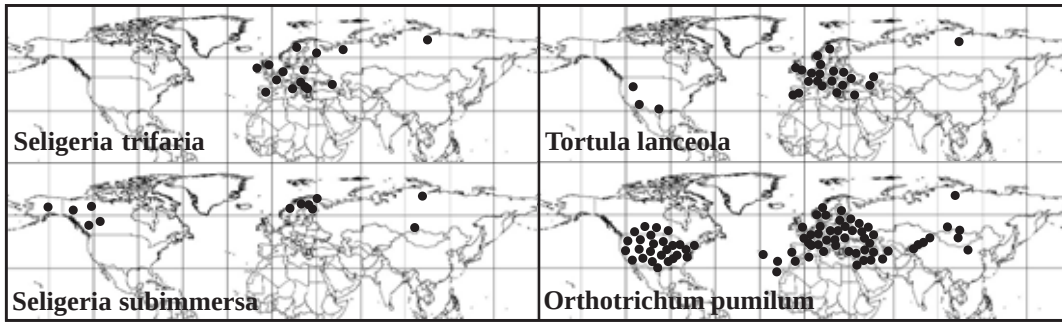


Fig. 4. Examples of southern distribution for species occurring in Anabar Plateau.

adjacent territories are affected in summer time by Yakutian anticyclones which often provide very hot weather. These factors explain the significant shift of the vegetation zones to the north, allowing successful existence of the northernmost forest in Ary-Mas and Lukunsky at 72°N, and also northernmost localities of *Picea*. Spruce forest on calcareous soils have *Timmia megapolitana* and *Entodon concinnuus* dominating in moss cover, while both mosses are very rare in the area as a whole. *Sciuro-hypnum reflexum, Orthotrichum pumilum* and *O. speciosum* were seen only on *Picea* trunks, while *O. obtusifolium* which is also common on spruce was found once on basaltic rock. Alder thickets, often under scattered *Larix*, provide room for *Brachythecium erythrorrhizon, Myuroclada maximowiczii, Mnium marginatum, Plagiomnium confertidens, P. rostratum, Plagiothecium curvifolium, Rhizomnium punctatum, Rhytidiadelphus subpinnatus,* etc. A number of other rare boreal species were found without any apparent concentration in specific plant communities, e. g. *Bryum weigelii, Buxbaumia aphylla, Campylidium sommerfeltii, Dichelyma capillaceum, Dicranum polysetum, Herzogiella turfacea, Leskea polycarpa, Myurella sibirica, Palustriella decipiens, Pylaisia selwynii, Rhytidiadelphus triquetrus, Sphagnum papillosum,* etc.

Western and Eastern elements in the moss flora are strongly unequal. **Western species** (cf. Fig. 5) known in the area near their eastern border are quite few and mostly insufficiently known. Among them there are recently described species (*Orthotrichum holmenii* known from NE European Russia, eastern Kazakhstan and Anabar), species with recently resurrected status (*Grimmia triformis,* Central Europe, Altai and Anabar), and rather insufficiently known *Tortula lingulata* (Northern Europe and Anabar, ?plus Central Asia) and not universally accepted *Fissidens exiguus* (Northern Europe and Anabar). A number of species are known in Europe, while in Asiatic Russia they were revealed so far in Anabar Plateau only, but have disjunctive distribution also in the North America: *Microbryum starkeanum, M. davallianum, Seligeria diversifolia, S. subimmersa, Tortella densa, Tortula cuveifolia*, *T. lanceola,* etc.; however, they hardly can be referred to a real Western elements.

Fig. 5. Examples of western distribution for species occurring in Anabar Plateau.



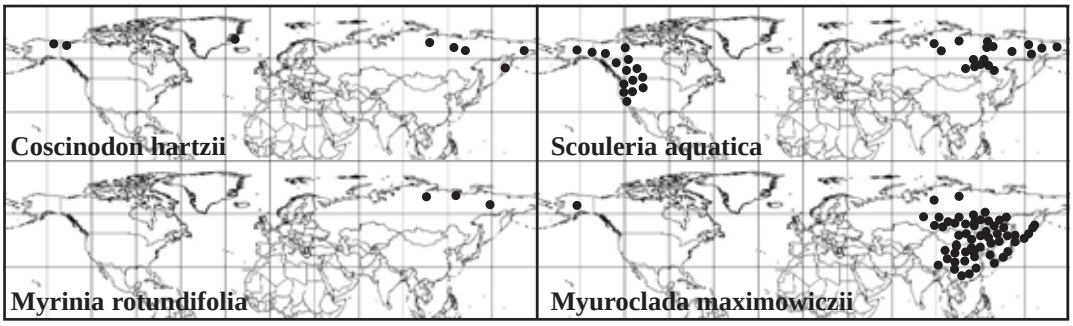


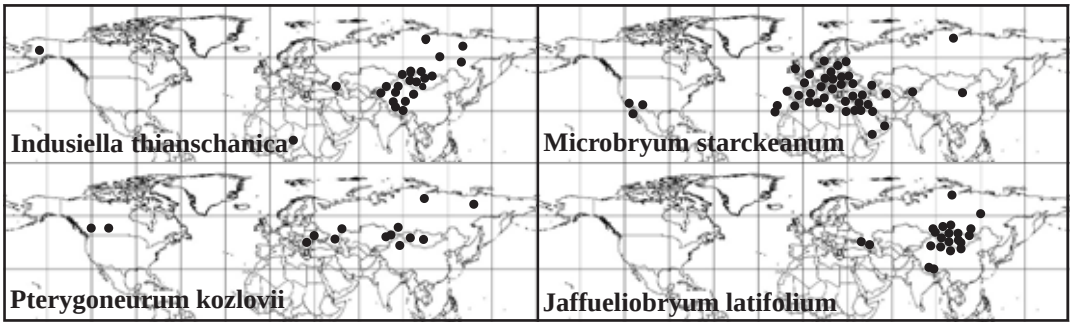
Fig. 6. Examples of eastern distribution for species occurring in Anabar Plateau.

At the same time, the **eastern species** (cf. Fig. 6), with Asiatic and Asiatic-American ranges, are much better represented in Anabar Plateau: *Aulacomnium acuminatum, *Barbula jacutica, Brachythecium boreale, B. jacuticum, Bryoerythrophyllum latinervium, *B. rotundatum, Coscinodon hartzii, Didymodon johansenii, D. zanderi, Grimmia jacutica, Lyellia aspera, *Myrinia rotundifolia, *Myurella acuminata, Myuroclada maximowiczii, Oligotrichum falcatum, Orthotrichum pellucidum, Scouleria aquatica, Sphagnum steerei, Stereodon fauriei.* Many of them are also recently described, although their distribution is more or less well-known and at least half of them are common in Asiatic Russia, but do not spread westward of Yenisey River. Species marked by asterisk are Siberian endemics, rare throughout their range as well as in Anabar Plateau.

The group of **xeric species** (cf. Fig. 7) in Anabar Plateau is well represented and reflects the relatively low precipitation. Distribution of some interesting species were discussed by Fedosov (2008c, 2010, 2011b) and Fedosov & Ignatova (2006, 2008, 2009). Some species have their closest localities in Europe, e.g. *Microbryum starckeanum, M. davallianum, Tortella densa, Tortula cuneifolia, T. lanceola,* while most of others occur sporadically in xeric regions of Siberia. The concentration of xeric species in a restricted area at such high latitude is remarkable: *Aloina rigida, *Bryoerythrophyllum latinervium, Conardia compacta, *Didymodon johansenii, Encalypta vulgaris, Grimmia anodon, G. tergestina, Hilpertia velenovskyi, Indusiella thianschanica, Jaffueliobryum latifolium, *Orthotrichum pellucidum, Pseudocrossidium obtusulum, Pterygoneurum kozlovii, P. ovatum, P. subsessile, Syntrichia caninervis, S. sinensis, Tortula obtusifolia, Weissia brachycarpa* (species with "Beringian *sensu lato*" distribution are marked by asterisk). A comparably great number of xeric moss species was observed probably only in the Subarctic Alaska (Murray, 1992); however, their populations in Alaska are not so strongly isolated from the more southern inland ones in Rocky Mountains. Our data suggest that Anabar Plateau is a unique isolated refugium of xeric species that have had a broader distribution in the past, most likely during the time of Pleistocene glaciation.

Xeric species are concentrated in Anabar Plateau in two habitats. The first includes rather

Fig. 7. Examples of xeric distribution for species occurring in Anabar Plateau.



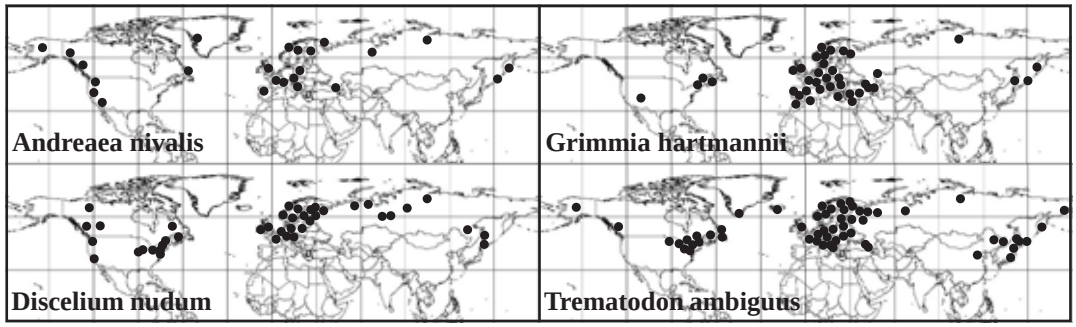


Fig. 8. Examples of suboceanic distribution for species occurring in Anabar Plateau.

common pure calcareous rocks where most xeric species grow (cf. Fedosov, 2011b). The second habitat is much rarer: it is formed by the mixture of Silurian-Permian carbonaceous sandstones, gypsum, salty aleurite, loess sediments, ferriferous rock outcrops, coal, etc. Usually these sites are free of mosses, but occasionally *Microbryum davallianum, Pterygoneurum kozlovii, P. lamellatum, P. ovarum, P. subsessile, Syntrichia caninervis, Tortula acaulon, T. lanceola* and *T. muralis* occur.

