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MOSS FLORA OF BERING ISLAND (COMMANDER ISLANDS, NORTH PACIFIC)

ФЛОРА МХОВ ОСТРОВА БЕРИНГА (КОМАНДОРСКИЕ ОСТРОВА, СЕВЕРНАЯ ПАЦИФИКА)

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Abstract

Moss flora of Bering Island, the westernmost in the Aleutian Archipelago, includes 312 species. This is the greatest number among islands of the North Pacific, including Kurils. Annotated list provides data on species frequency, habitat characteristics and associated species. Species composition in different types of habitats is overviewed. *Ditrichum zonatum* var. *scabrifolium* Dixon is new for Russia; five taxa, *Bucklandiella macounii* ssp. *alpina, Didymodon vinealis, Lescuraea saviana, Philonotis capillaris,* and *Drepanocladus sordidus* are new for Russian Far East, while five others, *Didymodon insulanus, Claopodium bolanderi, Lescuraea baileyi, Rhytidiadelphus loreus,* and *Ulota phyllantha*, have been known only from Medny Island, 70 km east of Bering Island. Comparison with a number of available regional moss floras on North Pacific indicates rather boreal than hypoarctic character of the moss flora of Bering Island, which in species composition is more similar to South Kamchatka, while by family composition exhibits sufficient similarity with Eastern and Middle Kamchatka. The sharpness of phytogeographic border between Commander Islands and Aleutians, the Tatewaki line, is confirmed.

Резюме

Бриофлора острова Беринга, самого западного острова Алеутской дуги, включает 312 видов – наибольшее число среди островов Северной Пацифики, включая Курилы. В аннотированном списке представлены данные о частоте встречаемости, характеристике местообитаний, сопутствующих видах. Описано распределение видов по типам местообитаний. *Ditrichum zonatum* var. *scabrifolium* Dixon приводится впервые для России. Пять видов (*Bucklandiella macounii* ssp. *alpina*, *Didymodon vinealis, Lescuraea saviana, Philonotis capillaris* и *Drepanocladus sordidus*) являются новыми для Российского Дальнего Востока, пять (*Didymodon insulanus, Claopodium bolanderi, Lescuraea baileyi, Rhytidiadelphus loreus* и *Ulota phyllantha*) были известны на его территории только для острова Медный, 70 км восточнее острова Беринга. Сравнение с другими бриофлорами Северной Пацифики свидетельствует о том, что флора острова Беринга имеет скорее бореальный характер, чем гипоарктический. По видовому составу изученная бриофлора оказывается ближе всего к Южной Камчатке, а по таксономической структуре – к бриофлорам Восточной и Срединной Камчатки. Подтверждены данные о существовании резкой фитогеографической границы между Командорами и островом Атту – Линии Татеваки.

KEYWORDS: Aleutians, Bering Island, biogeography, bryophyte vegetation, Commander Islands, Hultenia, moss flora, North Pacific, rare species, Russian Far East.

INTRODUCTION

Until recently moss flora of the Aleutian Archipelago (including the Commander Islands) has remained rather poorly explored in the North Pacific. Only scattered data on few islands were published: Attu – 136 species, Medny – 92, Amchitka – 84, Unalashka – 59, *etc.* (Frye & Clark, 1946; Harvill, 1947; Bakalin & Cherdantseva, 2008), with none of islands studied more or less completely, thus the total number of species being 221 (Bakalin & Cherdantseva, 2008). At the same time this territory seems to be interesting, particularly because of its transitional position between two rich and rather different East Asian and Western North American floras. Commander Islands is the closest to Eurasia part of Aleutian Archipelago, it consists of two large islands, Bering and Medny, and two small ones. The first data on the Bering

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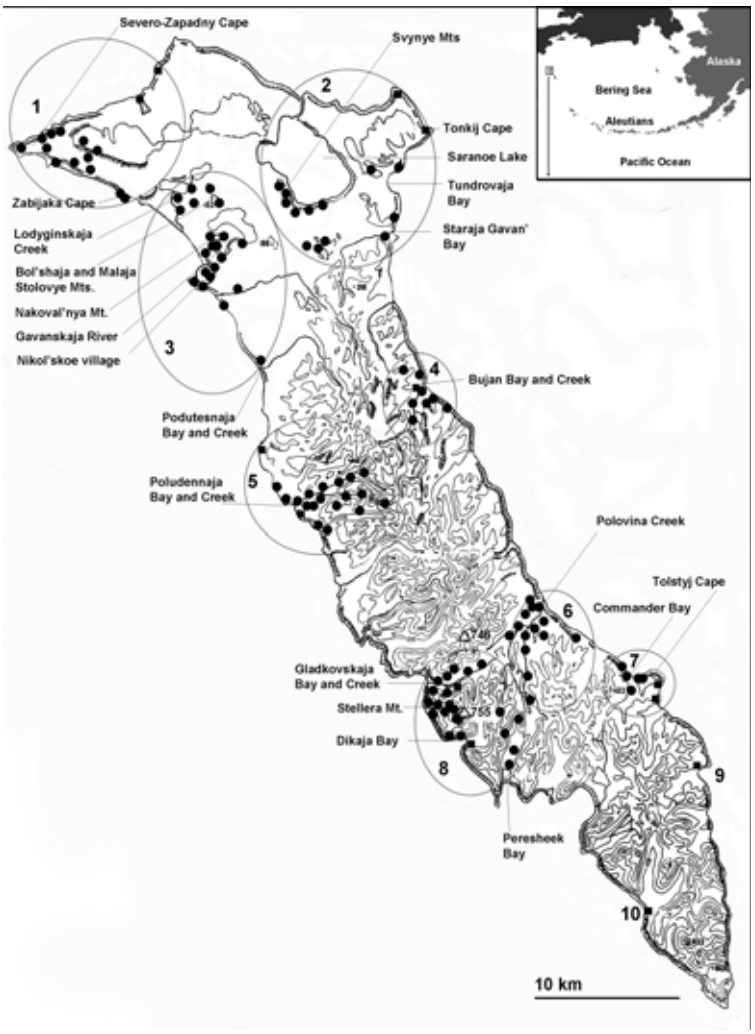


Fig. 1. Collecting localities of Fedosov (solid circles) and Mochalova, Ponomareva and Janitskaja (solid squares) – Места сбора мхов Федосовым (круги), Мочаловой, Пономарёвой и Яницкой (квадраты).
1. Cape Severo-Zapadny (55°14'-21'N – 165°44'-59'E, 0-185 m alt.) Fedosov, Mochalova – мыс Северо-западный, Федосов, Мочалова;
2. Saranoe Lake and Tonkij Cape (55°13'-19'N – 166°06'-13'E, 0-155 m alt.) Fedosov, Ponomareva & Janitskaja – озеро Сараное и мыс Тонкий, Федосов, Пономарёва и Яницкая;
3. Nikol'skoe village (55°08'-14'N – 165°59'-166°04'E, 0-160 m alt.) Fedosov – село Никольское, Федосов;
4. Buyan Bay (55°06'-08'N – 166°15-19'E, 0-130 m alt.) Fedosov, Mochalova – бухта Буян, Федосов, Мочалова;
5. Poludennaja Bay and Poludennaja Creek valley (55°00'-04'N – 166°04'-14'E, 0-650 m alt.) Fedosov, Ponomareva & Janitskaja – бухта Полуденная и долина р. Полуденной, Федосов, Пономарёва и Яницкая;
6. Polovina Bay and Polovina Creek valley (54°52'-58'N – 166°24'-29'E, 0-350 m alt.) Fedosov – бухта Половина и долина р. Половины, Федосов;
7. Tolstyj Cape and Commander Bay (54°53'-55'N – 166°32'-35'E, 0-110 m alt.), Fedosov, Mochalova – мыс Толстый и бухта Командор, Федосов, Мочалова;
8. Steller Mt. (54°50'-55'N – 166°17'-26'E, 0-740 m alt.) Fedosov, Ponomareva & Janitskaja – гора Стеллера, Федосов, Пономарёва и Яницкая;
9. Peregryobnaja Bay (ca. 54°50'N – 166°38'E, 0-100 m alt.) Ponomareva & Janitskaja – бухта Перегрёбная, Пономарёва и Яницкая;
10. Bobrovaja Bay (ca. 54°44'N – 166°34'E, 0-50 m alt.) Ponomareva & Janitskaja – бухта Бобровая, Пономарёва и Яницкая.

Island moss flora was published by Arnell (1917), who studied specimens collected by "Vega Expedition" in August of 1879; the list included 22 species. Not long ago both large Commander islands were explored for liverworts by V.A. Bakalin, who also collected mosses, subsequently identified by V.Ya. Cherdantseva (Bakalin & Cherdantseva, 2006b, 2008). Although the published data on mosses (23 and 92 species for Bering and Medny Islands correspondingly) were incomplete, some interesting records of mosses new for Russia (*Claopodium bolanderi*, *Lescuraea baileyi*), as well as some rare amphioceanic species new for the Russian Far East (*Rhytidiadelphus loreus, Ulota phyllantha*) were revealed (Cherdantseva, 2010).

From 5 to 30 August, 2010, the first author conducted additional field work in the Bering Island. Main areas and collecting localities are shown in Fig 1. Totally ca. 1300 specimens were collected. Two small collections from Bering Island, gathered by E.O. Ponomareva and T.O. Janitskaja in July-August 1986 and by O.A. Mochalova in August 1991 and August 2000 (totally 46 specimens), were also studied.

Bering Island (54°40' – 55°22'N; 165°45' – 166°40'E), the westernmost among the Commander Islands, is situated 175 km apart from the coast of the Kamchatka Peninsula. Being stretched from NW to SE, it is 88 km long and up to 20 km wide, covering 1667 km^2. Most part of the island is characterized by hilly to low mountain landscape, the highest point being Steller Mt., 755 m alt. Bedrocks in the island are composed of somewhat calcareous sedimentary rocks covered with friable quaternary deposits, the latter being thicker in the middle part of the island and less so in its southern part. Most slopes are very steep with numerous rock outcrops. Creek valleys are mostly V-shaped, sometimes with cliffy canyons and snow beds, which mostly melt off by September. Only lower courses of some big creeks have well developed peat-covered valleys. Mountain slopes to the sea coast are cliffy and with numerous waterfalls. North-western part of the island, westward from Nikol'skoe Village, is mainly boggy lowland with numerous lakes, which alternates with tablelands, composed of sedimentary and igneous basaltoid rocks. In the vicinity of Cape Severo-Zapadny extensive sandstone massifs occur.

The climate of the area under study is moderately oceanic with annual average temperature of +2.1°C; an amplitude of mean month temperature between the coldest month (February) and warmest one (August) is rather low, of about 15°, while the ultimate temperature limits being t_{min} = –18°C and t_{max} = +23°C. Annual precipitation is about 470 mm in the western part of island, where Nikol'skoe settlement is situated (Kursanova & Savchenko, 1966), while mountain local climatic conditions have not been studied. Atmospheric humidity is almost constantly high, rains are weak but prolonged. Oceanic impact is also expressed in mists and strong winds.

Vegetation

Tundra

Vegetation of the island has been described by Mochalova & Yakubov (2004); the vascular plant names cited below follow this publication. The Bering Island lacks any forest vegetation. Most watersheds are covered by tundra-like heaths, which cover also some coastal terraces, gentle hill slopes and turf-covered slopes up to 500-600 m alt. These communities have usually numerous hummocks, the latter often having a more or less disturbed tops. Among abundant dwarf shrubs are *Rhododendron aureum, Empetrum nigrum, Arctous alpina* and *Cassiope lycopodioides*, and they grow with *Chamaepericlymenum suecicum, Bistorta vivipara, Equisetum hyemale, etc.* Sparse moss cover is composed of *Hylocomium splendens, Pleurozium schreberi, Brachythecium albicans, Dicranum majus, D. flexicaule, D. fuscescens, Stereodon plicatulus, Sanionia uncinata, Polytrichum juniperinum, Pleuroziopsis ruthenica*.

Well drained *Empetrum*-dominating heath occurs on hills between Nikol'skoe Village and Staraja Gavan' Bay. Mosses are rare in this community, being represented mostly by *Dicranum* spp., *Sanionia uncinata, Stereodon plicatulus*. Spotty mountain tundra with *Cassiope lycopodioides, Arctous alpina, Bryanthus gmelinii, Diapensia obovata* and *Empetrum nigrum* on tops of highest ridges has numerous spots of bare ground with *Pogonatum urnigerum, Bucklandiella* spp., *Polytrichastrum alpinum, Niphotrichum ericoides, Polytrichum piliferum, Oligotrichum hercynicum, Racomitrium lanuginosum, Dicranum acutifolium, D. majus, Dicranella subulata, Ditrichum heteromallum, Ceratodon purpureus, Pohlia proligera, Hylocomiastrum pyrenaicum, Racomitrium lanuginosum, Rhytidium rugosum, etc.*, and lichens *Cetraria* spp., *Cladonia* spp., *Thamnolia vermicularis*.

Low terraces and plains in the northern part of the Bering Island are mainly covered by moist dwarf-shrub mossy tundra with *Empetrum nigrum, Rubus chamaemorus, Trichophorum cespitosum, Vaccinium uliginosum, Rubus arcticus, etc.* Among mosses, *Sphagnum fimbriatum, S. fuscum, S. girgensohnii, S. russowii, Dicranum elongatum, D. bonjeanii, Aulacomnium palustre, Polytrichum strictum, Rhizomnium andrewsianum, Pleurozium schreberi* are most abundant. Interesting moss communities were observed on mineral ground in disturbed strips of dry sandy terraces near road in the vicinity of Cape Severo-Zapadny. Only *Empetrum* is relatively frequent among vascular plants, while moss cover was well developed, composed of extensive pure mats of *Codriophorus fascicularis, Niphotrichum muticum, Niphotrichum ericoides, Bucklandiella laeta, Racomitrium lanuginosum*, covering many square meters.

Communities of *Betula exilis* are scattered in NW part of the island on hillocks among *Sphagnum* mires or in depressions in hummocky tundra. *Carex gynocrates, C. saxatilis, Empetrum nigrum, Lycopodium annotinum, Luzula multiflora* s.l. are most abundant among vascular plants, while the moss cover includes here *Dicranum elongatum, D. flexicaule, Sanionia uncinata, Climacium dendroides, Sphagnum girgensohnii, Hylocomium splendens, Pleurozium schreberi, Polytrichum juniperinum, P. strictum*.

Shrubs

The valleys of Bujan and Poludennaja Creeks are partly occupied by *Salix alaxensis, S. arctica* ssp. *crassijulis*, and *S. lanata* shrub communities with *Cacalia kamtschatica, Calamagrostis purpurea* s.l., *Filipendula camtschatica, Lerchenfeldia flexuosa, etc.* In moss layer, there are sparse *Brachythecium rivulare, Bryhnia hultenii, Rhizomnium magnifolium, R. nudum, Climacium dendroides, Plagiothecium denticulatum, P. cavifolium, Sciuro-hypnum reflexum, S. plumosum, S. uncinifolium, Rhytidiadelphus squarrosus, Plagiomnium magnifolium*.

In rather dry conditions bases of willow scrubs are sparsely covered by *Sciuro-hypnum reflexum, Amblystegium serpens, Sanionia uncinata, Herzogiella adscendens*; in more humid places, *e.g.* near water courses *Drepanocladus polygamus, Dichelyma capillaceum, Leptodictium riparium, Hygrohypnella ochracea* grow on willows.

Lower parts of Nakoval'nya tableland slopes near Nikol'skoe and rocky slopes of lowland creek canyons in Poludennaja Creek basin are partly covered by shrub *Sorbus sambucifolia* where it can be up to 1.5 m tall, with *Cacalia kamtschatica, Cirsium kamtschaticum, Dryopteris expansa, Maianthemum dilatatum, etc.* Moss cover includes: *Bryhnia hultenii, Sciuro-hypnum reflexum, Claopodium* spp., *Plagiothecium cavifolium, Pseudotaxiphyllum elegans, Climacium dendroides, Plagiomnium* spp., *Rhizomnium magnifolium, Sanionia uncinata, Ceratodon purpureus, Peuroziopsis ruthenica, Syntrichia ruralis, Timmia bavarica, Thuidium assimile*.

The low shrub communities of *Sorbus sambucifolia* and *Rhododendron aureum* occur in terraces and gentle steps of mountain slopes, in the middle part of the island. Under shrub canopy *Bistorta vivipara, Chamaepericlymenum suecicum, Coptis trifolia*, and other vas-

cular plant grow, while in moss cover *Heterocladium dimorphum, Rhytidiadelphus squarrosus, R. triquetrus, Niphotrichum muticum, Stereodon plicatulus, Dicranum majus, D. acutifolium, Hylocomium splendens, Polytrichastrum alpinum, Plagiomnium medium, Syntrichia norvegica, Sanionia uncinata* occur.

