

BRYOPHYTE FLORA OF THE "LEDYANAYA BAY" KEY PLOT
(BYRRANGA RANGE, TAIMYR, SIBERIAN ARCTIC)

БРИОФЛОРА КЛЮЧЕВОГО УЧАСТКА «БУХТА ЛЕДЯНАЯ»
(ГОРЫ БЫРРАНГА, ТАЙМЫР, СИБИРСКАЯ АРКТИКА)

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Abstract

The "Ledyanaya Bay" key plot is situated in the centre of Taimyr Peninsula (74°32' – 74°54' N, 99°13' – 100°11' E) on southern slope and on foothills of Byrranga Range. The local moss flora of Byrranga is investigated for the first time. It includes 233 species, 1 subspecies and 5 varieties of mosses. Richness of this moss flora much exceeds any of previously studied local floras of Taimyr. Annotated check-list includes species frequency, habitat characteristics and associated species. Forty eight species, 1 subspecies and 1 variety have found in Taimyr Peninsula for the first time. Moss composition of the main mesohabitats is described.

Резюме

Ключевой участок бухта Ледяная расположен в центральной части полуострова Таймыр (74°32' – 74°54' с. ш., 99°13' – 100°11' в.д.) на южном макросклоне и в предгорьях плато Бырранга. Впервые на плато Бырранга изучена локальная флора мхов. Она насчитывает 233 вида, 1 подвид и 5 разновидностей мхов. Богатство флоры мхов Бухты Ледяной существенно превышает богатство всех сопредельных локальных флор мхов. Приводится аннотированный список с характеристикой частоты встречаемости, перечислением местообитаний и сопутствующих видов. Сорок восемь видов, один подвид, одна разновидность мхов указываются для Таймыра впервые. Описаны основные моховые группировки исследованного района.

INTRODUCTION

Currently only 5 relatively complete moss floras of Taimyr Peninsula have been studied (Fig 1). They mostly belong to the plain territories of southern, western and northern Taimyr, avoiding a central part of the peninsula, which is occupied by Byrranga Range. The present paper is based on the material obtained by first author in 11.VI.2004 – 15.VIII.2004 during an expedition of the workgroup of Taimyr State Reserve at the shores of Ledyanaya Bay of Taimyr Lake. During the processing of this data about 3400 identifications were made.

The key plot "Ledyanaya Bay" is situated at the northeastern border of the main territory of Taimyr Reserve, 74° 32' – 74° 54' N, 99° 13' – 100° 10.5' E. The examined area encompasses about 400

km². The territory is occupied mainly by foothills and tablelands of Central mountain ridge of Byrranga, with the average elevation of 150-300 m and a maximum of 375 m. The mountain area is composed of a system of 5-6 parallel ridges of Hercynian rugosity, gradually ascending in a northerly direction. The southern slope of the Byrranga range descends to the shore of Taimyr Lake (5 m alt.), forming a strongly partitioned gentle slope that is subdivided into three steps. The topography of the mountains is quite gentle and peneplained; it is mostly composed of siltstones with strata of quartzite. Outcrops of limestone and sandstone form flat fields that are strongly dissected near their borders by erosion. Numerous intrusions of gabbro-diorites form dike complexes or ridge-like rock massifs on mainly flat landscape.

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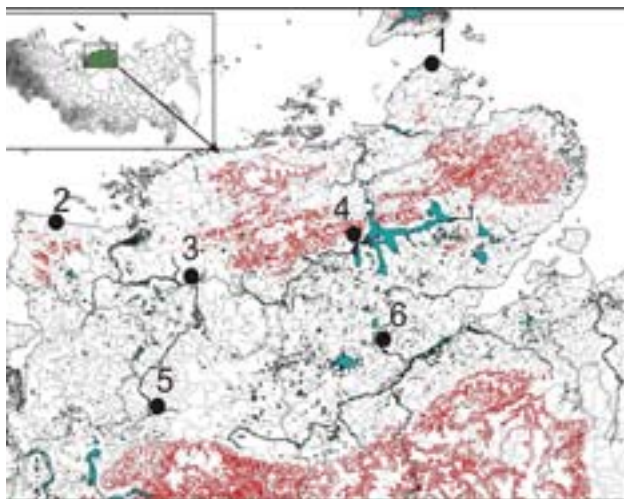


Fig. 1. Ledyanaja Bay and other local moss floras of Taimyr. – Рис. 1 Бухта Ледяная и некоторые другие локальные бриофлоры Таймыра.

1. Chelyuskin Cape – Мыс Челюскин / (Blagodatskikh & al., 1979; Afonina, 2004b): 88 species;
2. Mouth of Uboynaja River – Устье р. Убойной / (Kannukene & Matveyeva, 1996), with additions: 169 species;
3. Vicinity of Tareya settlement, middle course of Pyasina River – Окрестности пос. Тарейя, среднее течение р. Пясинны / (Blagodatskikh, 1974), with additions: 180 species;
4. Ledyanaja Bay of Taimyr Lake – Бухта Ледяная оз. Таймыр / present study: 235 species;
5. Vicinity of Kresty settlement – Окрестности пос. Кресты / (Kannukene & Matveyeva, 1986): 144 species;
6. Ary-Mas, middle course of Novaya River – Ары-Мас, среднее течение р. Новой / (Afonina, 1978): 141 species.

The foothills are composed of Carboniferous and Permian sediments forming a gentle relief subdivided by ridges of dike complexes and by table-like hills. Gentle and hilly plains are composed of sediments of complex colluvial-deluvial materials, excised by canyons of rivers and creeks with outcrops of parent material. Swamps are common in the lowlands.

The main range is dissected by valleys of the Karovaja and Uglensnaja Rivers. The foothill plain on Mutafi Cape is formed of moraine sediments of Muructin age (approximately corresponding to Valdai glaciation in the European Russia). It is characterized by hilly relief with average elevation about 120-170 m, is composed by tills and covered with rubbly cryo-eluvium. The southern shore of Ledyanaya bay is occupied by the deltaic plain of the Verhnyaja Taimyra River (Fig. 3). This plain have been formed as a result of marine transgression.

The region has an arctic climate that is distinctly continental with prolonged bleak winter and short cool summer. Annual average temperature is about -14.5°C , with only three summer months with mean temperatures above 0°C (Fig. 2). In addition, the region is influenced by cooling effect of Taimyr Lake, the largest arctic freshwater reservoir. January average temperature is -30.6°C with minimal value -45.7°C . July average temperature is $+6^{\circ}\text{C}$, but locally it may be up to $+24^{\circ}\text{C}$. Annual precipitation is 250-300 mm with maximum in warmer part of year (summer and September). Snow cover arrives in September and remains until June. Strong winter winds influence snow depth, and its thickness varies from 0 cm on steep slopes to 2-5 m in canyons where late lying snow-

fields may form. The active layer of soil varies from 30 to 100 cm.

VEGETATION AND MAIN MOSS HABITATS

The southern slope of Byrranga Range is gentle and does not protect the study area from the northern winds, and local climatic condition is cool in comparison with similar neighboring areas. As a result, no temperature inversions are observed at the slope base. Shrubs dominate the vegetation of all watersheds. The **zonal watershed's vegetation** is dominated by a tundra association composed of *Dryas punctata*¹ + *Carex arctisibirica* + mosses, usually called “spotty tundra” due to numerous spots of “boiled soil”. It occupies relatively well drained watersheds and low tablelands. Pioneer mosses occur on patches of bare soil (frost-boils): *Ceratodon purpureus*, *Dicranella crista*, *D. cerviculata*, *Cnestrum alpestre*, *Distichium capillaceum*, *Bryoerythrophyllum ferruginascens*, *Dichodontium pellucidum*, *Encalypta alpina*, *E rhaptocarpa*, *Pohlia andrewsii*, *Stegonia latifolia*, *Timmia comata*. Turf bulwarks around these frost-boiled spots are covered with *Hylocomium splendens* var. *obtusifolium*, usually with admixture of *Abietinella abietina*, *Aulacomnium turgidum*, *Pohlia nutans*, *Racomitrium lanuginosum*, *Rhytidium rugosum*, *Dicranum elongatum*, *D. acutifolium*, *D. spadiceum*, *Ditrichum flexicaule*, *Sanionia uncinata* etc. In depressions between hummocks *Tomentypnum nitens* dominates, abundantly occur also *Campylopusium stellatum*, *Oncophorus wahlenbergii*, *Sanionia uncinata*, *Philonotis fontana*, *Bryum pseudot-*

¹ – Nomenclature of vascular plant is according to Pospelova (1998), of hepatics – according to Konstantinova & al. (1992).

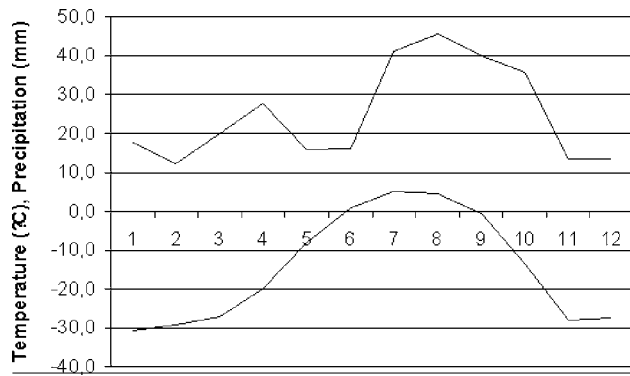


Fig. 2. Precipitation and temperature of Taimyr Lake vicinity (meteostation Ozhidaniya Bay), by months. – Рис. 2. Осадки и температура окрестностей оз. Таймыр (данные метеостанции «Бухта Ожидания»), по месяцам.

riquetrum, *Brachythecium mildeanum*, *Calliergon giganteum*, *C. richardsonii*, *Polytrichastrum alpinum*, *Limprichtia revolvens*, *Warnstorfia sarmentosa*, *Ptilidium ciliare*, *Sphenolobus minutus*. *Ptilidium ciliare* dominates in wet thermokarst depressions.

Dryas – herbaceous – mossy ‘medallion’ tundra develops on **rubbly (neutral rock) soils** at elevations of 150 to 350 m. Above 250 m *Dryas punctata* is gradually replaced by *Salix polaris*, *Cassiope tetragona*, and *Poa glauca* communities, with overall cover of 20-50%. The moss layer consists of *Hylocomium splendens* var. *obtusifolium* with *Abietinella abietina*, *Rhytidium rugosum*, *Hypnum vaucheri*, *H. revolutum*, *Sanionia uncinata* (dominant species). Frequent species include *Andreaea rupestris* var. *papillosa*, *Aulacomnium turgidum*, *Brachythecium mildeanum*, *Bryoerythrophyllum recurvirostrum*, *Bryum* sp., *Dicranum acutifolium*, *D. spadiceum*, *Ditrichum flexicaule*, *Distichium capillaceum*, *Encalypta alpina*, *E. rhamnifera*, *Hypnum bambergeri*, *Hypnum cupressiforme*, *Ortotrichum iwatsukii*, *Pohlia nutans*, *Pseudostereodon procerrimus*, *Racomitrium* spp., *Schistidium frigidum*, *Tetralophosia setiformis*, etc. A similar vegetation occupies ancient marine terrace surfaces, glacial terraces and their talus slopes.

The vegetation of **tablelands and gentle slopes formed of limestone** differs somewhat, and the vegetation cover is no more than 15%, consisting of separate tufts in depressions of microrelief. Besides *Dryas punctata*, other calciphilous species include *Puccinella* spp., *Poa abbreviata*, *Papaver polare*, *Braya purpurascens*, *Eritrichium villosum* ssp. *pulvinatum*, *Tephroses heterophylla*. The moss layer is dominated by *Abietinella abietina*, *Hylocomium splendens* var. *obtusifolium*, *Hypnum vaucheri*, *Pseudostereodon*

procerrimus, *Syntrichia ruralis*. Also common are *Encalypta procera*, *Kiaeria blyttii*, *Tortula mucronifolia*, etc.

At about the same elevation (150-350 m), **rocky ecotopes with gabbro-diorite or siltstone ground** occur. Vegetation cover varies from 5 to 20%. It is represented by tundra communities of mosses and herbs with *Dryas punctata* and *Salix polaris*, and also by petrophilous vegetation of herbs, lichens and mosses. Composition of mosses depends on type of rock and moisture conditions. Bare damp gabbro-diorite rocks are commonly characterized by *Dicranoweisia crispula*, *Andreaea rupestris* var. *papillosa*, *Grimmia elatior* (mainly in cracks), *G. longirostris*, *Racomitrium panschii*, *Cynodontium tenellum*, *Tetralophosia setiformis*; turfed rocks are covered with *Abietinella abietina*, *Rhytidium rugosum*, *Racomitrium lanuginosum*, and *Distichium capillaceum*. The edges of snowfields are characterized by *Hygrohypnum polare*, *Pseudohygrohypnum subeugyrium*, *Pseudocalliergon turgescens*, and *Ortothecium chryseon*. Relatively dry gabbro-diorite rock outcrops are poor in mosses, with the occasional occurrence of *Amphidium mougeotii*, *Grimmia longirostris*, *Stegonia latifolia*; deep dry cracks support *Neckera pennata*.

Gabbro-diorite cliff crevices and ledges are commonly covered by *Dicranoweisia crispula*, *Isopterygiopsis pulchella*, *Orthotrichum iwatsukii*, *Pohlia cruda*, *Pterigynandrum filiforme*, *Blepharostoma trichophyllum* var. *brevirete*, *Gymnomitrium concinnatum*. Occasionally one can also find *Andreaea rupestris* var. *papillosa*, *Bryoerythrophyllum recurvirostrum*, *Cnestrum alpestre*, *Cynodontium strumiferum*, *C. tenellum*, *Dichodontium pellucidum*, *Didymodon icmadophyllus*, *Distichium capillaceum*, *Ditrichum flexicaule*, *Eurhynchium pulchellum*, *Grimmia elatior*, *G. longirostris*, *Hypnum cupressiforme*, *Mni-*

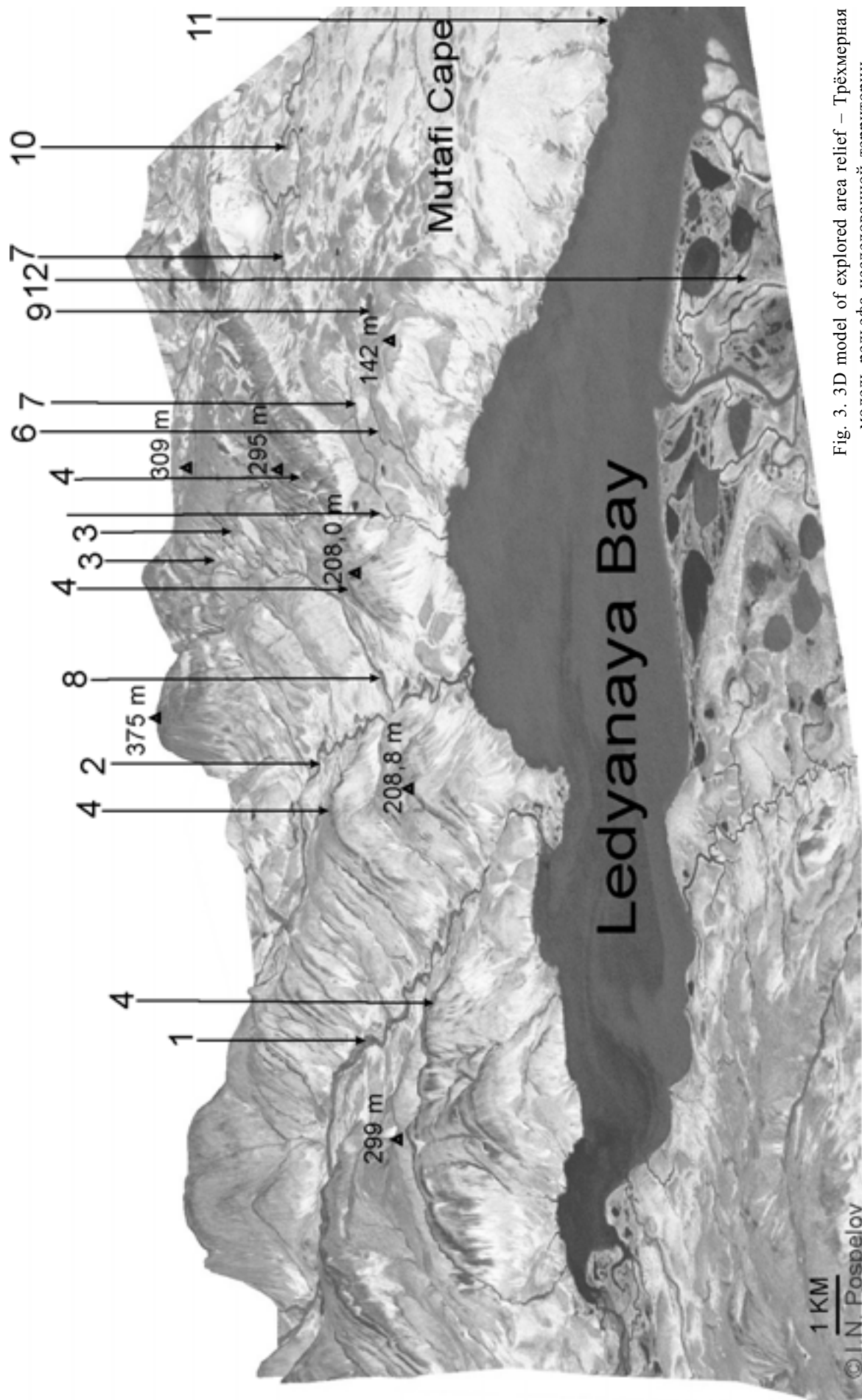


Fig. 3. 3D model of explored area relief – Трёхмерная модель рельефа исследованной территории