* * *

Many species mentioned above occur in the Anabar Plateau at a considerable distance from their closest localities, and a large number of other species with disjunctive distribution in the area can be added to this list. Species with montane distribution are especially common in this group, and many of them grow in a rather humid conditions and therefore are more common in areas with oceanic and **suboceanic climate** (cf. Fig. 8), e.g., *Arctoa fulvella, Bucklandiella* spp., *Codriophorus fascicularis, Grimmia hartmanii, Seligeria acutifolia, S. subimmersa.* However, some montane species are no less common in inland regions than in those with oceanic and suboceanic climates: *Orthothecium intricatum, Andreaea nivalis, Kiaeria starkei, Grimmia unicolor, Orthothecium intricatum, Orthotrichum alpestre, O. rupestre, Amblyodon dealbatus, Andreaea obovata, Barbula amplexifolia, Bryum marrattii, Tetrodontium brownianum.* There are also species, e.g., *Discelium nudum* and *Trematodon ambiguus*, those occur mostly in oceanic regions, but not necessarily in mountain areas. They were found in the study area in foothills (*Trematodon*) and in nearby lowland (*Discelium*).

ECOLOGICAL SPECIFICITY

Calciphilous mosses are numerous in the study area due to wide distribution of sedimentary rocks and some ignitious rocks with high Ca content, Widespread calciphilous mosses (*Bryum wrightii, Catoscopium nigritum, Distichium inclinatum, Ditrichum flexicaule, Gymnostomum aeruginosum, Hymenostylium recurvirostrum, Molendoa sendtneriana, Seligeria campylopoda, S. polaris, Stereodon bambergerii, S. procerrimus, Trichostomum crispulum,* etc.) are common on most types of calcareous rocks. At the same time, various types of calcareous rocks differ in composition of rare species. Among them dolomites are most abundant and well studied, and some rare species are associated with them: *Bryoerythrophyllum latinervium, Conardia compacta, Didymodon johansenii, Encalypta vulgaris, Grimmia tergestina, Jaffueliobryum latifolium, Microbryum starckeanum, Orthotrichum pellucidum, Pseudocrossidium obtusulum, Schistidium umbrosum, Seligeria donniana, Timmia megapolitana, Tortella densa, Tortula obtusifolia*. Only on limestone outcrops, which are relatively rare in study area, were found *Gymnostomum calcareum, Indusiella thianschanica* and *Orthothecium intricatum*. Only on marls occur *Aloina rigida, Didymodon perobtusus, Seligeria galinae, Syntrichia sinensis,* while only one peculiar species (*Tortula lingulata*) was found on carbonantites, being relatively abundant. Many calciphilous species considered to be rare in other regions are common in Anabar Plateau: *Schistidium andreaeopsis* occurs in mountain tundra on dolomites; *Encalypta longicolla* occupies fine soil both in tundra and on cliff and boulder ledges; *Schistidium frisvollianum* grows on dolomi-

tic cliffs and lumps; *Timmia megapolitana* is abundant in spruce forests on calcareous rocks. In addition, *Seligeria* spp. and xeric species also confined to calcareous rocks were discussed above.

Acidophilous mosses can be subdivided into four groups, comprising (1) ultra-acidophilous species that grow only on quartzite sandstones with 95-99% of SiO2; (2) moderate acidophilous species were found on gneiss, granite, etc., with SiO2 65-75%; (3) slightly acidophilous species growing on sienite, trachydolerite, diorite and andesite, SiO2 50-65%; and (4) broad acidophilous species that occupy rocks from ultra-acidic to neutral.

The species in ***ultra-acidophilous*** habitats in the study area include *Paraleucobryum longifolium, Tetrodontium brownianum, Pohlia lescuriana, Andreaea alpestris, A. obovata, Ditrichum lineare, D. zonatum, Oligotrichum falcatum, Rhabdoweisia crispata, Schistidium succulentum, Sphagnum steerei, S. magellanicum,* etc. Most of them occur only on quartzite sandstones, while *Ditrichum lineare, Oligotrichum falcatum* and *Sphagnum steerei* grow also on sandy river terraces. Homogeneous quartzite sandstones which are most common in the area, are mostly covered by *Grimmia incurva*, while stratiform sandstones, characteristic of the western part of sandstone massif, are more diverse in species composition with dominance of *Rhabdoweisia crispata* and *Ditrichum* spp., and the occurence of *Paraleucobryum longifolium, Schistidium succulentum* and *Tetrodontium brownianum*.

Moderately acidophilous species are segregated here as those that grow on acid rocks, but never occur on ultra-acid quartzite sandstone: *Dichelyma falcatum, Didymodon zanderii, Grimmia torquata, G. unicolor, Orthotrichum rupestre, Ulota curvifolia*. Abundant in such habitats are *Isopterygiopsis muelleriana* and *Plagiothecium berggrenianum*.

Slightly acidophilous mosses include *Andreaea blyttii, A. nivalis, Anomobryum julaceum, Grimmia mollis, G. muhlenbeckii, Kiaeria starkei, Niphotrichum canescens, N. ericoides, Orthotrichum alpestre, Sanionia georgico-uncinata, Schistidium obscurum*. Many of them are nival species, and this can be explained by the fact that snow-fields are the most numerous in Anabar Plateau in the area formed by sienite and acid basaltoid rocks. For example, this probably explains the occurrence of *Andreaea blyttii* in Anabar Plateau mostly on sienite and ± acidic basaltoids with SiO2 content below 60%, while Elvebakk (1984) considers it to be the most acidophilus species of the genus in Svalbard.

Composition of "***broad acidophilous****"* species is as follow: *Amphidium meugeottii, Arctoa fulvella, Blindia acuta, Grimmia donniana, G. incurva.*

Small group of **"metallophytes"** is composed of two species, *Mielichhoferia mielichhoferiana* and *Coscinodon hartzii*, that strongly prefer rocks with high content copper or other heavy metals (Shacklette, 1967), as well of some species that increase their abundance in such places. *Mielichhoferia mielichhoferiana* belongs to a genus quite strictly confined to such substrates, while some *Coscinodon* species grow also on schists (and *C. yukonensis* seems to be quite indifferent to rock composition). Three species, *Bryum moravicum, Ditrichum heteromallum* and *Grimmia triformis* were also found only in this type of habitat, although at least two former species usually grow in different habitats. At the same time *Ditrichum lineare, Oligotrichum hercynicum, Pohlia andalusica* which are sometimes reported together with "metallophytes", were never found in the area on rocks with high content of heavy metals.

NEW MOSS RECORDS

New for Russia

Seligeria acutifolia – left N-facing slope of Kotuykan River valley near Sobul Creek mouth (70°41' 19"N – 105°39'29"E, 100 m alt.), on the shaded moist surface of Proterozoic limestone in turf-covered rock-field in larch forest, 4.VIII.2011, Fedosov (MW); S+. Its distribution includes most territory of Europe (from Spain to Ireland and Svalbard), Turkey and Georgia in Asia, Alaska and British Columbia in North America.

Sphagnum beringiense – boggy bottom of Novaja River Valley near Ary-Mas Station (72° 28'18"N – 101°50'59"E, 20 m alt.), hummocky *Eriophorum* and *Carex*-dominated bog in tundra near lake shore, on hummock, with *Aulacomnium palustre, Bryum pseudotriquetrum, Calli-*

ergon giganteum, Oncophorus virens, 1.IX. 2007, Fedosov # 07A-1-4 (MW), det. Maksimov. The species was recently described from Arctic Alaska (Shaw et al., 2008), so Ary-Mas area in North-Siberian lowland is the first published locality of the species beyond its previously known limits in Alaska.

New for Asiatic Russia

Microbryum davallianum – only one plant was found among *Bryum spp*., *Encalypta procera, E. mutica, Bryoerythrophyllum recurvirostrum*, etc., in collection from right bank of Kotuy River ~7 km upstream Ereechka River mouth (71°15'53"N – 102°57'57"E, 30 m alt.), on fine soil, VII.1983, Andreeva (MW), S+. Xeric species with highly disjunctive distribution throughout Holarctic, known also from Mexico and New Zealand.

Seligeria subimmersa – canyon of Kugda-Yuryakh Creek near its confluence with Kotuy River (70°38'35"N – 103°26'01"E, 40 m alt.), on moist fine calcareous soil on ledge of Proterozoic limestone cliff, extensive pure mats, 12.VIII. 2011, Fedosov (MW); S+. In Russia the species was known only in Karelia (Volkova & Maksimov, 1993); it was also reported from Scandinavia, Western Canada and Alaska.

New for Krasnoyarsk Territory

Bryum bimum – Maymecha River valley 7 km upstream Chopko River mouth (70°45'18"N – 101°13'09"E, 110 m alt.), moist moss community at the turf-covered base of basaltoid rock in canyon of creek, with *Bryoerythrophyllum recurvirostrum, Encalypta ciliata, Brachythecium* cf. *salebrosum,* etc., 1.VII.2009, Fedosov (MW)det. Zolotov; S+.

B. moravicum – S-facing slope of Odikhincha Mt. (70°55'30"N – 103°00'33"E, 460 m alt.), in creek canyon, in cracks of ferriferous cliff, with *Ditrichum heteromallum* & *Pohlia sp*., 14.VIII. 2011, Fedosov (MW). Probably this is the northernmost locality of this widespread, mostly southern species.