Meadows

Along the seashore different types of meadows occur. The closest to beach are *Leymus mollis* communities with some marine halophytes. Moss may be absent or otherwise well developed here. Abundant species include *Syntrichia ruralis* and *Hennediella heimii*. Further inland meadows of *Senecio pseudoarnica* are developed, with *Heracleum lanatum, Angelica gmelinii, Conioselinum chinense, etc.* Moss cover also strongly varies here in composition and abundance: *Barbula convoluta, B. unguiculata, Hennediella heimii, Bryoerythrophyllum recurvirostrum, Ceratodon purpureus, Pohlia wahlenbergii, Bryum argenteum, B. creberrimum, B. knowltonii, B. salinum* grow on sandy sediments, while *Rhytidiadelphus* spp., *Sanionia uncinata, Brachythecium* spp., *Polytrichum juniperinum, P. commune, Leptobryum pyriforme, Amblystegium serpens, Syntrichia ruralis, Plagiomnium* spp., *Philonotis fontana* are more characteristic on soil rich in humus, and *Tortula mucronifolia, T. hoppeana, Bartramia ithyphylla, Timmia norvegica, Trachycystis flagellaris, Herzogiella adscendens, Sciuro-hypnum reflexum, Plagiothecium cavifolium, Hylocomium splendens* occur on rocky substrates.

These coastal meadows are substituted toward the inner part of the island by tall herbage communities with *Aconitum maximum, Cacalia kamtschatica, Senecio cannabifolius, Veratrum oxysepalum, etc.* Moss cover in more humid conditions here is similar to that in willow & tall herbage communities in river valleys, while in more drained places – to that of *Sorbus sambucifolia* and tall herbage communities mentioned above.

Dry meadows on steep rocky slopes to the sea coast are characterized by *Aster sibiricus, Festuca rubra, Parageum calthifolium, Saxifraga serpyllifolia, etc.*, interrupted by numerous thalus strips. Mosses are not common here, growing mostly under grass canopy: *Polytrichastrum alpinum, Polytrichum juniperinum, Pleurozium schreberi, Rhytidiadelphus squarrosus, Pogonatum urnigerum, Bartramia ithyphylla, Dicranella* spp., *Pohlia cruda, P. bulbifera, P. proligera, Ceratodon purpureus, Bryoerythrophyllum recurvirostrum, etc.*

On saddle slopes, in narrow hollows and fern-dominating communities, composed of *Athyrium filix-femina, Dryopteris expansa, Oreopteris quelpaertensis, Polystichum braunii* with admixture of other vascular plants, the moss composition is as follow: *Brachythecium* spp., *Heterocladium dimorphum, Hylocomiastrum pyrenaicum, Hylocomium splendens, Climacium dendroides, Rhizomnium nudum, R. magnifolium, Rhytidiadelphus subpinnatus, R. loreus, Dicranum majus, Lescuraea* spp., *etc.*

Phyllodoce aleutica and *P. caerulea*-dominated alpine meadows with *Rhododendron camtschaticum, Vaccinium uliginosum, Anemone narcissiflora, Carex* spp., *Diphasiastrum alpinum* occupies saddles of highest ridges and borders of snow beds. Its sparse moss cover includes *Sanionia uncinata, Dicranum majus, D. groenlandicum, Codriophorus fascicularis, C. corrugatus, Niphotrichum muticum, Hylocomiastrum pyrenaicum, Pohlia nutans, Bartramia ithyphylla, Pogonatum urnigerum, Oligotrichum* spp., *etc.* Somewhat similar communities in nival brook canyons include *Salix arctica* s.l., *S. reticulata, Anemone narcissiflora, Loiseleuria procumbens, etc.* while moss cover is composed of *Lescuraea patens, L. saxicola, Bucklandiella* spp., *Codriophorus fascicularis, Dicranum spadiceum, Dicranella subulata, Polytrichastrum alpinum, Pohlia* spp.

Nival strips along snow beds are most abundant in southern part of island on steep slopes of highest tops and also occur in creek canyons almost to the sea level. Vascular plant vegetation is represented by *Alopecurus alpinus* subsp. *stejnegeri, Carex* spp., *Iris setosa, Lagotis glauca, Polemonium acutiflorum, etc.*, while among mosses the most common are *Bucklandiella* spp., *Niphotrichum* spp., *Pohlia drummondii, Conostomum tetragonum, Racomitrium lanuginosum, Hymenoloma crispulum, Schistidium papillosum, Polytrichastrum sexangulare, Pogonatum urnigerum, P. contortum, Arctoa fulvella, Kiaeria starkei.*

Communities near relatively late melting snow beds at lower elevation differ in moss composition on different substrates. Rocky and sandy places have extensive moss carpets formed by *Bucklandiella* spp., *Codriophorus* spp., *Niphotrichum ericoides, N. canescens, Racomitrium lanuginosum, Conostomum tetragonum, Kiaeria starkei, Arctoa fulvella*, while *Polytrichum juniperinum, Sanuonia uncinata, Polytrichastrum alpinum, Conostomum tetragonum, Pogonatum dentatum, Hylocomiastrum pyrenaicum, Pleurozium schreberi* grow on soil rich in humus.

Wet meadows occur in trough-like creek valleys and bog edges in NW part of island. Vascular plants include here *Carex lyngbyei* subsp. *cryptocarpa, C. macrochaeta, Bistorta vivipara, Iris setosa, Parnassia palustris, etc.*, while moss cover is composed of *Drepanocladus aduncus, D. arcticus, D. sordidus, Climacium dendroides, Pohlia wahlenbergii, Dicranum bonjeanii, Dichodontium* spp., *Philonotis fontana, Rhizomnium andrewsianum, R. nudum, R. pseudopunctatum, Bryum pseudotriquetrum, Cratoneuron filicinum, Campyliadelphus chrysophyllus.*

Mires

In Gavanskaja River valley between Nakoval'nya Mt. and Nikol'skoe Village, a lowland hummocky rich fen with *Eriophorum polystachion, Menyanthes trifoliata, Pedicularis* spp., *Carex rariflora, etc.* is situated. Moss

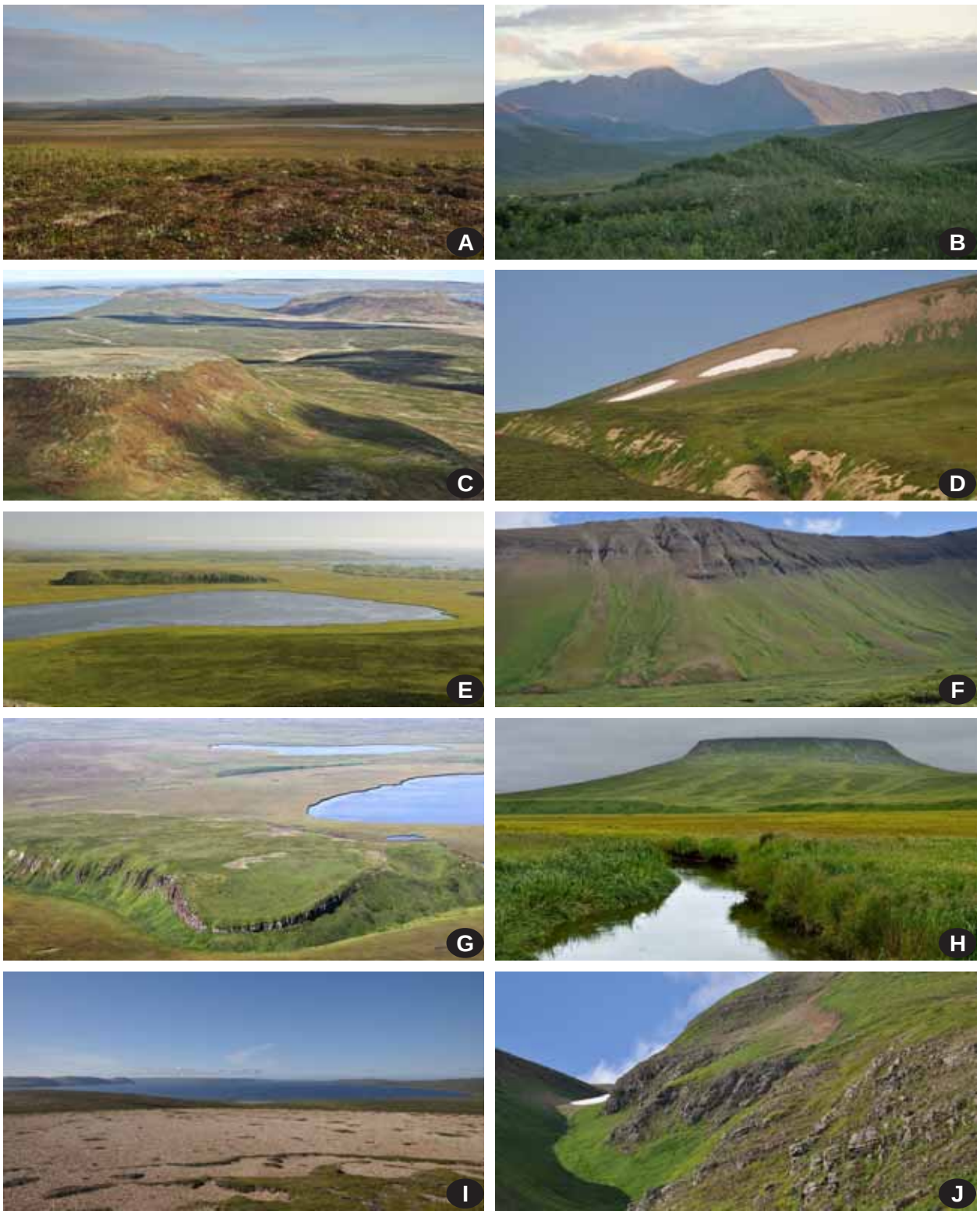


Fig. 2. Landsapes of Bering Island: **A** – lowland northern part of the island, Gavanskaja River valley, hummocky tundra; **B** – Steller Mt., view from Polovina Creek valley, coastal meadow; **C** – Malaja Stolovaja Mt. (in front), mountain rocky tundra and rock fields, Swinye Mts & Saranoe Lake (back); **D** – upper course of Poludennaja Creek; mountain rocky tundra, screes & snow beds; **E** – scree and hummocky tundra on Bol'shaja Stolovaja Mt. slope, sphagnous mire (around the lake), Nakoval'nya Mt. (beyond the lake) and dunes (to the right); **F** – Steller Mt. N slope with screes, cliffs and alpine meadows, and Gladkovskaja Creek valley with rich fens and willow schrub communities, in front – alpine meadow; **G** – Nakoval'nya Mt. and rich fen in Gavanskaja River valley (in front) and sphagnous mires on Lodyginskaja Creek valley (back); **H** – Malaja Stolovaja Mt., view from Gavanskaja River valley; **I** – rubbly crowberry deflational tundra on the top of watershed westward of Staraja Gavan' Bay, and Saranoe Lake (back); **J** – snow bed, brook canyon with alpine meadows and rock outcrops on S slope of the mountain with altitudinal mark 747 m.

cover is formed by *Sphagnum squarrosum, S. warnstorfii, Aulacomnium palustre, Meesia triquetra, Scorpidium revolvens, Pseudobryum cinclidioides, Helodium blandowii, Calliergon giganteum, C. richardsonii, Warnstorfia* spp., *Dicranum undulatum, Campylium stellatum, Bryum pseudotriquetrum, Drepanocladus aduncus, Cinclidium* spp., *etc.* Other bogs in NW part of the island with *Andromeda polifolia, Ledum decumbens, Vaccinium uliginosum, etc.*, have hummocks composed of *Sphagnum magellanicum, S.* cf. *papillosum, S. fuscum, S. russowii, Polytrichum strictum, Aulacomnium palustre, Dicranum laevidens,* which alternate with carpets of *Sphagnum angustifolium, S. fallax, S. teres, S. fimbriatum, S. inexspectatum,* and hollows with *S. lindbergii, S. jensenii, S. obtusum, Warnstorfia exannulata, W. trichophylla*.

Borders of Polovina Creek valley are characterized by scattered rich fens with *Eriophorum polystachion, Pedicularis* spp., *Carex rariflora, Parnassia palustris, etc.*, while in moss cover *Helodium blandowii, Paludella squarrosa, Tomentypnum nitens, Scorpidium revolvens, Straminergon stramineum, Aulacomnium palustre,* and *Campylium stellatum* are most abundant. These species form strips apparently associated with calcareous springs, and intermix with sphagnous communities.

Small bogs in the same valley are occupied mostly by *Comarum palustris, Menyanthes trifoliata, Cicuta virosa, etc.*, with extensive moss cover of *Aulacomnium palustris, Calliergon cordifolium, C. giganteum, Warnstorfia exannulata, Drepanocladus aduncus, Straminergon stramineum, Sphagnum riparium, S. squarrosum*.

In gentle wet hollows on mountain slopes with *Trichophorum cespitosum, Carex rariflora* s.l., *Chamaepericlymenum suecicum, etc.*, moss cover is composed mostly of *Oncophorus virens* and *Sphagnum compactum*. On some plain strips of a saddle between the Polovina and Gladkovskaya Creek basins, fens with *Scorpidium scorpioides, S. revolvens,* and *Warnstorfia sarmentosa* occur. One more interesting mire community was found on boggy lake bank in the Polovina Creek basin, with dominance of *Fissidens adiantoides,* and besides *Bryum neodamense, Campylium stellatum, Calliergon cordifolium, Rhizomnium pseudopunctatum, Drepanocladus aduncus, Straminergon stramineum, Sphagnum girgensohnii*. Mires in Gladkovskaya and Poludennaya Creek valleys are characterized by *Eriophorum polystachion*-sedge communities with *Sphagnum subsecundum, S.* cf. *papillosum, Helodium blandowii, Aulacomnium palustre, Calliergon richardsonii, Dicranum undulatum* and scattered occurrence of *Scorpidium cossonii, Oncophorus wahlenbergii, Loeskypnum badium,* and *Warnstorfia pseudostraminea.*

Rock fields, placers and rock outcrops

Dry rocky slopes, partly covered by colluvium, are mainly characterized by *Draba borealis, Epilobium hornemannii, Equisetum arvense, Festuca rubra, Saxifraga serpyllifolia* open communities. Moss cover is not constant, mostly composed of *Polytrichum juniperinum, P. piliferum, Polytrichastrum alpinum, Oligotrichum hercynicum, O. parallelum, Bucklandiella* spp., *Pogonatum urnigerum, Syntrichia ruralis.*

Tops of the ridges and their steep slopes are occupied by placers with disperse vegetation formed by *Artemisia furcata, Cassiope lycopodioides, Cerastium beeringianum, Draba aleutica, Saxifraga serpyllifolia, Silene acaulis* and *Viola crassa*. Moss cover is composed of petrophytes, *e.g. Andreaea rupestris, Schistidium* spp., *Hymenoloma crispulum, etc.*, and species growing on fine soil, *e.g. Racomitrium lanuginosum, Codriophorus fascicularis, Bucklandiella laeta, Pogonatum* spp., *Tortula hoppeana*.

Rock outcrops significantly vary in vegetation. More or less dry basaltoid rocks somewhat distant from coast are sparsely covered by *Cerastium aleuticum, Festuca brevissima, Potentilla beringii, P. vulcanicola, Sagina intermedia, Saxifraga calycina.* Fine soil on cliff ledges is mostly occupied by *Stereodon revolutus, Didymodon insulanus, Oxystegus tenuirostris, Trachycystis flagellaris, Bryum knowltonii, B. amblyodon, Ditrichum flexicaule, Lescuraea patens, L. saxicola, Bryoerythrophyllum recurvirostrum, Amblystegium serpens, Tortula mucronifolia, T. hoppeana, Herzogiella adscendens* with *Amphidium lapponicum, Distichium capillaceum, Bryoxiphium norvegicum, Platydictia jungermannioides, Eurhynchiastrum pulchellum, Hypnum cupressiforme, Pohlia cruda* dominating in shaded niches. On bare cliff surface *Hymenoloma crispulum, Schistidium tenuinerve* and *Orthotrichum pylaisii* occur.

At ca. 100 m alt., on table-hills Bol'shaja & Malaja Stolovye Mts most common mosses are *Amphidum lapponicum, Plagiothecium cavifolium, Stereodon plicatulus, Bucklandiella* spp., *Isopterygiopsis* spp., *Andreaea rupestris, Schistidium* spp., *Lescuraea* spp. On basaltoid rocks near snow beds near Cape Severo-Zapadny *Bucklandiella microcarpa* is dominating, with sparse *Arctoa fulvella, Kiaeria starkei, Andrea rupestris, Codriophorus fascicularis* cushions.

Peculiar moss communities were found on sandstone outcrops in Cape Severo-Zapadny vicinity. Moist and somewhat shaded cliff bases are covered by dense pure tufts of *Tortula edentula*. In some places *Didymodon* cf. *brachyphyllus, Hennediella heimii, Timmia* spp., *Leptobryum pyriforme* are locally abundant, and *Tortula hoppeana, T. mucronifolia, Bryum algovicum, Rhytidiadelphus japonicus, Pohlia cruda, P. tundrae, Tetrodontium repandum, Dicranodontium denudatum* occur on cliff ledges partly covered by soil or in moist shaded cliff crevices.