1 – Кароуауа River – р. Каровая; 2 – Uglenoznaуа River – р. Угленосная; 3 – Limestone outcrops – выходы известняков; 4 – Gabbro-diorite ridges – габбро-диоритовые хребты; 5 – Pereval'nyu Creek – ручей Перевальный; 6 – Obryvistyu Creek – ручей Обрывистый; 7 – Dike complexes – дайковые комплексы; 8 – Primetnyu Creek – ручей Приметный; 9 – Melkoe Lake – озеро Мелкое; 10 – Neravil'nyaуа River – р. Неравильная; 11 – Rusyuokova Cape – Кордон «Мыс Рысюкова»; 12 – Verkhnyaуа Taimyга River estuary – дельта р. Верхняя Таймыра.

um spp., *Myurella julacea*, *Plagiothecium bergrenianum*, *P. cavifolium*, *Pohlia nutans*, *Polytrichastrum alpinum*, *Pseudoleskeella rupestris*, *Saelania glaucescens*, *Schistidium papillosum*, *S. platyphyllum*, *S. rivulare*, *Timmia austriaca*, *T. comata*, *Tortella alpicola*, *Leiocolea heterocolpos*, *Scapania spitsbergensis*, *Tritomaria quinquedentata*, etc. The species composition of mosses varies depending on microclimatic conditions, elevation, and other environmental characteristics.

Siltstone outcrops are common at slopes of foothill creek canyons. The composition of bryophytes dominating there differs from those of gabbro-diorite outcrops. The most abundant are *Bryoerythrophyllum recurvirostrum*, *Didymodon icmadophyllus*, *Distichium capillaceum*, *Ditrichum flexicaule*, *Ortotrichum iwatsukii*, *Myurella julacea*, *Encalypta rhaptocarpa*, *E. procera*, *Syntrichia ruralis*, *Hypnum revolutum*, *H. cupressiforme*, rather frequent are *Bryoerythrophyllum ferruginascens*, *Pogonatum dentatum*, *Pseudostereodon procerrimus*, *Kiaeria blyttii*, *Syntrichia norvegica*. Species that dominate at gabbro-diorite cliffs (*Andreaea rupestris* var. *papillosa*, *Dicranoweisia crispula*, *Grimmia* spp.) are rare or absent on this kind of rocks, although this fact might be caused as well by microclimatic difference in places of ourcrops.

On bare **limestone surfaces** *Seligeria tristichoides* and *Grimmia anodon* occasionally settle, while crevices and other niches of these rocks are suitable for *Bryoerythrophyllum recurvirostrum*, *Syntrichia ruralis*, *Encalypta procera*, *Isopterygiopsis pulchella*, *Pseudoleskeella tectorum*, *Ditrichum flexicaule*, *Ortothecium strictum*, *Timmia austriaca*, *Tortula mucronifolia*, *Hymenostylium recurvirostre*, *Platydictya jungermannioides*, *Trichostomum* spp., etc. Turf-covered limestones are covered with *Dicranum acutifolium*, *D. spadiceum*, *Distichium* spp., *Ditrichum flexicaule*, *Encalypta procera*, *Kiaeria blyttii*, *Ortothecium strictum*, *Pseudostereodon procerrimus*, *Syntrichia ruralis*, *Tortula mucronifolia*, *Bryoerythrophyllum* spp., *Bryum* sp., *Didymodon asperifolius* var. *gorodkovii*, *Grimmia anodon*, *Encalypta* spp., *Pohlia nutans*, etc.

Mountain habitats higher than 350 m have herb-lichen dominated communities with *Physcia algida*, *Poa abbreviata*, *Papaver polare*, *Festu-*

ca hyperborea, *Myosotis asiatica*, etc.; dominant moss species include *Racomitrium panschii*, *Polytrichum piliferum*, *Polytrichastrum alpinum*, *Tetralophozia setiformis*. Some dominant species in rubbly shrubby-mossy tundra, especially in depressions, include *Abietinella abietina*, *Hylocomium splendens* var. *obtusifolium*, *Hypnum* spp., and *Rhytidium rugosum*. The ‘cryophilic desert belt’ presented in the Higher Byrranga was not observed in the study area.

Relatively **steep talus slopes** (more than 15°) have herb communities composed of *Poa pseudoabbreviata*, *Papaver polare*, *Draba* spp., *Tephrosieris heterophylla*, *Cystopteris dickieana*, etc. Species richness on limestone rocks increases with the addition of *Deschampsia glauca*, *Elymus vassiljevi*, *Puccinella byrrangensis*, *Astragalus tolmaczewii*. Total vegetation cover varies from 10 to 50% (Pospelova & Pospelov, unpubl.). Mosses of calcareous talus slopes include *Hypnum cupressiforme*, *H. vaucheri*, *Bryoerythrophyllum recurvirostrum*, *Didymodon asperifolius* var. *gorodkovii*, *Encalypta procera*.

Gentle slopes with loamy and rubbly ground are characterized by deluvial process over the permafrost layer. As a result, so-called ‘dell complexes’ are formed, representing specific alternation of turfed beds (ass. *Dryas punctata* - *Carex arctisibirica* - *Tomentypnum nitens* + *Hylocomium splendens* var. *obtusifolium*) and narrows (ass. *Salix* spp. – *Erioporum vaginatum* – mosses). The composition of mosses in the turfed bed association is similar to one on hummocks of spotty tundra. The moss vegetation in narrows is composed of *Meesia triquetra*; *Ortothecium chryseon*, *Pseudocalliergon brevifolius*, *Tortella tortuosa*, *Warnstorfia sarmentosa* as local dominants. Also common are *Bryum cryophilum*, *B. pseudotriquetrum*, *Calliergon giganteum*, *C. richardsonii*, *Campylium stellatum*, *Cinclidium arcticum*, *C. latifolium*, *Limprichtia revolvens*, *Meesia uliginosa*, *Oncophorus wahlenbergii*, *Philonotis fontana*, *Sphagnum teres*, *S. russowii*, *S. aongstroemii*, *S. warnstorffii*, *Tomentypnum nitens*, *Tortella arctica*, *Aulacomnium palustre*, *A. turgidum*, *Catoscopium nigratum*, *Philonotis tomentella*, *Rhizomnium andrewsianum*, *Schistidium papillosum*, *Sphagnum balticum*, *S. lenense*, *S. subsecundum*, *Frullania nisquallensis* and *Herbertus*

sakuraii. Hummock-hollow topography is formed at the base of gentle deluvial slopes, with hummocks covered by *Campylium stellatum*, *Oncophorus wahlenbergii*; *Sphagnum russowii*, *Sphenolobus minutus*, and hollows covered by *Pseudocalliergon brevifolius*, *Tomentypnum nitens*, *Limprichtia revolvens*, *Sphagnum teres*, *Warnstorfia sarmentosa* and *Mesoptychia sahlbergii*. The importance of *Meesia triquetra*, *Ortothecium chryseon*, *Tortella tortuosa* decreases in hummock-hollow complex and the frequency of *Sphagnum* increases.

Gentle loamy slopes of marine and glacial terraces and on landslides of Uglensnaya and Karovaya Rivers are occupied by cotton-grass and sedge-mossy tundra with total vegetation cover about 100%. This high cover is mainly due to herbs with moss cover generally low and species composition poor. The dominant mosses are *Tomentypnum nitens*, *Campylium stellatum*, *Oncophorus wahlenbergii*, and *Plagiomnium curvatulum*; rather frequent are *Aulacomnium spp.*, *Brachythecium mildeanum*, *Calliergon giganteum*, *C. cordifolium*, *C. richardsonii*, *Cirriphylum cirrosum*, *Dicranum laevidens*, *Limprichtia spp.*, *Rhizomnium andrewsianum*, *Sanionia uncinata*, *Straminergon stramineum*, *Warnstorfia sarmentosa*, *Chiloscyphus spp.* Hillock remnants and hummocks are dominated by *Aulacomnium spp.*, *Dicranum elongatum*, *D. laevidens*, *Polytrichum hyperboreum*, *P. strictum*, *Sphagnum squarrosum*, *S. subsecundum*, *S. russowii*, and *Lophozia ventricosa*.

Limestone massif dell complexes have less diverse vegetation. Herb communities are composed mainly by *Puccinella byrrangensis*, *Carex macrogyna*, *Eriophorum callitrix*, moss communities are dominated by *Tomentypnum nitens*, *Ortothecium chryseon*, *Pseudocalliergon brevifolius*, *Tortella spp.*, *Ditrichum flexicaule*, *Didymodon asperifolius* var. *gorodkovii* etc., with hummocks of *Campylium stellatum*, *Catoscopium nigrum*, *Dicranum elongatum*, *Sphagnum russowii*, *S. girgensohnii*, *S. fimbriatum*, *Hylocomium splendens* var. *obtusifolium*.

Homogenous sedge-moss and mossy mires occur in the Verkhnyaya Taimyra River valley and in depressions of former lakes drained by termokarst. Total vegetation cover reaches 100%,

mainly due to mosses, but their species composition is relatively poor because of homogeneous conditions: *Hamatocaulis vernicosus*, *Limprichtia revolvens* and *Warnstorfia sarmentosa* prevail, while *Aulacomnium palustre*, *Bryum cryophilum*, *B. pseudotriquetrum*, *Cinclidium latifolium*, *C. subrotundum*, *Meesia triquetra*, *Oncophorus wahlenbergii*, *Pseudocalliergon brevifolius*, *Calliergon cordifolium*, *C. giganteum* and other mire mosses are rather frequent.

Polygonal mires occupy large areas on the southern shore of the Ledyanaya Bay, but become rare and less developed on its northern shore – in Uglensnaya and Karovaya River valleys. They are composed of numerous polygons separated by flooded ditches. Typical polygons are slightly concave and have wet, sometimes flooded center with a vegetation and moss composition similar to that of homogenous mires. *Pseudocalliergon brevifolius* dominates in shallow "lakes" of the polygon centres, and this is the only habitat where *Scorpidium scorpioides* occurs. Moisture availability gradually decreases toward the margins which are occupied by relatively well-drained turf billows and communities of *Sphagnum teres*, *S. subsecundum*, *S. squarrosum*, *Oncophorus wahlenbergii*, *Tomentypnum nitens*, *Campylium stellatum*, *Polytrichastrum alpinum*, *Polytrichum hyperboreum*, *P. strictum*, *P. juniperinum* as well as other tundra' mosses. Ditches are dominated by hydrophilous moss communities – in addition to those listed for homogenous mires, *Sphagnum obtusum*, *S. orientale* and *Warnstorfia exannulata* also occur here.

Ledyanaya Bay northern shore is bordered with **pebbly gravel bars**, sometimes covered by silty sediments; the creek and river banks are similar. Mosses in this habitat can be divided into two groups: (1) pioneers of silty sediments and (2) hygrophytes growing on stones in water or near it. Most abundant silty sediment pioneers are *Bryum pseudotriquetrum*, *Campylium stellatum*, *Ceratodon purpureus*, *Philonotis fontana*, *Hennediella heimii* var. *arctica*, *Dicranella grevilleana*, rather frequent are also *Brachythecium turgidum*, *Calliergonella lindbergii*, *Dichodontium pellucidum*, *Dicranella schreberiana*, *Ditrichum cylindricum*, *Drepanocladus aduncus*, *Meesia uliginosa*, and *Pseudocalliergon brevifo-*

lius. Wet stones at the shore are covered by *Calliergonella lindbergii*, *Fontinalis antipyretica* var. *gracilis*, *F. hypnoides*, *Hygrohypnum alpestre*, *H. luridum*, *H. polare*, *Schistidium platyphyllum*, *S. pulchrum*, *S. rivulare*, *Scouleria aquatica*, *Warnstorfia exannulata*, and *W. fluitans*. *Racomitrium panschii*, *Brachythecium turgidum*, *Sanionia uncinata*, *Syntrichia ruralis* dominate on relatively dry beach stripes, and *Brachythecium mildeanum*, *Ceratodon purpureus*, *Distichium capillaceum*, *Ditrichum flexicaule*, *Encalypta alpina*, *E. rhaptocarpa*, *Polytrichastrum alpinum*, *Schistidium frigidum*, *S. agassizii*, *Timmia austriaca*, and *T. comata* are also more or less abundant.

On the **lowermost Ledyanaya Bay terrace** geese usually cast their feathers, and that leads to habitat eutrophication and development of communities with *Eriophorum vaginatum*, *Gastrolychnis apetala*, *Saxifraga* spp., *Papaver variegatum*, *Cochlearia lenensis*. Mosses include *Aulacomnium turgidum*, *Brachythecium turgidum*, *Bryum cryophyllum*, *B. intermedium*, *B. neodamense*, *B. pseudotriquetrum*, *Campylium stellatum*, *Ceratodon purpureus* var. *purpureus* and var. *rotundifolius*, *Dichodontium pellucidum*, *Distichium capillaceum*, *Ditrichum flexicaule*, *Oncophorus wahlenbergii*, *Philonotis fontana*, *Pohlia andrewsii*, *P. nutans*, *Polytrichastrum alpinum*, *Polytrichum jensenii*, *Pseudocalliergon brevifolius*, *Sanionia uncinata*, *Timmia comata*, and *Tortella fragilis*.

Ledyanaya Bay shores composed of loamy moraine sediments have low landslides cutted by creek canyons. At places baydzharakh massifs occur there; it is a specific relief formed in the course of melting of polygonal ice veins (often near slopes), resulting in a massif of steep-sloped hills, 1-10 m high, often standing in chess-board order. Slopes of baydzharahks represent all stages of succession, with numerous eroded faces, while their tops are occupied by meadow-grass vegetation. On **bare moraine ground** there are communities of pioneer mosses dominated by *Dicranella crispa*, *Psilopilum cavifolium* and *P. laevigatum*. Other mosses are much less frequent there, including *Bryoerythrophyllum recurvirostrum*, *Cnestrum alpestre*, *Dichodontium pellucidum*, *Dicranella subulata*, *D. grevilleana*, *Fis-*

sidens viridulus, *Funaria hygrometrica*, *Hennediella heimii* var. *arctica*, *Leptobryum pyriforme*, *Pogonatum dentatum*, *P. urnigerum*. Turf-covered stripes and frost crevices are overgrown with *Bartramia ithyphylla*, *Brachythecium mildeanum*, *B. velutinum*, *Bryobrittonia longipes*, *Cirriphyllum cirrosum*, *Eurhynchium pulchellum*, *Isopterygiopsis pulchella*, *Myurella tenerrima*, *Plagiothecium cavifolium*, *P. denticulatum*, *Pohlia cruda*, *P. nutans*, *Polytrichastrum alpinum*, *Saelania glaucescens*, and *Timmia* spp.