Coscinodon hartzii – Merkyu River valley 4 km upstream its mouth (70°19'11"N – 106°52' 22"E, 300 m alt.), on ferriferous schist cliff, 18. VII.2011, Fedosov (MW); S+. Rare species of cold mountain regions of NE Asia, NW North America and Greenland. Anabar Plateau apparently represents the westernmost locality of the species in Asia.

Grimmia triformis – S-facing slope of Odikhincha Mt. (70°55'30"N – 103°00'33"E, 460 m alt.), canyon of creek, in depressions, on dry surface of ferriferous cliff, several pure tufts, 14.VIII. 2011, Fedosov (MW); S+. Rare species, known from few places in the Alps and from one highly isolated locality in the Altai Mts. It was recently found also in Mus-Khaya Mt. area in SE Yakutia (Ignatova et al., 2011). Anabar locality is even more distant, being the northernmost locality in Asia.

Mielichhoferia mielichhoferiana – Merkyu River valley 4 km upstream its mouth (70°19' 11"N – 106°52'22"E, 300 m alt.), on shaded moist ledge of ferriferous schist cliff, 18.VII.2011, Fedosov (MW); S+. Rare species, with disjunctive distribution, growing usually on rocks rich in heavy metals.

Orthotrichum sordidum – steep S-facing slope of unnamed tributary of Kotuy River (71°00' 52"N – 102°26'44"E, 60 m alt.), larch forest with dense canopy of *Duscheckia fruticosa*, on base of alder trunk, 16.VIII.2011, Fedosov (MW); S+. Widespread species in Russian Far East, southern Siberia and eastern Caucasus, but in Europe known only in Svalbard.

Plagiothecium curvifolium – steep slope of valley of Kotuy River left tributary (71°00' 52"N – 102°26'44"E, 60 m alt.), larch forest with dense canopy of *Duscheckia fruticosa*, on moist and shaded surface of decaying branch, with *Mnium marginatum*, 16.VIII.2011, Fedosov (MW). Common in Europe, with scattered and poorly known distribution in Asia.

Pohlia andalusica – Merkyu River valley 1.2 km upstream its mouth (70°19'14"N – 106°50' 22"E, 280 m alt.). On bare sandy sediments under roots of fallen trunk in larch forest, 18.VII. 2011, Fedosov (MW). Circumboreal species, rare in Siberia.

Pterygoneurum kozlovii – W-facing right slope of Kotuy River valley ~7 km upstream Ereechka River mouth (71°15'53"N – 102°57'57"E, 40 m alt.), tundro-steppe community in upper part of steep rocky slope, on somewhat salted humificated soil, with *P. subsessile, P. lamellatum, P. ovatum, Stegonia latifolia, Encalypta rhaptocar-*

pa, Syntrichia sp., *Abietinella abietina, Bryum argenteum*, *Bryum spp., Encalypta procera, E. mutica, Bryoerythrophyllum recurvirostrum*, etc. 21.VIII.2011, Fedosov (MW), S+. Rare xeric species associated with moderate climatic conditions of Asia and North America.

Seligeria brevifolia – right slope of Kotuykan River valley near Churbuka Creek mouth (70°34' 54"N – 104°10'28"E, 80 m. alt.), on the shaded moist surface of Proterozoic dolomite boulders in larch forest, 7.VIII.2011, Fedosov (MW); S+. Rare species, included in the Red List of Krasnoyarsk Territory.

S. diversifolia – Right slope of Kotuykan River valley near Sobul Creek mouth (70°41'19"N – 105°39'29"E, 100 m alt.), on the shaded moist surface of Proterozoic limestone in turf-covered rock-field in larch forest, 4.VIII.2011, Fedosov (MW); S+. This species was previously reported from few places in southern Siberia; however, these records need confirmation.

Sphagnum papillosum – sphagnous mire at the bottom of Merkyu River Valley 1 km upstream its mouth (70°19'14"N – 106°50'22"E, 270 m alt.), dominates on hummocks and in wet depressions among them, 18.VII.2011, Fedosov (MW). Widely distributed in boreal zone, while the locality in Anabar Plateau is apparently at northern limit of its distribution.

S. perfoliatum – Right slope of Kotuykan River valley 1 km upstream Merkyu River mouth (70°31'58"N – 106°04'48"E, 180 m alt.), sphagnous mire on terrace of river, 14.VII.2007, Fedosov # 07-516 (MW), det. Maksimov. Rare species, known from Western Siberia, Arctic Yakutia, Chukotka, Kamchatka Peninsula, and Alaska.

New for Taimyr Municipal District

Bryum weigelii – unnamed creek valley 1.3 km upstream its confluence with Kotuy River (71°00'52"N – 102°26' 44"E, 50 m alt.), in swampy river-bed, on turf-covered boulder, with *Drepanocladus sp*., 16.VIII. 2011, Fedosov (MW). Rare species in Siberian Subarctic.

Dichelyma capillaceum – Medvezh'ya River valley 5 km upstream its mouth (71°09'39"N – 102°44'17"E, 30 m alt.), on willow trunk bases and on log near water, in small group and as some solitary plants, with *Drepanocladus sp*. and *Tortula mucronifolia*, 19.VIII.2011, Fedosov (MW). Rare species with apparently circumboreal distribution; its closest locality is near Nizhnyaya Tunguska River mouth (Fedosov & Popov, 2007).

Ditrichum heteromallum – S-facing slope of Odikhincha Mt. (70°55'30"N – 103°00'33"E, 460 m alt.), in creek canyon, in moist cracks of ferriferous cliff, some pure tufts, 14.VIII.2011, Fedosov (MW). The species with scattered and poorly known distribution in Asiatic Russia.

Herzogiella turfacea (Lindb.) Z.Iwats. – N-facing left slope of Kotuykan River valley near Churbuka Creek mouth (70°34'54"N – 104°10'28"E, 80 m alt.), in larch forest, on rotten wood in shaded moist soil niche, 7.VIII.2011, Fedosov (MW). Widely distributed boreal species, known mostly in much more southern regions.

Grimmia unicolor – Merkyu River valley 3 km upstream its mouth (70°19'12"N – 106°51' 41"E, 300 m alt.), on exposed surface of gneiss boulder at the base of steep slope, compact pure tuft, 18.VII.2011, Fedosov (MW), S+. Montane circumpolar species, known in Russia from Karelia, Caucasus, mountains of South Siberia and Khabarovsk Territory; the locality in Anabar Plateau is the northernmost one in Asia.

Myuroclada maximoviczii – steep slope of valley of the left tributary of Kotuy River (71°00' 52"N – 102°26'44"E, 50 m alt.), larch forest with dense canopy of *Duscheckia fruticosa*, on moist dead tree branch near small brook, with *Plagiothecium denticulatum* and *Hygrohypnella polaris*, as some solitary plants, 16.VIII.2011, Fedosov (MW). The species with prevailingly East Asiatic distribution; there are also several records in East Siberian North (Enisey River lower course), Yakutia, West Siberia, Northern Europe, etc.

Orthotrichum pumilum – right slope of Kotuykan river valley, 7 km upstrwam its mouth (70°34'18"N – 103°33'52"E, 50 m alt.), on emergent spruce root, compact pure tufts, with *O. obtusifolium,* 9.VIII.2011, Fedosov (MW); S+. Widely distributed southern species, mostly associated with open deciduous forests. In Asiatic Russia it is known only in Altai Mts. and Sayano-Shushensky Nature Reserve (Ignatov et al., 2004). Anabar Plateau is the northernmost known locality in Russia and, perhaps, in the world.

O. rupestre – right slope of Kotuykan river valley (70°19’49"N – 103°48’47"E, 260 m alt.), open larch forest, on shaded surface of gneiss outcrop, with *Ulota curvifolia* and *Isopterygiopsis muelleriana,* 19.VII.2011, Fedosov (MW); S+. The species is widely distributed in mountain regions of Holarctic and outside it. The closest localities are known in Ural and Altay Mts.

Palustriella decipiens – on Maymecha River bank near Bysy-Yuryakh Creek mouth (70°38’ 01"N – 101°27’45"E, 80 m alt.), on moist base of limestone cliff, with *Encalypta procera, Hymenostylium recurvirostre, Seligeria tristichoides, Myurella julacea*, 28.VI.2009, Fedosov (MW). Species with more southern distribution, with closest known localities in southern Yakutia.

Paraleucobryum longifolium – slope of canyon of Merkyu River right tributary (70°32’ 01"N – 105°54’02"E, 350 m alt.), on sandstone cliff ledge, with *Rhabdoweisia crispata*, 2.VIII.2011, Fedosov (MW). Montane species, occurring in most mountain regions of Russia and relatively abundant in areas with acidic rocks.

Pylaisia selwynii – left slope of Kotuykan river valley, 7 km upstream its mouth (70°34’18"N – 103°33’52"E, 50 m alt.), on dead spruce trunk, with *Orthotrichum obtusifolium,* 9.VIII.2011, Fedosov (MW); S+. Widely distributed semiboreal species, mostly associated with more southern territories.

Schistidium tenerum – right slope of Kotuy River valley in 3 km downstream Potakay Creek mouth (71°00’52"N – 102°26’44"E, 180 m alt.), on the top and slopes of ridge, on basaltic cliffs, with *Grimmia longirostris, Orthotrichum iwatsukii, Platydictya jungermannioides, Syntrichia laevipila, S. ruralis,* etc., 16.VIII.2011, Fedosov (MW). Rare species, with scattered know localities in Chukotka, Yakutia, and Irkutsk Province.

Seligeria pusilla – right slope of Kotuykan River valley near Sobul Creek mouth (70°41’ 19"N – 105°39’29"E, 100 m alt.), on shaded moist surface of Proterozoic limestone and dolomite in turf-covered rock-field in larch forests, 4.VIII.2011, Fedosov (MW); S+. The species with main distribution in Central and South Europe, Middle Asia and Southern Siberia, found distant from this area; Anabar Plateau is likely the northernmost known locality of the species.