Sedimentary coastal rocks are partly occupied by vascular plants *Cochlearia officinalis, Leymus mollis, Oxyria digina, Poa turneri, Saxifraga bracteata, Arctanthemum arcticum, Cerastium fischeri, Epilobium hornemannii, Saxifraga nelsoniana* ssp. *insularis*. Moss cover

strongly depends on marine impact. Cliffs near upper tide line are mostly covered by *Tortula mucronifolia.* In such habitats with oozing fresh water *Amblystegium serpens, Didymodon insulanus, Schistidium maritimum* may also occasionally occur. At a certain distance from the sea these species increase abundance on cliffs, and other species, mostly widespread on inland cliffs, appear.

Coastal cliffs well above the sea level are mostly disturbed by bird colonies. Among vascular plants, *Angelica gmelinii, Cochlearia officinalis, Heracleum lanatum, Leymus mollis,* and halophytes *Arctanthemum arcticum, Arctopoa emines, Ligusticum scoticum* are most abundant. Among mosses, *Didymodon ferrugineus, Bryum argenteum, B. elegans, B. intermedium, B. salinum, Syntrichia ruralis, Pohlia proligera, P. cruda, Plagiobryum zierii, Philonotis capillaris, Amblystegium serpens, Ceratodon purpureus, Cratoneuron filicinum, Didymodon insulanus, Brachythecium udum* occur.

Near snow beds and on wet cliffs on slopes of the Steller Mt. and adjacent high peaks, the following species are abundant: *Grimmia alpestris, Bucklandiella macounii* ssp. *alpina, B. laeta, Kiaeria starkei, Hymenoloma crispulum, Lescuraea patens, L. radicosa, L. saxicola, Schistidium papillosum, Andreaea rupestris, Codriophorus fascicularis*, each forming at places extensive monospecific communities.

On drier cliff ledges in brook canyons and near the top of the Steller Mt., A*mphidium lapponicum, Distichium capillaceum, Bryoxiphium norvegicum, Bryoerythrophyllum recurvirostrum, Brachythecium cirrosum, Mnium* spp., *Myurella* spp., *Tortella fragilis, T. tortuosa, T. alpicola, Tortula hoppeana, Eurhynchiastrum pulchellum, Bartramia pomiformis, Dichodontium pellucidum, Encalypta ciliata, Saelania glaucescens* occur.

Creek banks and aquatic vegetation

Creek banks are mostly covered with sandy or gravel alluvium, where pioneer moss communities can be found; they are composed of *Hygrohypnella ochracea, Brachythecium frigidum, Dichodontium* spp., *Philonotis fontana, Pohlia wahlenbergii, Bryum schleicheri, Stereodon plicatulus, Calliergonella lindbergii, Climacium dendroides.* On more distant from water and relatively drier gravel banks *Codriophorus corrugatus, C. fascicularis, Niphotrichum muticum, N. canescens* dominate with constant admixture of *Pleurozium schreberi, Rhytidiadelphus squarrosus, Sanionia uncinata.*

Waterfalls are numerous at places along coastal cliffs. On wet cliffs and boulders near them liverworts are dominating; among mosses most frequent are: *Hygrohypnella bestii, Brachythecium frigidum, Dichodontium palustre, D. pellucidum, Pohlia wahlenbergii, P. drummondii, Bryum weigelii, Philonotis* spp., *Timmia* spp.

Mosses in or near running creek water grow on rotten logs brought by sea, bush branches, on boulders both under and over water; the common species include *Hygrohypnella ochracea, Brachythecium frigidum, Fontinalis hypnoides,* while *Schistidium rivulare, S. platyphyllum, Niphotrichum muticum* occur rarer. In brooks on steep mountain slopes, moss vegetation resembles that of waterfalls, being composed most commonly of *Hygrohypnella bestii, Schistidium rivulare,* and *Dichodontium palustre*.

In tundra hollows with aquatic vegetation of *Hippuris vulgaris, Sparganium hyperboreum, Batrachium trichophyllum, Callitriche palustris, etc.*, mosses are represented by sparse to rather dense cover of *Calliergon giganteum, Warnstorfia trichophylla, W. exannulata, Sphagnum lindbergii, S. riparium.* Large lakes with gravel bottom lack any aquatic vegetation, including mosses.

Ruderal moss communities

Moss communities in disturbed places correspond to soil and moisture. On bare sand on roadsides and in Nikol'skoe Village *Pohlia wahlenbergii, Bryum argenteum, B. amblyodon, B. creberrimum, B. intermedium, B. salinum, B. teres, Ceratodon purpureus, Aloina brevirostris, Hennediella heimii, Syntrichia ruralis, Drepanocladus* spp., *Hygroamblystegium varium, Barbula convoluta, B. unguiculata, Ditrichum heteromallum, Funaria hygrometrica, etc.*, occur. Disturbed soil rich in humus in abandoned road ruts and roadsides as well as in soil slides are covered by *Polytrichum commune, P. juniperinum, Polytrichastrum alpinum, P. longisetum, Oligotrichum hercynicum, O. parallelum, O. falcatum, Dicranella subulata, Pogonatum contortum, P. urnigerum, Leptobryum pyriforme.* The species on bare loamy soil in lowland tundra include *Dicranella crispa, D. cerviculata, D. schreberiana, Bryum pallens, Pohlia proligera, P. bulbifera, P. beringiensis, Psilopilum laevigatum, Fissidens bryoides, Ceratodon heterophyllus, Ditrichum cylindricum, D. heteromallum, Tayloria tenuis, Bryoerythrophyllum recurvirostrum, Tortula cernua, Barbula* spp. An interesting pioneer moss community with *Bryoerythrophyllum ferruginascens, Bryum archangelicum, Pohlia filum, P. beringiensis, Pogonatum dentatum, Tortula mucronifolia* was found in a landslide on slope of Svinye Mts. Another one, composed of *Trematodon ambiguus, Psilopilum cavifolium* and *Pohlia filum,* was observed on the silty bottom of a denudated pond. As Bering Island is deprived of forest vegetation, epixilic moss communities form on wood rubbish. In such conditions *Brachythecium salebrosum, Ceratodon purpureus, Leptobryum pyriforme, Plagiothecium denticulatum,* and *Pohlia nutans* occur.

List of species

Nomenclature of mosses follows Ignatov, Afonina, Ignatova *et al.* (2006). Species are annotated with frequency (Un – unique; Rar – rare; Sp – sparse; Fr – frequent; Com – common), occurrence in eight areas of moss collection (by number as defined in Fig. 1), ecology, associated species (if they were noticed), sporophyte (S+) or vegetative reproduction (P+) presence. Specimens are kept in MW.

Abietinella abietina (Hedw.) M. Fleisch. – Rar; 5. Poludennaja Creek mouth, on dry rocky slope at cliff base, with *Didymodon insulanus, Tortula hoppeana* and *Ceratodon purpureus*.

Aloina brevirostris (Hook. & Grev.) Kindb. – Un; 1. Seashore near Zabijaka Cape, on sandy creek alluvium on the roadside, few plants scattered among *Ceratodon purpureus, Hennediella heimii, Bryoerythrophyllum recurvirostrum.*

Amblystegium serpens (Hedw.) Bruch et al. – Fr; 1,3,4,5, 7,8. Common species on moist ledges of both coastal and inland cliffs and boulders, mostly with *Tortula mucronifolia, Schistidium maritimum, Bryoxiphium norvegicum,* and also on rotten wood, bare turf and peat. S+.

Amphidium lapponicum (Hedw.) Schimp. – Sp; 1,3,8. On rather dry cliff ledges and in cliff niches, with *Bryoxiphium norvegicum, Distichium capillaceum, Hypnum cupressiforme, Pohlia cruda.* S+.

Andreaea alpestris (Thed.) Bruch et al. – Un; 8. Western slope of Steller Mt. near its top, on boulder in brook canyon under snow bed, with *Hymenoloma crispulum*, compact pure tuft.

A. rupestris Hedw. – Sp; 1,6,8. On cliffs and boulders in mountain tundra and near snow beds, with *Hymenoloma crispulum, Bucklandiella macounii* ssp. *alpinum, B. microcarpa, Racomitrium lanuginosum*. S+.

Anomobryum julaceum (Schrad. ex P. Gaertn., B. Mey. & Scherb.) Schimp. – Un; 7. Northern slope of Cape Tolsty, on fine soil in crevices and on cliff ledges with *Plagiobryum zierii, Syntrichia norvegica,* and *Didymodon erosodenticulatus.*

Anomodon longifolius (Brid.) Hartm. – Rar; 3. Two collections from cliff ledges of Nakoval'nya Mt. slopes, pure carpets.

Arctoa fulvella (Dicks.) Bruch et al.– Sp; 1,5,8. On fine soil on rock outcrops, on steep rocky slopes, near snow beds, in rocky mountain tundra, mainly in rather dry conditions, with *Bucklandiella* spp., *Kiaeria starkei, Niphotrichum ericoides*. S+. We found a great variation in seta length and the capsule position from emergent to highly exserted with a full set of intergradations; thus the status and differentiation characters of *A. andersonii* Wich., a species different from *A. fulvella* mainly in short seta, needs additional study.

Aulacomnium palustre (Hedw.) Schwägr. – Sp. 1,3,4,5, 6,8. On hummocks in *Sphagnum*-dominated mires, rich fens (with *Calliergon* spp., *Pseudobryum cinclidioides, Drepanocladus aduncus, Scorpidium revolvens*), swamped creek beds in their uppermost courses, and in depressions in moist mountain tundra near brooks, with *Dichodontium palustre, Philonotis fontana, Pohlia wahlenbergii*. P+.

A. turgidum (Wahlenb.) Schwägr. – Rar; 8. Southern slope of Steller Mt. near its top, moss community on slope of brook canyon near snow bed, with *Hylocomiastrum pyrenaicum* and *Sphagnum girgensohnii,* compact pure tuft.

Barbula convoluta Hedw. – Rar; 1,3. On bare sandy soil and in ruderal moss communities with other pioneer mosses; the species dominates on Cape Zabijaka on disturbed sandy roadside.

B. unguiculata Hedw. – Rar; 1,3. In ruderal moss communities in Nikol'skoe Village and on roadsides, with *Ceratodon purpureus, Barbula convoluta, Bryum argenteum, Bryoerythrophyllum recurvirostrum, Pohlia proligera*.

Bartramia ithyphylla Brid. – Fr; 1,2,3,4,6,8. On soil rich in humus on steep rocky slopes with tundra communities, on cliff ledges, in different soil niches, mostly intermixed with *Dicranella subulata, Pohlia cruda, Eurhynchiastrum pulchellum, Tortula hoppeana, Polytrichastrum alpinum, Sanionia uncinata.* S+.

B. pomiformis Hedw. – Rar; 8. On western slope of Steller Mt., on fine soil in moist cliff niches near brook, with *Bryoerythrophyllum recurvirostrum, Distichium capillaceum, Bryoxiphium norvegicum, Pohlia cruda, Tortella fragilis.* S+.

Bartramiopsis lescurii (James) Kindb. – Un; 7. On steep rocky slope to seashore in Commander Bay vicinity, with *Polytrichastrum alpinum, Pohlia proligera, Dicranella subulata*. S+.

Brachymenium nepalense Hook. – Rar; 7. Twice collected somewhat distant from shore of Commander Bay (cf 100 m. alt.), on ledges of cliff with bird colonies, among *Amblystegium serpens, Ceratodon purpureus, Syntrichia norvegica, Didymodon ferrugineus, Tortula mucronifolia.* S+.

Brachytheciastrum trachypodium (Brid.) Ignatov & Huttunen – Rar; 2,3. In hummocky tundra near the top of Svynye Mts, in soil niche, with *Bartramia ithyphylla*; on rock field on the top of Bol'shaja Stolovaja Table-hill, on fine soil in niche near boulder.

Brachythecium albicans (Hedw.) Bruch et al. – Sp; 1,3,4,6,7. In disturbed moss communities on rather dry upper edges of slopes, in places with disturbed turf cover in tundra, on rather dry rock outcrops, in tall herbage communities on sandy banks along coast, with *Syntrichia ruralis, Sanionia uncinata, Polytrichastrum alpinum.*

B. cirrosum (Schwägr.) Schimp. – Rar; 8. On fine soil of cliff ledges on western slope of Steller Mt., with *Tortella fragilis, Pohlia cruda, Mnium lycopodioides.*

B. cf. *coruscum* I. Hagen – Rar; 2,8. On fine soil near cliff base on western slope of Steller Mt.; in hummokky tundra near top of Svynye Mts. Ridge, on eroded top of hummock, with *Pohlia nutans* and *Dicranella subulata*. Both specimens represent transitional forms to *B. albicans*.

B. frigidum (Müll. Hal.) Besch. – Sp; 4,6,7,8. On sandy alluvium and rotten wood at creek banks, on boulders in shallow and slow-flowing creek, often with *Hygrohypnella ochracea, Hygroamblystegium humile, Dich-*

odontium spp., *Pohlia wahlenbergii*; on wet cliffs on waterfalls, with *Hygrohypnella bestii*, *Dichodontium* spp. The species forms extensive pure cushions.

B. irinae Ignatov – Un; 3. – Slope of Lodyginskaja Creek valley, in dwarf-shrub tundra community near seashore, on tundra soil rich in humus.

B. rivulare Bruch et al. – Rar; 4,6. In willow shrub–tall-herbage communities in valleys of Bujan and Polovina Creeks, near water on sandy alluvium, rotten willow branches and soil, with *Rhizomnium magnifoilum, Climacium dendroides, Plagiothecium denticulatum, P. cavifolium, Sciuro-hypnum reflexum.*

B. cf. *rotaeanum* De Not. – Un; 3. On basaltoid boulder placer at seashore near Nikol'skoe Village, in moist shaded niche with *Plagiothecium cavifolium, Rhizomnium magnifolium*.

B. salebrosum (F. Weber & D. Mohr) Bruch et al. – Rar; 4,5. On the edge of landslide near Bujan Creek mouth, with *Pohlia* spp., *Dicranella* spp.; on tundra litter, in dwarf-shrub hummocky tundra on the slope of Poludennaja Creek valley, with *Stereodon plicatulus* and *Hylocomiastrum pyrenaicum*.

B. udum I. Hagen – Un; 7. In Commander Bay vicinity, somewhat distant from sea shore (ca. 100 m. alt.), on moist ledge of cliff with bird colonies, with *Didymodon ferrugineus*.

Bryhnia hultenii E.B. Bartram – Fr; 1,3,4,5,8. On humus soil, litter, rotten wood, rocks and fine soil in mesic tall herbage communities at cliff bases, in willow-tall herbage communities in creek valleys, mainly with *Rhizomnium magnifolium, R. nudum, Plagiomnium* spp., *Brachythecium rivulare, Sciuro-hypnum reflexum, S. uncinifolium, Plagiothecium* spp. Once was found on cliff ledge.

Bryoerythrophyllum brachystegium (Besch.) K. Saito – Un; 4. On bare loamy soil at the edge of Bujan Creek bank near mouth, with *Pohlia proligera.*

B. ferruginascens (Stirt.) Giacom. – Rar; 2,3. On landslide on steep slope of Svynye Mts. to Saranoe Lake, on fine soil covering rock outcrop, with *Bryum archangelicum*; in rock crevices on slope of Nakoval'nya Mt.

B. recurvirostrum (Hedw.) P.C. Chen – Sp; 1,2,3,4,5,8. On mineral soil at creek banks, with *Dicranella* spp., *Pohlia proligera, Dichodontium pellucidum, Bartramia ithyphylla*; on sandy alluvium of Gavanskaja River, with *Pohlia wahlenbergii* and *Bryum* spp.; on fine soil in cliff niches, with *Amphidium lapponicum, Distichium capillaceum, Eurhynchiastrum pulchellum, Pohlia cruda*. S+.

Bryoxiphium norvegicum (Brid.) Mitt. – Fr; 1,2,3,8. On rather dry to mesic cliff ledges, in crevices and cliff niches, on fine soil and humus, with *Amphidium lapponicum, Distichium capillaceum, Hypnum cupressiforme, Timmia* spp., *Pohlia cruda, Herzogiella adscendens, Trachycystis flagellaris, Amblystegium serpens, Didymodon insulanus*.

Bryum algovicum Sendtn. ex Müll. Hal. – Un; 1. On moist base of sandstone cliff on the northern coast of Cape Severo-Zapadny, with *Hennediella heimii* and *Tortula edentula*. S+.

B. amblyodon Müll. Hal. – Sp; 3,5. On cliff ledge on slope of Nakoval'nya Mt.; in rocky tundra on the top of watershed southward from Polovina Creek valley; in ruderal moss community in Nikol'skoe Village. S+.

B. archangelicum Bruch et al. – Rar; 2,8. On landslide on steep slope of Svynye Mts. to Saranoe Lake, on fine soil covering rock outcrop, with *Bryoerythrophyllum ferruginascens;* on humus-covered ledge of coastal cliff in Gladkovskaja Bay. S+.

B. argenteum Hedw. – Sp; 3,7. In ruderal moss communities (especially abundant on dust on joints of concrete plates of roads), with *Barbula* spp., *Bryum* spp., etc; on ledges of cliffs with bird colonies in Commander Bay vicinity, with *Syntrichia norvegica, Tortula mucronifolia*, *Bryum* spp., *Pohlia* spp.