Other pioneer moss communities occur on **loamy and rubbly borders of foothill creek canyons**. *Abietinella abietina*, *Aulacomnium turgidum*, *Brachythecium mildeanum*, *B. velutinum*, *Bryoerythrophyllum recurvirostrum*, *Cirriphyllum cirrosum*, *Dichodontium pellucidum*, *Dicranella crispa*, *Dicranum acutifolium*, *D. spadicum*, *Distichium capillaceum*, *Ditrichum flexicaule*, *Eurhynchium pulchellum*, *Hypnum cupressiforme*, *Mnium* spp., *Myurella* spp., *Orthothecium chryseon*, *Plagiomnium curvatulum*, *Pogonatum* spp., *Pohlia nutans*, *P. cruda*, *Polytrichum juniperinum*, *Sanionia uncinata*, *Schistidium papillosum*, *Syntrichia ruralis*, *Tetraplodon mnioides*, *Timmia austriaca*, *T. comata*, and *Tortella tortuosa* grow there. Rubbly and loamy canyon slopes are characterized by *Encalypta procerca*, *E. rhaptocarpa*, *Fissidens viridulus*, *Hypnum revolutum*, *Polytrichum piliferum*, *Schistidium frigidum*, *S. papillosum* moss composition.

Disturbed places are few and include those impacted by previous expeditions, e. g. old roads and waste constructions. Dominant species are *Ceratodon purpureus* and some species that are rare in natural habitats, e.g. *Bryum arcticum*. *B. argenteum*, *B. creberrimum*, *B. pallens*, *Dicranella subulata*, *Syntrichia ruralis*. Moist places are occupied by *Marchantia polymorpha*, which can be abundant. Other frequent species include *Brachythecium mildeanum*, *Cirriphyllum cirrosum*, *Dichodontium pellucidum*, *Dicranella crispa*, *Distichium capillaceum*, *Ditrichum flexicaule*, *Encalypta alpina*, *E. rhaptocarpa*, *Eurhynchium pulchellum*, *Funaria hygrometrica*, *Hennediella heimii* var. *arctica*, *Leptobryum pyriforme*, *Pogonatum urnigerum*, *Pohlia andrewsii*, *P. cruda*, *Pohlia nutans*, *Polytrichum juniperinum*, *P. piliferum*, *Psilopilum laevigatum*,

Sanionia uncinata, *Stegonia latifolia*, *Timmia austriaca*, *T. comata*, and *Tortula mucronifolia*. One species, *Tortula leucostoma*, was collected only in these secondary habitats.

Reindeer excrements, animal corpses and other **organic remnants** support species of the Splachnaceae family. In relatively dry places all these microhabitats are occupied by *Tetraplodon mnioides* and in moist ones by *Aplodon wormskjoldii*, *Splachnum sphaericum*, *S. vasculosum* and also by widespread mosses such as *Ceratodon purpureus* and *Pohlia nutans*.

LIST OF SPECIES

Nomenclature of taxa is cited mainly according to Afonina (2004a) with some changes and additions. Specimens are in MW. Each annotation includes species frequency, habitats and substrates. Associated species and occurrence as scattered plants, pure tufts, or continuous cover, etc. are usually indicated. Frequency is marked as follow: common (Com.) – species collected more than 15 times and having significant role in plant communities of the studied territory; frequent (Fr.) – collected 10-15 times; sporadic (Sp.) – 6-9 times; rare (Rar.) – 2-5 times; unique (Un.) – collected once. For species collected 1-3 times herbarium labels are cited. Species marked out by asterisk are reported for Taimyr for the first time.

Abietinella abietina (Hedw.) Fleisch. – Com. On hummocks in foothill tundra, on borders and rubbly slopes of canyons, remains of ancient marine terraces, on rock outcrops covered by turf. One of the most common species (with *Hylocomium splendens* var. *obtusifolium*, *Rhytidium rugosum* and *Ditrichum flexicaule*) in rubbly mountain tundra and in cryophilic steppe associations.

Aloina brevirostris (Hook. et Grev.) Kindb. – Un. On bare loamy soil of landslide on the southern shore of Ledyanaya Bay, with *Dicranella crispa*, *D. grevilleana*, *Ditrichum cylindricum*, *Psilopilum* spp.

**Amphidium mougeotii* (B.S.G.) Schimp. – Rar. On limestone rock outcrop, scattered stems in *Orthothecium strictum* and *O. chryseon* tuft; on gabbro-diorite cliff, with *Grimmia longirostris*; on calcareous eluvial slope base, with *Cinclidium arcticum*, *Campylium stellatum*, *Meesia uliginosa* and *Orthothecium chryseon*.

Andreaea rupestris Hedw. – Un. On pebbly bar of Ledyanaya Bay, compact pure tuft among *Distichium* spp., *Bryum* spp., *Pohlia* spp., *Aulacomnium turgidum*.

A. rupestris var. *papillosa* (Lindb.) Podp. – Fr. On moist gabbro-diorite cliffs and large rocks; sometimes form-

ing dense cover. Most abundant in nival belt, near late snowfields, in shady crevices. Usually occurs with *Grimmia longirostris*, *Racomitrium* spp., *Ortotrichum iwatsukii*, *Blepharostoma trichophyllum* var. *brevirete*, *Tetralophozia setiformis*.

**Aongstroemia longipes* (Somm.) B.S.G. – Un. On creek sediments under limestone outcrops; scattered plants among *Dicranella humilis*, *Distichium* spp., *Ceratodon purpureus*, *Gymnomitrium corallioides*. The database of the Taimyr Reserve includes also some unpublished data on the locality of this species in the basin of Verkhnyaya Taimyra River.

Aplodon wormskjoldii (Hornem.) Kindb. – Sp. On reindeer excrements in moist habitats: in different types of tundras, mainly in foothill tundra, and in mires.

Aulacomnium palustre (Hedw.) Schwaegr. – Fr. In wet foothill shrubby-mossy and cotton-grass-sedge tundra, on hillocks and polygonal mires (frequently with *Sphagnum* species), wet slope bases and hillside swamps, usually among *Sphagnum* on hummocks.

A. turgidum (Wahlenb.) Schwaegr. – Com. One of most common species in foothill spotty and hummocky tundra with *Dryas punctata*, *Carex arctisibirica*, *Novosiversia glacialis*, *Luzula* spp., *Saxifraga* spp.; often forming compact tufts among *Tomentypnum nitens*, *Hylocomium splendens* var. *obtusifolium* and *Ptilidium ciliare*. Common in rubbly mountain tundra with *Hylocomium splendens* var. *obtusifolium*, *Abietinella abietina*, *Hypnum* spp. Sporadically occurs in moist tundra and in different mires. Also occurs in pioneer moss associations of moist loamy ground.

**Barbula convoluta* Hedw. – Un. On pebbly bank of Obryvisty creek, on loamy substratum, scattered plants among *Ceratodon purpureus*, *Didymodon icmadophyllus*, *Dicranella subulata*.

Bartramia ithyphylla Brid. – Sp. Mostly in shady habitats: in tundra under dense cover of *Dryas*, on loam in niches and crevices of gabbro-diorite cliffs, at borders of frost-boils in spotty tundra, on turf-covered slopes of baidzharachs, on landslides. Usually as scattered plants or small loose tufts with *Cnestrum alpestre*, *Conostomum tetragonum*, *Pohlia* spp., *Bryoerythrophyllum* spp., etc.

B. pomiformis Hedw. – Sp. In foothill spotty and hummocky tundra, at banks of creeks and lakes, on eluvial slope bases and hillside mires, in nival habitats. Forms dense pure cushions.

Brachythecium mildeanum (Schimp.) Schimp. – Sp. Most abundant in foothill cotton-grass or sedge tundra, along with *Cirriphyllum cirrosum*, *Plagiomnium* spp., *Aulacomnium palustre* and other species; in valleys of creeks and in shrubby-mossy associations at canyon bottoms, in places with disturbed turf cover. More rarely it occurs in spotty and hummocky

- tundra, on hillocky or polygonal mires; avoids mountain habitats.
- B. turgidum* (Hartm.) Kindb. – Sp. On bare mineral ground with different grain composition: on overgrown pebbly bars, silty and sandy sediments along streams, on sand of the shore billows, mainly with *Pohlia* spp., *Dicranella* spp., *Philonotis fontana* and other species of bare soil.
- B. velutinum* (Hedw.) B.S.G. – Sp. On loamy substratum in niches of cliffs, on slopes of baydzharachs, on borders of steep canyons, on tundra soil under dense cover of *Dryas*, mostly with *Cirriphyllum cirrosum*, *Eurhynchium pulchellum*, *Pohlia* spp., *Bartramia itchyphylla*, etc.
- Breidleria pratensis* (Koch) Loeske – Rar. On loamy slopes of creeks, as scattered plants among *Cirriphyllum cirrosum*, *Eurhynchium pulchellum*, *Timmia* spp., etc.
- Bryobrittonia longipes* (Mitt.) Horton – Un. On silty sediments of Uglenosnaja River in its estuary, as scattered plants with *Molendoa sendtneriana*, *Ceratodon purpureus*, *Dicranella* spp., *Pohlia* spp., etc.
- **Bryoerythrophyllum ferruginascens* (Stirt.) Giac. – Sp. On loam in niches of siltstone and limestone cliffs, on slopes of baydzharachs and canyons, on frost-boils in spotty tundra. Forms pure tufts or grows with other acrocarpous pioneer mosses of loamy bare soil.
- B. recurvirostrum* (Hedw.) Chen – Fr. On soil in cracks, ledges and niches of gabbro-diorite, siltstone and limestone cliffs, on different bare soil microhabitats in calcareous tundra. Usually occurs with *Encalypta alpina*, *E. rhaptocarpa*, *Didymodon icmadophyllus*, *Pohlia* spp., etc.
- Bryum arcticum* (R.Br.) B.S.G. – Sp. In foothill tundra, mostly in places with undeveloped or disturbed turf cover: on frost-boils, landslide borders, in disturbed places, with other *Bryum* species, *Ceratodon purpureus*, *Pohlia* spp., etc.
- B. argenteum* Hedw. – Rar. On silty sediments in crack of siltstone outcrop at the border of northern shore of Ledyanaya Bay; on dry site of overgrown shore, with *Brachythecium mildeanum*. In both cases forms compact pure tufts.
- B. creberrimum* Tayl. – Sp. In cryophilic steppe associations on remains of ancient marine terraces, on dry fine soil trains under limestone outcrops, on ruins of woody building. Pioneer species of relatively dry habitats with undeveloped or disturbed turf cover; grows with *Leptobryum pyriforme*, *Ceratodon purpureus* and *Dicranella subulata*.
- B. cryophilum* O.Mart. – Com. In wet foothill tundra and different mires (usually with *Bryum pseudotriquetrum*), on hillside mires and dell complexes, in wet nival habitats, frequently with *Meesia* spp., *Distichium capillaceum* and *Orthothecium chryseon*, dominates in places with later snow melt. Besides this it settles on wet silty and sandy sediments with other *Bryum* species, *Philonotis fontana*, *Campyllum stellatum*, *Drepanocladus* spp., *Pohlia* spp., etc. It grows as scattered plants in mixed moss tufts or forms large pure tufts and covers. The most abundant *Bryum* species in study area.
- **B. dichotomum* Hedw. – Un. On slope of Obryvisty creek canyon, in niche of siltstone cliff covered with humus fine soil. Presented by small sterile plants with large gemmae (commonly one gemma per leaf axil).
- **B. elegans* Nees – Rar. In shady moist niches of gabbro-diorite cliffs and debris at cliff base, with *Andreaea rupestris* var. *papillosa*, *Dicranoweisia crispula*, *Grimmia longirostris*, in places with later snow melt; forms compact pure tufts.
- B. intermedium* (Brid.) Bland. – Un. On terrace of Ledyanaya Bay enriched during goose moulting and overgrown with *Eriophorum medium*, among *Bryum arcticum*, *Distichium* spp., *Encalypta rhaptocarpa*, *Pohlia* spp., etc.
- **B. neodamense* Jtzigs. – Rar. On overgrown terrace of Ledyanaya Bay; in wet coastal tundra with disturbed moss layer (old geologist station), with *Bryum arcticum* and *Ceratodon purpureus*.
- **B. neodamense* var. *ovatum* Lindb. et Arn. – Un. On overgrown rocky terrace of Ledyanaya Bay, with *Bryum arcticum*, *Distichium* spp., *Encalypta rhaptocarpa*, *Pohlia* sp., *Ceratodon purpureus* var. *rotundifolius*, *Philonotis fontana*, etc.
- B. pallens* Sw. – Rar. At places with disturbed moss and turf cover: on landslides at shores, slopes of baydzharachs, at anthropogenically transformed places. As scattered plants among *Ceratodon purpureus*, *Bryum* spp., *Distichium* spp., *Oncophorus* spp., *Brachythecium mildeanum*, etc., or as more or less pure compact tufts.
- B. pseudotriquetrum* (Hedw.) Gaertn. et al. – Fr. In quite different moist and wet habitats: in moist foothill tundra, different mires, at places with late snowfields temporary flooded places, at dell bottoms and lake shores, avoiding mountain habitats. Mainly mixed with *Timmia* spp., *Cinclidium* spp., *Rhizomnium andrewsianum*, *Plagiomnium curvatulum*, *Warnstorfia sarmentosa*, *Campyllum stellatum*, *Straminergon stramineum*, etc., or as pure tufts.
- **B. schleicheri* Schwaegr. – Un. At flooded strip of lake shore in estuary of Uglenosnaja River, as large pure tuft among *Cinclidium* spp., *Calliergon* spp., *Campyllum stellatum*, *Warnstorfia pseudostraminea*.
- B. teres* Lindb. – Rar. On overgrown terrace of Ledyanaya Bay, on relatively dry polygon of polygonal tundra strip in valley of Uglenosnaja River. As a pure