S. trifaria – canyon of Kugda-Yuryakh Creek near its confluence with Kotuy River (70°38’35"N – 103°26’01"E, 40 m alt.), on moist calcareous silt cover on niche under Proterozoic limestone cliff, extensive pure mats, 12.VIII.2011, Fedosov (MW); S+. According to Ignatov, Afonina, Ignatova et al. (2006), in Russia the species occures in the Komi Republic and the Caucasus, while all Siberian records are considered as doubtful. Therefore the presented record is a third confirmed one in Russia and the first one in Asiatic Russia.

Tayloria acuminata – gentle slope of watershed to Lukunskaya River valley (72°32’01"N – 104°51’20"E, 15 m alt.), in wet tundra dominated by *Tomentypnum nitens, Aulacomnium palustre, Scorpidium cossonii*, 24.VI.2010, Pospelov (MW); S+. Rare species with scattered distribution in Holarctic.

Tetrodontium brownianum – (1) slope of canyon of second right tributary of Merkyu River (70°32’01"N – 105°54’02"E, 450 m alt.), on shaded moist sandstone cliff bases in niches, abundant; (2) Burdur River valley at the mouth of first tributary (70°32’00"N – 105°52’17"E, 350 m alt.), stratificated sandstone cliffs at the base of steep slope, 2.VIII.2011, Fedosov (MW), S+. The species with scattered distribution in mountain areas of Holarctic.

Rare in Taimyr Municipal District

Bryum calophyllum – Khatanga settlement (71°58’57"N – 102°29’05"E, 20 m alt.), on moist mineral soil in ruderal moss community, with *B. altaicum*, 5.VI.2009, Fedosov (MW), det. Zolotov; S+. The species is known from most regions of Russian Arctic but is rare throughout its distribution range. In Taimyr Municipal District it is also known from Severnaya Zemlya Archipelago and Syrutaturku Lake, North-Siberian Lowland (Zolotov, 2006).

Buxbaumia aphylla – Merkyu River valley 2 km upstream its mouth (70°19’14"N – 106°50’ 22"E, 290 m alt.). On bare humificated sandy sediments of steep slope to flood valley, in larch forest, 18.VII.2011, Fedosov (MW); S+. Species with widespread boreal distribution, but scattered in Siberia. The closest known locality is in Putorana Plateau (Czernyadjeva, 1990).

Discelium nudum – Tommot Lake shore (72°30’13"N – 105°11’27"E, 10 m alt.), on bare

loamy soil with *Aloina brevirostris, Dicranella varia, Funaria hygrometrica,* 2.VII.2010, Pospelov (MW); S+. Rare species, distributed mainly in suboceanic areas. The closest locality is known from Yenisey River mouth (specimen in MW).

Pohlia lescuriana – watershed of Merkyu and Burdur Rivers (70°32’04"N – 105°53’45"E, 420 m alt.), on sandy soil in *Cassiope* dominating tundra, mixed with *Dicranella cerviculata, Oligotrichum falcatum, Pogonatum urnigerum,* 2.VIII.2011, Fedosov (MW); S+. Rare species with disjunctive distribution in Arctic and Subarctic mountains.

P. obtusifolia – (1) eastern slope of Plateau with altitudinal mark 698 m to Kotuy River valley (70°59’31"N – 102°20’24"E, 320 m alt.), near snow bed in creek valley, with *Brachythecium udum, Pohlia drummondii, Sanionia uncinata*, 17.VIII.2011, Fedosov (MW); (2) gentle slope of watershed to Lukunskaya River valley (72°32’ 01"N – 104°51’20"E), snow bed in creek course, with *Bryum spp.* and hepatics, 22.VII.2010, Pospelov (MW). Rare species with disjunctive distribution in Arctic and Subarctic mountains.

Polytrichum swartzii – sphagnous mire in the bottom of Merkyu River valley 1 km upstream its mouth (70°19’14"N – 106°50’22"E, 270 m alt.), on hummock, with *Sphagnum papillosum*, 18.VII.2011, Fedosov (MW). In Taimyr Municipal District the species also is known from Sibiryakova Island (Ignatov, Afonina, Ignatova et al., 2006).

Rhytidiadelphus subpinnatus – N-facing slope of Afanas’evskie Lakes depression (71°34’48"N – 106°02’11"E, 180 m alt.), larch forest with shrub alder canopy on the dolerite intrusion, on soil, as admixture to *Sanionia uncinata,* 23.VI. 2006, Fedosov (MW). Widely distributed in boreal zone, however, mostly avoiding permafrost area (e.g., in Yakutia known only from its southern part).

Sphagnum fuscum – (1) right slope of Fomich River valley 4 km upstream Kamenisty Creek mouth (71°30’22"N – 106°15’01"E, 90 m alt.), sphagnous bog in area formed by extensive dolerite outcrop, on hummock, 2.VIII.2006, Fedosov (MW); (2) Chopko River valley 1 km upstream its mouth (70°46’49"N – 101°04’06"E, 50 m alt.), *Ledum* and *Sphagnum* dominated boggy open larch forest, on hummock, 6.VII.2009, Fedosov (MW). Widespread circumboreal species, found at northern limit of its distribution; occurs also on Putorana Plateau (Czernyadjeva, 1990).

Trematodon ambiguus – Kysyl-Khaya-Yuryakh River bank 1 km upstream its mouth (71°16’37"N – 103°00’11"E, 30 m alt.), steep slope of bank, on bare loamy sediments, several plants among *Dicranella crispa, Funaria hygrometrica, Pohlia proligera,* 21.VIII.2011, Fedosov (MW); S+. Species with wide distribution in Europe and Russian Far East, but extremely rare in Siberia. The closest locality is in Putorana Plateau (Czernyadjeva, 1991).

Voitia hyperborea – (1) north-western slope of Odikhincha Mt. (70°56’58"N – 103°00’58"E, 570 m alt.), moss community with dominating *Blindia acuta* on moist rocky slope, on organic substratum, several plants among *Tetraplodon paradoxus* and *Bryum sp.*, 13.VIII.2011, Fedosov (MW); S+; (2) southern slope of Odikhincha Mt. (70°55’19"N – 103°01’59"E, 550 m alt.), similar community, on moist ground with *Bryum sp*., 14.VIII.2011, Fedosov (MW); S+. Rare arctic species, known in Russia also from Chukotka and Severnaya Zemlya Archipelago.

PRELIMINARY LIST OF SPECIES OF ANABAR PLATEAU AND ADJACENT TERRITORY

Species are annotated with the frequency (Un – unique; Rar – rare; Sp – sparse; Fr – frequent; Com – common), occurrence in four accepted geological units defined in Fig. 1, and sporophyte (S+) or vegetative reproduction (P+) presence.

Abietinella abietina (Hedw.) M. Fleish. – Com; 1,2,3,4.
Aloina brevirostris (Hook. & Grew.) Kindb. – Sp; 2,3,4; S+.
A. rigida (Hedw.) Limpr. – Rar; 2; S+.
Amblyodon dealbatus (Hedw.) P. Beauv. – Un; 3; S+.
Amblystegium serpens (Hedw.) Bruch et al. – Rar; 2,3,4; S+.
Amphidium lapponicum (Hedw.) Schimp. – Fr; 1,3; S+.
A. mougeotii (Bruch et al.) Schimp. – Rar; 1,3.
Andreaea alpestris (Thed.) Bruch et al. – Rar; 1; S+.
A. blyttii Bruch et al. – Rar; 3; S+.
A. nivalis Hook. – Rar; 3; S+.
A. obovata Thed. – Rar; 1; S+.
A. rupestris Hedw. – Com; 1,2,3,4. S+.
Anomobryum julaceum (Schrad. ex P. Gaertn., B. Mey.