B. creberrimum Taylor – Fr; 3,4,5,7. Almost always participates in pioneer moss communities on mesic sandy alluvium, at the borders of rivers and creeks, rarer on humus soil in tundra, with *Dicranella crispa, D. cerviculata, Pohlia proligera, P. cruda, Bryum intermedium, Dichodontium pellucidum*. Also occurs in ruderal communities in Nikol'skoe village. S+.

B. elegans Nees – Rar; 7,8. In vicinity of Commander Bay, on somewhat distant from coast dry cliff ledges; on western slope of Steller Mt., with *Bryoxiphium norvegicum, Syntrichia norvegica, Herzogiella adscendens.*

B. intermedium (Brid.) Blandow – Sp; 3,5,7. Relatively common on cliff ledges on steep rocky slopes to the coast in Commander Bay and Cape Tolsty, with *Amblstegium serpens, Tortula mucronifolia, Syntrichia norvegica.* Once was collected in similar condition in Poludennaja Bay vicinity, and once more in pioneer moss community in Nikol'skoe Village. S+.

B. knowltonii Barnes – Rar. 3,7. Collections from Cape Tolsty affinities and Nikol'skoe Village were made in conditions similar to these of *B. intermedium.* Twice was collected on basaltoid cliff ledges of Nakoval'nya Mt. S+.

B. neodamense Itzigs. – Un; 6. On boggy shore of lake in tundra on slope step of Polovina Creek valley, dominates on few hummocks, among *Campylium stellatum, Calliergon cordifolium, Drepanocladus aduncus, Straminergon stramineum.*

B. pallens Sw. ex anon. – Un; 5. On eroded loamy soil on steep slope at bank of Poludennaja Creek, with *Bryum* sp., *Pohlia proligera, P. wahlenbergii, Dichodontium pellucidum, Dicranella cerviculata, D. crispa, D.* sp. S+.

B. pseudotriquetrum (Hedw.) P. Gaertn., B. Mey, & Scherb. – Sp; 3,4,6,8. In wet depressions in rich fens, mainly as an admixture to *Rhizomnium pseudopunctatum, Cinclidium* spp., *Paludella squarrosa, Campy-*

lium protensum, Straminergon stramineum, Meesia spp. Once was collected near waterfall.

B. salinum I. Hagen ex Limpr. – Sp; 3,4,5,7. On eroded loamy soil, fine soil on cliff ledge, in ruderal moss communities in localities and conditions similar to those for *B. intermedium*. S+.

B. schleicherii DC. – Sp; 2,4,6,8. In moist depressions of Bujan and Poludennaja Creek banks, near tundra brooks at low elevations and near waterfalls, with *Philonotis fontana, Bryum weigelii, Dichodontium* spp., *Brachythecium frigidum, Hygrohypnella ochracea, Pohlia wahlenbergii.*

B. teres Lindb. – Rar; 3. On eroded tops of hummocks on slope of Lodyginskaja Creek valley; on moist sandy alluvium on the bottom of Gavanskaja River valley near Nikol'skoe Village.

B. weigelii Spreng. – Rar; 4,6,7,8. On wet soil and rocks under waterfalls and in their vicinity, with *Dichodontium* spp., *Bryum schleicheri, Philonotis fontana, Pohlia wahlenbergii*; in swamped ancient creek beds, with *Aulacomnium palustre, Calliergon* spp., *Warnstorfia exannulata*.

Bucklandiella laeta (Besch. & Cardot) Bednarek-Ochyra & Ochyra – Fr; 1,3,5,6,7,8. On rocks, boulders and fine soil in different types rocky tundra, on placers and rocky slopes, in sparse communities near snow beds, on rock outcrops, rarely on creek and brook banks, with *Niphotrichum ericoides, N. canescens, Codriophorus fascicularis, Bucklandiella* spp., *Racomitrium lanuginosum, Lescuraea* spp., *Pohlia* spp., *Kiaeria starkei, Hymenoloma crispulum, Hylocomiastrum pyrenaicum*; especially abundant on basaltoid rocky placers on slopes of Stolovye Mts, where other *Bucklandiella* species are very rare (*B. sudetica*) or do not occur. S+.

B. macounii (Kindb.) Bednarek-Ochyra & Ochyra ssp. *alpina* (E.Lawton) Bednarek-Ochyra & Ochyra – Sp; 5,8. In moss communities near snow beds; on moist cliffs in brook canyons and near the top of Steller Mt.; it often forms pure communities, alternating with ones formed by *Lescuraea radicosa* and (or) other *Lescuraea* species, sometimes grows with *Lescuraea* spp., *Schistidium* spp., *Bucklandiella microcarpa, B. laeta, Andreaea rupestris, Schistidium papillosum*. Often forms extensive pure mats, partly covered with fine soil. Closer to snow beds, *B. macounii*-dominated communities are replaced by those formed by *Hymenoloma crispulum* and *Grimmia alpestris*.

B. microcarpa (Hedw.) Bednarek-Ochyra & Ochyra – Sp; 1,5,8. The ecology and distribution of this species on Bering Island in general are similar to those of *B. laeta*. This species significantly varies yet, being represented by at least two different forms. „Typical" *B. microcarpa* occurs in southern part of the island, being most frequent near snow beds in Poludennaja Creek basin and on slopes of Steller Mt. Unlike *B. macounii* ssp. *alpina*, it grows mostly on fine soil on rocky slopes and cliff ledges, with *Niphotrichum* spp., *Kiaeria starkei, Arctoa fulvella, Codriophorus brevisetus, Pohlia drummondii*. S+. Very peculiar plants are widespread on places with late snow melting on SW slope of tablehill in 4 km westward from Cape Severo-Zapadny, dominating on fine soil on boulders and among them. These plants are only occasionally branched, blackish, with narrow and crisped leaves, and abundant sporophytes. Their perichaetial leaf structure, however, exclude any other species except *B. microcarpa*.

B. sudetica (Funck) Bednarek-Ochyra & Ochyra – Sp; 1,6,8. S+. The distribution and habitats of the species are similar to those of *B. laeta*; however, occurrence of *B. sudetica* is rarer. Delimitation of these two species in collections from the Bering Island sometimes was problematic: according to Frisvoll (1988), only serrulation of leaf margins separates them, but in most specimens of this group both serrulate and entire margins occur on different leaves from the same plant. In most cases weaker plants with dark-green coloration correspond to *B. sudetica* (weak or absent serrulation), while more robust olive-green plants were kept in *B. laeta* due to strong and more constant serrulation. However, this trend can be affected by local shade and moisture conditions, representing variation of single taxa.

Calliergon cordifolium (Hedw.) Kindb. – Rar; 3,6,8. On swamped distal parts of Polovina and Gladkovskaja Creek valleys and in rich fen between Nakoval'nya Mt. and Gavanskaja River, with *Straminergon stramineum, Pseudobryum cinclidioides, Helodium blandowii, Dicranum undulatum.*

C. giganteum (Schimp.) Kindb. – Sp; 1,3,4,6,8. In ancient beds of Bujan and Polovina Creeks, on moist loamy soil, with *Climacium dendroides* and *Drepanocladus aduncus*, and in boggy moss communities, with *Straminergon stramineum, Calliergon cordifolium, Aulacomnium palustre*; once collected on moist sand on the border of rich fen in Gavanskaja River valley, with *Drepanocladus aduncus.*

C. megalophyllum Mikut. – Rar; 1,4. On *Sphagnum* mire between the tableland in vicinity of Cape Severo-Zapadny; on coast, in wet depression near abandoned road, with *Scorpidium revolvens;* in swamped ancient bed of Bujan Creek, with *Warnstorfia exannulata.*

C. richardsonii (Mitt.) Kindb. – Sp; 3,5, 8. In rich fens, as it was described for *C. cordifolium*, and in moist tundra in creek hollows, with *Oncophorus virens, Sphagnum* spp., *Sanionia uncinata, Scorpidium revolvens*.

Calliergonella lindbergii (Mitt.) Hedenäs – Rar; 5. On sandy bank of creek in 0.5 km southward from Poludennaja Creek mouth, in willow shrub community, few scattered pure mats.

Campyliadelphus chrysophyllus (Brid.) R.S. Chopra – Rar; 3,4. On moist loamy soil in ruderal moss commu-

nity in Nikol'skoe Village, with *Drepanocladus* cf. *aduncus, Bryoerythrophyllum recurvirostrum, Bryum salinum, Rhizomnium andrewsianum,* and near road in Bujan Creek valley, with *Ceratodon purpureus, Dicranella cerviculata*.

Campylium protensum (Brid.) Kindb. – Rar; 3,6. In rich fen between Nakoval'nya Mt. and Gavanskaja River, on hummock with *Aulacomnium palustre, Dicranum laevidens, Bryum pseudotriquetrum*; in swamped distal parts of Polovina Creek valley, in place with spring influence, on hummock with *Pseudobryum cinclidioides*.

C. stellatum (Hedw.) C.E.O. Jensen – Sp; 1,3,4,5,6. In rich fens or, rarely, in *Sphagnum* mires near pools, with *Sphagnum warnstorfii, Bryum pseudotriquetrum, Dicranum bonjeanii, Aulacomnium palustre, Calliergon* spp., *Drepanocladus aduncus*.

Ceratodon heterophyllus Kindb. – Un; 2. Vicinity of Staraja Gavan' Bay, on moist silty sediments bordering pool on abandoned road, with *Pohlia* sp. and *Fissidens bryoides*.

C. purpureus (Hedw.) Brid. – Fr; 1,2,3,4,5,6,7,8. On fine soil, disturbed soil rich in humus, bare loamy soil or sandy alluvium in different tundras, rock outcrops, near creek banks, in different pioneer communities, especially abundant in ruderal habitats. S+.

Cinclidium stygium Sw. – Rar; 3. In rich fen with springs between Nakoval'nya Mt. and Gavanskaja River, on low hummock, among *Campylium protensum, Meesia uliginosa, Bryum pseudotriquetrum, Aulacomnium palustre, Sphagnum warnstorfii*. S+.

C. subrotundum Lindb. – Un; 3. Two collections from rich fen, where previous species was found, in depressions with *Straminergon stramineum, Bryum pseudotriquetrum, Meesia triquetra, Scorpidium revolvens.* S+.

Claopodium bolanderi Best – Rar; 5,6. On steep rocky slopes covered with tall herbage communities under rock outrops, near Poludennaja Creek mouth, with *Sciuro-hypnum uncinifolium, Bryhnia hultenii, Claopodium pellucinerve, Plagiomnium medium*; in tundra-like shrub communities on steep hill slopes in Polovina Creek basin and in fern communities near bottoms of small hollows, with *Heterocladium dimorphum, Syntrichia ruralis, Sanionia uncinata, Hylocomiastrum pyrenaicum, Rhytidiadelphus squarrosus.*

C. pellucinerve (Mitt.) Best – Sp; 3,5,8. On steep rocky slopes covered with tall herbage communities under rock outrops, in lower part of valley slopes; on soil rich in humus, litter, shaded bases of boulders, with *Bryhnia hultenii, Sciuro-hypnum reflexum, S. uncinifolium, Sanionia uncinata, Claopodium bolanderi, Plagiomnium medium, Rhzomnium magnifolium, Syntrichia ruralis, Climacium dendroides.*

Climacium dendroides (Hedw.) F. Weber & D. Mohr – Sp; 3,4,5,6. In willow-shrub communities in creek valleys, temporarily moisted abandoned creek beds, on disturbed spots of slopes near creeks, at edges of lowland rich fens and creek banks, near waterfalls, mostly scattered among *Pseudobryum cinclidioides, Rhizomnium* spp., *Pleurzium schreberi, Pleuroziopsis ruthenica, Philonotis fontana, Rhytidiadelphus squarrosus*.

Codriophorus brevisetus (Lindb.) Bednarek-Ochyra & Ochyra – Rar; 5,8. On fine soil in subnival habitats, *e.g.* in places of late snow bed melting on slopes of Steller Mt., and in canyon of stream in Poludennaja Creek basin, with *Arctoa fulvella, Kiaeria* spp., *Codriophorus corrugatus, Lescuraea baileyi, L. patens, Niphotrichum* spp.

C. corrugatus Bednarek-Ochyra – Sp; 1,5,6,8. On gravelly creek banks, with *Niphotrichum muticum, Pohlia wahlenbergii, Brachythecium frigidum*; in habitats common with *C. brevisetus*; in sparse rocky tundra on the tops of the highest watersheds, with *Racomitrium lanuginosum, Dicranum groenlandicum, D. spadiceum, Pogonatum* spp., *Polytrichum* spp. S+.

C. fascicularis (Hedw.) Bednarek-Ochyra & Ochyra – Sp; 1,3,4,6,8. The most frequent species of the genus in Bering Island, occurs in all habitats, where two previous species grow, occasionally forms pure communities on moist cliff bases on western slope of Steller Mt., also occurs on basaltoid rock fields on the slopes of Stolovye Gory, where other *Codriophorus* species were not observed; forms extensive pure mats alternating with those of *Racomitrium lanuginosum, Niphotrichum ericoides, N. muticum, Bucklandiella laeta* on disturbed places of sandy terraces in the vicinity of Cape Severo-Zapadny. S+.

C. mollis (Cardot) Bednarek-Ochyra & Ochyra – Un; 1. On moist surface of boulder somewhat above water of tundra creek 4 km eastward from Cape Severo-Zapadny.

Conostomum tetragonum (Hedw.) Lindb. – Sp; 1,5,8. S+. In different nival communities: rarely in open moss communities near extensive semi-permanent snow beds, and rather frequent in places with late, ca. in July, snow melting, on mineral background, where *Racomitrium* s.l.–dominating moss communities occur, with *Kiaeria starkei, Hymenoloma crispulum, Sanionia uncinata, Lescuraea* spp.; *Conostomum* grows here in moist depressions. It also occurs in similar conditions on soil rich in humus, with *Sanionia uncinata, Pleurozium schreberi, Hylocomiastrum pyrenaicum, Polytrichum juniperinum*.

Cratoneuron filicinum (Hedw.) Spruce – Sp; 6,7. Most abundant on wet ledges of coastal cliffs with oozing water on Cape Tolsty, with *Amblystegium serpens, Didymodon ferrugineus, Tortula mucronifolia*; once was collected in willow shrub community in Polovina Creek valley.

Cynodontium asperifolium (Lindb. & Arnell) Paris – Un; 1. In moist crevice of basaltoid cliff on Zabijaka Cape, with *Orthotrichum pylaisii*.

Dichelyma capillaceum (With.) Myrin – Rar; 5,6. Abundant in two localities: on the eastern coast between Polovina and Commander Bays, in dense willow shrub community at creek mouth, on bases of willow trunks; in middle course of Poludennaya Creek, in willow shrub community at the edge of former river bed, on bases of willow trunks, with *Leptodictium riparium.* S+.

Dichodontium palustre (Dicks.) M. Stech – Sp; 2, 4,5,6,7,8. Quite frequent and abundant on wet boulders and soil near brooks and waterfalls in the mountains, with *Hygrohypnella bestii, Pohlia wahlenbergii, Philonotis fontana, Schistidium* spp., *Bryum schleicherii, B. pseudotriquetrum, B. weigelii, Dichodontium pellucidum*; occasionally on wet alluvium on creek banks, with *Hygrohypnella ochracea, Brachythecium frigidum, Dichodontium pellucidum, Philonotis fontana*.

D. pellucidum (Hedw.) Schimp. – Fr; 1,2,3,4,5,6,7,8. On loamy ground, alluvium, fine soil, on cliff ledges, boulders near waterfalls, creek banks, near water in mountain brooks, in different disturbed places, ruderal communities. with *Ceratodon purpureus, Philonotis* spp., *Pohlia wahlenbergii, P. proligera, Bryoerythrophyllum recurvirostrum, Bryum* spp., *Dicranella* spp. and other pioneer mosses. S+; P+.

Dicranella cerviculata (Hedw.) Schimp. – Rar; 5. On bare loamy soil in rut on abandoned road near Poludennaja Creek mouth, on eroded slope to creek bed and on creek bank in the same locality, with *Oligotrichum hercynicum, Dicranella crispa, D. subulata, Pohlia proligera, P. cruda, Bryum* spp. S+.

D. crispa (Hedw.) Schimp. – Rar; 4,6. On bare loamy soil on steep rocky coastal slope near Bujan Creek mouth, with *D. subulata, Pohlia proligera, Ceratodon purpureus, Ditrichum heteromallum*. S+.

D. schreberiana (Hedw.) Hilf. ex H.A. Crum & L.E. Anderson – Rar; 1. On bare loamy soil on ruts of abandoned road near Cape Zabijaka, with *Ditrichum heteromallum, Pohlia* spp., *Barbula convoluta, Bryum* sp., *Ceratodon purpureus,* few scattered pure groups.