- tuft among *Distichium inclinatum*, *Fissidens osmundoides* and *Polytrichum* spp.
- B. wrightii* Sull. et Lesq. – Rar. On loamy substratum at frost-boil border; on baydzharach's slope at the shore of Ledyanaya Bay, with *Dicranella crispa*, *D. subulata*, *Psilopilum* spp., *Funaria hygrometrica*, etc.
- Callialaria curvicaulis* (Jur.) Ochyra – Un. On silty sediments at the shore of Ledyanaya Bay, as scattered plants among *Drepanocladus arcticus*, *D. aduncus*, *Campylium stellatum*, *Philonotis fontana*, *Calliergonella lindbergii*.
- Calliergon cordifolium* (Hedw.) Kindb. – Sp. In moist mossy tundra, homogenous and polygonal cotton-grass and sedge-mossy mires, willow-mossy associations of canyons bottoms. Most abundant in wetlands of southern shore of Ledyanaya Bay and in swampy river estuaries. Mostly at low altitudes, rare in foothill area and not found in the mountains. Mainly in mixed cover with *Warnstorfia sarmentosa*, *Campylium stellatum*, *Limprichtia revolvens*, *Cinclidium* spp., *Pseudobryum cinclidioides* and other hygrophilous mosses.
- C. giganteum* (Schimp.) Kindb. – Fr. In moist foothill tundra, in homogenous and polygonal mires, at lake and stream shores (usually submerged in water), in mountain swamps at wet slope bases and plateau. In mixture with other hygrophilous mosses or as pure covers in water.
- C. megalophyllum* Mik. – Rar. On eluvial slope bases, with *Pseudocalliergon brevifolium*, *Meesia triquetra*, *Catoscopium nigratum*, *Cinclidium* spp. etc., at the shores of mountain lakes. In contrast to previous species, it does not occur in foothill plain.
- C. richardsonii* (Mitt.) Kindb. – Sp. In different foothill mires, on wet polygons of polygonal mires, in cotton-grass and sedge foothill tundra, in flooded depressions in hummocky tundra, more rare in hillside mountain mires.
- Calliergonella lindbergii* (Mitt.) Hedenäs – Sp. On pebbly bar of Ledyanaya Bay, at creek and river banks on silt sediments, at the edges of shrub-mossy associations of dell bottoms. More rare on moist slopes of canyons and baydzharachs. Usually occurs with *Schistidium rivulare*, *Campylium stellatum*, *Drepanocladus aduncus*, *Philonotis fontana*, etc.
- Campylium protensum* (Brid.) Kindb. – Sp. In cotton-grass-sedge-mossy tundra, willow-mossy dell associations, with *Plagiomnium* spp., *Calliergon* spp., *Warnstorfia sarmentosa*, *Oncophorus wahlenbergii*, *Bryum pseudotriquetrum*, *B. cryophilum*; more rare on eluvial slope bases.
- C. stellatum* (Hedw.) Jens. – Com. Everywhere. One of the main dominants in foothill spotty, hummocky and hillocky tundra, different cotton-grass, sedge, willow-mossy tundras, mires, where it occurs mostly on hummocks. In wetter conditions (for example on homogenous mires) it is replaced by *Hamatocaulis vernicosus* and different species of Mniaceae. Very active pioneer species colonizing bare sandy, loamy and silty substrates. In mountains the species occurs mainly in dell complexes and eluvial slope bases.
- Catoscopium nigratum* (Hedw.) Brid. – Sp. On hillside swamps, dell complexes and on eluvial slope bases, especially abundant in wet calcareous associations. Forms very dense hummocks among cover of *Pseudocalliergon brevifolium*, *Orthothecium chryseon*, *Limprichtia revolvens*, *Hamatocaulis vernicosus*, *Meesia* spp., *Warnstorfia sarmentosa*, *Cinclidium* spp., etc.
- Ceratodon purpureus* (Hedw.) Brid. – Sp. Very expansive pioneer moss occurring on different loamy substrates, mainly in foothill plain: on silty sediments, strips with disturbed turf cover, at the borders of canyons and on frost-boils in spotty tundra, with *Bryum* spp., *Dicranella* spp., *Pohlia* spp., *Hennediella heimii*, *Tortula leucostoma*, etc.
- C. purpureus* var. *rotundifolius* Berggr. – Rar. On silty sediments of Ledyanaya Bay, and on its overgrown terrace, on the border of loamy frost-boils in spotty tundra. Always as scattered plants among *Philonotis fontana*, *Dichodontium pellucidum*, *Distichium* spp., *Bryum* spp., *Dicranella* spp., *Encalypta* spp., *Campylium stellatum*, *Aulacomnium turgidum*, etc., in more moist places than previous taxon.
- Cinclidium arcticum* B.S.G. – Fr. In mountain swamps, on eluvial slope bases; more rare in dells, homogenous mires, at flooded shores of tundra lakes on foothill plain. Forms very dense pure hummocks or grows mixed with *Warnstorfia sarmentosa*, *Pseudocalliergon brevifolium*, *Limprichtia revolvens*, *Meesia* spp., *Philonotis fontana*, *Campylium stellatum*, *Tomentypnum nitens*, *Calliergon* spp.
- C. latifolium* Lindb. – Fr. The habitat distribution of this species is similar to previous one, but it occasionally occurs in mountains and is more frequent in the foothill plains. It is common there in homogenous and polygonal mires, dells and in other wet habitats.
- C. subrotundum* Lindb. – Rar. On flooded polygons of polygonal mire at mountain table top, with *Hamatocaulis vernicosus* and *Pseudocalliergon brevifolium*, abundant; on homogenous mire in Karovaja river estuary, scattered stems in mixed tuft of *Campylium stellatum*, *Limprichtia revolvens*, *Straminergon stramineum*.
- Cirriphyllum cirrosum* (Schwaegr.) Grout – Fr. In foothill spotty, hummocky cotton-grass and sedge tundra, on places with disturbed turf cover, bare soil microhabitats, in cliff niches, usually with *Campylium stellatum*, *Calliergon* spp., *Brachythecium mildeanum*, *Plagiomnium curvatum*, *Hypnum* spp., etc.

- Cnestrum alpestre* (Wahlenb.) Nyholm ex Mogensen – Sp. On loamy and humus substratum in niches and crevices of gabbro-diorite cliffs, on baydzharach's slopes, on bare patches in spotty tundra. Mostly as relatively large and pure tufts, or as scattered plants among *Distichium spp.*, *Bryum spp.*, *Ceratodon purpureus* and other pioneer mosses.
- Conostomum tetragonum* (Hedw.) Lindb. – Sp. In foothill tundra at turf-covered slopes of cryogenic hills, billows of polygonal mires and tundras, on borders and walls of crevices in polygonal tundra, more rare at canyon borders. Forms dense cushions among *Distichium spp.*, *Bartramia ithyphylla*, *Ceratodon purpureus*, *Bryum spp.*, *Timmia spp.*, *Dicranum spadiceum* or grows in mixture with them.
- Cynodontium strumiferum* (Hedw.) Lindb. – Rar. On ledges and in niches of gabbro-diorite cliffs, on large rocks and turf-covered rock outcrops, with *Pohlia nutans*, *P. cruda*, *Amphidium mougeotii*, *Grimmia spp.*, *Schistidium spp.*, *Cynodontium tenellum*. Usually occurs in relatively dry places as large pure cushions.
- C. tenellum* (B.S.G.) Limpr. – Sp. In moist niches and at the bases of gabbro-diorite outcrops, on cliff ledges, with *Dicranoweisia crispula*, *Cnestrum alpestre*, *Grimmia elatior*, *Andreaea rupestris* var. *papillosa*, *Pohlia nutans*, *Racomitrium spp.*, *Bryum spp.*, *Scapania spitsbergensis*, *Blepharostoma trichophyllum*. As pure cushions or in mixture with other mosses, in more moist places than previous species.
- Cyrtomnium hymenophylloides* (Hüb.) Nyholm ex T. Kop. – Rar. In niche of gabbro-diorite cliff covered with humus substratum, with *Pohlia cruda* and *Isopterygiopsis pulchella*; in hummocky tundra at the border of Ledyanaya Bay bar, with *Dicranum spadiceum*, *Hylocomium splendens* var. *obtusifolium*, *Eurhynchium pulchellum*, *Breidleria pratensis*, etc.
- C. hymenophyllum* (B.S.G.) Holmen – Un. In moist niche under gabbro-diorite cliff on eastern slope of the ridge with altitude 208,8 m, on humus substrate; some plants among *Myurella julacea*, *Mnium lycopodioides*, *Bryum pseudotriquetrum*, *Distichium capillaceum*, *Philonotis fontana*.
- Dichodontium pellucidum* (Hedw.) Schimp. – Sp. On bare loam, mostly on foothill plain: on frost-boils in spotty tundra, silty deposits, mainly with *Bryum spp.*, *Timmia comata*, *Cnestrum alpestre*, *Distichium inclinatum*, *Ceratodon purpureus*, *Encalypta spp.*, etc., as a pioneer moss species.
- Dicranella cerviculata* (Hedw.) Schimp. – Un. In calcareous cryophilic steppe grass association with *Puccinella spp.*, on fine soil deposits of creek. As scattered plants among *Dicranella humilis*, *Distichium spp.*, *Bryoerythrophyllum recurvirostrum*, *Ceratodon purpureus*, *Gymnomitrium corallioides*.
- D. crispa* (Hedw.) Schimp. – Fr. On bare loamy soil: on frost-boils in spotty tundra, relatively dry silty deposits, with *Dicranella subulata*, *Ceratodon purpureus*, *Encalypta spp.*, etc. On the shore landslides forms stable association with *Psilopilum laevigatum*, *P. cavifolium* and sometimes *Pogonatum urnigerum*.
- **D. grevilleana* (Brid.) Schimp. – Rar. On moist bare loamy and silty substratum on landslides of southern shore of Ledyanaya Bay, with *Pohlia spp.*, *Philonotis fontana*, *Hennediella heimii* var. *obtusifolia*, *Funaria hygrometrica*, etc.
- **D. humilis* Ruthe – Rar. Two specimens from calcareous cryophilic steppe grass association with *Puccinella spp.* (see annotation to *Dicranella cerviculata*).
- D. schreberiana* (Hedw.) Hilp. ex Crum et Anderson – Rar. On silty sediments in canyon of Obryvisty Creek, with *Schistidium platyphyllum*; on an overgrown terrace of Ledyanaya Bay, with *Ceratodon purpureus* var. *rotundifolius*, *Philonotis fontana*, *Bryum spp.*, *Dichodontium pellucidum*, etc.; around border of frost-boils in spotty tundra.
- D. subulata* (Hedw.) Schimp. – Fr. On different soil baring in foothill tundrae (see annotation to *Dicranella crispa*), on sandy billow at southern shore of Ledyanaya Bay, with *Philonotis fontana*, *Pohlia sp.*; on dry fine soil deposits under limestone outcrops (see annotation to *D. humilis*), on strips with disturbed turf-cover, with *Leptobryum pyriforme*, *Bryum creberrimum*. Often found in drier places than other *Dicranella* species.
- D. varia* (Hedw.) Schimp. – Rar. On silty sediments at the shore of Uglenosnaya River, with *Hennediella heimii* var. *obtusifolia*, *Ceratodon purpureus* and *Didymodon fallax*. At borders of frost-boils in spotty tundra.
- Dicranoweisia crispula* (Hedw.) Milde – Com. Abundant on moist gabbro-diorite cliffs, its ruins and dike complexes, borders of southern slope of Byrranga range, in nival habitats. Mainly with *Andreaea rupestris* var. *papillosa*, *Grimmia longirostris*, *G. elatior*, *Racomitrium spp.*, *Ditrichum flexicaule*, *Cynodontium spp.*, *Polytrichastrum alpinum*, *Blepharostoma trichophyllum* and other species of relatively acidic rocks.
- **D. intermedia* J.J. Amann – Un. In moist niche of siltstone cliff in canyon of Perevalny Creek, as a compact tuft among *Tortella alpicola*, *Didymodon icmadophyllum*, *Encalypta sp.*, *Myurella julacea*, *Orthotrichum iwatsukii*, *Pseudostereodon procerimus*.
- Dicranum acutifolium* (Lindb. et H. Arnell) C. Jens. ex Weinm. – Fr. In foothill spotty and hummocky tundra, especially abundant at the borders of canyons and on turf-covered rock outcrops; in mountain rub-

- bly tundra, billows of dell complexes. Rarer in cryophilic steppe associations on remains of ancient marine terraces. Grows as scattered plants or small tufts among cover of *Hylocomium splendens* var. *obtusifolium*, *Hypnum revolutum*, *Rhytidium rugosum*, *Abietinella abietina*, often with *Dicranum spadicum*.
- D. brevifolium* (Lindb.) Lindb. – Un. In foothill hummocky tundra, on hummock, with *Dicranum spadicum*, *Hylocomium splendens* var. *obtusifolium*, *Rhytidium rugosum*, *Abietinella abietina*, etc.
- D. elongatum* Schleich. ex Schwaegr. – Com. Species of drained foothill spotty and hummocky tundra, on billows and hillocks of mires; there it forms large hummocks, often in mixture with *Sphenobolus minutus*. More rare in mountain tundra.
- D. flexicaule* Brid. – Rar. On hillside swamp at slope of ancient marine terrace. As large pure cushions among *Pseudocalliergon brevifolium*, *Sphagnum teres*, *Dicranum elongatum*, *Loeskyppnum badium*, *Campylium stellatum*, *Fissidens osmundoides*, *Frullania nisquallensis*, *Mesoptychia sahlbergii*; in wet depressions in spotty tundra at the shore of Ledyanaya Bay; in cotton-grass-sedge tundra on NW-facing slope of ridge with 208 m elevation, among *Hamatocaulis vernicosus*.
- D. groenlandicum* Brid. – Rar. In rubbly mountain tundra, foothill spotty and hummocky tundra, mainly among *Hypnum revolutum*, *H. cupressiforme*, *Hylocomium splendens* var. *obtusifolium*, *Rhytidium rugosum*, *Dicranum acutifolium*, *D. spadicum*, *Tortella* spp., etc., as dense pure tufts.
- D. laevidens* R. S. Williams – Sp. On eluvial slope bases and hillside swamps, in wet cotton-grass foothill tundra and polygonal mires, as pure tufts, or more often as scattered plants in *Sphagnum* cover with *Aulacomnium palustre*.
- D. spadicum* Zett. – Fr. In different, mainly well-drained foothill and mountain dwarf-mossy tundra, at borders and slopes of canyons, and on turf-covered rock outcrops, as scattered plants or small loose tufts with *Timmia* spp., *Hypnum* spp., *Dicranum acutifolium*, *Rhytidium rugosum*, *Hylocomium splendens* var. *obtusifolium*, etc.
- **D. spadicum* var. *subscabrifolium* Schljakov – Rar. On turf-covered ledge of gabbro-diorite cliff, with *Polytrichastrum alpinum*, *Pohlia* sp., *Cynodontium strumiferum*; at the border of Obryvisty Creek's canyon, in hillocky dwarf-mossy tundra.
- Didymodon asperifolius* var. *gorodkovii* (A. Abr. et I. Abr.) Afonina – Sp. Mostly in calcareous habitats: on loamy fine soil or rubbly slopes, with *Syntrichia ruralis*, *Hypnum vaucheri*, *Distichium* spp., *Kiaeria blyttii*, *Encalypta procera*; more rarely on eluvial slope faces, with *Dicranum elongatum*, *Tomentypnum nitens*, *Tortella tortuosa*, *Orthothecium chryseon*, etc.
- in both situations as large pure cushions. Some specimens of *Didymodon* closely resemble *D. asperifolius* because of strongly reflected leaves and relatively small leaf lamina cells; these plants may belong to *D. maximus* (Syed et Crundw.) M. O. Hill, but because of obscure differences between these taxa we refer our material to *Didymodon asperifolius* var. *gorodkovii* which differs from the type variety by smaller cells without papillae.
- D. fallax* (Hedw.) Zander – Un. On silty sediments at the shore of Uglenosnaya River in its estuary, as scattered plants among *Dicranella varia* and *Ceratodon purpureus*.
- D. icmadophyllus* (Schimp. ex Müll. Hal.) Saito – Sp. On fine soil and loamy substratum in niches of siltstone, more rarely on gabbro-diorite and limestone cliffs, at cliff ledges, in rubbly tundra and on canyon slopes. Mainly as compact pure tufts surrounded by *Encalypta alpina*, *E. rhamnoides*, *Ditrichum flexicaule*, *Distichium* spp., *Hypnum* spp., *Myurella* spp., *Orthotrichum iwatsukii*.
- D. rigidulus* Hedw. – Rar. Collected twice from niches of limestone cliffs, on loamy substratum, with *Encalypta procera*, *Trichostomum arcticum*, *Isopterygiopsis pulchella*, *Hymenostylium recurvirostre*.
- Distichium capillaceum* (Hedw.) B.S.G. – Com. Found in a wide variety of habitats, avoiding only very wet ones. Frequently on bare loamy substratum in foothill spotty hummocky and polygonal tundra, on billows in polygonal mires, rubbly canyon slopes, overgrown bank borders, in mountain tundra and swamps, cliff niches. Usually with *Distichium inclinatum*, *Ditrichum flexicaule*, *Bryum* spp., *Pohlia nutans*, *P. cruda*, *Encalypta* spp., *Ceratodon purpureus*, *Gymnomytium* spp.
- D. inclinatum* (Hedw.) B.S.G. – Rar. On borders of frost-boils in spotty tundra, with *Ceratodon purpureus*, *Distichium capillaceum*, *Ditrichum flexicaule*, *Encalypta* spp., etc; on slope of baidzharakh. This species probably has a wider distribution, but when sterile it is not easily differentiated from the previous species.
- **Ditrichum cylindricum* (Hedw.) Grout – Sp. On silty sediments of rivers and creeks, loamy landslides, in niches of gabbro-diorite cliffs. Usually as scattered plants with *Pohlia* spp., *Dicranella* spp., *Philonotis fontana*, *Ceratodon purpureus* and other pioneer mosses.
- D. flexicaule* (Schwaegr.) Hampe – Com. Mainly in relatively dry mountain habitats: rubbly tundra, stony placers, various (especially siltstone) cliffs, in hillside swamps and dell complexes, on eluvial slope bases; also on strips with disturbed turf cover in spotty tundra, on baidzharakhs and in disturbed places. In all habitats, the species occupies similar