& Scherb.) Schimp. – Un; 3.
Aongstroemia longipes (Sommerf.) Bruch et al. – Rar; 3,4; S+.
Aplodon wormskjoldii (Hornem.) R. Br. – Sp; 1,2,3,4; S+.
Arctoa fulvella (Dicks.) Bruch et al. – Sp; 1,3; S+.
Aulacomnium acuminatum (Lindb. & Arnell) Kindb. – Sp; 2,4.
A. palustre (Hedw.) Schwägr. – Com; 1,2,3,4; S+, P+.
A. turgidum (Wahlenb.) Schwägr. – Com; 1,2,3,4; S+.
Barbula amplexifolia (Mitt.) A. Jaeg. – Rar; 3; P+.
B. convoluta Hedw. – Sp; 2,3,4; S+.
B. jacutica Ignatova – Rar; 3; S+.
B. unguiculata Hedw. – Sp; 2,3,4; S+.
Bartramia ithyphylla Brid. – Fr; 1,2,3,4; S+.
B. pomiformis Hedw. – Sp; 1,2,3,4; S+.
B. subulata Bruch et al. – Rar; 3.
Blindia acuta (Hedw.) Bruch et al. – Sp; 1,3; S+.
Brachytheciastrum trachypodium (Brid.) Ignatov & Huttunen – Fr; 1,2,3,4; S+.
Brachythecium albicans (Hedw.) Bruch et al. – Rar; 2,3.
B. boreale Ignatov – Rar; 3.
B. campestre (Müll.Hal.) Bruch et al. – Un; 3.
B. capillaceum (F. Weber & D. Mohr) Giacom – Rar; 2,3.
B. cirrosum (Schwägr.) Schimp. – Fr; 1,2,3,4.
B. coruscum I. Hagen – Rar; 3.
B. erythrorrhizon Bruch et al. – Rar; 3.
B. jakuticum Ignatov – Rar; 2.
B. mildeanum (Schimp.) Schimp. Sp; 1,2,3,4.
B. rivulare Bruch et al. Un; 3; S+.
B. salebrosum (F. Weber & D. Mohr) Schimp. – Rar; 2,3.
B. turgidum (Hartm.) Kindb. – Sp. 2,3,4.
B. udum I. Hagen – Sp. 2,3,4.
Breidleria pratensis (W.D.J. Koch ex Spruce) Loeske – Rar; 2,3,4.
Bryhnia brachycladula Cardot – Un; 3.
Bryobrittonia longipes (Mitt.) D.G. Horton – Sp; 2,3,4.
Bryoerythrophyllum ferruginascens (Stirt.) Giacom – Sp; 1,2,3,4; P+.
B. latinervium (Holmen) Fedosov & Ignatova – Rar; 2.
B. recurvirostrum (Hedw.) P.C. Chen – Fr; 1,2,3,4; S+.
B. rotundatum (Lindb. & Arnell) P.C. Chen – Rar; 2,3; S+.
Bryum algovicum Sendtn. ex Müll. Hal. – Sp; 1,2,3,4; S+.
B. altaicum Broth. – Sp; 1,3,4; S+.
B. amblyodon Müll. Hal. – Sp; 1,2,3,4; S+.
B. archangelicum Bruch. et al. – Rar; 2,3; S+.
B. arcticum (R.Br.) Bruch et al. – Sp; 1,2,3,4; S+.
B. argenteum Hedw. – Sp; 1,2,3,4; S+, P+.
B. axel-blyttii Kaurin ex H. Philib. – Sp; 3,4; S+.
B. bimum (Schreb.) Turner – Un; 3; S+.
B. caespiticium Hedw. – Un; 2; P+.
B. calophyllum R.Br. – Un; 4; S+.
B. capillare Hedw. – Un; 2; S+.
B. creberrimum Taylor – Sp; 1,2,3,4; S+.
B. cryophilum Mårtensson – Rar; 2.
B. cyclophyllum (Schwägr.) Bruch. et al. – Fr; 1,2,3,4; S+.
B. dichotomum Hedw. – Rar; 2,3; S+.
B. elegans Nees – Sp; 1,2,3,4.
B. intermedium (Brid.) Blandow Sp; 1,2,3,4; S+.
B. kunzei Hornsch. Rar; 2,3.
B. lonchocaulon Müll. Hal. – Un; 3; S+.
B. marratii Hook. f. & Wilson – Rar; 3; S+.
B. mildeanum Jur. – Un; 1.
B. moravicum Podp. – Un; 3; P+.
B. neodamense Inzigs. – Rar; 2,3,4.
B. pallens Sw. ex anon. – Rar; 2,3; S+.
B. pallescens Schleich. ex Schwägr. – Rar; 2,3; S+.
B. pseudotriquetrum (Hedw.) P. Gaertn., B.Mey. & Scherb. – Com; 1,2,3,4; S+.
B. rutilans Brid. – Rar; 3,4.
B. salinum I. Hagen ex Limpr. – Rar; 3,4; S+.
B. schleicheri DC. – Rar; 2,3.
B. teres Lindb. – Rar; 2,3.
B. turbinatum (Hedw.) Turner – Un; 2.
B. wrightii Sull. – Fr; 1,2,3,4; S+.
B. weigelii Spreng. – Un; 3.
Bucklandiella microcarpa (Hedw.) Bednarek-Ochyra & Ochyra – Rar; 1;3.
B. sudetica (Funck) Bednarek-Ochyra & Ochyra – Un; 3.
Buxbaumia aphylla Hedw. – Un; 1; S+.
Calliergon cordifolium (Hedw.) Kindb. – Rar; 3,4.
C. giganteum (Schimp.) Kindb. – Fr; 1,2,3,4; S+.
C. megalophyllum Mikut. – Rar; 2,3,4.
C. richardsonii (Mitt.) Kindb. – Sp; 1,2,3,4.
Calliergonella cuspidata (Hedw.) Loeske – Un; 2.
C. lindbergii (Mitt.) Hedenäs – Fr; 1,2,3,4.
Campyliadelphus chrysophyllus (Brid.) R.S. Chopra – Rar; 3;4.
Campylidium sommerfeltii (Myrin) Ochyra – Rar; 2;3.
Campylium longicuspis (Lindb. & Arnell) Hedenäs – Rar; 2,4.
C. protensum (Brid.) Kindb. – Sp; 2,3,4.
C. stellatum (Hedw.) C.E.O. Jensen – Fr; 1,2,3,4; S+.
Campylophyllum halleri (Hedw.) M. Fleisch. – Rar; 2.
Catoscopium nigritum (Hedw.) Brid. – Fr; 1,2,3,4; S+.
Ceratodon heterophyllus Kindb. – Un; 4.
C. purpureus (Hedw.) Brid. – Fr; 1,2,3,4; S+.
Cinclidium arcticum (Bruch et al.) Schimp. – Fr; 1,2,3,4; S+.
C. latifolium Lindb. – Sp; 1,2,3,4; S+.
C. stygium Sw. – Rar; 2,3,4.
C. subrotundum Lindb. – Sp; 1,2,3,4; S+.

Climacium dendroides F. Weber & D. Mohr – Sp; 1,2,3,4.
Cnestrum alpestre (Wahlenb. ex Huebener) Nyholm ex Mogensen – Sp; 1,3,4; S+.
C. glaucescens (Lindb. & Arnell) Holmen ex Mogensen & Steere – Rar; 1,3; S+.
C. schistii (F. Weber & D. Mohr) I.Hagen – Rar; 1,3; S+.
Codriophorus fascicularis (Hedw.) Bednarek-Ochyra & Ochyra – Rar; 1.
Conardia compacta (Drumm. ex Müll. Hal.) H. Rob. – Rar; 2; P+.
Conostomum tetragonum (Hedw.) Lindb. – Fr; 1,3,4; S+.
Coscinodon cribrosus (Hedw.) Spruce – Un; 1.
C. hartzii C.E.O.Jensen – Rar; 1; S+.
Cratoneuron curvicaule (Jur.) G. Roth – Sp; 2,3,4.
C. filicinum (Hedw.) Spruce – Rar; 2.
Ctenidium molluscum (Hedw.) Mitt. – Rar; 2,3.
Cynodontium asperifolium (Lindb. & Arnell) Paris – Rar; 1; S+.
C. polycarpon (Hedw.) Schimp. – Un; 1; S+.
C. strumiferum (Hedw.) Lindb. – Fr; 1,2,3,4; S+.
C. tenellum (Schimp.) Limpr. – Sp; 1,3; S+.
Cyrtomnium hymenophylloides (Huebener) T.J. Kop. – Fr;1,2,3,4.
C. hymenophyllum (Bruch et al.) Holmen – Fr; 1,2,3,4.
Dichelyma capillaceum (Dicks.) Myrin – Un; 3.
D. falcatum (Hedw.) Myrin – Rar; 1.
Dichodontium pellucidum (Hedw.) Schimp. – Sp; 1,2,3,4.
Dicranella cerviculata (Hedw.) Schimp. – Sp; 1,3,4; S+.
D. crispa (Hedw.) Schimp. – Rar; 1;3;4.
D. grevilleana (Brid.) Schimp. – Rar; 3;4.
D. humilis R.Ruthe – Un; 2.
D. schreberiana (Hedw.) Hilf. ex H.A. Crum & L.E. Anderson – Rar; 3,4.
D. subulata (Hedw.) Schimp. – Rar; 3,4; S+.
D. varia (Hedw.) Schimp. – Sp; 2,3,4; S+.
Dicranodontium denudatum (Brid.) E. Britton – Un; 3.
Dicranum acutifolium (Lindb. & Arnell) C.E.O. Jensen – Sp; 1,2,3,4; S+.
D. angustum Lindb. – Un; 1.
D. bardunovii Tubanova & Ignatova – Un; 3.
D. bonjeanii De Not. – Rar; 3.
D. elongatum Schleich. ex Schwägr. – Com; 1,2,3,4; S+.
D. flexicaule Brid. – Fr; 1,2,3,4; S+.
D. fragilifolium Lindb. – Un; 3.
D. fuscescens Turner – Sp; 1,2,3; S+.
D. groenlandicum Brid. – Rar; 3;4.
D. laevidens R.S. Williams – Fr; 1,2,3,4; S+.
D. leioneuron Kindb. – Un; 3; P+.
D. majus Turner – Sp; 1,3.
D. montanum Hedw. – Rar; 2,3.
D. polysetum Sw. – Un; 1.
D. scoparium Hedw. – Rar; 2,3.
D. spadiceum J.E. Zetterst. – Sp; 1,3,4.
D. undulatum Schrad. ex Brid. – Rar; 3.
Didymodon asperifolius (Mitt.) H.A. Crum, Steere & L.E. Anderson – Rar; 2.
D. fallax (Hedw.) R.H. Zander. – Sp; 2,3,4; S+.
D. ferrugineus (Schimp. ex Besch.) M.O. Hill – Fr; 2,3,4; S+.
D. icmadophilus (Schimp ex Müll. Hal.) R.H. Zander – Rar; 2.
D. johansenii (R.S.Williams) H.A. Crum – Rar; 2; S+.
D. perobtusus Broth. – Un: 2; P+.
D. rigidulus Hedw. – Rar; 2,3; P+.
D. validus Limpr. – Rar; 2,3,4.
D. zanderii Afonina & Ignatova – Rar; 1.
Discelium nudum (Dicks.) Brid. – Un; 4; S+.
Distichium capillaceum (Hedw.) Bruch et al. – Com; 1,2,3,4; S+.
D. hagenii Ryan ex H. Philib. – Rar; 2,3; S+.
D. inclinatum (Hedw.) Bruch et al. – Sp; 2,3,4; S+.
Ditrichum cylindricum (Hedw.) Grout – Rar; 3.4; S+.
D. flexicaule (Schwägr.) Hampe – Com; 1,2,3,4; S+.
D. heteromallum (Hedw.) E. Britton – Rar; 3.
D. lineare (Sw.) Lindb. – Rar; 1,3.
D. zonatum (Brid.) Kindb. – Rar; 1.
Drepanium recurvatum (Lindb. & Arnell) G. Roth – Rar; 2,3.
Drepanocladus aduncus (Hedw.) Warnst. – Rar; 2;3;4.
D. arcticus (R.S.Williams) Hedenäs – Rar; 3;4.
D. polygamus (Bruch et al.) Hedenäs – Rar; 2,3,4.
D. sendtneri (Schimp. ex H. Müll.) Warnst. – Rar; 2,3.
D. sordidus (Mull. Hal.) Hedenäs – Rar; 3.
Encalypta affinis R.Hedw. – Rar;
E. alpina Sm. – Rar; 2,3,4; S+.
E. brevicolla (Bruch et al.) Ångstr. – Fr; 1,3; S+.
E. brevipes Schljakov – Rar; 3; S+.
E. ciliata Hedw. – Rar; 1,3; S+.
E. longicolla Bruch – Sp; 2,4;S+.
E. mutica I. Hagen – Sp; 2,3,4; S+.
E. procera Bruch – Fr; 1,2,3,4; S+, P+.
E. rhaptocarpa Schwägr. – Fr; 2,3,4; S+.
E. trachymitria Ripart – Rar; 2,3; S+.
E. vulgaris Hedw. – Rar; 2; S+.
Entodon concinnus (De Not.) Paris – Rar; 2;3.
Eurhynchiastrum pulchellum (Hedw.) Ignatov & Huttunen – Fr; 1,2,3,4; S+.
Fissidens adianthoides Hedw. – Rar; 2.
F. arcticus Bryhn – Rar; 2,4; S+.
F. bryoides Hedw. – Rar; 3; S+.
F. exiguus Sull. – Un; 3; S+.
F. osmundoides Hedw. – Rar; 2,3,4.
F. viridulus (Sw.) Wahlenb. – Sp; 2,3,4; S+.