D. subulata (Hedw.) Schimp. – Sp; 1,2,3,4,5. In habitats, similar to those of *D. crispa*, on eroded soil and places with disturbed turf cover in different tundra communities, with *Bartramia ithyphylla, Oligotrichum* spp. and *Pogonatum* spp., on rock outcrops and fine soil near cliff bases, with *Tortula hoppeana, Sanionia uncinata, Bryoerythrophyllum recurvirostrum, Bartramia ithyphylla.* S+.

Dicranodontium denudatum (Brid.) E. Britton – Rar; 1. Twice collected on turf-covered surfaces of sandstone outcrops on NW coast of Cape Severo-Zapadny, with *Tortula hoppeana, Rhytidiadelphus* spp., *Hylocomiastrum pyrenaicum, Pohlia* spp.

Dicranum acutifolium (Lindb. & Arnell) C.E.O. Jensen – Sp; 2,3,4,5,6,7. In dwarf-shrub hummocky tundra, with *Pleurozium schreberi, Polytrichum juniperinum, Hylocomiastrum pyrenaicum, Sanionia uncinata, Stereodon plicatulus, Pohlia nutans,* and in rocky mountain tundra, with *Racomitrium lanuginosum, Polytrichum juniperinum, Polytrichastrum alpinum, Pogonatum urnigerum, Pleurozium schreberi*; once collected also on humus-covered surface of rock outcrop.

D. angustum Lindb. – Un; 3. On hummock in *Sphagnum* mire with *Oxycoccus* sp., *Rubus chamaemorus,* in Lodyginskaja Creek valley among lakes; as an admixture to *Sphagnum russowii, S. magellanicum, Polytrichum strictum*.

D. cf. *bardunovii* Tubanova & Ignatova – Un; 5. Two rather poor collections in dwarf-shrub hummocky tundra, with *Pleurozium schreberi, Polytrichum juniperinum, Sanionia uncinata, Stereodon plicatulus,* on lowland watershed southward from Poludennaja Creek lower course.

D. bonjeanii De Not. – Rar; 3,5,6,7,8. On boggy meadows and rich fens in distal parts of Polovina, Gladkovskaja and Peresheek Creek valleys and in rich fen between Nakoval'nya Mt and Gavanskaja River, with *Sphagnum subsecundum, Climacium dendroides, Drepanocladus aduncus, Calliergon richardsonii, Helodium blandowii.*

D. brevifolium (Lindb.) Lindb. – Un; 6. In dwarf-shrub tundra on gentle slope of watershed northward from Polovina Creek valley, with *Polytrichastrum alpinum.*

D. elongatum Schleich. ex Schwägr. – Rar; 1,3. On hummocks in moist depressions in mountain tundra on the top of Bol'shaja Stolovaja Mt. and between tops of Svynye Mts, with *Polytrichum juniperinum* and *Hylocomiastrum pyrenaicum.*

D. flexicaule Brid. – Rar; 2,3,5. Among hummocks in dwarf-shrub communities in localities similar to those of *D. elongatum* and in watershed southward from Poludennaja Creek valley, with *Polytrichum juniperinum, Polytrichastrum alpinum, Sanionia uncinata, Stereodon plicatulus.*

D. fuscescens Turner – Rar; 6,7. In willow shrub – tall-herbage community in lower course of creek on the coast of Commander Bay, with *Climacium dendroides*; in mountain tundra on the top of watershed northward from Polovina Creek valley.

D. groenlandicum Brid. – Rar; 3. In depression between Bol'shaja and Malaja Stolovaja Mts. in dwarf-shrub tundra, on hummock; in *Sphagnum* mire in valley of Lodygynskaja Creek, on hummock, with *Polytrichum strictum*.

D. laevidens R.S. Williams – Rar; 3,5,6. On hummocks in *Sphagnum* mires and rich fens, with *Sphagnum warnstorfii, Bryum pseudotriquetrum, Aulacomnium palustre*.

D. leioneuron Kindb. – Un; 6. In moist depressions in mountain tundra on the top of watershed northward from Polovina Creek valley.

D. majus Turner – Com; 1,2,3,4,5,6,8. The most frequent species of the genus on Bering Island, widespread in

rocky tundra, with *Polytrichum juniperinum, Polytrichastrum alpestre, Pogonatum urnigerum, Bucklandiella* spp., *Codriophorus fascicularis, Racomitrium lanuginosum*; also it is one of the most frequent species in hummocky dwarf-shrub tundra, with *Pleurozium schreberi, Sanionia uncinata, Hylocomiastrum pyrenaicum, Stereodon plicatulus, Polytrichastrum alpinum, Polytrichum juniperinum*.

D. septentrionale Tubanova & Ignatova – Rar; 5. In hummocky dwarf shrub tundra on the slope of Poludennaja Creek valley, with *Pleurozium schreberi* and *Stereodon plicatulus*.

D. spadiceum J.E. Zetterst. – Rar; 5,6. In hummocky dwarf shrub tundra on watershed southward from Poludennaja Creek valley; in rocky mountain tundra southward from Polovina Creek valley, with *Polytrichum juniperinum, Racomitrium lanuginosum* and *Bucklandiella microcarpa*.

D. undulatum Schrad. ex Brid. – Rar; 1,3. In rich fen between Nakoval'nya Mt. and Gavanskaja River, with *Straminergon stramineum, Pseudobryum cinclidioides, Helodium blandowii, Dicranum undulatum*; in *Sphagnum* bog between tableland in affinities of Cape Severo-Zapadny and coast, near abandoned road, with *Aulacomnium palustre* and *Sphagnum* spp.

Didymodon brachyphyllus (Sull.) R.H. Zander – Rar; 4,7. On fine soil on cliff ledge and near cliff base on steep rocky slopes to Bujan and Commander Bays, with *Bryum* sp. P+.

**D.* cf. *brachyphyllus* – Rar; 1. Two collections from moist sandstone cliffs on northern coast of Cape Severo-Zapadny, compact pure tufts among *Leptobryum pyriforme, Hennediella heimii, Timmia bavarica*, etc; S+. Morphologically both identical specimens do not allow exact identification, thus nrITS1-2 & 5.8S gene sequence was studied. Phylogenetic analysis placed studied specimen in a clade with *D. brachyphyllus* and little known European *D. lamyanus*, somewhat closer to the first species. At the same time, both specimens from the Bering Island lack gemmae, which almost always present in *D. brachyphyllus*, but have sporophytes which are very rare in the latter species. Absence of a peristome also does not correspond to *D. brachyphyllus*, but is characteristic for *D. lamyanus*. Leaves are bright green, somewhat reddish near base, and this and some other gametophyte features and specific ecology also distinguish Bering' specimens from *D. brachyphyllus*. After adittional sequence involved, the studied specimen was found with another specimen of *D. brachyphyllus* affinity from Colorado but ouside main *D. brachyphyllus* clade. According to personal communication with J.Kuèera, the specimen from Colorado agrees well with the studied specimen from the Bering Island by morphology. Apparently, these specimens represent undescribed *Didymodon* species close to *D. lamyanus* (Schimp.) Thér.

D. erosodenticulatus (Müll. Hal.) K. Saito – Un; 7. Northern slope of Cape Tolsty, on cliff ledge covered with fine soil, with *Plagiobryum zierii, Syntrichia norvegica, Anomobryum julaceum, Ceratodon purpureus.*

D. ferrugineus (Schimp. ex Besch.) M.O. Hill – Rar; 7. On wet ledges of coastal cliffs with oozing water on Cape Tolsty, with *Amblystegium serpens, Cratoneuron filicinum, Tortula mucronifolia.*

D. insulanus (De Not.) M.O. Hill – Sp; 1,3,5. On rather dry fine soil on cliff ledges, in crevices, near rock bases, with *Herzogiella adscendens, Amblystegium serpens, Lescuraea baileyi, Bryum* spp., *Tortula mucronifolia, T. hoppeana*. Most frequent on cliffs near Poludennaja Creek mouth and on rocky slopes of Nakoval'nya Mt.

D. rigidulus Hedw. – Un; 7. On dry cliff ledge over steep rocky slope to the coast of Commander Bay, with *Tortula mucronifolia* and *Bryum* sp. P+.

D. vinealis (Brid.) R.H. Zander – Un; 1. On moist base of sandstone cliff on the northern coast of Cape Severo-Zapadny, with *Tortula edentula* and *Pseudoleskeella rupestris*.

Distichium capillaceum (Hedw.) Bruch et al. – Rar; 1,3,8. In rather dry to mesic shaded cliff niches, on fine soil and humus, with *Amphidium lapponicum, Distichium capillaceum, Hypnum cupressiforme, Timmia* spp., *Pohlia cruda, Herzogiella adscendens, Trachycystis flagellaris, Amblystegium serpens, Didymodon* spp., most abundant in brook canyons in middle part of western slope of Steller Mt.; also occurs on rocky slopes of Nakoval'nya Mt. and on basaltoid rocky outcrops in Cape Severo-Zapadny vicinity. S+.

Ditrichum cylindricum (Hedw.) Grout – Un; 1. On bare sandy slope to creek bed ca. 4 km northward from Cape Severo-Zapadny, with *Plagiobryum demissum.*

D. flexicaule (Schwägr.) Hampe – Rar; 3,8. On rather dry fine soil on cliff ledges on slope of Nakoval'nya Mt., with *Stereodon revolutus, Didymodon insulanus*, and on northern slope of Steller Mt., with *Bucklandiella sudetica*.

D. heteromallum (Hedw.) E. Britton – Sp; 2,3,4,5. In ruderal moss communities in Nikol'skoe Village; in rocky tundra, on fine soil near snow beds, on steep rocky slopes to the coast, with *Ceratodon purpureus, Barbula convoluta, Pohlia proligera, P. drummondii, Dicranella subulata*.

**D. zonatum* (Brid.) Kindb. var. *scabrifolium* Dixon – Un; 8. On fine soil near snow bed in brook canyon near the top of Steller Mt., with *Hymenoloma crispulum, Oligotrichum hercynicum* and *Polytrichum juniperinum.*

Drepanium recurvatum (Lindb. & Arnell) G. Roth. – Un; 3. On dry cliff ledges on slopes of Nakoval'nya Mt., with *Didymodon insulanus, Tortula hoppeana, T. mucronifolia, Platydictya jungermannioides, Encalypta rhaptocarpa, Bryum* spp.

Drepanocladus aduncus (Hedw.) Warnst. – Sp; 3,4,5,6.

In rich fens between Nakoval'nya Mt. and Gavanskaja River and in wet depressions in Polovina Creek valley, on the drift wood trunks and sandy alluvium on the Gavanskaja River and Polovina Creek banks, on banks of flooded former creek beds, with *Drepanocladus polygamus, Warnstorfia exannulata, Calliergon cordifolium, Bryum pseudotriquetrum, Philonotis fontana*.

D. arcticus (R.S. Williams) Hedenäs – Un; 3. At the edge of rich fen between Nakoval'nya Mt and Gavanskaja River, on moist sand near base of coastal dune, with *Pohlia wahlenbergii* and *Philonotis fontana*.

D. polygamus (Bruch et al.) Hedenäs – Rar; 3,5,6. On willow trunk bases near flooded ancient beds of Poludennaja and Polovina Creeks; on hummock slope in rich fen between Nakoval'nya Mt. and Gavanskaja River, with *Pseudobryum cinclidioides* and *Drepanocladus aduncus*; in disturbed moss community on slope of ditch in Nikol'skoe Village.

D. sordidus (Müll. Hal.) Hedenäs – Rar; 3. In rich fen with springs between Nakoval'nya Mt. and Gavanskaja River, in wet depression among hummocks; at the border of this rich fen, on moist sand near base of coastal dune.

Echinophyllum sachalinense (Lindb.) O'Brian – Rar; 2. Hummocky tundra near the top of Svynye Mts, in moist depression between hummocks, with *Sanionia uncinata, Timmia norvegica, Rhizonmium andrewsianum*; large pure mat.

Encalypta ciliata Hedw. – Un; 8. Western slope of Steller Mt., on fine soil in moist niche at cliff base, with *Myurella julacea* and *Lescuraea radicosa*. S+.

E. rhaptocarpa Schwägr. – Sp; 1,3. On dry cliff ledges on Cape Severo-Zapadny and Nakoval'nya Mt., with *Didymodon insulanus, Tortula hoppeana, T. mucronifolia, Platydictya jungermannioides, Stereodon revolutus, Bryum* spp. S+.

Eurhynchiadelphus eustegia (Besch.) Ignatov & Huttunen – Un; 7. In moist niche near base of coastal cliff on steep rocky slope in Commander Bay vicinity.

Eurhynchiastrum pulchellum (Hedw.) Ignatov & Huttunen – Fr; 1,2,3,4,5,7,8. On soil rich in humus on steep rocky slopes with tundra, on cliff ledges, in different soil niches, mostly intermixed with *Bartramia ithyphylla, Pohlia cruda, P. nutans, Didymodon* spp., *Bryoerythrophyllum recurvirostrum, Amphidium lapponicum, Distichium capillaceum, Bryoxiphium norvegicum.* S+.

Fissidens adianthoides Hedw. – Rar; 6. On boggy shore of lake in tundra on step of slope of Polovina Creek valley, growing in almost pure carpet over few square meters, with admixture of *Campylium stellatum, Calliergon cordifolium, Drepanocladus aduncus, Straminergon stramineum*.

F. bryoides Hedw. – Rar; 2,8. Vicinity of Staraja Gavan' Bay, on moist silty sediments around pool on an abandoned road, with *Ceratodon heterophyllus* and *Pohlia* sp.; on cliff ledge on western slope of Steller Mt. below its top, with *Mnium lycopodioides.* S+.

F. osmundoides Hedw. – Rar; 6,7. On moist ledge of cliff in Commander Bay vicinity, mixed with *Tayloria lingulata, Amblystegium serpens*; in dry tundra on northern slope of Polovina Creek valley, on edge of spot of bare fine soil, pure cushion.

Fontinalis antipyretica Hedw. – Un; 1. On northern coast of Bering Island, submerged in creek, on rocky bottom. Coll. Mochalova, VIII.1991.

F. hypnoides Hartm. – Rar; 2,6. On willow branches in mountain brooks in cirque 1.5 km northward from Polovina Creek lower course; on boulder in brook near waterfall in the vicinity of Tundrovaja Bay.

Funaria hygrometrica Hedw. – Rar; 3. In Nikol'skoe Village, on moist loamy soil in pioneer moss community, with *Ditrichum heteromallum* and *Barbula unguiculata*; in Gavanskaja Creek valley on sandy soil, with *Pohlia wahlenbergii, Drepanocladus aduncus, Philonotis fontana* and *Bryum creberrimum*.

Gollania turgens (Müll. Hal.) Ando – Un; 8. On western slope of Steller Mt. just below its top, on moist inclined cliff surface.

Grimmia alpestris (F. Weber & D. Mohr) Schleich. – Sp; 8. Abundant in upper part of slopes of Steller Mt. and adjacent mountain northward from it, on cliffs and covered with fine soil cliff bases near snow beds, in pure cushions among *Schistidium papillosum, Bucklandiella macounii, Andreaea rupestris, Hymenoloma crispulum, Lescuraea* spp. S+.

G. hartmanii Schimp. – Rar; 1,3,8. On cliff ledges covered by soil rich in humus, or fine soil in Cape Zabijaka vicinity, and on slopes of Nakoval'nya Mt. and Steller Mt., with *Orthotrichum pylaisii, Bryoxiphium norvegicum, Lescuraea saxicola*.

Helodium blandowii (F. Weber & D. Mohr) Warnst. – Rar; 3,5,6,8. In rich fens around Nakoval'nya Mt., with *Aulacomnium palustre, Dicranum bonjeanii, D. undulatum, Scorpidium revolvens*; in Polovina and Gladkovskaja Creek valleys, with *Paludella squarrosa, Tomentypnum nitens, Sphagnum subsecundum, S. papillosum, Scorpidium* spp.

Hennediella heimii (Hedw.) R.H. Zander – Sp; 1,3. On sand and on moist bases of sandstone cliffs along coasts, apparently the most halophylic species of the studied flora, appearing in places closest to the beach and sometimes abundantly growing in coastal communities of *Leymus mollis;* grows in pure tufts or intermixed with *Tortula edentula, T. hoppeana, Bryhnia hultenii*.

Herzogiella adscendens (Lindb.) Z. Iwats. & W.B. Schofield – Sp; 1,2,3,5,6. On fine soil and soil rich in humus covering rock outcrops, in cliff niches and on cliff bases mostly in northern part of the island, once collected in spotty tundra near the top of Svynye Mts.; occasionally grows also on bases of willow trunks.

Heterocladium dimorphum (Brid.) Bruch et al. – Sp;

5,6,8. On steep slopes in dwarf-shrub tundra and meadow communities, on soil rich in humus, with *Pleurozium schreberi, Rhytidiadelphus* spp., *Hylocomiastrum pyrenaicum, Sanionia uncinata, Syntrichia ruralis*, and in fern communities on slopes to hollows, with *Rhytidiadelphus squarrosus, Plagiomnium ellipticum, Pleurozіopsis ruthenica*, once collected in rocky mountain tundra and just once on rock outcrop.