- places as *Distichium capillaceum* and often both species grow together, although *D. flexicaule* is more abundant in mountain habitats and less so in foothill tundra.
- Drepanocladus aduncus* (Hedw.) Warnst. – Rar. On silty substratum on pebbly bar of Ledyanaya Bay, with *Drepanocladus arcticus*, *Calliergonella lindbergii*, *Philonotis fontana*, *Campylium stellatum*, *Pohlia* spp., etc.; on homogenous mossy swamp in Karovaya river estuary, as scattered plants among *Straminergon stramineum*, *Calliergon cordifolium*, *Limprichtia revolvens*, *Pseudocalliergon brevifolium*, *Campylium stellatum*, etc.
- D. arcticus* (R.S.Williams) Hedenäs – Rar. On silty sediments at Ledyanaya Bay shore, with *Drepanocladus aduncus*, *Calliergonella lindbergii*, *Callialaria curvicaulis*, *Philonotis fontana*; in willow-sedge-mossy dells with *Plagiomnium curvatulum*, *Straminergon stramineum*, *Warnstorfia sarmentosa*, *Bryum pseudotriquetrum*, *B. cryophilum*.
- D. polygamus* (B.S.G.) Hedenäs – Un. At border of Perevalny Creek shore on bare humus substratum, with *Calliergonella lindbergii*.
- D. sordidus* (Müll. Hal.) Hedenäs – Un. On silty sediments of pebbly bar of Ledyanaya Bay, as scattered plants with *Drepanocladus arcticus*, *Calliergonella lindbergii*, *Philonotis fontana*, *Campylium stellatum*.
- Encalypta alpina* Sm. – Sp. On loamy substratum in niches of different cliffs, between stones on canyon slopes, at the borders of frost-boils in spotty tundra and on hummocks in hummocky tundra. In mixture with other mosses or as compact pure tufts.
- **E. brevipes* Schljakov – Un. In niches of gabbro-diorite cliffs at south-eastern slope of ridge with elevation of 208,0 m. On moist humus substratum, with *Grimmia elatior*, *Isopterygiopsis pulchella*, *Pohlia nutans*, and *Myurella julacea*.
- **E. longicollis* Bruch – Un. On the eastern slope of mountain ridge with elevation of 171,7 m, on slope of Primetny Creek canyon, on silty sediments in cracks of sandstone cliffs.
- E. procera* Bruch – Fr. Most abundant on limestone outcrops: in niches of limestone outcrops, between stones on talus slopes, with *Syntrichia ruralis*, *Hypnum vaucheri*, *Kiaeria blyttii*, *Didymodon asperifolius* var. *gorodkovii*; more rarely in niches of siltstone cliffs and in foothill spotty and hummocky tundra, as scattered plants among *Distichium* spp., *Bryum* spp., *Dicranella subulata* and other species.
- E. rhaptocarpa* Schwaegr. – Sp. In similar habitats with *E. alpina*, preferring siltstone cliffs, with *Hypnum cupressiforme*, *Myurella* spp., *Orthotrichum iwatsukii*, etc.
- Eurhynchium pulchellum* (Hedw.) Jenn. – Fr. In various, mainly well-drained foothill tundras, especially near borders of canyons; on loamy substrate of frost-boils in spotty tundra, on humus under dense *Dryas* and *Cassiope* cover, mainly with *Plagiothecium* spp., *Plagiomnium curvatulum*, *Bartramia ithyphylla*, *Brachythecium velutinum*, *Cirriphyllum cirrosum*, *Hypnum* spp.; in cliff niches, with *Isopterygiopsis pulchella*, *Pterigynandrum filiforme*, *Pohlia cruda*.
- Fissidens osmundoides* Hedw. – Rar. On eluvial slope bases, admixed to *Frullania nisquallensis* and *Herbertus sakurarii*, or to *Schistidium papillosum*, *Pseudocalliergon brevifolium*, *Orthothecium chryseon*; on dry polygon of polygonal tundra strip, as low dense tuft among *Distichium inclinatum*, *Bryum teres* and *Polytrichum* spp..
- F. viridulus* (Sw.) Wahlenb. – Sp. On moist and shady loamy substratum under stones, in gabbro-diorite cliff niches, as scattered plants among *Isopterygiopsis pulchella*, *Bryoerythrophyllum recurvirostrum*, *Myurella* spp., *Blepharostoma trichophyllum*, *Cryptocolea imbricata*, or in small loose tufts.
- **Fontinalis antipyretica* Hedw. var. *gracilis* (Lindb.) Schimp. – Rar. On small slightly silted strip of pebbly bar at the north-eastern shore of Ledyanaya Bay; relatively abundant on stones, with *Scouleria aquatica*, but not always occurring in similar places. It is possible that the species occurs here in association because the creek’s water chemistry is enriched where it flows into the bay.
- F. hypnoides* Hartm. – Rar. Common species in shallow belt of rubbly bottom of Melkoe Lake, with *Warnstorfia exannulata*, but not occurring in similar bottom strips of other small lakes. Collected once at bar strip of Ledyanaya Bay with *F. antipyretica* var. *gracilis* and *Scouleria aquatica*.
- Funaria arctica* (Berggr.) Kindb. – Un. On moist bare loam in narrow dell formed by melting water, between baidzharakhs at north-eastern shore of Ledyanaya Bay.
- F. hygrometrica* Hedw. – Rar. On moist loamy or silty substrate at Ledyanaya Bay shores, with *Dicranella grevilleana*, *Hennediella heimii* var. *arctica*, *Ceratodon purpureus* etc.; on frost-boils in spotty tundra.
- **Grimmia anodon* B.S.G. – Sp. On limestone and calcareous sandstone outcrops, in cliff niches, turf-covered cliffs and talus slopes, with *Syntrichia ruralis*, *Tortula mucronifolia*, *Hypnum* spp., *Pseudoleskeella tectorum*.
- **G. elatior* Bruch ex Bals.-Griv. et De Not. – Fr. On gabbro-diorite outcrops, in crevices and on ledges of cliffs, mainly on fine soil, and almost never immediately on rock surface (in contrast to, e.g., *G. longirostris*); mostly with *Andreaea rupestris* var. *papillosa*, *Racomitrium* spp., *Dicranoweisia crispula*, *Blepharostoma trichophyllum* var. *brevirete*, *Tetralophozia setiformis*.

- **G. funalis* (Schwaegr.) B.S.G. – Un. On large gabbro-diorite rock in rubbly *Dryas*-mossy tundra on smooth top of hill with 142.5 m elevation; among *Hylocomium splendens* var. *obtusifolium*, *Hypnum cupressiforme*, *Abietinella abietina*, *Rhytidium rugosum*, *Ditrichum flexicaule*.
- **G. incurva* Schwaegr. – Un. On gabbro-diorite boulder at the top of ridge with 295 m elevation, among *Grimmia longirostris*, *Racomitrium* spp. and *Andreaea rupestris* var. *papillosa*.
- **G. jacutica* Ignatova et al. – Rar. Collected twice: on gabbro-diorite outcrop and in rubbly mountain tundra, in both cases with *Hypnum vaucheri*, *Ditrichum flexicaule*, *Rhytidium rugosum*, *Dicranum* spp.
- **G. longirostris* Hook. – Fr. On gabbro-diorite cliffs, most abundant in nival habitats, covers cliff surface in moist crevices and places with late snow melting, mainly with *Andreaea rupestris* var. *papillosa* (in wet places completely replaced by this species), on relatively dry dike cliffs, often as dense tufts among *Dicranoweisia crispula* and *Orthotrichum iwatsukii*; very rare on siltstone and limestone cliffs.
- Hamatocaulis vernicosus* (Mitt.) Hedenäs – Com. Dominates in homogenous mires (with *Warnstorfia sarmentosa*, *Limprichtia revolvens*, *Pseudocalliergon brevifolius*, *Cinclidium latifolium*, *Oncophorus* spp., etc.), on wet polygons of polygonal mires, with *Scorpidium scorpioides*, *Limprichtia revolvens*, *Calliergon* spp.; more rare on hillside swamps and eluvial slope bases, avoiding mountain habitats.
- Hennediella heimii* var. *arctica* (Lindb.) Zander – Sp. On silty sediments at Ledyanaya Bay shores, bare slopes of baidzharachs, mainly as scattered plants with *Ceratodon purpureus*, *Cnestrum alpestre*, *Dicranella crispa*, *D. grevilleana*, *Ditrichum cylindricum*, *Pohlia* spp., *Bryum* spp., *Funaria hygrometrica*; found once on glass wool as a compact pure tuft.
- Hygrohypnum alpestre* (Hedw.) Loeske – Rar. Collected twice: on stone in dry creek bed at southern slope of ridge with elevation 259 m; on pebbly bank of Uglensnaya River covered by silt, with *Calliergonella lindbergii* and *Brachythecium turgidum*.
- H. luridum* (Hedw.) Jenn. – Rar. At the base of siltstone cliff washed by stream in Perevalny creek canyon, with *H. polare*, *Distichium capillaceum* and *Orthothecium chryseon*; on stone in the creek between ridges with elevation 299.7 and 233.4 m. In both cases as dense pure cover.
- H. polare* (Lindb.) Loeske – Fr. On gabbro-diorite stones in creeks and rivers and on stony banks; near the borders of summer snowfields. Found once in wet crevice of gabbro-diorite cliff, with *Pseudohygrohypnum subeugyrium*, *Orthothecium chryseon* and *Distichium capillaceum*. Mainly grows as large pure tufts.
- H. polare* var. *falcatum* Broth. – Rar. In habitats similar to type variety.
- Hylocomium splendens* var. *obtusifolium* (Geh.) Par. – Com. The dominant species of foothill spotty and hummocky tundra where it occupies hummocks with admixture of *Aulacomnium turgidum*, *Rhytidium rugosum*, *Abietinella abietina*, *Racomitrium lanuginosum*, changing to *Tomentypnum nitens* in moist depressions, also on moderately drained strips of different mires, etc., in different types of mountain dwarf-mossy tundra, with *Hypnum* spp., *Abietinella abietina*, *Dicranum* spp., *Ditrichum flexicaule*, etc.
- Hymenostylium recurvirostre* (Hedw.) Dix. – Un. In cracks of limestone cliffs in Primetny Creek canyon, with *Bryoerythrophyllum ferruginascens*, *Trichostomum crispulum*, *Seligeria tristichoides*, *Encalypta alpina*, as compact pure tuft.
- Hypnum bambergeri* Schimp. – Rar. On talus slopes mainly in calcareous places, between stones, with other *Hypnum* species, *Didymodon asperifolius* var. *gorodkovii*, *Hylocomium splendens* var. *obtusifolium*, etc.; on ledges of siltstone cliffs, with *Distichium capillaceum*, *Bryoerythrophyllum recurvirostrum*, *Encalypta* spp.; at the border of frost-boils in foothill tundra.
- H. cupressiforme* Hedw. – Fr. In rubbly mountain tundra, on talus slopes on turf-covered mainly siltstone rock outcrops, in cryophilic steppe communities. Forms pure carpets, often surrounded by *Distichium* spp., *Hypnum vaucheri*, *H. revolutum*, *Hylocomium splendens* var. *obtusifolium*, *Sanionia uncinata*, *Ditrichum flexicaule*, *Encalypta* spp. In more calcareous conditions it is replaced by *H. vaucheri*.
- H. hamulosum* B.S.G. – Un. In hummocky tundra at western slope of hill with elevation 142 m; as a pure tuft among *Aulacomnium turgidum*, *Tomentypnum nitens*, *Sanionia uncinata*, *Campylium stellatum*.
- H. holmenii* Ando – Un. On eluvial slope bases at southern slope of ridge with 208,0-295 m elevation; with *Pseudocalliergon brevifolium*, *Limprichtia revolvens*, *Oncophorus wahlenbergii*, *Orthothecium chryseon*.
- H. revolutum* (Mitt.) Lindb. – Fr. In habitats similar to those of *Hypnum cupressiforme*; mostly avoids calcareous habitats, dominates in gabbro-diorite and siltstone rubbly tundra, often in more drained places than *H. cupressiforme*.
- H. subimponens* Lesq. – Rar. In willow-mossy community of Obryvisty Creek canyon bottom, as pure tufts among cover of *Plagiomnium curvatulum*, *Sanionia uncinata*, *Campylium stellatum*; also on talus slope of this canyon.
- H. vaucheri* Lesq. – Com. Common species of mountain rubbly tundra, especially in calcareous habitats and in cryophilic steppe communities, associated with limestone and more rarely with siltstone cliffs. Mainly with *Pseudostereodon procerrimus*, *Encalypta* spp.,

- Syntrichia ruralis*, *Hylocomium splendens* var. *obtusifolium*.
- **Isopterygiopsis muelleriana* (Schimp.) Iwats. – Rar. In niches of gabbro-diorite cliffs on humus substratum, as scattered plants among *I. pulchella*, *Mnium blyttii*, *Dicranoweisia crispula*, *Pterigynandrum filiforme*, *Plagiothecium cavifolium*.
- I. pulchella* (Hedw.) Iwats. – Fr. On humus, fine soil or loamy substratum in different cliff niches on shore landslides and baydzharachs, more rarely in hummocky and spotty tundra, on billows of polygonal mires and places with disturbed turf-cover. Usually as scattered plants among *Encalypta* spp., *Bryoerythrophyllum recurvirostrum*, *Brachythecium velutinum*, *Pohlia cruda*, *Hypnum* spp., *Eurhynchium pulchellum*, *Plagiothecium* spp., *Cirriphyllum cirrosum*, *Pseudoleskeella* spp., *Pterigynandrum filiforme*.
- **Kiaeria blyttii* (Schimp.) Broth. – Sp. On turf-covered limestone rock outcrops, between stones on calcareous talus slopes, as dense pure cushions among *Hypnum vaucheri*, *Pseudostereodon procerrimus*, *Syntrichia ruralis*, *Encalypta procera*, *Grimmia anodon*, *Dicranum* spp., etc.; rarer in foothill hummocky tundra and in gabbro-diorite cliff niches.
- Leptobryum pyriforme* (Hedw.) Wils. – Rar. A pioneer species colonizing relatively dry places with disturbed turf-cover: on fine soil sediments, on frost-boils in spotty tundra, baydzharachs slopes, on silty sediments at rubbishy places, as scattered plants among *Bryum* spp., *Distichium* spp., *Ceratodon purpureus*, *Dicranella subulata*, etc.
- Limprichtia cossoni* (Schimp.) Anderson et al. – Rar. In moist dwarf-willow-mossy community in Obryvisty Creek dell, as scattered plants mixed with *Sanionia uncinata*, *Campylium protensum*, *Bryum pseudotriquetrum*, *Plagiomnium curvatulum*; in homogenous mire at the lakes shore in Uglenosnaya River estuary, with *Limprichtia revolvens*, *Warnstorfia sarmentosa*, *Calliergon* spp., *Cinclidium latifolium*, etc.; in polygonal mire at southern shore of Ledyanaya Bay, with *Limprichtia revolvens*, *Sphagnum* spp., *Cinclidium latifolium*, etc.
- L. revolvens* (Sw.) Loeske – Fr. In homogenous swamps and polygonal mires, with *Hamatocaulis vernicosus*, *Cinclidium latifolium*, *Calliergon* spp., *Warnstorfia sarmentosa*, at the lake shores and in wet depressions, in mountain swamps, as pure tufts or more often in mixture with *Pseudocalliergon brevifolium*, *Meesia* spp., *Loeskyppnum badium*, *Mesoptychia sahlbergii*, etc.
- Loeskyppnum badium* (Hartm.) Paul – Sp. On eluvial slope bases, usually as scattered plants among *Pseudocalliergon brevifolium*, *Meesia* spp., *Limprichtia revolvens*, *Mesoptychia sahlbergii*, in homogenous mires, with *Hamatocaulis vernicosus*, *Limprichtia revolvens*, *Cinclidium latifolium* and *Pseudobryum cinclidioides*.
- Meesia triquetra* (Richter) Aongstr. – Fr. Most abundant in mountain hillside swamps and dell complexes where it forms a pure cover or grows with *Meesia uliginosa*, *Limprichtia revolvens*, *Loeskyppnum badium*, *Orthothecium chryseon*, *Tortella tortuosa*; frequent in polygonal and homogenous mires at the lake shores, mainly as scattered plants among *Hamatocaulis vernicosus*, *Cinclidium latifolium*, *Calliergon* spp., *Warnstorfia sarmentosa*, etc.
- M. uliginosa* Hedw. – Sp. On eluvial slope bases and dell complexes, with *Meesia triquetra*, *Pseudocalliergon brevifolium*, *Orthothecium chryseon*, *Tortella tortuosa*, *Campylium stellatum*, *Oncophorus wahlenbergii*, among other mosses or as pure tufts, more rare on loamy substratum on baydzharakh slopes and frost-boils in spotty tundra, with *Philonotis fontana*, *Dicranella grevilleana*, *Hennediella heimii* var. *arctica*, etc.
- Mnium blyttii* B.S.G. – Sp. At canyon borders in foothill tundra, on loamy or humus substratum, with *Pohlia nutans*, *Hypnum* spp., *Sanionia uncinata*, *Myurella* spp., *Eurhynchium pulchellum*, in gabbro-diorite and siltstone cliff niches, in moist calcareous habitats.
- **M. lycopodioides* Schwaegr. – Sp. On humus substratum in moist niches and crevices of gabbro-diorite cliffs, with *Dicranoweisia crispula*, *Cynodontium tenellum*, *Pohlia cruda*, *Mnium blyttii*, *Tritomaria quinquedentata*, *Barbilophozia* spp., more rarely at borders of canyons, on baydzharakh slopes and shore landslides.
- **Molendooa sendtneriana* (B.S.G.) Limpr. – Un. On silty sediments in Uglenosnaya River estuary, as scattered plants among *Ceratodon purpureus*, *Dicranella* spp., *Pohlia* spp.
- Myurella julacea* (Schwaegr.) Schimp. – Fr. In siltstone and gabbro-diorite cliff niches and on ledges, on rubble slopes, on soil banks and slopes, on loamy or humus substratum, with other pioneers species: *Encalypta* spp., *Ditrichum flexicaule*, *Distichium* spp., *Hypnum* spp., *Mnium* spp., *Timmia* spp.
- M. tenerrima* (Brid.) Lindb. – Sp. In the same microhabitats as previous species, but most abundant on soil banks and slopes, whereas *M. julacea* prefers cliff niches.
- **Neckera pennata* Hedw. – Sp. On walls of deeply shaded and relatively dry crevices of gabbro-diorite cliffs, as pure tufts; often with admixture of *Pseudoleskeella rupestris*, *Grimmia elatior*, and *Radula complanata*.
- Oncophorus compactus* (B.S.G.) Schljakov – Rar. At the borders of frost-boils in spotty tundra, with *Distichium capillaceum*, *Ditrichum flexicaule*, *Ceratodon*