Fontinalis antipyretica Hedw. – Rar; 3,4.
F. hypnoides Hartm. – Rar; 1,2.
Funaria arctica (Berggr.) Kindb. – Rar; 3,4; S+.
F. hygrometrica Hedw. – Sp; 2,3,4; S+.
F. polaris Bryhn – Rar; 2; S+.
Grimmia anodon Bruch et al. – Rar; 2; S+.
G. donniana Sm. – Sp; 1,3; S+.
G. elatior Bruch ex Bals.-Criv. & De Not. – Sp; 1,3; S+.
G. funalis (Schwägr.) Bruch. et al. – Sp; 1,3.
G. hartmanii Schimp. – Un; 3.
G. incurva Schwägr. – Sp; 1,3.
G. jacutica Ignatova, Bednarek-Ochyra, Afonina & J. Muńoz – Sp; 1,3.
G. longirostris Hook. – Com; 1,2,3; S+.
G. mollis Bruch et al. – Un; 3; S+.
G. muehlenbeckii Schimp. – Un; 3; S+.
G. reflexidens Müll. Hal. – Rar; 3; S+.
G. teretinervis Limpr. – Sp; 2.
G. tergestina Tomm. ex Bruch et al. – Rar; 2.
G. torquata Drumm. – Rar; 1; P+.
G. triformis Carestia & De Not. – Rar; 3; S+.
G. unicolor Hook. – Un; 1; S+.
Gymnostomum aeruginosum Sm. – Sp; 2,3.
Gymnostomum calcareum Nees & Hornsch. – Un; 2.
Hamatocaulis lapponicus (Norrl.) Hedenäs – Rar; 3,4; S+.
H. vernicosus (Mitt.) Hedenäs – Sp; 2,3,4; S+.
Hedwigia ciliata (Hedw.) P. Beauv. – Rar; 1,3; S+.
Helodium blandowii (F. Weber & D. Mohr) Warnst. – Rar; 3,4.
Hennediella heimii (Hedw.) R.H. Zander – Sp; 2,3,4; S+.
Herzogiella turfacea (Lindb.) Z. Iwats. – Un; 3.
Hilpertia velenovskyi (Schiffn.) R.H. Zander – Un; 2; S+.
Homomallium incurvatum (Schrad. ex Brid.) Loeske – Un; 3; S+.
Hygroamblystegium humile (P. Beauv.) Vanderp., Goffinet & Hedenäs – Rar; 3.
H. varium (Hedw.) Mönk. – Un; 2.
Hygrohypnella ochracea (Turner ex Wilson) Ignatov & Ignatova – Sp; 3; S+.
H. polaris (Lindb.) Ignatov & Ignatova – Fr; 1,3,4; S+.
Hygrohypnum luridum (Hedw.) Jenn. – Fr; 1,2,3,4; S+.
Hylocomiastrum pyrenaicum (Spruce) M. Fleisch. – Rar; 3.
Hylocomium splendens (Hedw.) Bruch et al. – Com; 1,2,3,4.
Hymenoloma crispulum (Hedw.) Ochyra – Fr; 1,3,4; S+.
H. intermedium (J.J. Amman) Ochyra – Rar; 3; S+.
Hymenostylium recurvirostrum (Hedw.) Dixon – Fr; 2,3; S+.
Hypnum cupressiforme Hedw. – Fr; 1,3,4.
Indusiella thianschanica Broth. & Müll. Hal. – Un; 2; S+.
Isopterygiopsis alpicola (Lindb. & Arnell) Hedenäs – Sp; 1,2,3.
I. muelleriana (Schimp.) Z. Iwats. – Rar; 1,3.
I. pulchella (Hedw.) Z. Iwats. – Fr; 1,2,3,4; S+.
Jaffueliobryum latifolium (Lindb. & Arnell) Thér. – Rar; 2; S+.
Kiaeria blyttii (Bruch et al.) Broth. – Rar; 2,3.
K. glacialis (Berggr.) I. Hagen – Rar; 3, S+.
K. starkei (F. Weber & D. Mohr) I. Hagen – Rar; 3, S+.
Leptobryum pyriforme (Hedw.) Wilson – Sp; 2,3,4; S+.
Leptodictyum riparium (Hedw.) Warnst. – Rar, 3; S+.
Leskea polycarpa Hedw. – Un; 3.
Lescuraea radicosa (Mitt.) Mönk. – Rar; 1,3.
L. saxicola (Bruch et al.) Molendo – Un; 3.
Loeskypnum badium (Hartm.) H.K.G. Paul – Fr; 1,2,3,4; S+.
Lyellia aspera (I. Hagen & C.E.O. Jensen) Frye – Rar; 1,3; S+.
Meesia longiseta Hedw. – Rar; 3.
M. triquetra (Jolycl.) Ångstr. – Sp; 1,2,3,4; S+.
M. uliginosa Hedw. – Sp; 1,2,3,4; S+.
Microbryum davallianum (Sm.) R.H. Zander – Un; 3; S+.
M. starckeanum (Hedw.) R.H. Zander – Rar; 2; S+.
Mielichhoferia mielichhoferiana (Funck) Loeske – Rar; 1,3; S+.
Mnium blyttii Bruch et al. – Sp; 1,2,3,4.
M. lycopodioides Schwägr. – Fr; 1,2,3,4; S+.
M. marginatum (Dicks.) P. Beauv. – Rar; 3; S+.
M. spinosum (Voit) Schwägr. – Rar; 1,3.
M. stellare Hedw. – Rar; 3.
M. thomsonii Schimp. – Rar; 2,3.
Molendoa sendtneriana (Bruch et al.) Limpr. – Sp; 2,3.
M. tenuinervis Limpr. – Rar; 2,3.
Myrinia pulvinata (Wahlenb.) Schimp. – Sp; 1,2,3,4; S+.
M. rotundifolia (Arnell) Broth. – Rar; 2,3; S+.
Myurella acuminata Lindb. & Arnell – Rar; 2,3.
M. julacea (Schwägr.) Bruch et al. – Fr; 1,2,3,4; S+.
M. sibirica (Müll. Hal.) Reimers - Un; 3.
M. tenerrima (Brid.) Lindb. – Sp; 1,3,4.
Myuroclada maximoviczii (G.G. Borshch.) Steere & W.B. Schofield – Un; 3.
Neckera pennata Hedw. – Sp; 1,2,3; S+.
Niphotrichum canescens (Hedw.) Bednarek-Ochyra & Ochyra – Un; 3.
N. ericoides (Brid.) Bednarek-Ochyra & Ochyra – Rar; 3.
N. panschii (Müll. Hal.) Bednarek-Ochyra & Ochyra – Fr; 1,2,3,4.