Hygroamblystegium humile (P. Beauv.) Vanderp., Goffinet & Hedenäs – Rar; 4,5. Lower course of Bujan Creek, on steep eroded slope of creek bed near water, with *Dicranella crispa, Pohlia proligera, Climacium dendroides*; in middle course of Poludennaya Creek, in willow shrub community at the edge of ancient river bed, on bases of willow trunks.

H. varium (Hedw.) Mönk. – Un; 7. On moist ledge of coastal cliff on Cape Tolsty, with *Tortula mucronifolia*.

Hygrohypnella bestii (Renauld & Bryhn) Ignatov & Ignatova – Sp; 2,6,8. Abundant in mountain brooks and in waterfalls on wet bouders, often submerged in water, growing in pure cushions or with *Dichodontium palustre, D. pellucidum* and *Schistidium rivulare* above water level.

H. ochracea (Turner ex Wilson) Ignatov & Ignatova – Fr; 1,2,4,5,6,8,9. On rocky and sandy creek banks near water, on rotten wood and willow branches, in rather slowly runnung creeks, often with *Brachythecium frigidum, Hygroamblystegium humile, Dichodontium* spp., *Pohlia wahlenbergii.*

Hylocomiastrum pyrenaicum (Spruce) M. Fleisch. – Com; 1,2,3,4,5,6,7,8. One of the most frequent species in hummocky dwarf-shrub tundra, with *Pleurozium schreberi, Sanionia uncinata, Dicranum majus, Stereodon plicatulus, Polytrichastrum alpinum, Polytrichum juniperinum*; somewhat less frequent in rocky tundra, with *Polytrichum juniperinum, Polytrichastrum alpinum, Pogonatum urnigerum, Bucklandiella* spp., *Codriophorus fascicularis, Racomitrium lanuginosum*, on steep rocky slopes to the coasts with the same species, on steep inland slopes covered with sparse meadow communities, with *Pleurozium schreberi, Rhytidiadelphus* spp., *Sanionia uncinata, Heterocladium dimorphum, Syntrichia ruralis*, in moss communities near snow beds, on turf-covered rock outcrops.

Hylocomium splendens (Hedw.) Bruch et al. – Sp; 1,3,8. In moist hummocky tundra at the base of watershed slope to Lodyginskaja Creek valley; on hummocks with *Betula nana* among *Sphagnum* mires, with *Sphagnum* spp., *Polytrichum juniperinum, Dicranum laevidens, Sanionia uncinata, Dicranum majus, Pleurozium schreberi*; once collected in wet hummocky tundra near the base of Steller Mt. slope.

Hymenoloma crispulum (Hedw.) Ochyra – Com; 1,2,3,5, 6,8. Widespread throughout the territory and at all elevations, near permanent and late snow beds, on cliffs, boulders and fine soil. The occurrence of *H. crispulum* increases in nival environments. Near fronts of snow beds it forms pure communities, otherwise growing with *Andreaea rupestris, Kiaeria starkei, Niphotrichum* spp., *Bucklandiell*a spp. Interestingly, the occurrence of *Andreaea rupestris* in rocky nival communities is significantly less than that of *Hymenoloma*.

Hypnum cupressiforme Hedw. – Rar; 1,3. On humus-covered ledges of basaltoid cliffs and in cliff niches, with *Bryoxiphium norvegicum, Distichium capillaceum, Platydictya jungermannioides, Timmia* spp., *Pohlia cruda.*

Isopterygiopsis muelleriana (Schimp.) Z. Iwats. – Rar; 2,3. On ledge and in niche of basaltoid cliffs on slopes of Svynye Mts and Malaja Stolovaja Mt., with *Stereodon plicatulus* and *Pohlia cruda*.

I. pulchella (Hedw.) Z. Iwats. – Rar; 3,4,7,8. On soil rich in humus, in shaded cliff niches, with *Amphidium lapponicum, Hypnum cupressiforme, Distichium capillaceum, Pohlia cruda*; once collected among tall-herbage and willow schrubs in Bujan Creek valley, in soil niche on steep slope.

Iwatsukiella leucotricha (Mitt.) W.R. Buck & H.A. Crum – Un; 3. In moist shaded niche of basaltoid cliff on southern slope of Nakoval'nya Mt., pure mat on fine soil.

Kiaeria blyttii (Bruch et al.) Broth. – Rar; 5,8. In niche near cliff base on western slope of Steller Mt., on fine soil, with *Lescuraea saxicola,* pure cushion. One specimen with characters intermediate with *K. falcata* (with strongly falcate leaves, strongly mamillose cells in upper part of leaf and well differentiated guide cells) was collected on mineral soil on roadside in place with late snow melting.

K. falcata (Hedw.) I. Hagen – Rar; 1,5. On boulders covered with fine soil layer in places with late snow melting: in vicinity of Cape Severo-Zapadny on slope of tableland, with *Andreaea rupestris* and *Bucklandiella* cf. *microcarpa;* near Poludennaja Creek mouth at cliff base, with *Hymenoloma crispulum*.

K. glacialis (Berggr.) I. Hagen – Un; 3. Basaltoid rock field on slope of Stolovaja Mt. near its top, in place with late snow melting; grows in extensive pure tufts, being the neighbor of *Bucklandiella laeta* and *Codriophorus fascicularis*.

K. starkei (F. Weber & D. Mohr) I. Hagen – Fr; 1,5,6,8. Widespread on fine soil and boulders near snow beds and in places with late snow melting, with *Hymenoloma crispulum, Actoa fulvella, Bucklandiella* spp., *Niphotrichum* spp., *Codriophorus* spp., *Pohlia* spp. S+.

Leptobryum pyriforme (Hedw.) Wilson – Rar; 1,2,3,4. In ruderal moss communities in ruts of abandoned roads, mostly near settlements, in disturbed places, on rotten wood of old abandoned houses and other rubbish, mostly with *Ceratodon purpuerus, Bryum* spp., *Pohlia nutans, Syntrichia ruralis, Brachythecium albicans*; on moist shaded bases of sandstone outcrops on northern

coast of Cape Severo-Zapadny, with *Hennediella heimii, Didymodon* cf. *brachyphyllus, Tortula edentula*. S+.

Leptodictyum riparium (Hedw.) Warnst. – Un; 5. On willow trunk bases on the edge of flooded ancient creek bed of Poludennaja Creek, with *Dichelyma capillaceum*.

Lescuraea baileyi (Best & Grout) E. Lawton – Sp; 5,6. In rocky tundra, on steep rocky slopes, both coastal and inland, on shaded bases of sedimentary rock outcrops, with *Heterocladium dimorphum, Lescuraea patens, L. saxicola, Rhytidiadelphus subpinnatus, Sciuro-hypnum* spp., *Plagiomnium* spp., *Claopodium* spp.

L. patens Lindb. – Sp; 3,5,8. On fine soil on basaltoid and sedimentary rock outcrops, in places with late snow melting; most abundant near Poludennaja Creek mouth and in middle part of western slope of Steller Mt., with *Schistidium* spp., *Andreaea rupestris, Hymenoloma crispulum, Bucklandiella macounii, Kiaeria* spp.

L. radicosa (Mitt.) Mönk – Rar; 3,8. On cliff ledge on western slope of Nakoval'nya Mt., with *Amphidium lapponicum*; on moist cliff bases in brook canyon on western slope of Steller Mt., in pure communities or with sparse admixture of *Bucklandiella macounii* ssp. *alpina, Andreaea rupestris, Schistidium papillosum, Lescuraea saxicola*.

L. saviana (De Not.) E. Lawton – Un; 8. On cliff ledge in brook canyon on western slope of Steller Mt., with *Amphidium lapponicum, Distichium capillaceum, Bryoerythrophyllum recurvirostrum, Lescuraea saxicola*.

L. saxicola (Bruch et al.) Molendo – Sp; 1,3,6,8. On soil rich in humus on ledges of basaltoid and sedimentary rock outcrops, on turf-covered rock outcrops, in places with late snow melting, on inland steep rocky slopes, with *Heterocladium dimorphum, Lescuraea patens, L. baileyi, Rhytidiadelphus* spp., *Hylocomiastrum pyrenaicum*; in brook canyons on western slope of Steller Mt.

Loeskypnum badium (Hartm.) H.K.G. Paul – Rar; 5. In boggy valley of Poludennaja Creek in middle course, pure carpet, with *Sphagnum papillosum, Oncophorus wahlenbergii* and *Scorpidium revolvens*; in the same area, in nival moss community, few plants among *Sanionia uncinata, Bryum pseudotriquetrum, Campylium stellatum*.

Meesia triquetra (Jolycl.) Ångstr. – Rar; 3. In rich fen with springs between Nakoval'nya Mt. and Gavanskaja River, in wet depressions, as pure cushions or with *Straminergon stramineum, Bryum pseudotriquetrum, Scorpidium revolvens.*

M. uliginosa Hedw. – Rar; 2,3. In rich fen, with previous species, on low hummock, as admixture to *Cinclidium stygium, Campylium protensum, Aulacomnium palustre*; in deep moist niche at cliff base on the top of Svynye Mts, on fine soil, with *Blepharostoma trichophyllum*.

Mnium lycopodioides Schwägr. – Un; 8. On southern slope of Steller Mt., on fine soil in rock crevice, with *Amphidium lapponicum, Pohlia cruda*, and *Tortella alpicola*.

M. thomsonii Schimp. – Rar; 8. On western slope of Steller Mt., on fine soil in moist cliff niche near brook, with *Bryoerythrophyllum recurvirostrum, Amphidium lapponicum, Bryoxiphium norvegicum, Pohlia cruda*.

Myurella julacea (Schwägr.) Bruch et al. – Rar; 8. On western slope of Steller Mt., on fine soil on cliff ledge, with *Heterocladium dimorphum* and *Tortella fragilis*; in the same area, in moist niche at cliff base, with *Encalypta ciliata* and *Lescuraea radicosa*.

M. tenerrima (Brid.) Lindb. – Un; 3. On shaded rock outcrop, in niche on the slope of Nakoval'nya Mt., with *Isopterygiopsis pulchella, Bryoerythrophyllum recurvirostrum* and *Blepharostoma trichophyllum*.

Niphotrichum canescens (Hedw.) Bednarek-Ochyra & Ochyra – Fr; 1,4,5,6,7,8. Most abundant on rocks and fine soil in places with late snow melting, with *Kiaeria starkei, Racomitrium lanuginosum, Codriophorus* spp., *Bucklandiella laeta, B. microcarpa, Hymenoloma crispulum*; also on creek banks, disturbed places on sandy terraces, in rocky tundra, however less abundant than *N. ericoides*; once collected on wet gravel near waterfall.

N. ericoides (Brid.) Bednarek-Ochyra & Ochyra – Com; 1,3,4,5,6,8. Throughout the territory, in all habitats where previous species occurs, equally abundant in both nival and rather dry places; sometimes forming pure communities on creek banks and sandy terraces in vicinity of Cape Severo-Zapadny (see annotation to *Codriophorus fascicularis*). S+.

N. muticum (Kindb.) Bednarek-Ochyra & Ochyra – Com; 1,4,5,6,8. The species dominates on rather dry strips of gravel on Bujan and Poludennaja Creek banks, especially on non-overgrown strips of ancient creek banks, with admixture of *N. ericoides, Syntrichia ruralis, Brachythecium* spp., and on sandy terraces in vicinity of Cape Severo-Zapadny (see annotation to *Codriophorus fascicularis*); somewhat less abundant on inland steep rocky slopes, with sparse meadow vegetation, with *Heterocladium dimorphum, Lescuraea* spp., *Rhytidiadelphus* spp., *Hylocomiastrum pyrenaicum*; also in rocky tundra and in lowland moss communities in places with late snow melting. S+.

N. panschii (Müll. Hal.) Bednarek-Ochyra & Ochyra – Rar; 5,6. In places with late snow melting in upper courses of Polovina and Poludennaja Creek tributaries, with *Kiaeria starkei, Bucklandiella* spp., *Codriophorus* spp., *Arctoa fulvella, Hymenoloma crispulum.*

Ochyraea duriuscula (De Not.) Ignatov & Ignatova – Rar; 6,8. On moist gravelly bank of Polovina Creek, with *Brachythecium frigidum*; on boulder in mountain brook on western slope of Steller Mt., pure carpet.

Oligotrichum aligerum Mitt. – Un; 6. On wet eroded surface of peat and on loamy soil in hollow in Polovina Creek valley, with *Fissidens adiantoides, Pogonatum contortum, Polytrichastrum longisetum, Oligotrichum parallelum, Psilopilum cavifolium, Dicranella subulata, Pohlia proligera*.

O. falcatum Steere – Rar; 1,6. On loamy soil in rocky mountain tundra on the watershed southward from Polovina Creek valley and on soil in dwarf-shrub tundra near Stolovye Mts., with *Pogonatum dentatum, P. urnigerum, Dicranella subulata, Ceratodon purpureus, Pohlia* spp.

O. hercynicum (Hedw.) Lam. & DC. – Fr; 1,4,5,6,8. On eroded soil and in places with disturbed turf cover in different tundra communities, with *Bartramia ithyphylla, Dicranella subulata* and *Pogonatum* spp., on steep rocky slopes and on fine soil near cliff bases, with *Tortula hoppeana, Sanionia uncinata, Bryoerythrophyllum recurvirostrum, Bartramia ithyphylla*, in places with late snow melting, on eroded slopes of creek beds, on creek banks. S+.

O. parallelum (Mitt.) Kindb. – Fr; 1,2,3,5,6. In habitats similar to those of the pervious species, but in somewhat wetter places. Most abundant on shaded vertical soil banks in ruts of abandoned road, with *Bartramia ithyphylla, Dicranella subulata, Oligotrichum hercynicum, Pogonatum urnigerum, Polytrichastrum longisetum, Pohlia* spp., sometimes also occurs in places with late snow melting, on steep rocky slopes. S+.

Oncophorus virens (Hedw.) Brid. – Sp; 3,5,6. The species forms hummocks in hollows on slopes to Polovina Creek valley, with *Sphagnum compactum*; also occurs on hummocks of rich fen between Nakoval'nya Mt. and Gavanskaya River, with *Aulacomnium palustre*.

O. wahlenbergii Brid. – Rar; 5,6. In boggy valley of Poludennaja Creek in its middle course, pure carpet with *Sphagnum papillosum, Loeskypnum badium, Campylium stellatum, Scorpidium revolvens*; in hollow on slope to Polovina Creek valley, on hummock, pure tuft among cushions of *Sphagnum compactum*. S+.

Orthothecium strictum Lorentz – Rar; 1,3. Twice collected on cliff ledges: on sandstone on northern coast of Cape Severo-Zapadny and on basaltoid on slope of Nakoval'nya Mt.

Orthotrichum pylaisii Brid. – Fr; 1,2,3. On basaltoid cliffs near Nikol'skoe Village, on slopes of Nakoval'nya Mt., on Cape Zabijaka and on southern coast of the island 4 km eastward from Cape Severo-Zapadny, in abundance, especially in wetter conditions. In the first locality it forms pure communities on cliff surface with oozing water, in other localities grows with *Schistidium tenuinerve, Lescuraea* spp., *Amphidium lapponicum, Amblystegium serpens, Syntrichia norvegica, Herzogiella adscendens.* S+.

O. sordidum Sull. & Lesq. – Un; 1. On moist shaded surface of basaltoid cliff near Cape Zabijaka, with *Amphidium lapponicum, Pohlia cruda, Bryoxiphium norvegicum.* S+.

Oxystegus tenuirostris (Hook. & Taylor) A.J.E. Sm. – Rar; 5,8. On shaded cliff ledge and on fine soil in brook canyon on western slope of Steller Mt.; on soil rich in humus covering cliff base in tall-herbage community near Poludennaja Creek mouth, with *Plagiothecium cavifolium* and *Didymodon insulanus*.

Paludella squarrosa (Hedw.) Brid. – Rar; 6,8. In rich fens in Polovina and Gladkovskaja Creek valleys, mostly with *Helodium blandowii, Aulacomnium palustre, Scorpidium revolvens, Tomentypnum nitens, Sphagnum warnstorfii*.

Paraleucobryum enerve (Thed.) Loeske – Rar; 5,8. Twice collected in open tundra communities on rocky slopes of Poludennaja Creek valley and Steller Mt, in both localities with *Dicranum majus.*

Philonotis americana Dism. – Rar; 4. On wet cliff base near waterfall, with *Dichodontium palustre*; on bare loamy soil near Bujan Creek, with *Pohlia cruda, P. proligera, P. wahlenbergii, Dichodontium pellucidum*; on moist patch on steep rocky slope under rock outcrops, on fine soil, with *Ceratodon purpuerus, Dichodontium pellucidum, Timmia norvegica, Dicranella subulata, Pohlia proligera*.

P. capillaris Lindb. – Rar; 7. Twice collected on fine soil on ledge of cliff above steep slope to the coast of Commander Bay, and at the base of similar cliff, with *Pohlia wahlenbergii* and *Plagiobryum zierii*.