- purpureus*, *Bryum* spp.; in siltstone cliff niches, with *Encalypta* spp., *Ditrichum flexicaule*, *Syntrichia ruralis*; on calcareous eluvial slope bases, with *Bryum* sp., *Pohlia* sp., and *Ceratodon purpureus*.
- O. virens* (Hedw.) Brid. – Sp. In moist cotton-grass and sedge tundra, with *Campylium stellatum*, *Calliargon* spp., *Plagiomnium curvatulum*, *Oncophorus wahlenbergii*, *Dicranum laevidens*, *Sphagnum* spp., *Aulacomnium palustre*, *Bryum pseudotriquetrum*, *Cirriphyllum cirrosum*; in homogenous swamps, on wet polygons of polygonal mires and at flooded lake shores. More rarely in mountain swamps, moist Ledyanaya Bay terraces, spotty and hummocky tundras, on bare loamy substratum.
- O. wahlenbergii* Brid. – Com. Dominates in the moss cover in hummocky, hillocky sedge and cotton-grass tundra, willow-mossy communities, in different mountain swamps and moist eluvial slope bases; more rarely in polygonal and homogenous mires. Forming large pure hummocks or grows mixed with other moss species.
- Orthothecium chryseon* (Schwaegr. ex Schultes) B.S.G. – Fr. One of dominant species on bare ground with seeping water. Often forms pure carpets on dell complexes, eluvial slope bases, or with admixture of *Meesia* spp., *Pseudocalliargon brevifolius*, *Tortella tortuosa* etc.; on wet, mainly siltstone cliffs, with *Schistidium papillosum*, *Distichium capillaceum*, *Hygrohypnum* spp., *Pseudohygrohypnum subeugyrium*. Rare and not abundant in spotty tundra, on slopes and borders of canyons, on relatively dry turf-covered limestone rock outcrops, with *Orthothecium strictum*, *Hypnum* spp., etc., in nival habitats.
- O. strictum* Lor. – Sp. In niches of dry turf-covered limestone rock outcrops, mostly with *Hypnum vaucheri*, *Kiaeria blyttii*, *Pseudostereodon procerrimus*, *Syntrichia ruralis*, *Encalypta procera*, *Grimmia anodon*.
- **Orthotrichum iwatsukii* Ignatov – Fr. One of dominant species on bare surfaces of gabbro-diorite and siltstone cliffs, on fine soil or loamy substratum in cracks and dents, as compact pure tufts; among *Encalypta* spp., *Pohlia* spp., *Dicranoweisia crispula*, *Ditrichum flexicaule*, *Cynodontium* spp., etc., in rubble mountain tundra, with *Hypnum vaucheri*, *Hylocomium splendens* var. *obtusifolium*, *Abietinella abietina*, *Ditrichum flexicaule*, *Distichium* spp. Much more rare in similar habitats on calcareous rocks.
- **O. pallens* Sw. – Un. In Perevalny Creek canyon, on ledges of siltstone cliff covered with fine soil, as compact pure tuft surrounded by *Orthotrichum iwatsukii*, *Ditrichum flexicaule*, *Encalypta alpina*, *E. procera*, *Myurella julacea*.
- Philonotis fontana* (Hedw.) Brid. – Fr. Most abundant near moist eluvial slope bases and steep swampy slopes, in both calcareous and noncalcareous habitats, where it forms large and very dense hummocks neighboring with *Bartramia pomiformis*, *Pseudocalliargon lycopodioides*, *Oncophorus wahlenbergii*, *Sphagnum russowii*, *S. teres*, etc.; more rarely in foothill hummocky tundra, moist places with disturbed turf-cover. It is an active pioneer species of silty and sandy sediments, growing as scattered plants among *Bryum* spp., *Pohlia* spp., *Ceratodon purpureus*, *Hennediella heimii* var. *arctica*, *Campylium stellatum*, *Drepanocladus aduncus*, etc.
- P. tomentella* Molendo – Rar. On eluvial slope bases, with *Catoscopium nigratum*, *Cinclidium arcticum*, *Limprichtia revolvens*, *Loeskypnum badium*, *Mesoptychia sahlbergii*, as dense pure tufts.
- Plagiomnium curvatulum* (Lindb.) Schljakov – Fr. In foothill sedge and cotton-grass tundra, with *Cirriphyllum cirrosum*, *Brachythecium mildeanum*, *Oncophorus wahlenbergii*, *O. virens*, *Campylium stellatum*; in willow-mossy communities of dell bottoms, on hummocky tundra, especially on moraine sediments, on turf-covered river alluvium, near late snowfields; rarely on billows in polygonal mires.
- P. ellipticum* (Brid.) T. Kop. – Sp. The habitats of this species are similar to those of the previous one, but *P. ellipticum* is more frequent along mossy banks of narrow streams, with *Warnstorfia sarmentosa*, *Cinclidium latifolium*, *Limprichtia revolvens*, *Bryum pseudotriquetrum*, *Brachythecium mildeanum*, etc.
- Plagiopus oederianus* (Sw.) Crum et Anderson – Rar. On hillside swamps and eluvial slope bases, with *Philonotis* spp., *Sphagnum russowii*, *S. teres*, *S. capillifolium*, *S. subsecundum*, *Limprichtia revolvens*; in foothill hummocky tundra, with *Tomentypnum nitens*, *Oncophorus wahlenbergii*, *Campylium stellatum*, *Aulacomnium turgidum*. Forms dense tomentose pure tufts.
- Plagiothecium berggrenianum* Frisvoll – Sp. In gabbro-diorite cliff niches, with *Pohlia cruda*, *Pterigynandrum filiforme*, *Mnium* spp., *Plagiothecium denticulatum*, etc., on shady moist cliff and on boulder, with *Saelania glaucescens*, *Anthelia juratzkana*, *Plagiothecium cavifolium*, *Isopterygiopsis pulchella*, occurring rarely on loamy and turf baring on polygonal mire billows, at canyon borders and baydzharakhs. Mainly as scattered plants among other mosses.
- P. cavifolium* (Brid.) Iwats. – Sp. In places similar to those of the previous species but more often found with *Hypnum cupressiforme*, *Sanionia uncinata*, *Eurhynchium pulchellum*, etc.; as pure tufts or mixed with other species.
- P. denticulatum* (Hedw.) B.S.G. – Rar. In gabbro-diorite cliff niches, with *Pohlia cruda*, *Pterigynandrum filiforme*, *Mnium* spp., etc. On shady moist cliff surface, with *Saelania glaucescens*, *Plagiothecium cav-*

- ifolium*, *Isopterygiopsis pulchella*, *Blepharostoma trichophyllum* var. *brevirete*.
- Plagiothecium laetum* Schimp. – Rar. In similar habitats with *P. berggrenianum* and *P. cavifolium*; as scattered plants among other species, often with *Brachythecium velutinum* and *Fissidens viridulus*.
- Platydictya jungermannioides* (Brid.) Crum – Rar. In gabbro-diorite cliff niches, with *Pseudoleskeella rupestris*, *Pterigynandrum filiforme*, *Neckera pennata*, *Grimmia elatior*; in limestone cliff niche, with *Seligeria tristichoides*, *Pseudoleskeella tectorum*, *Encalypta procera*.
- Pogonatum dentatum* (Brid.) Brid. – Sp. On borders of dry loamy and rubbly patches in spotty tundra, at places with disturbed moss cover, on borders and talus slopes of canyons, in siltstone cliff cracks, mainly with *Encalypta* spp., *Syntrichia ruralis*, *Pogonatum urnigerum*, *Ceratodon purpureus*, *Bryum* spp.
- P. urnigerum* (Hedw.) P. Beauv. – Sp. In places with disturbed turf-cover, on bare loamy substratum: on borders and slopes of canyons, polygonal mire billows, on baydzharakh slopes and on landslides at the shore of Ledyanaya Bay (in the latter case with *Psilopilum* spp. and *Dicranella crispa*), in disturbed places, usually with *Pogonatum dentatum*, *Bryum* spp., *Polytrichum juniperinum*, *Dicranella* spp., *Conostomum tetragonum*, *Distichium capillaceum*. Sometimes forms dense pure patches.
- Pohlia andrewsii* Shaw – Sp. At the borders of frost-boils in spotty tundra, bare soil on canyon and baydzharakh slopes, silty sediments, at moist Ledyanaya Bay terraces enriched by geese excrements. Grows as more or less pure tufts, with *Bryum* spp., *Philonotis fontana*, *Conostomum tetragonum*, *Ceratodon purpureus*, *Cnestrum alpestre*, etc.
- P. cruda* (Hedw.) Lindb. – Fr. Characteristic and very abundant species of relatively dry gabbro-diorite and siltstone cliff niches, grows with *Plagiothecium* spp., *Pohlia nutans*, *Pterigynandrum filiforme*, *Neckera pennata*, *Isopterygiopsis pulchella*; more rare on loamy canyon and baydzharakh slopes with *Eurhynchium pulchellum*, *Cirriphyllum cirrosum*, *Pohlia nutans*, etc., on silty sediments.
- P. crudoides* (Sull. et Lesq.) Broth. – Un. On moist humus substratum at the base of large gabbro-diorite rock on dike complex with elevation 130.7 m; with *Plagiomnium curvatulum*, *Cynodontium tenellum*, *Mnium blyttii*, *Timmia comata*, *Tritomaria quinque-dentata*, *Barbilophozia* spp.
- P. drummondii* (Müll. Hal.) Andrews. – Rar. At the border of frost-boiling in spotty tundra, with *Distichium* spp., *Dicranella crispa*, *Cnestrum alpestre*; in moist crevice of gabbro-diorite cliff at southern slope of ridge with elevation 295 m; with *Mnium blyttii*, *Pseudohygrohypnum subeugyrium*, *Fissidens viridulus*.
- P. nutans* (Hedw.) Lindb. – Fr. In spotty and hummocky tundra, at canyon borders and on talus slopes, often in calcareous habitats, by places with disturbed turf-cover, on wood and other debris; on silty sediments and baydzharakh slopes, overgrown bar borders etc.. As compact pure tufts or mixed with *Timmia* spp., *Brachythecium mildeanum*, *Bryum pseudotriquetrum* (and other *Bryum* species), *Dichodontium pellucidum*, *Conostomum tetragonum*; in gabbro-diorite cliff niches, with *Pohlia cruda*, etc.
- P. prolifera* (Kindb. ex Breidl.) Lindb. et H. Arnell – Un. At the border of frost-boils in foothill spotty tundra on western slope of hill at elevation 142 m; as small loose tuft, with *Bryoerythrophyllum ferruginascens*, *Dicranella subulata*, *Bryum arcticum*.
- Polytrichastrum alpinum* (Hedw.) G.L.Sm. – Fr. In foothills and plain at canyon borders, loamy landslides, hillocks and billows of polygonal mires, especially at places with intermittent water flow, concerned with regular underflooding: on pebbly bar and borders of moist Ledyanaya Bay terraces, in thermokarst depressions, etc., usually mixed with *Timmia austriaca*, *Plagiomnium* spp., *Bryum pseudotriquetrum*, *Oncophorus virens*, *Polytrichum jensenii*. On dry turf-covered or almost bare gabbro-diorite and limestone rock outcrops and in its cracks, on rubbly ground in nival belt at the table tops where *P. alpinum* dominates together with *Racomitrium* spp. and *Polytrichum piliferum*. Mixed with other species or as tall pure tufts.
- Polytrichum hyperboreum* R.Br. – Fr. At the hummock tops in different foothill tundras, on hillocks and billows of polygonal mires. Forms dense more or less pure tufts or grows in mixture with *Polytrichum strictum*, *Aulacomnium turgidum*, *Campylium stellatum*, *Oncophorus wahlenbergii*.
- P. jensenii* Hag. – Sp. On overgrown pebbly bar strips, on moist Ledyanaya Bay terraces, in thermokarst depressions of stream dells, in swampy tundra, in river estuaries; in mixture with *Timmia austriaca*, *Plagiomnium* spp., *Bryum pseudotriquetrum*, *B. cryophilum*, *Polytrichastrum alpinum*, *Aulacomnium turgidum*, *Campylium stellatum*, *Drepanocladus* spp., *Oncophorus virens*, *Philonotis fontana*.
- P. juniperinum* Hedw. – Fr. On hummocks in hummocky tundra, at canyon borders and on slopes and in other places with ongoing disturbance of the moss cover. Also in mountain rubbly tundra and in nival habitats. Mainly with *Pogonatum* spp., *Polytrichum piliferum*, *Sanionia uncinata*, *Abietinella abietina*, *Racomitrium panschii*, *Hypnum* spp.
- P. piliferum* Hedw. – Fr. On dry borders and talus canyon slopes, with previous species (but more rare), in