Ochyraea alpestris (Hedw.) Ignatov & Ignatova – Rar; 1,3; S+.
O. cochlearifolia (Venturi) Ignatov & Ignatova – Rar; 3.
O. duriuscula (De Not.) Ignatov & Ignatova Rar; 1,3.
O. norvegica (Bruch et al.) Ignatov & Ignatova – Rar; 1,3; S+.
Oligotrichum falcatum Steere – Sp; 1,4; S+.
O. hercynicum (Hedw.) Lam. & DC. – Un; 3.
Oncophorus compactus (Bruch et al.) Kindb. – Rar; 1,3.
O. virens (Hedw.) Brid. – Sp; 1,2,3,4; S+.
O. wahlenbergii Brid. – Fr; 1,2,3,4; S+.
Orthothecium chryseon (Schwägr.) Bruch et al. – Sp; 1,2,3,4.
O. intricatum (Hartm.) Bruch et al. – Un; 2.
O. strictum Lorentz – Fr; 1,2,3,4.
Orthotrichum alpestre Hornsch. ex Bruch et al. – Rar; 3; S+; P+.
O. anomalum Hedw. – Fr; 2,3; S+.
O. holmenii Lewinsky-Haapasaari – Rar; 3; S+.
O. iwatsukii Ignatov – Fr; 1,2,3,4; S+.
O. obtusifolium Brid. – Rar; 2,3; P+.
O. pallens Bruch ex Brid. – Sp; 1,2,3; S+; P+.
O. pellucidum Lindb. – Rar; 2; S+.
O. pumilum Sw. ex anon. – Un; 3; S+.
O. rupestre Schleich. ex Schwägr. – Un; 1; S+.
O. sordidum Sull. & Lesq. – Un; 2; S+.
O. speciosum Nees – Rar; 2,3; S+.
Oxystegus tenuirostris (Hook. & Taylor) A.J.E. Sm. – Rar; 3.
Paludella squarrosa (Hedw.) Brid. – Sp; 1,2,3,4; S+.
Palustriella decipiens (De Not.) Ochyra – Rar; 2.
Paraleucobryum longifolium (Hedw.) Loeske – Rar; 2.
Philonotis caespitosa Jur. – Rar; 3.
P. fontana (Hedw.) Brid. – Rar; 3.
P. tomentella Molendo – Sp; 1,2,3,4. S+.
Plagiobryum demissum (Hook.) Lindb. – Un; 3; S+.
P. zierii (Hedw.) Lindb. – Un; 1.
Plagiomnium confertidens (Lindb. & Arnell) T.J. Kop. – Un; 3.
P. curvatulum (Lindb.) Schljakov – Fr; 1,2,3,4; S+.
P. ellipticum (Brid.) T.J. Kop. – Sp; 1,3,4.
P. medium (Bruch et al.) T.J. Kop. – Rar; 3; S+.
P. rostratum (Schrad.) T.J. Kop. – Rar; 3; S+.
Plagiopus oederianus (Sw.) H.A. Crum & L.E. Anderson – Sp; 2,3; S+.
Plagiothecium berggrenianum Frisvoll – Rar; 1,2,3,4.
P. cavifolium (Brid.) Z. Iwats. – Rar; 2,3,4; S+.
P. curvifolium Schlieph. ex Limpr. – Rar; 3.
P. denticulatum (Hedw.) Bruch et al. – Fr; 1,2,3,4; S+.
P. laetum Bruch et al. – Fr; 1,2,3,4; S+.
Platydictya jungermannioides (Brid.) H.A. Crum. – Sp; 1,2,3.
Pleurozium schreberi (Brid.) Mitt. – Sp; 1,2,3,4.
Pogonatum dentatum (Brid.) Brid. – Rar; 1,3.
P. urnigerum (Hedw.) P. Beauv. – Fr, 1,2,3,4; S+.
Pohlia andalusica (Höhn.) Broth. – Rar; 1; P+.
P. andrewsii A.J. Shaw – Sp; 3,4; P+.
P. atropurpurea (Wahlenb.) Lindb. – Rar; 2,3,4; S+.
P. beringiensis A.J. Shaw – Sp; 1,3,4; P+.
P. bulbifera (Warnst.) Warnst. – Rar; 1,3; P+.
P. cruda (Hedw.) Lindb. – Com; 1,2,3,4; S+.
P. crudoides (Sull. & Lesq.) Broth. – Rar; 1,3.
P. drummondii (Müll. Hal.) A.L. Andrews – Sp; 1,3,4; P+.
P. elongata Hedw. – Rar; 1; S+.
P. filum (Schimp.) Mårtensson – Sp. 3,4; P+.
P. lescuriana (Sull.) Ochi – Un; 1; S+.
P. longicollis (Hedw.) Lindb. – Rar; 1; S+.
P. nutans (Hedw.) Lindb. – Fr; 1,2,3,4; S+.
P. obtusifolia (Vill. ex Brid.) L.F. Koch – Rar, 3,4.
P. proligera (Kindb.) Lindb. ex Broth. – Sp; 1,2,3,4; P+.
P. sphagnicola (Bruch et al.) Broth. – Un; 4.
P. wahlendbergii (F. Weber & D. Mohr) A.L. Andrews – Sp; 1,2,3,4; S+.
Polytrichastrum alpinum (Hedw.) G.L. Sm. – Com, 1,2,3,4; S+.
P. longisetum (Sw. ex Brid.) G.L. Sm. – Sp; 1,2,3; S+.
P. pallidisetum (Funck) G.L. Sm. – Un; 2.
P. sexangulare (Floerke ex Brid.) G.L. Sm. – Rar; 3.
Polytrichum commune Hedw. – Rar; 3.
P. hyperboreum R. Br. – Sp; 1,2,3,4; S+.
P. jensenii I. Hagen – Rar; 3,4.
P. juniperinum Hedw. – Fr; 1,2,3,4; S+.
P. piliferum Hedw. – Sp; 1,3,4.
P. strictum Brid. – Sp; 1,2,3,4; S+.
P. swartzii Hartm. – Un; 1.
Pseudobryum cinclidioides (Huebener) T.J. Kop. – Rar; 2,3,4.
Pseudocalliergon brevifolium (Lindb.) Hedenäs – Fr; 2,3,4; S+.
P. trifarium (F. Weber & D. Mohr) Loeske – Rar; 2,3.
P. turgescens (T. Jensen) Loeske – Sp; 2,3,4.
Pseudocrossidium obtusulum (Lindb.) H.A. Crum & L.E. Anderson – Rar; 2; P+.
Pseudohygrohypnum subeugyrium (Renauld. & Cardot) Ignatov & Ignatova – Sp; 1,3: S+.
Pseudoleskeella catenulata (Brid. ex Schrad.) Kindb. – Sp; 2.
P. papillosa (Lindb.) Kindb. – Sp; 1,2,3.
P. rupestris (Berggr.) Hedenäs & Söderstr. – Fr; 1,2,3.
P. tectorum (Funck ex Brid.) Kindb. ex Broth. – Rar; 2,3.
Psilopilum cavifolium (Wilson) I. Hagen – Sp; 1,3,4; S+.
P. laevigatum (Wahlenb.) Lindb. – Rar; 3,4; S+.
Pterigynandrum filiforme Hedw. – Sp; 1,3; P+.
Pterygoneurum kozlovii Laz. – Rar; 3; S+.
P. lamellatum (Lindb.) Jur. – Rar; 2,3,4; S+.
P. ovatum (Hedw.) Dixon – Sp; 2,3: S+.