P. fontana (Hedw.) Brid. – Fr; 1,2,3,4,5,6,7,8. On loamy ground, alluvium, fine soil, on ledges of wet cliffs and on boulders near waterfalls, at creek banks, along mountain brooks, on moist ground in different disturbed places and ruderal communities, with *Dichodontium* spp., *Pohlia wahlenbergii, P. proligera, Bryoerythrophyllum recurvirostrum, Bryum* spp., *Drepanocladus* spp., *Codriophorus* spp., *Niphotrichum muticum, Brachythecium frigidum, Sciuro-hypnum* spp. S+

Plagiobryum demissum (Hook.) Lindb. – Rar; 1,5. On bare sandy slope to creek bed at ca. 4 km northward from Cape Severo-Zapadny, with *Ditrichum cylindricum*; in similar microhabitat near mouth of Poludennaja Creek, with *Dicranella cerviculata, Bryum* spp.

P. zierii (Hedw.) Lindb. – Un; 7. On ledge of coastal cliff with bird colonies in Commander Bay vicinity, among *Amblystegium serpens, Ceratodon purpureus, Tortula mucronifolia.*

Plagiomnium curvatulum (Lindb.) Schljakov – Rar; 1,8. On wet soil rich in humus in places of late snow melting in lower part of SW slope of Steller Mt., and on bank of hollow in Cape Severo-Zapadny vicinity, with *Sanionia uncinata, Sphagnum* spp., *Polytrichastrum alpinum, Conostomum tetragonum, Pogonatum dentatum.*

P. ellipticum (Brid.) T.J. Kop. – Rar; 3,4. On bare mineral ground near the road to Bujan Cape, with *Sanionia uncinata, Brachythecium* sp., *Pohlia nutans*; on the edge of rich fen between Nakoval'nya Mt. and Gavanskaja River, on moist sand near the base of coastal dune, with *Pohlia wahlenbergii* and *Philonotis fontana*.

P. medium (Bruch et al). T.J. Kop. – Sp; 1,3,4,5,6. On steep rocky slopes covered with tall herbage commu-

nities under rock outrops, in lower parts of valley slopes, on soil rich in humus, with *Bryhnia hultenii, Sciuro-hypnum reflexum, S. uncinifolium, Sanionia uncinata, Claopodium* spp., *Rhizomnium magnifolium, Syntrichia ruralis, Climacium dendroides*; in willow-shrub communities at creek mouthes, with *Sanionia uncinata, Brachythecium* sp., *Climacium dendroides, Sciuro-hypnum* spp.

Plagiothecium cavifolium (Brid.) Z. Iwats. – Fr; 1,3,8. On rock outcrops covered with turf, in shaded cliff niches and on ledges, in crevices among boulders, with *Pohlia cruda, Sciuro-hypnum* spp., *Trachycystis flagellaris, Timmia* spp., *Distichium capillaceum, Isopterygiopsis* spp.

P. denticulatum (Hedw.) Bruch et al. – Sp; 3,5,6,8. On humus, litter, rotten wood, rocks and fine soil in mesic tall herbage communities at cliff bases, in willow – tall herbage communities in creek valleys, mainly with *Rhizomnium magnifolium, R. nudum, Plagiomnium* spp., *Bryhnia hultenii, Brachythecium rivulare, Sciuro-hypnum reflexum, S. uncinifolium*; once found on cliff ledge.

Platydictya jungermannioides (Brid.) H.A.Crum – Sp; 2,3,4,8. On dry cliff ledges, on rock outcrops somewhat covered with turf, in cliff crevices and niches, on fine soil, with *Didymodon insulanus, Tortula hoppeana, T. mucronifolia, Encalypta rhaptocarpa, Stereodon revolutus, Bryum* spp.

Pleuroziopsis ruthenica (Weinm.) Kindb. ex E. Britton – Sp; 5,8. On soil rich in humus on steep slopes in dwarf-shrub tundra communities, with *Pleurozium schreberi, Rhytidiadelphus* spp., *Hylocomiastrum pyrenaicum, Sanionia uncinata*, in fern communities on slopes of hollows, with *Rhytidiadelphus squarrosus, Plagiomnium ellipticum, Heterocladium dimorphum, Syntrichia ruralis*, in tall herbage communities at bases of cliffs, with *Bryhnia hultenii, Sciuro-hypnum* spp., *Climacium dendroides*.

Pleurozium schreberi (Brid.) Mitt. – Com; 1,2,3,4,5,6, 8,10. Dominant species in hummocky dwarf-shrub tundra where it grows with *Sanionia uncinata, Dicranum majus, Stereodon plicatulus, Polytrichastrum alpinum, Polytrichum juniperinum*; in rocky tundra, with *Polytrichum juniperinum, Hylocomiastrum pyrenaicum, Polytrichastrum alpinum, Pogonatum urnigerum, Bucklandiella* spp., *Codriophorus fascicularis, Racomitrium lanuginosum*, on steep rocky slopes, among dwarf-schrubs, with the same moss species; on steep inland slopes covered with sparse meadow communities, with *Rhytidiadelphus* spp., *Sanionia uncinata, Heterocladium dimorphum, Syntrichia ruralis*, in moss communities near snow beds, mostly at low elevation, on turf-covered rock outcrops, on hummocks at edges of *Sphagnum* and on hummock with *Betula nana, Hylocomium splendens, Polytrichum* spp.

Pogonatum contortum (Brid.) Lesq. – Rar; 1,5,6. On moist mineral and organic soil on steep eroded slopes, with *Oligotrichum parallelum, Pohlia proligera, Polytrichastrum longisetum*; once collected in place with late snow melting, also with *Oligotrichum parallelum.* S+.

P. dentatum (Brid.) Brid. – Rar; 6. On loamy soil in rocky mountain tundra on the watershed southward from Polovina Creek valley, with *Oligotrichum falcatum, Pogonatum urnigerum, Dicranella subulata, Ceratodon purpureus, Pohlia* spp.

P. urnigerum (Hedw.) P. Beauv. – Fr; 1,2,3,4,5,6,8. S+. In rocky mountain tundra, in places with late snow melting, both on mineral ground and wet tundra soil, on bare soil on steep coastal slopes, in landslides and other disturbed places, with *Pohlia* spp., *Polytrichastrum alpinum, Bryum* spp., *Oligotrichum* spp., *Dicranella* spp. S+.

Pohlia andalusica (Höhn.) Broth. – Un; 3. On SE slope of Malaya Stolovaya Mt., in hummocky dwarf-shrub tundra; on bare loamy soil along a road, pure tuft. P+.

P. andrewsii A.J. Shaw – Rar; 4,6. Twice collected on rocky steep coastal slopes: southward from Bujan Creek mouth and northward from Polovina Creek mouth, on bare loamy soil, with *Pohlia proligera, Dichodontium pellucidum, Polytrichastrum alpinum, Pogonatum urnigerum*. P+.

P. beringiensis A.J. Shaw – Rar; 1,4. On fine soil in places with late snow melting on southern slope of tableland in Cape Severo-Zapadny vicinity and in Bujan Creek valley, with *Dicranella subulata, Pogonatum urnigerum, Pohlia* spp., *Bryum* sp. P+.

P. bulbifera (Warnst.) Warnst. – Un; 1. On the lower edge of steep slope to the coast, on sandy alluvium near creek mouth, with *Philonotis fontana, Bryum* sp. P+.

P. cruda (Hedw.) Lindb. – Fr; 1,2,3,4,6.8. On mineral ground at creek banks, with *Dicranella* spp., *Pohlia proligera, Dichodontium pellucidum, Bartramia ithyphylla*; on fine soil in cliff niches, with *Amphidium lapponicum, Distichium capillaceum, Eurhynchiastrum pulchellum*; on steep rocky slopes, with *Pogonatum urnigerum, Oligotrichum* spp., *Bartramia ithyphylla*; in rocky mountain tundra, on disturbed spots in lowland tundra, in niches with soil rich in humus, on rather dry alluvium. S+.

P. crudoides (Sull. & Lesq.) Broth. – Un; 4. On steep rocky coastal slope southward from Bujan Creek mouth, with *Oligotrichum hercyniclum, Dicranella subulata, Pogonatum urnigerum*. S+.

P. drummondii (Müll. Hal.) A.L. Andrews – Sp; 2,3,4,5,8. On bare loamy soil in mountain tundra and in places with late snow melting, with *Arctoa fulvella, Kiaeria starkei, Bucklandiella* spp., *Racomitrium lanuginosum, Niphotrichum* spp. P+.

P. filum (Schimp.) Mårtensson – Rar; 1. Swamped creek hollow near road 2.4 km eastward from Cape Severo-Zapadny, in pioneer moss community on dry lake bottom, on moist silt, with *Psilopilum cavifolium* and

Trematodon ambiguus; in the same place, on eroded slope of creek bed, with *Dichodontium pellucidum*. P+.

P. longicollis (Hedw.) Lindb. – Un; 6. S+. On sandy alluvium, on the edge of Polovina Creek bank, with *Bryum* sp., *Pohlia proligera*, *Ditrichum* cf. *heteromallum*, *Oligotrichum* spp. S+.

P. nutans (Hedw.) Lindb. – Fr; 1,2,3,5,7. In ruderal moss communities in ruts of abandoned roads, mostly near settlements, in disturbed places, on rotten wood of old abandoned houses and other rubbish, mostly with *Ceratodon purpuerus*, *Bryum* spp., *Leptobryum pyriforme*, *Syntrichia ruralis*, *Brachythecium albicans*; rarer occurs on steep coastal slopes, in mountain and hummocky tindra, on turf-covered rock outcrops. S+.

P. obtusifolia (Vill. ex Brid.) L.F. Koch – Un; 8. On fine soil in rock crevice near snow bed on western slope of Steller Mt., with *Arctoa fulvella*, *Kiaeria starkei*, *Bucklandiella* sp., *Hymenoloma crispulum*, *Codriophorus fascicularis*.

P. proligera (Kindb.) Lindb. ex Broth. – Fr; 1,3,4,5,6,7, 9. On loamy ground, alluvium, fine soil. on steep rocky coastal slopes, creek banks, in different disturbed places, with *Dichodontium pellucidum*, *Ceratodon purpureus*, *Philonotis* spp., *Pohlia wahlenbergii*, *Bryoerythrophyllum recurvirostrum*, *Bryum* spp., *Dicranella* spp. and other pioneer mosses. P+.

P. tundrae A.J. Shaw – Rar; 1,4. On shaded bases of sandstone cliffs in vicinity of Cape Severo-Zapadny; on the lower edge of steep slope to the coast, on sandy alluvium near creek mouth, with *Philonotis fontana*, *Bryum* sp.; on steep rocky coastal slope southward from Bujan Creek mouth, on bare loamy soil, with *Dichodontium pellucidum*, *Dicranella subulata*, *Pogonatum urnigerum*. P+.

P. wahlendbergii (F. Weber & D. Mohr) A.L. Andrews – Fr; 1,2,3,4,5,6,7,8. Most frequent and abundant on wet alluvium on creek banks, with *Hygrohypnella ochracea*, *Brachythecium frigidum*, *Dichodontium pellucidum*, *Philonotis fontana*; on wet boulders and soil near mountain brooks and waterfalls, with *Hygrohypnella bestii*, *Pohlia wahlenbergii*, *Philonotis fontana*, *Schistidium* spp., *Bryum schleicherii*, *B. pseudotriquetrum*, *B. weigelii*, *Dichodontium pellucidum*, on wet bases of coastal dunes, with *Bryum* spp. and *Drepanocladus* spp.; in ruderal moss communities, with *Bryum* spp., *Funaria hygrometrica*, *Campyliadelphus chrysophyllus*. S+.

Polytrichastrum alpinum (Hedw.) G.L. Sm. – Fr; 1,2,3,4, 5,6,7,8.The species is widespread in rocky tundra, with *Polytrichum juniperinum*, *Pogonatum urnigerum*, *Bucklandiella* spp., *Codriophorus fascicularis*, *Racomitrium lanuginosum*, on steep rocky slopes to the coast, with the same species, on hummocks with *Betula nana* among *Sphagnum* mires, in various disturbed places in hummocky dwarf-shrub tundra, with *Pleurozium schreberi*, *Hylocomiastrum pyrenaicum*, *Sanionia uncinata*, *Dicranum majus*, *Stereodon plicatulus*, *Polytrichum juniperinum*; in moss communities near snow beds, mostly at low elevation, on turf-covered rock outcrops. S+.

P. longisetum (Sw. ex Brid.) G.L. Sm. – Rar; 5,6. On eroded soil rich in humus in Polovina Creek valley, with *Pogonatum contortum*, *Oligotrichum parallelum*, *Psilopilum cavifolium*, *Pohlia proligera*; on vertical banks of ruts of abandoned roads and eroded tops of hummocks in the vicinity of Poludennaja Creek mouth, with *Dicranella* spp.

P. pallidisetum (Funck) G.L. Sm. – Un; 5. Poludennaja Creek valley, without exact locality, with *Sanionia uncinata*, *Sphagnum* sp. Coll. Ponomareva & Yanitskaja 22.VIII.1986.

P. sexangulare (Flörke ex Brid.) G.L. Sm. – Rar; 8. On steep rocky slope of canyon, in upper part of Steller Mt. western slope, on fine soil with *Hymenoloma crispulum*, *Pohlia drummondii*, *Bucklandiella microcarpa*, *Pogonatum urnigerum*.

Polytrichum commune Hedw. – Rar; 1. On hummocks at the border between dwarf-shrub tundra and *Sphagnum* mire between tableland and southern coast, with *Sphagnum* spp., *Pleurozium schreberi*, *Polytrichum juniperinum*.

P. juniperinum Hedw. – Fr; 1,2,3,4,5,6,8. In places with disturbed turf cover at bases of slopes, in rocky tundra, with *Polytrichastrum alpinum*, *Pogonatum urnigerum*, *Bucklandiella* spp., *Codriophorus fascicularis*, *Racomitrium lanuginosum*, on steep rocky slopes to the coast, on hummocks with *Betula nana* among *Sphagnum* mires, in different disturbed places in hummocky dwarf-shrub tundra, with *Pleurozium schreberi*, *Hylocomiastrum pyrenaicum*, *Sanionia uncinata*, *Dicranum majus*, *Stereodon plicatulus*, *Polytrichastrum alpinum*; in disturbed habitats along roadsides and near settlements, on rotten wood of old abandoned houses and turf-covered rubbish, mostly with *Ceratodon purpuerus*, *Bryum* spp., *Pohlia nutans*, *Syntrichia ruralis*, *Brachythecium albicans*. S+.

P. piliferum Hedw. – Rar; 1,3,6,8. On dry fine soil among rocks in rocky tundra on the tops of watersheds, with *Pogonatum urnigerum*, *Polytrichum juniperinum*, *Polytrichastrum alpinum*, *Pohlia* spp., *Dicranella subulata*.

P. strictum Brid. – Rar; 1,3,6. On hummocks with *Betula nana* in *Sphagnum* mires between tableland and southern coast, 3.8 km southward from Cape Severo-Zapadny, in Lodygynskaja and Polovina Creek valleys, with *Sphagnum* spp., *Aulacomnium palustre*, *Dicranum laevidens*, *Polytrichum juniperinum*, *Hylocomium splendens*, *Pleurozium schreberi*.

Pseudobryum cinclidioides (Huebener) T.J. Kop. – Sp; 3,5,6,7. Most frequent in rich fen between Nakoval'nya Mt. and Gavanskaja River, in wet depressions, with *Helodium blandowii*, *Aulacomnium palustre*, *Bryum pseudotriquetrum*, *Scorpidium revolvens*; occasional-

ly also in willow-shrub communities in slightly flooded lower courses of creeks.

Pseudohygrohypnum subeugyrium (Renauld & Cardot) Ignatov & Ignatova – Un; 1. On moist boulder on creek bank crossed by road in 4 km eastward from Cape Severo-Zapadny.

Pseudoleskeella papillosa (Lindb.) Kindb. – Un; 3. In shaded cliff niche on slope to Nakoval'nya Mt., with *Blepharostoma trichophyllum* and other liverworts.

P. rupestris (Berggr.) Hedenäs & L. Söderstr. – Sp; 1,2,8. The species is locally abundant on dry rock outcrop on the crest of Cape Severo-Zapadny, where it grows on shaded ledges and in niches, with *Syntrichia norvegica* and *Amblystegium serpens*; also collected in similar habitats on slopes of Svinye and Steller Mts.

Pseudotaxiphyllum elegans (Brid.) Z. Iwats. – Sp; 5. Locally frequent in tall-herbage communities in lower course of Poludennaja Creek valley, especially at cliff bases, with *Bryhnia hultenii, Sciuro-hypnum* spp., *Plagiomnium medium, Claopodium* spp., *Pleuroziopsis ruthenica*.

Psilopilum cavifolium (Wilson) I. Hagen – Un; 6. On wet eroded surface of peat and loam in hollow in Polovina Creek valley, with *Fissidens adianthoides, Pogonatum* spp., *Polytrichastrum longisetum, Oligotrichum spp., Dicranella subulata, Pohlia proligera*.