- rubbly tundra, on dry fine soil substratum. Most abundant in nival belt on dry rubbly ground, especially at the plateau tops, there this species shares dominant position with *Polytrichastrum alpinum*, *Racomitrium* spp. Forms loose pure tufts.
- P. strictum* Brid. – Sp. At the tops of the hummocks in moist foothill sedge and cotton-grass tundra, more rare on billows of polygonal mires, in hummocky tundra, eluvial slope bases and hillside swamps. Grows in tall tomentose tufts or mixed with *Sphagnum russowii*, *S. warnstorffii*, *Polytrichum hyperboreum*, *Aulacomnium* spp., *Campylium stellatum*, *Calliergon* spp.
- Pseudobryum cinclidioides* (Hueb.) T. Kop. – Rar. In moist mossy tundra and homogenous mires, at flooded lake shores in Karovaya and Uglensnaya River estuary. As scattered plants among *Meesia triquetra*, *Warnstorffia sarmentosa*, *W. pseudostraminea*, *Sphagnum subsecundum*, *Campylium stellatum*, *Limprichtia revolvens*, *Straminergon stramineum*, *Calliergon cordifolium*.
- Pseudocalliergon brevifolius* (Lindb.) Hedenäs – Com. Dominates in the majority of wet moss communities but especially abundant in different mountain swamps, dell complexes, eluvial slope bases, and in wet nival habitats; grows with *Meesia* spp., *Orthothecium chryseon*, *Oncophorus wahlenbergii*, *Campylium stellatum*, *Catoscopium nigrum*, *Frullania nisquallensis*, *Herbertus sakurarii*, etc. Also grows on polygonal mire polygons at lake shores, and submerged in water (mainly in flooded polygons on southern shore of Ledyanaya Bay), in homogenous mires, on moist Ledyanaya Bay terraces and wetlands at river estuaries, with *Limprichtia revolvens*, *Calliergon cordifolium*, *Straminergon stramineum*, *Warnstorffia sarmentosa*, *Cinclidium latifolium*, *Pseudobryum cinclidioides*, *Campylium stellatum*, etc. Usually as a pioneer species on moist loamy and silty substrates; more rarely on wet siltstone cliffs, with *Hygrohypnum* spp., *Orthothecium chryseon*, *Schistidium papillosum*.
- P. turgescens* (T.Jens) Loeske – Rar. At the base of ancient marine terrace slope, with *P. brevifolium*, *Warnstorffia sarmentosa*, *Mesoptychia sahlbergii*, *Meesia uliginosa*; on polygon of polygonal mire at Ledyanaya Bay shore; on wet rubbly mounting slope at the snowfield border (collected in August), on stones with *Andreaea rupestris* var. *papillosa* and *Hygrohypnum polare* var. *falcatum*.
- **Pseudohygrohypnum subeugyrium* Ren. et Card. – Rar. Collected twice in wet crevices of gabbro-diorite cliff in nival mountain belt, on fine soil substratum, with *Andreaea rupestris* var. *papillosa*, *Mnium blyttii*, *Ditichium capillaceum*, *Orthothecium chryseon*.
- **Pseudoleskeella catenulata* (Brid. ex Schrad.) Kindb. – Un. On limestone cliff at the southern slope of Primetny Creek canyon, with *Seligeria tristichoides*, *Hypnum* spp., *Encalypta procera*.
- **P. papillosa* (Lindb.) Kindb. – Un. On shady moist surface of gabbro-diorite stone in moist foothill tundra, with *Plagiothecium berggrenianum*, *Isopterygiopsis pulchella*, *Saelania glaucescens*.
- **P. rupestris* (Berggr.) Hedenäs et Söderström – Sp. In gabbro-diorite and limestone cliff niches covered by fine soil or humus layer, with *Isopterygiopsis pulchella*, *Pterigynandrum filiforme*, *Pohlia cruda*, *Dicranoweisia crispula*, *Encalypta* spp., *Cynodontium* spp., etc.
- **P. tectorum* (Funck ex Brid.) Kindb. – Sp. In limestone cliff niches and on shady surface of limestones, mainly on fine soil, with *Seligeria tristichoides*, *Bryoerythrophyllum recurvirostrum*, *Encalypta procera*, *Grimmia anodon*, *Bryum* sp., etc.; collected once in gabbro-diorite cliff niche.
- Pseudostereodon procerrimus* (Molendo) Fleisch. – Fr. On turf-covered limestone and siltstone rock outcrops on talus slopes mainly formed of limestone, in rubbly tundra, as scattered plants among *Encalypta* spp., *Hypnum* spp., *Distichium capillaceum*, *Sanionia uncinata*, *Syntrichia ruralis*, *Myurella* spp., *Eurhynchium pulchellum*, or in pure mats. More rare in foothill hummocky tundra.
- Psilopilum cavifolium* (Wils.) Hag. – Sp. On loamy shore landslides and slopes, on baydzharakhs and polygonal tundra billows, on silty fine soil, with *Psilopilum laevigatum*, *Pogonatum urnigerum* and *Dicranella crispa*, sometimes covers significant strips.
- P. laevigatum* (Wahlenb.) Lindb. – Sp. Colonizes places similar to those mentioned for the previous species, but prefers somewhat more dry and alight habitats. As a pure cover or with admixture of *Dicranella crispa* and other species.
- **Pterigynandrum filiforme* Hedw. – Fr. In niches of gabbro-diorite outcrops, on relatively dry loamy or humus substratum, as pure patches among *Pseudoleskeella* spp., *Pohlia* spp., *Isopterygiopsis pulchella*, *Neckera pennata* or mixed with these species; sometimes on epilithic lichens, more rarely on bare cliff surface.
- Racomitrium lanuginosum* (Hedw.) Brid. – Fr. On hummocks in foothill hummocky tundra and on billows of frost-boils in spotty tundra, on turf-covered gabbro-diorite rock outcrops and large rocks, on stony ground; more rarely in rubbly tundra, on talus canyon slopes, etc. Mainly mixed with *Racomitrium panschii*, *Rhytidium rugosum*, *Abietinella abietina*, *Hylocomium splendens* var. *obtusifolium*, *Polytrichum juniperinum*, *Polytrichastrum alpinum*.
- R. panschii* (Müll. Hal.) Kindb. – Com. Characteristic species of stony habitats formed by gabbro-diorites: dominant species of relatively moist rubbly slopes

- of ridges and canyons, stony ground on tableform tops, less abundant along river banks, in mountain tundra, in crevices and niches of cliffs. Usually occurs with *Racomitrium lanuginosum*, *Grimmia* spp., *Andreaea rupestris* var. *papillosa*, *Dicranoweisia crispula*, *Rhytidium rugosum*, *Polytrichum piliferum*, *Polytrichastrum alpinum*.
- Rhizomnium andrewsianum* (Steere) T.Kop. – Sp. In foothill mires, and in wet depressions in tundra, as scattered plants among *Hamatocaulis vernicosus*, *Limprichtia revolvens*, *Warnstorfia sarmentosa*, *Bryum pseudotriquetrum*, *Calliergon* spp.; on hillside swamps and eluvial slope bases; once in moist gabbro-diorite cliff niche on humus substratum, with *Mnium blyttii*, *Blepharostoma trichophyllum*, *Odontoschisma macounii*, *Leiocolea heterocolpos*, etc.
- Rhytidium rugosum* (Hedw.) Kindb. – Fr. On hummocks and billows in foothill hummocky and spotty tundra, as admixture to *Hylocomium splendens* var. *obtusifolium*, on rubbly slopes and in mountain tundra, on turf-covered gabbro-diorite rock outcrops; avoids similar calcareous habitats. Mainly with *Abietinella abietina*, *Hylocomium splendens* var. *obtusifolium*, *Hypnum* spp., *Sanionia uncinata*, *Racomitrium* spp. and other species of well-drained tundra.
- Saelania glaucescens* (Hedw.) Broth. – Sp. In moist gabbro-diorite outcrops, cliff crevices and niches, especially in nival belt and in other places with cold microclimatic conditions, on shady moist rock surfaces, loamy or fine soil substratum, mainly with *Plagiothecium cavifolium*, *Fissidens viridulus*, *Isopterygiopsis pulchella*, *Pseudoleskeella* spp., *Blepharostoma trichophyllum* var. *brevirete*, *Anthelia juratzkana*. Less frequently in niches of polygonal tundra billows and baydzharakh slopes.
- Sanionia uncinata* (Hedw.) Loeske – Fr. Most abundant in moist foothill habitats: in sedge and cotton-grass tundra, more rare in depressions in spotty and hummocky tundra, on borders and rubbly canyon slopes, in willow-mossy communities of dell bottoms, in places with late snow melting, on turf-covered siltstone cliffs in cryophilic steppe communities on ancient marine terrace remains, in places with disturbed turf-cover. Usually grows as pure mats surrounded by *Hypnum cupressiforme*, *H. revolutum*, *Campylium stellatum*, *Plagiomnium curvatulum* and some other species depending on moisture conditions. Much more rare in mountains and in calcareous habitats.
- Schistidium agassizii* Sull. et Lesq. – Sp. On stones and rocks in stream water or on dry stream-beds, pebbly bars of rivers and of Ledyanaya Bay, as pure tufts among *S. platyphyllum*, *S. rivulare*, *Scouleria aquatica*, *Hygrohypnum polare*, *Calliergonella lindbergii*.
- **S. frigidum* Blom – Fr. This is the most abundant *Schistidium* species in the study area. On gabbro-diorite, siltstone, more rarely on limestone cliffs, humus substratum in cliff niches, in rubbly mountain tundra, canyon borders and slopes, on stony river banks. As compact pure tufts among *Encalypta* spp., *Distichium* spp., *Ditrichum flexicaule*, *Racomitrium panschii*, *Bryum* spp., *Bryoerythrophyllum recurvirostrum*, etc. [*Schistidium andreaeopsis* (C.Müll.) Lazar. cited for vicinity of Ledyanaya Bay by Fedosov (2005) was further reidentified as this species].
- **S. frivollianum* Blom – Rar. Collected twice in calcareous habitats: on limestone cliff and in rubbly dwarf-mossy tundra, with *Hypnum vaucheri*, *Kiaeria blyttii*, *Syntrichia ruralis*; once at moist base of gabbro-diorite outcrop in foothill hummocky tundra, with *Mnium lycopodioides*.
- **S. papillosum* Culm. – Fr. Mostly in wet mountain habitats: in hillside swamps and eluvial slope bases, with *Pseudocalliergon brevifolium*, *Orthothecium chryseon*, *Tomentypnum nitens*, *Philonotis fontana*, *Calliergon giganteum*, *Meesia* spp., *Warnstorfia sarmentosa*; on wet, mostly siltstone cliffs, with *Orthothecium chryseon*, *Distichium capillaceum*, *Hygrohypnum* spp.; less frequent in foothill hummocky tundra and at canyons borders.
- **S. platyphyllum* Blom – Sp. On humus or fine soil substratum in niches of gabbro-diorite and siltstone cliffs, on pebbly river and creek banks, with *Schistidium agassizii*, *S. rivulare*, *Calliergonella lindbergii*.
- **S. pulchrum* Blom – Rar. Collected twice: in gabbro-diorite cliff crevice in dike complex on top of hill with elevation 130.7 m, with *Grimmia longirostris*, *Dicranoweisia crispula*; on pebbly bar of Ledyanaya Bay, on stone, with *Scouleria aquatica* and *Schistidium platyphyllum*.
- S. rivulare* (Brid.) Podp. – Sp. In wet crevices and niches of different rocks; on pebbly banks and bar of Ledyanaya Bay, sometimes in running water, with other *Schistidium* species, *Scouleria aquatica*, etc.
- **S. submuticum* Broth. ex Blom – Un. In cryophilic steppe community with *Puccinella* spp., on dry calcareous fine soil sediments, with *Dicranella cerviculata*, *D. humilis*, *Distichium* spp., *Ceratodon purpureus*, *Gymnomitrium corallioides*.
- **S. submuticum* ssp. *arcticum* Blom – Rar. In gabbro-diorite dike complex at the top of ridge at elevation 130.7 m, on humus substratum in cliff crevice, with *Mnium lycopodioides*, *Isopterygiopsis pulchella*; in limestone cliff crevice, with *Bryoerythrophyllum recurvirostrum*.
- Scorpidium scorpioides* (Hedw.) Limpr. – Rar. On flooded polygons in polygonal mire at Ledyanaya Bay southern shore. Forms pure cover surrounded by *Hamatocaulis vernicosus*, *Cinclidium latifolium*, *Lim-*

- prichitia revolvens*, *Pseudocalliergon* spp., *Calliergon* spp.
- Scouleria aquatica* Hook. – Sp. Locally abundant on silted strip of pebbly bar at the northern shore of Ledyanaya Bay, that is flooded in June-July but becomes still dry after extensive snow melting. Forms pure tufts on big stones, among *Fontinalis antipyretica* var. *gracilis*, *Schistidium platyphyllum*, *Calliergonella lindbergii*, *Warnstorfia fluitans*. Not found in other places.
- **Seligeria tristichoides* Kindb. – Rar. In cracks and on overhanging shaded surface of limestone cliffs, mainly on bare rock surface, with *Trichostomum crispulum*, *Pseudoleskeella tectorum*; abundant in these habitats.
- Sphagnum angustifolium* (Russ.) C. Jens. – Rar. On hummocks in wet mossy tundra near the top of ridge with elevation 130.7 m; with *Sphagnum balticum*, *S. capillifolium*, *Tortella tortuosa*, *Oncophorus wahlenbergii*, *Limprichtia revolvens*, *Loeskypnum badium*.
- S. aongstroemii* C.Hartm. – Sp. In sedge and cotton-grass tundra, on dells, on billows in polygonal mires, in mountain swamps. Forms pure hummocks, more rarely grows mixed with *Sphagnum fimbriatum*, *S. russowii*, *S. orientale* and *Polytrichum* spp.
- S. balticum* (Russ.) Russ. – Sp. Forms hummocks on foothill eluvial slope bases and hillside swamps, more rare in foothill cotton-grass tundra. Mainly accompanied by *Sphagnum russowii*, *S. teres*, *Campylium stellatum*, *Pseudocalliergon* spp., *Cinclidium* spp., etc.
- S. capillifolium* (Ehrh.) Hedw. – Rar. In hillside swamps and on eluvial slope bases, with *Sphagnum russowii*, *Campylium stellatum*, *Oncophorus wahlenbergii*, etc.; forms dense pure hummocks among *Aulacomnium* spp., *Polytrichum* spp., and *Dicranum laevidens*.
- S. contortum* Schultz – Rar. In hillside swamp on Obryvisty Creek canyon slope, on hummock with *Sphagnum teres*, *S. lenense*, *Oncophorus wahlenbergii* etc., in sedge-cotton-grass tundra at hill with elevation 142 m; on gentle slope on hummock, with *Campylium stellatum*, *Aulacomnium palustre*.
- **S. denticulatum* Brid. – Un. In polygonal mire at hill with elevation 142 m; on gentle slope on hummock, at the border of polygon, with *Brachythecium mildeanum*, *Warnstorfia sarmentosa*, *Calliergon* spp., *Polytrichum hyperboreum*.
- S. fimbriatum* Wils. – Rar. Forms hummocks in wet foothill sedge and cotton-grass tundra, on flooded lake shores (with *Sphagnum squarrosum*, *Warnstorfia* spp., *Meesia triquetra*, *Calliergon* spp.); found once on calcareous eluvial slope base, with *Cassiope tetragona*, *Tomentypnum nitens*, *Orthothecium chryseon*, *Didymodon asperifolius* var. *gorodkovii*.
- S. girgensohnii* Russ. – Rar. In the same places as the previous species.
- S. lenense* H.Lindb. ex Pohle – Rar. In hillside swamp on slope of Obryvisty Creek canyon, with *Sphagnum teres*, *S. contortum*, *S. russowii*, *Campylium stellatum*, *Oncophorus wahlenbergii*, *Aulacomnium* spp.; on southern slope of ridge with elevation 208,0-295 m, accompanied by *Shagnum aongstroemii*, *Pseudocalliergon brevifolium*, etc.
- S. obtusum* Warnst. – Un. On flooded lake shore in Uglenosnaya River estuary, in wet depression, with *Meesia triquetra*, *Cinclidium latifolium*, *Campylium stellatum*, *Warnstorfia sarmentosa*, *W. pseudostraminea*, *Calliergon* spp.
- S. orientale* L.Savicz – Un. In polygonal mire at the southern shore of Ledyanaya Bay, with *Sphagnum subsecundum*, *Limprichtia revolvens*, *Pseudocalliergon brevifolium*, *Warnstorfia sarmentosa*, *W. pseudostraminea*, *Calliergon richardsonii*.
- S. platyphyllum* (Braithw.) Warnst. – Un. In wet thermokarst depression in foothill sedge-cotton-grass tundra on Ledyanaya Bay northern slope, submerged in water.
- S. russowii* Warnst. – Fr. Most abundant in different mires on slopes. Forms hummocks on eluvial slope bases and hillside swamps; less frequent on wet strips of hummocky and spotty tundra, on billows in polygonal mires, in dell bottoms, often with admixture of *Aulacomnium palustre*, *A. turgidum*, *Polytrichum strictum*, *P. hyperboreum*, *Cinclidium* spp. on hummocks and with *Sphagnum teres* in depressions.
- S. squarrosum* Crome – Sp. Forms dense pure hummocks in foothill cotton-grass and sedge tundra, in swamps in river estuaries, at flooded lake shores, in polygonal mires (mainly on borders of polygons), in willow-mossy communities at dell bottoms, more rarely on eluvial slope bases and in moist calcareous tundra. Usually surrounded by *Sphagnum fimbriatum*, *S. subsecundum*, *Calliergon* spp., *Straminergon stramineum*, *Plagiomnium curvatulum*, *Meesia triquetra*, *Tomentypnum nitens*. Absent in mountain habitats where it is apparently replaced by *Sphagnum aongstroemii*.
- S. subsecundum* Nees – Sp. In foothill area this species occurs in similar places as *S. squarrosum*, but is somewhat less frequent. Colonizes dell complexes, eluvial slope bases, different hillside swamps; grows with *Sphagnum russowii*, *S. teres*, *S. contortum*, *Limprichtia* spp., *Loeskypnum badium*, *Mesoptychia sahlbergii*, etc.
- S. teres* (Schimp.) Aongstr. – Fr. This is the most abundant *Sphagnum* species in the study area, it occurs in the full range of habitats suitable for species of this genus: in moist foothill tundra, in homogenous and polygonal mires, on boggy lake shores and dell bottoms, eluvial slope bases and hillside swamps, including calcareous one. Mainly occupies depressions