P. subsessile (Brid.) Jur. – Rar; 2,3; S+.
Ptilium crista-castrensis (Hedw.) De Not. – Sp. 1,3,4.
Pylaisia polyantha (Hedw.) Bruch et al. – Sp. 2,3; S+.
P. selwynii Kindb. – Rar; 2; S+.
Racomitrium lanuginosum (Hedw.) Brid. – Fr; 1,2,3,4.
Rhabdoweisia crispata (Dicks. ex With.) Lindb. – Rar; 1; S+.
Rhizomnium andrewsianum (Steere) T.J. Kop. – Rar; 1,3,4.
R. pseudopunctatum (Bruch & Schimp.) T.J. Kop. – Rar; 3.
R. punctatum (Hedw.) T.J. Kop. – Un; 3.
Rhytidiadelphus subpinnatus (Lindb.) T.J. Kop. – Un; 2.
R. triquetrus (Hedw.) Warnst. – Un; 3.
Rhytidium rugosum (Hedw.) Kindb. – Com; 1,2,3,4.
Saelania glaucescens (Hedw.) Broth. – Fr; 1,2,3,4; S+.
Sanionia georgicouncinata (Müll. Hal.) Ochyra & Hedenäs – Rar; 3; S+.
S. uncinata (Hedw.) Loeske – Com; 1,2,3,4; S+.
Schistidium abrupticostatum (Bryhn) Ignatova & H.H. Blom – Sp; 1,2,3; S+.
S. agassizii Sull. & Lesq. – Sp; 1,2,3,4; S+.
S. andreaeopsis (Müll. Hal.) Laz. – Fr; 2,3. S+.
S. boreale Poelt – Sp; 1,2,3; S+.
S. crenatum H.H. Blom – Un; 3; S+.
S. dupretii (Ther.) W.A.Weber – Un; 3: S+.
S. flexipilum (Lindb. ex Broth.) Roth – Rar; 3; S+.
S. frigidum H.H. Blom – Fr; 1,2,3; S+.
S. frisvollianum H.H. Blom – Fr; 2; S+.
S. grandirete H.H. Blom – Un; 2; S+.
S. liliputanum (Müll. Hal.) Deguchi – Un; 2; S+.
S. obscurum H.H. Blom, Köckinger & Ignatova – Un; 3; S+.
S. papillosum Culm. – Fr; 1,2,3; S+.
S. platyphyllum (Mitt.) Perss. – Fr; 1,2,3,4; S+.
S. pulchrum H.H. Blom – Fr; 1,2,3; S+.
S. rivulare (Brid.) Podp. – Rar; 2,3; S+.
S. sordidum I. Hagen – Rar; 1; S+.
S. submuticum Broth. ex H.H. Blom – Sp; 2,3; S+.
S. succulentum Ignatova & H.H. Blom – Un; 1; S+.
S. tenerum (J.E. Zetterst.) Nyholm – Rar; 3; S+.
S. tenuinerve Ignatova & H.H. Blom – Un; 3; S+.
S. umbrosum (J.E. Zetterst.) H.H. Blom – Rar;
S. venetum H.H. Blom – Rar; 3; S+.
Sciuro-hypnum curtum (Lindb.) Ignatov – Un; 3 .
S. glaciale (Bruch et al.) Ignatov & Huttunen – Un; 3.
S. latifolium (Kindb.) Ignatov & Huttunen – Rar; 3.
S. ornellanum (Molendo) Ignatov & Huttunen – Un; 3.
S. plumosum (Hedw.) Ignatov & Huttunen – Rar; 3 .
S. reflexum (Starke) Ignatov & Huttunen – Rar; 3 .
Scorpidium cossonii (Schimp.) Hedenäs – Sp; 1,2,3,4; S+.
S. revolvens (Sw. ex anon.) Rubers – Fr; 1,3,4; S+.
S. scorpioides (Hedw.) Limpr. – Sp; 2,3,4.
Scouleria aquatica Hook. – Sp; 2,3.
Seligeria acutifolia Lindb. – Rar; 2; S+.
S. brevifolia (Lindb.) Lindb. – Un; 2; S+.
S. campylopoda Kindb. – Sp; 1,2,3; S+.
S. diversifolia Lindb. – Un; 2; S+.
S. donniana (Sm.) Müll. Hal. – Un; 2; S+.
S. galinae Mogensen & I. Goldberg – Rar; 2; S+.
S. polaris Berggr. – Sp; 2,3,4; S+.
S. pusilla (Hedw.) Bruch et al – Rar; 2; S+.
S. subimmersa Lindb. – Un; 2; S+.
S. trifaria (Brid.) Lindb. – Un; 2; S+.
S. tristichoides Kindb. – Rar; 2 : S+.
Sphagnum angustifolium (C.E.O. Jensen ex Russow) C.E.O. Jensen – Fr; 1,2,3,4.
S. aongstroemii Hartm. – Rar; 1,3,4.
S. arcticum Flatberg & Frisvoll – Rar; 3.
S. balticum (Russow) C.E.O. Jensen – Fr; 1,2,3,4; S+.
S. beringiense A.J. Shaw, R.E. Andrus & B. Shaw – Un; 4.
S. capillifolium (Ehrh.) Hedw. – Rar; 1,3,4.
S. compactum Lam. & DC. – Rar; 1,3,4; S+.
S. contortum Schultz. – Rar; 1.
S. fimbriatum Wilson – Rar; 1,3,4.
S. fuscum (Schimp.) H. Klinggr. – Un; 3.
S. girgensohnii Russow – Sp; 1,3,4.
S. lenense H. Lindb. ex L.I. Savicz – Fr; 1,3,4.
S. lindbergii Schimp. – Rar; 1,4.
S. magellanicum Brid. – Rar; 1.
S. obtusum Warnst. – Rar; 3,4.
S. orientale L.I. Savicz. – Rar; 3,4.
S. papillosum Lindb. – Rar; 1.
S. perfoliatum L.I. Savicz – Un; 1.
S. riparium Ångstr. – Rar; 3,4.
S. rubellum Wilson – Rar; 3,4.
S. russowii Warnst. – Rar; 1,3,4.
S. squarrosum Crome – Fr; 1,2,3,4; S+.
S. steerei R.E. Andrus – Rar; 1,4.
S. subfulvum Sjörs – Rar; 2,3.
S. teres (Schimp.) Ångstr. – Fr; 1,2,3,4.
S. tundrae Flatberg – Rar; 1,3,4.
S. warnstorfii Russow – Fr; 1,2,3,4.
Splachnum luteum Hedw. – Sp; 1,2,3; S+.
S. rubrum Hedw. – Un, 2.
S. sphaericum Hedw. – Rar, 2,3,4; S+.
S. vasculosum Hedw. – Rar, 2,3,4; S+.
Stegonia latifolia (Schwägr.) Venturi ex Broth. – Fr; 2,3,4; S+.
S. pilifera (Brid.) H.A. Crum & L.E. Anderson – Rar; 2; S+.
Stereodon bambergeri (Schimp.) Lindb. – Fr; 2,3,4.
S. fauriei (Cardot) Ignatov & Ignatova – Rar; 2; S+.
S. hamulosus (Bruch et al.) Lindb. – Rar; 2,3; S+.
S. holmenii (Ando) Ignatov & Ignatova – Rar; 1,2,3,4; S+.
S. plicatulus Lindb. – Sp; 1,2,3,4.
S. procerrimus (Molendo) Bauer – Rar; 2,3,4.

S. revolutus Mitt. – Rar; 1,3.
S. subimponens (Lesq.) Broth. – Rar; 2,3; S+.
S. vaucheri (Lesq.) Lindb. ex Broth. – Fr; 2,3.
Straminergon stramineum (Dicks. ex Brid.) Hedenäs – Sp; 1,2,3,4.
Syntrichia caninervis Mitt. – Rar; 2,3.
S. laevipila Brid. – Sp, 1,2,3; P+.
S. norvegica F. Weber – Rar; 1,3,4; S+.
S. ruralis (Hedw.) F. Weber & D. Mohr – Fr; 1,2,3,4; S+.
S. sinensis (Müll. Hal.) Ochyra – Un; 2; S+.
Tayloria acuminata Hornsch. – Rar, 2,4; S+.
T. lingulata (Dicks.) Lindb. – Rar, 2,3; S+.
T. tenuis (Dicks. ex With.) Schimp. – Un; 2; S+.
Tetraphis pellucida Hedw. – Rar; 3; S+, P+.
Tetraplodon angustatus (Hedw.) Bruch et al. – Rar; 1,3; S+.
T. mnioides (Hedw.) Bruch. et al. – Fr; 1,2,3,4; S+.
T. pallidus I. Hagen – Rar; 3; S+.
T. paradoxus (R. Br.) I. Hagen – Rar; 3,4; S+.
T. urceolatus (Hedw.) Bruch et al. – Un; 3; S+.
Tetrodontium brownianum (Dicks.) Schwägr. – Rar; 1; S+.
Thuidium assimile (Mitt.) A. Jaeger – Sp; 2,3,4.
T. recognitum (Hedw.) Lindb. – Sp; 1,2,3,4.
Timmia austriaca Hedw. – Sp; 2,3,4.
T. bavarica Hessl. – Rar; 2,3; S+.
T. comata Lindb. & Arnell – Fr; 1,2,3,4.
T. megapolitana Hedw. – Rar; 2.
T. norvegica J.E. Zetterst. – Sp; 3,4.
T. sibirica Lindb. & Arnell – Sp; 2,3,4.
Tomentypnum nitens (Hedw.) Loeske – Com; 1,2,3,4; S+.
Tortella alpicola Dixon – Rar; 2,3; P+.
T. arctica (Arnell.) Crundw. & Nyholm – Rar; 2.
T. densa (Lorentz & Molendo) Crundwell & Nyholm – Rar; 2.
T. fragilis (Hook. et Wils.) Limpr. – Fr; 1,2,3,4.
T. tortuosa (Hedw.) Limpr. – Sp; 1,2,3,4.
Tortula acaulon (With.) R.H. Zander – Un, 3.
T. cernua (Huebener) Lindb. – Rar; 2,3,4; S+.
T. cuneifolia (Dicks.) Turner – Rar; 2; S+.
T. hoppeana (Schultz) Ochyra – Rar; 2,3.
T. lanceola R.H. Zander – Un; 3; S+.
T. laureri (Schultz) Lindb. – Rar; 2; S+.
T. leucostoma (R. Br.) Hook. & Grew. – Sp; 2,3,4; S+.
T. lingulata Lindb. – Rar; 3; S+;
T. mucronifolia Schwägr. – Fr; 1,2,3,4; S+.
T. muralis Hedw. – Un; 3; S+.
T. obtusifolia (Schwägr.) Mathieu – Rar; 2; S+.
T. systylia (Schimp.) Lindb. – Rar; 2,3,4; S+.
Trematodon ambiguus (Hedw.) Hornsch. – Un; 3; S+.
Trichostomum arcticum Kaal. – Sp; 2.
T. crispulum Bruch – Sp; 2,3,4; S+.
Ulota curvifolia (Wahlenb.) Lilj. – Sp; 1; S+.
Voitia hyperborea Grev. & Arn. – Rar; 3; S+.
Warnstorfia exannulata (Bruch et al.) Loeske – Fr; 1,2,3,4; S+.
W. fluitans (Hedw.) Loeske – Sp; 1,2,3.
W. pseudostraminea (Müll. Hal.) Tuom. & T.J. Kop. – Sp; 2,3,4.
W. sarmentosa (Wahlenb.) Hedenäs – Fr; 1,2,3,4; S+.
W. trichophylla (Warnst.) Tuom. & T.J. Kop. – Rar; 2,3.
W. tundrae (Arnell) Loeske – Sp; 2,3,4; S+.
Weissia brachycarpa (Nees & Hornsch.) Jur. – Rar; 2; S+.

EXCLUDED SPECIES

Anoectangium aestivum (Hedw.) Mitt. (Fedosov, 2006) – The specimen was reidentified as *Hymenostylium recurvirostrum* (Ignatova, 2008).
Dicranum pseudacutifolium Otnyukova – specimen reidentified as *D. bardunovii*.
Gymnostomum boreale Nyholm & Hedenäs (Fedosov, 2007a) – Taxon with questionable status; specimens were reidentified as *G. aeruginosum.*
Sphagnum auriculatum – was cited for Ary-Mas area (Fedosov & Afonina, 2009). Specimen was reidentified as *S. beringiense.*
S. inundatum – was cited for Ary-Mas area (Fedosov & Afonina, 2009). Specimens were reidentified.
Weissia exserta (Broth.) P.C. Chen (Fedosov, 2006) – Specimen was reidentified as *W. brachycarpa*.

ACKNOWLEDGEMENTS

We are grateful to E.B. Pospelova & I.N. Pospelov for help with field work arrangement and to V.I. Zolotov for *Bryum* specimens identification. The work was partly supported by the Federal program «Scientific and educational personalities of innovative Russia 2009-2013», government contracts №№ 16.740.11.0680, 14.740.11.0165 & 16.740.11.0177 and Biodiversity Program of RAS.

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