- in habitats with microrelief, often among hummocks of *Sphagnum russowii*.
- S. warnstorffii* Russ. – Sp. In the same places as *S. russowii*.
- Splachnum sphaericum* Hedw. – Sp. On reindeer excrements in moist foothill tundra, at eluvial slope bases and in other habitats with suitable substratum and moderately but permanently wet places.
- S. vasculosum* Hedw. – Rar. In places similar to those of previous species.
- Stegonia latifolia* (Schwaegr.) Vent.ex Broth. – Sp. On rubbly calcareous slopes, with *Syntrichia ruralis*, *Kiaeria blyttii*, *Encalypta* spp., *Hypnum vaucheri*; in disturbed places and on strips with disturbed moss cover, accompanied by *Bryum* spp., *Ceratodon purpureus*; on silty sediments, with *Hennediella heimii* var. *arctica*; on gabbro-diorite cliff on southern slope of ridge with elevation 208.0 m.
- Straminergon stramineum* (Dicks. ex Brid.) Hedenäs – Sp. In foothill tundras and mires, especially abundant in willow-mossy communities of dell bottoms. Somewhat less abundant in homogenous mires at river estuaries, polygonal mires, often as scattered plants among *Warnstorfia sarmentosa*, *Limprichtia revolvens*, *L. cossoni*, *Calliergon cordifolium*, *Cinclidium latifolium*, *Campylium stellatum*; in relatively drier microhabitats than *Calliergon giganteum* and *C. richardsonii*.
- Syntrichia norvegica* Web. f. – Un. On siltstone cliff ledge in Obryvisty Creek canyon, on fine soil substratum, as compact pure tufts among *Syntrichia ruralis*, *Didymodon icmadophyllus*, *Encalypta alpina*, *Distichium capillaceum*, *Ditrichum flexicaule*.
- S. ruralis* (Hedw.) Web. et Mohr – Fr. On relatively dry rocky habitats with undeveloped or disturbed turf-cover: on overgrown borders of pebbly bars, turf-covered rock outcrops, rubbly slopes of canyons, with *Racomitrium panschii*, *Rhytidium rugosum*, *Polytrichum* spp., *Pogonatum urnigerum*; most abundant in similar calcareous habitats, with *Encalypta procera*, *Hypnum vaucheri*, *Bryoerythrophyllum recurvirostrum*, *Kiaeria blyttii* and other species; on different rock outcrops, in disturbed places.
- Tetraplodon mnioides* (Hedw.) B.S.G. – Fr. On different organic substrates: e.g., animal excrements and corpses; rarely on bare loamy substratum in different tundras, including relatively dry mountain and calcareous ones; as large dense pure tufts or with *Splachnum* spp., *Aplodon wormskjoldii* and other tundra mosses (*Dicranum elongatum*, *Pohlia nutans*, etc.). Especially abundant in places with zoogenic microrelief.
- Thuidium philibertii* Limpr. – Un. On eluvial slope base under limestone outcrops, found as a single plant in moss cover of *Limprichtia revolvens*, *Hamatocaulis vernicosus*, *Meesia* spp., *Oncophorus wahlenbergii*, *Sphagnum teres*, *S. russowii*, *Tomentypnum nitens*.
- Timmia austriaca* Hedw. – Sp. On bare loamy substratum in places with disturbed turf-cover, at canyon and bank borders, moist terraces of Ledyanaya Bay, in niches of gabbro-diorite, siltstone and limestone cliffs, and at moist outcrop bases, on baydzharakh, mainly mixed with *Bryum pseudotriquetrum*, *Pohlia* spp., *Brachythecium mildeanum*, *Aulacomnium turgidum*, *Sanionia uncinata*, *Plagiomnium* spp., *Rhizomnium andrewsianum* and other mosses.
- T. comata* Lindb. et H.Arnell – Sp. In niches of siltstone and limestone cliffs, on turf-covered rock outcrops, in rubbly tundra and on canyon slopes, in hummocky and spotty tundra, in disturbed places. Found in drier places than previous species, co-occurring with *Bryoerythrophyllum recurvirostrum*, *Ditrichum flexicaule*, *Distichium capillaceum*, *Hypnum* spp., *Encalypta* spp., *Bryum* spp., *Pohlia* spp., *Dichodontium pellucidum*, and *Ceratodon purpureus*.
- T. norvegica* Zett. – Un. On bare loamy soil on the border of Uglenosnaya River terrace, with *Myurella* spp., *Mnium lycopodioides*, *Pohlia nutans*, *Encalypta rhapsocarpa*, *Eurhynchium pulchellum*, *Cirriphyllum cirrosum*.
- **T. sibirica* Lindb. et H.Arnell – Un. In dry creek bed on Ledyanaya Bay northern shore, on dying tuft of *Bryum pseudotriquetrum*.
- Tomentypnum nitens* (Hedw.) Loeske – Com. Widespread species in moist habitats, either in mountains or in plains. The species dominates in moss cover of foothill sedge and cotton-grass tundras, between hummocks in hummocky and spotty tundra; in wet thermokarst depressions it is replaced by *Ptilidium ciliare*, and on drier hummock slopes it is replaced by *Hylocomium splendens* var. *obtusifolium*. Dominates in willow-mossy communities of dell bottoms, in dell complexes and hillside swamps. Less abundant in polygonal mires and at swampy lake shores, rare in homogenous swamps.
- **Tortella alpicola* Dix. – Rar. In niches of gabbro-diorite, siltstone and limestone cliffs, as compact dense tufts on loamy or fine soil substratum, with *Encalypta alpina*, *Distichium* sp., *Ditrichum flexicaule*, *Didymodon icmadophyllus* in first case, *Cnestrum alpestre* in second case, *Trichostomum arcticum* in third one.
- T. arctica* (H.Arnell.) Grundw. et Nyh. – Rar. On dell complexes and eluvial slope bases mainly near calcareous rock outcrops, as pure cushions among *Tomentypnum nitens*, *Sphagnum teres*, *S. russowii*, *Ditrichum flexicaule*, *Orthothecium chryseon*, *Philonotis tomentella*, *Catoscopium nigratum*.
- T. fragilis* (Hook.et Wils.) Limpr. – Sp. In niches of gabbro-diorite, siltstone and limestone cliffs, in rub-

- bly mountain tundra, at canyon slopes and dry fine soil sediments, mostly in calcareous places. Forms pure tufts or grows mixed with *Hypnum spp.*, *Sanionia uncinata*, *Encalypta spp.*, *Ditrichum flexicaule*, *Distichium spp.* and other species.
- T. tortuosa* (Hedw.) Limpr. – Fr. A common species of eluvial slope bases and dell complexes, where it forms large pure dense carpets among *Pseudocalliergon brevifolium*, *Meesia triquetra*, *Orthothecium chryseon*, *Catoscopium nigratum*; less frequent in nival habitats, with *Bryum cryophilum*, on moist turf-covered rock outcrops, at canyon borders, in foothill hummocky tundra.
- **Tortula hoppeana* (Schultz) Ochyra (= *Tortula eurhyphylla* Zander, *Desmatodon latifolius* (Hedw.) Brid.) – Un. On humus substratum, on rubbly slope on limestone rock outcrops with *Cystopteris fragrans*, *Alyssum obovatum*, *Astragalus tolmaczevii* in Primetny Creek canyon, among *Syntrichia ruralis*, *Encalypta procera*, *E. rhaptocarpa*, *Kiaeria blyttii*, *Hypnum spp.* and other mosses.
- T. leucostoma* (R.Br.) Hook. et Grev. – Un. Found at the southern apex of Mutafi Cape, near Rysyukova Cape, on strip with disturbed moss cover; on bare loamy soil, as scattered plants among *Ceratodon purpureus*, *Encalypta procera*, *Dichodontium pellucidum*, *Dicranella subulata*, *Distichium capillaceum*, *Bryum spp.*
- T. mucronifolia* Schwaegr. – Sp. In niches of limestones, more rarely of gabbro-diorite cliffs, in rubbly tundra, especially in calcareous places, as scattered plants among *Syntrichia ruralis*, *Kiaeria blyttii*, *Pseudostereodon procerrimus*, *Hypnum vaucheri*. Found once on pebbly bank of Perevalny Creek.
- **T. truncata* (Hedw.) Mitt. (= *Pottia truncata* (Hedw.) Fuernr.) – Un. In calcareous cryophilic steppe community, on dry turf-covered rubbly loamy slope of southern exposition, single generative plant among *Hypnum vaucheri*, *Syntrichia ruralis*, *Pseudostereodon procerrimus*, *Tortula mucronifolia*.
- Trichostomum arcticum* Kaal. – Rar. On moist loamy substratum in niches of limestone cliffs; on moist calcareous fine soil sediments at the border of Primetny Creek bank.
- T. crispulum* Bruch – Rar. In cracks and crevices of limestone cliffs, as compact pure tufts among *Bryerythrophyllum spp.*, *Encalypta procera*, *Seligeria tristichoides*; once found on frost-boiling in foothill spotty tundra.
- Warnstorfia exannulata* (B.S.G.) Loeske – Rar. Collected twice on flooded lake shore in foothill area, with *Sphagnum squarrosum*, *S. subsecundum*, *Meesia triquetra*, *Calliergon giganteum*, *Pseudocalliergon brevifolium*, and found once in lake water with *Fontinalis hypnoides* (Melkoye Lake).
- W. fluitans* (Hedw.) Loeske – Rar. On silt cover of pebbly bar strip at the northern shore of Ledyanaya Bay, with *Fontinalis antipyretica* var. *gracilis* and *Scouleria aquatica*.
- W. pseudostraminea* (Müll. Hal.) Tuom. et Kop. – Rar. In homogenous mires in river estuaries, at lake shores, as scattered plants among *Sphagnum spp.*, *Pseudobryum cinclidioides*, *Calliergon cordifolium*, *Straminergon stramineum*, *Warnstorfia sarmentosa*.
- W. sarmentosa* (Wahlenb.) Hedenäs – Fr. One of dominant species of homogenous mires and on polygons of polygonal mires, at flooded lake shores, with *Sphagnum spp.*, *Calliergon cordifolium*, *Hamatocaulis vernicosus*, *Warnstorfia tundrae*, *Plagiomnium ellipticum*, *Straminergon stramineum*, *Limprichtia revolvens*, *Cinclidium latifolium*; in foothill sedge and cotton-grass tundra, at dell bottoms, more rare on eluvial slope bases and in wet nival habitats.
- W. tundrae* (Arnold) Loeske – Un. In wet narrow on pass between ridges with elevations 208.0 and 295 m; with *Hygrohypnum polare*, *Bryum cryophilum*, *Calliergon giganteum*, *Warnstorfia sarmentosa*.
- **Weissia* cf. *brachycarpa* (Nees et Hornsch.) Jur. – Un. On frost-boils in spotty tundra on gentle western slope of hill with elevation 142,7 m, as low compact pure tuft surrounded by *Ceratodon purpureus* and *Pohlia andrewsii*. Because sporophytes were absent we were unable to confirm with certainty the identification of this species but some features (relatively large plants with broadly incurved leaf margins) allowed us to refer the specimen to this species.

The moss flora consists of 233 species, one subspecies and five varieties. Its richness exceeds all other local moss floras of Taimyr; until now the most diverse was the moss flora of Tareya that included 179 species (Blagodatskikh, 1974, with some additions). The high moss diversity of Ledyanaya Bay is explained best by the following:

- (1) substantial intensity of moss collecting;
- (2) landscape diversity;
- (3) rock diversity, ranging from limestone to neutral (siltstone) and slightly acid (gabbro-diorite);
- (4) great diversity of habitats due sharp differences in light, temperature, wind and moisture conditions, different snow quantity, etc.;
- (5) use of recent taxonomic revisions, which have “split” previous complex species into more taxa.

Forty eight species, one subspecies and one variety of mosses are reported for Taimyr Peninsula for the first time. These are species more or less characteristic for mountain habitats. They

include species of gabbro-diorite cliffs (four *Grimmia* species, *Isopterygiopsis muelleriana*, *Pseudohygrohypnum subeugyrium*, *Pterigynandrum filiforme*, *Pseudoleskeella* spp., *Neckera pennata*, some *Schistidium* species and others), some of them are frequent and abundant in these habitats. Other species (*Barbula convoluta*, *Weissia brachycarpa*, *Timmia sibirica*, *Pottia truncata*, *Dicranella humilis*, and *Molendia sendtneriana*) are rare in this area and occur more or less sporadically in the region. Some of these species (*Grimmia jacutica*, *Orthotrichum iwatsukii*, *Schistidium* spp.) are recently described, while data on some others (*Aongstroemia longipes*, *Grimmia elatior*) were until now unpublished.

Some rare and interesting moss species were found; among them are species that are rare throughout their world range: *Aloina brevirostris*, *Aongstroemia longipes*, *Dicranella humilis*, *Dicranoweisia intermedia*, *Encalypta brevipes*, *E. longicollis*, *Funaria arctica*, *Pseudohygrohypnum subeugyrium*, *Timmia sibirica*, *Tortella alpicola*. Many others are at the edges of their ranges (Fedosov, 2005). The latter include species with more southern distribution and for which Ledyanaya Bay is the northernmost known locality in Eurasia: *Barbula convoluta*, *Bryum elegans*, *Didy-*

modon fallax, *Fontinalis antipyretica* var. *gracilis*, *Grimmia anodon*, *Isopterygiopsis muelleriana*, *Neckera pennata*, *Pseudoleskeella catenulata*, *P. papillosa*, *P. rupestris*, *P. tectorum*, *Pterigynandrum filiforme*, *Tortella alpicola*, *Tortula truncata*, *Weissia brachycarpa*. About 20 species are at the western limit of their distribution. These are Asian- and Eurasian-American species (known for Europe from few localities, and isolated from main area of distribution): *Bryobrittonia longipes*, *Bryoerythrophyllum ferruginascens*, *Dicranoweisia intermedia*, *Didymodon asperifolius* var. *gorodkovii*, *Grimmia jacutica*, *Isopterygiopsis muelleriana*, *Orthotrichum iwatsukii*, *Racomitrium panschii*, *Scouleria aquatica*, *Timmia sibirica*.

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