P. laevigatum (Wahlenb.) Lindb. – Rar; 1,3. In swamped creek hollow near road 2.4 km eastward from Cape Severo-Zapadny, in pioneer moss community on the bottom of dry lake, on moist silt, abundant, intermixed with *Trematodon ambiguus* and *Pohlia* spp.; on SE slope of Malaya Stolovaya Mt., on bare loamy soil on roadside, pure tuft. S+.

Ptilium crista-castrensis (Hedw.) De Not. – Rar; 3,5,6. In rocky tundra on the top of Makaja Stolovaja Mt., with *Polytrichum juniperinum, Rhytidiadelphus triquetrus*; in hummocky tundra on slopes of watersheds to Polovina and Poludennaja Creek valleys, with *Hylocomiastrum pyrenaicum, Pleurozium schreberi, Stereodon plicatulus, Sanionia uncinata.*

Racomitrium lanuginosum (Hedw.) Brid. – Fr; 1,2,3,6,8. On fine soil in places with late snow melting, with *Kiaeria starkei, Niphotrichum* spp., *Codriophorus* spp., *Bucklandiella laeta, B. microcarpa, Hymenoloma crispulum*; in rocky mountain tundra, with *Pogonatum urnigerum, Polytrichastrum alpinum, Pleurozium schreberi, Hylocomiastrum pyernaicum,* it also occurs along creek banks, and on disturbed places of sandy terraces in the vicinity of Cape Severo-Zapadny, with *Codriophorus fascicularis, Niphotrichum ericoides, N. muticum, Bucklandiella laeta*.

Rhizomnium andrewsianum (Steere) T.J. Kop. – Rar; 2,3,4. In hummocky tundra near the top of Svynye Mts, in moist depression between hummocks, with *Echinophyllum sachalinense, Sanionia uncinata, Timmia norvegica*; on steep eroded creek bank in lower course of Bujan Creek, with *Timmia comata, Pohlia proligera, Tayloria tenuis*; in Nikol'skoe Village, on moist loamy soil in ruderal moss community, with *Drepanocladus* cf. *aduncus, Bryoerythrophyllum recurvirostrum, Campyliadelphus chrysophyllus, Bryum salinum.*

R. gracile T.J. Kop. – Un; 4. On steep eroded slope of creek bed in lower course of Bujan Creek, with *Timmia comata, Pohlia proligera, Tayloria tenuis, Climacium dendroides.*

R. magnifolium (Horik.) T.J. Kop. – Sp; 1,3,5,6,7,8. On soil rich in humus and on litter in mesic tall herbage communities under cliff bases and along sea coast, in willow – tall herbage communities in creek and rivulet valleys., mainly with *Bryhnia hultenii, Rhizomnium nudum, Plagiomnium medium, Sciuro-hypnum reflexum, S. uncinifolium, Plagiothecium* spp.; once collected in shaded niche among basaltoid boulders near sea coast, with *Plagiothecium laetum* and *Brachythecium* cf. *capillaceum.*

R. nudum (E. Britton & R.S. Williams) T.J. Kop. – Sp; 1,3,4,5,7,8. In general growing similar to previous species, but in somewhat more moist habitats; the species is most frequent in willow shrub – tall herbage communities along banks of creeks, with *Brachythecium rivulare, Sciuro-hypnum uncinifolium* and *Climacium dendroides*.

R. pseudopunctatum (Bruch & Schimp.) T.J. Kop. – Sp; 1,3,6. In rich fens in Gladkovskaja and Polovina Creek valleys, with *Fissidens adiantoides, Campylium stellatum, Calliergon cordifolium, Drepanocladus aduncus, Straminergon stramineum*; in moist tundra on creek bank invicinity of Cape Severo-Zapadny, with *Aulacomnium palustre* and *Bryum pseudotriquetrum*.

Rhytidiadelphus japonicus (Reimers) T.J. Kop. – Rar; 1. On hummock in hummocky tundra between tableland and southern coast, 3.5 km southward from Cape Severo-Zapadny, with *Pleurozium schreberi*; on turf-covered surface of sandstone outcrop on northern coast of Cape Severo-Zapadny, with *Tortula hoppeana*.

R. loreus (Hedw.) Warnst. – Rar; 5,6. In hummocky tundra on gentle slope of watershed to Polovina Creek valley, with *Pelurozium schreberi* and *Polytrichastrum alpinum*; in open meadow at oceanic coast near Poludennaja Creek mouth, with *Sanionia uncinata* and *Syntrichia ruralis*.

*R. squarrosus (*Hedw.) Warnst. – Sp; 2,3,5,6,8. On soil rich in humus in dwarf-shrub tundra and meadows on steep slopes, with *Pleurozium schreberi, Polytrichastrum alpinum, Hylocomiastrum pyrenaicum, Sanionia uncinata, Syntrichia ruralis,* on sandy alluvium on coastal meadows, with similar species; in fern communities on slopes to hollows, with *Heterocladium dimorphum, Pleuroziopsis ruthenica,* in disturbed places along roads, with *Ceratodon purpuerus, Bryum* spp., *Pohlia nutans, Syntrichia ruralis, Brachythecium albicans*. Not frequent but usually locally abundant.

R. subpinnatus (Lindb.) T.J. Kop. – Rar; 5,6. Two collections from hummocky tundra with close dwarf-shrub canopy, on soil rich in humus, with *Dicranum majus*.

R. triquetrus (Hedw.) Warnst. – Sp; 3,4,6,8. In hummocky tundra with relatively open dwarf-shrub canopy, with *Pleurozium schreberi, Hylocomiastrum pyrenaicum, Dicranum majus*; on slightly turf-covered rock field on Malaja Stolovaja Mt. slope, with *Codriophorus fascicularis, Bucklandiella laeta, Dicranum majus*.

Rhytidium rugosum (Hedw.) Kindb. – Rar; 2,8. In rocky tundra near the top of Svynye Mts and on NW slope of Steller Mt., with *Hylocomiastrum pyrenaicum, Dicranum acutifolium, D. majus, Pleurozium schreberi.*

Rigodiadelphus robustus (Lindb.) Nog. – Un; 3. In moist shaded cliff crevice above a pool on eastern slope of Nakoval'nya Mt., with *Bryoxiphium norvegicum* and *Amblystegium serpens*, pure mat.

Saelania glaucescens (Hedw.) Broth. – Un; 8. On western slope of Steller Mt., on fine soil in moist cliff niches near brook, with *Distichium capillaceum, Pohlia cruda.* S+.

Sanionia uncinata (Hedw.) Loeske – Com; 1,2,3,4,5, 6,7,8. The species is widespread in most types of studied habitats, being most abundant in rocky tundra, with *Polytrichum juniperinum, Pogonatum urnigerum, Polytrichastrum alpinum, Bucklandiella* spp., *Codriophorus fascicularis, Racomitrium lanuginosum*, on steep rocky slopes to the coast, with the same species, in a variety of disturbed places in hummocky dwarf-shrub tundra, with *Pleurozium schreberi, Hylocomiastrum pyrenaicum, Rhytidiadelphus* spp., *Dicranum majus, Stereodon plicatulus, Polytrichum juniperinum*; in moss communities near snow beds, on coastal meadows, in wet depressions in various, mostly eutrophyc bogs, in tall herbage communities, on turf-covered rock outcrops, on fine soil, litter, rotten wood, bases of willow schrubs, rubbish. S+.

Schistidium lancifolium (Kindb.) H.H. Blom – Un; 7. Vicinity of Commander Bay, on fine soil near cliff base on steep rocky coastal slope, with *Syntrichia ruralis, Polytrichastrum alpinum.*

S. maritimum (Turner ex R. Scott) Bruch et al. – Fr; 1,3,5, 7,8. On ledges and in crevices of coastal cliffs and boulders, being very frequent and abundant along SW coast of island, where it dominates in zone of oceanic spray, growing with *Amblystegium serpens* and *Bryum* spp., but relatively rare along NE coast. Occasionally it occurs on rock outcrops, distant from coast up to 5 km. S+.

S. obscurum H.H. Blom, Köckinger & Ignatova – Un; 8. On wet boulder in brook on western slope of Steller Mt. near its top. S+.

S. papillosum Culm. – Sp; 2,8. In moist rocky mountain tundra, at cliff bases, in places of late snow bed melting, not rare in upper part of Steller Mt. slopes, also occurs on the unnamed peak «747 m alt.», and on Svynye Mts., mainly with *Bucklandiella* spp., *Lescuraea* spp., *Andreaea rupestris, Hymenoloma crispulum, Kiaeria starkei.* S+.

S. platyphyllum (Mitt.) Perss. – Rar; 5,8. On wet boulders in Poludennaja Creek near bank and in brook canyon in middle part of Steller Mt. western slope. S+.

S. pulchrum H.H. Blom – Rar; 1,7. On fine soil in rock crevices: 3.5 km to SEE from Cape Severo-Zapadny, on slope of tableland, in moss community in late snow bed, with *Bucklandiella microcarpa, Andreaea rupestris*; on shaded cliff base in Commander Bay shore, in niche.

S. rivulare (Brid.) Podp. – Sp; 3,5,8. On wet rocks on slopes and occasionally in streams, in cliff crevices, on fine soil upon rocky substrates.

S. tenuinerve Ignatova & H.H. Blom – Rar; 3,5. On lowland rock outcrops on Nakoval'nya Mt. and near mouth of Poludennaja Creek, on ledges covered with fine soil, pure tufts among *Didymodon insulanus, Lescuraea baileyi, Encalypta rhaptocarpa, Herzogiella adscendens*. S+.

Sciuro-hypnum latifolium (Kindb.) Ignatov & Huttunen – Un; 8. In moist niche under rock outcrop in brook canyon on Steller Mt. western slope, on fine soil.

S. plumosum (Hedw.) Ignatov & Huttunen – Rar; 6,8. On moist silty alluvium on Polovina creek bank; on moist finesoil near creek on western slope of Steller Mt.

S. reflexum (Starke) Ignatov & Huttunen – Com; 1,3,4, 5,6. Widespread on soil rich in humus, litter, rotten wood, bases of willow schrubs, rocks and fine soil in mesic tall herbage communities, at the cliff bases, in willow shrub – tall herbage communities, in creek valleys, mainly with *Rhizomnium magnifolium, R. nudum, Plagiomnium medium, Bryhnia hultenii, Sciuro-hypnum uncinifolium*, in hummocky tundra, various places with disturbed turf cover, with *Sanioia uncinata, Dicranum majus, Polytrichastrum alpinum, Polytrichum juniperinum, Ceratodon purpureus, Pohlia* spp., *Bryum* spp., somewhat rarer it occurs on humus-covered cliff ledges and turf covered rock outcrops, with *Plagiothecium laetum, Timmia* spp., *Trachycystis flagellaris, Eurhynchiastrum pulchellum, Tortula hoppeana*. S+.

S. uncinifolium (Broth. & Paris) Ochyra & Żarnowiec – Fr; 3,4,5,6. On humus soil and litter in mesic tall herbage communities near cliff bases and along sea coast, in willow – tall herbage communities in creek valleys, mainly with *Bryhnia hultenii, Rhizomnium nudum, Plagiomnium* spp., *Sciuro-hypnum reflexum, Plagiothecium* spp.; in similar habitats along creeks, with *Brachythecium rivulare, Climacium dendroides, Rhizomnium nudum*, on creek banks, moist rock outcrops, mostly near waterfalls, on turf-covered cliff bases.

Scorpidium cossonii (Schimp.) Hedenäs – Rar; 8. In rich fen with springs on left slope of Gladkovskaya Creek valley, forming extensive pure covers alternating with

Warnstorfia sarmentosa and *Philonotis fontana*.

S. revolvens (Sw. ex anon.) Rubers – Fr; 1,3,6,8. The most characteristic and abundant moss species on various rich fens, both in lowland in Gavanskaja River valley and on mountain slopes to Polovina, Peresheek and Gladkovskaja Creeks, with *Sphagnum squarrosum, Helodium blandowii, Paludella squarrosa, Tomentypnum nitens, Straminergon stramineum, Warnstorfia sarmentosa.*

S. scorpioides (Hedw.) Limpr. – Rar; 8. In rich fen with springs in the upper course of Gladkovskaya Creek, locally abundant in wet depressions, with *Scorpidium revolvens, Warnstorfia sarmentosa, Calliergon richardsonii*.

Seligeria campylopoda Kindb. – Rar; 8. On fine soil in rock crevices on western slope of Steller Mt. S+.

Sphagnum angustifolium (C.E.O. Jensen ex Russow) C.E.O. Jensen – Un; 3. Oligotrophic *Sphagnum* mire with *Rubus chamaemorus* and *Vaccinium uliginosum* in Lodygynskaja Creek valley, in depression among hummocks, with *S. riparium* and *S. teres.*

S. balticum (Russow) C.E.O. Jensen – Un; 3. In same locality and conditions, on hummock, with *S. rubellum*.

S. capillifolium (Ehrh.) Hedw. – Rar; 6,8. In moist tundra on bottoms of hollows on rather steep watershed slopes, with *S. compactum, S. papillosum* and *Oncophorus virens*; in *Sphagnum* mire in Polovina and Gladkovskaja Creek valleys, with *S. teres, S. subsecundum, S. girgensohnii.*

S. compactum Lam. & DC. – Fr; 5,6,8. One of dominanting species (with *Oncophorus virens*) in moist tundra on the bottoms of hollows on rather steep watershed slopes in middle part of the island, forming pure hummocks among wet depressions with liverwort communities. Rarer occurs in drained edges of *Sphagnum* mires in creek valleys.

S. fallax (H. Klinggr.) H. Klinggr. – Sp; 1,5,8. On hummocks in mesotrophic mires in Poludennaja and Gladkovskaja Creek valleys with *Sphagnum papillosum, S. rubellum, Aulacomnium palustre*, and in wet depression near the base of tableland in Cape Severo-Zapadny vicinity, on hummock, with *S. girgensohnii,* and at the edge of pool, with *S. jensenii* and *S. inexspectatum*.

S. fimbriatum Wilson – Sp; 3,5,6. On mesotrophic and eutrophic mires in Polovina and Poludennaja Creeks and Gavanskaja River valleys, with *S. girgensohnii, S. squarrosum, Aulacomnium palustre, Straminergon stramineum, Drepanocladus aduncus*.

S. fuscum (Schimp.) H. Klinggr. – Sp; 1,3,5. On mesotrophic mire in Poludennaja Creek valley and in *Sphagnum* mires in northern part of the island, in wet depression near the base of tableland in vicinity of Cape Severo-Zapadny and in Lodygynskaja Creek valley, mostly with other oligotrophic *Sphagnum* species. S+.

S. girgensohnii Russow – Fr; 1,3,6,8. In different types of bogs, on hummocks with *Betula nana*, in wet tundra communities in upper courses of creeks and in wet places near late snow beds, with *S. russowii, S. fallax, Pleurozium schreberi, Polytrichastrum alpinum, Polytrichum* spp., *Aulacomnium palustre, Sanionia uncinata*, in hollows on rather steep watershed slopes, with *Oncophorus virens* and *Sphagnum compactum*; near mountain brooks, at bases of wet cliffs on watersheds, with *Philonotis fontana, Bryum* spp., *Dichodontium palustre*.

S. inexspectatum Flatberg – Rar; 1,6. In mesotrophic mires in Polovina Creek valley and in wet depression near the base of tableland in Cape Severo-Zapadny vicinity, with *S. riparium* and *S. jensenii*.

S. jensenii H. Lindb. – Rar; 1. In mesotrophic mire in wet depression near the base of tableland in Cape Severo-Zapadny vicinity, with *S. inexspectatum* and *S. lindbergii*.

S. lindbergii Schimp. – Fr; 1,3,5,6. The species is most frequent in pools and at their edges in mesotrophic and oligotrophic *Sphagnum* mires in northern part of the island, with *Warnstorfia trichophylla, Sphagnum riparium, S. inexspectatum*, and with ocasional occurrence in mires in Polovina and Poludennaja Creek valleys where it was found with *S. tenellum*. S+.

S. magellanicum Brid. – Rar; 3. Relatively frequent on hummocks in oligotrophic *Sphagnum* mire with *Rubus chamaemorus* and *Vaccinium uliginosum* in Lodygynskaja Creek valley, with *S. rubellum, S. fuscum, Polytrichum strictum.*

S. obtusum Warnst. – Rar; 8. Two collections from pools in wet tundra in lower part of gentle slope from unnamed peak «747 m alt.» to Gladkovskaja Creek valley, with *Warnstorfia exannulata*.

S. cf. *papillosum* Lindb. – Sp; 3,5,6,8. On hummocks in mesotrophic mires in Polovina, Poludennaja and Gladkovskaja Creek valleys and in wet tundra communities in upper courses of creeks, in places with late snow melting, and on gentle strips on slopes of Steller Mt. and unnamed peak «747 m alt.», among *S. teres, S. fallax, S. girgensohnii, S. subsecundum, Aulacomnium palustre*. Once was collected in oligotrophic sphagnous mire in Lodygynskaja Creek valley. All specimens referred here to this species have papillae on cell walls between chlorophyllous and hyaline cells in stem leaves, being similar in this respect to *S. austinii* Sull. from *S. imbricatum*-complex (Maksimov, 2007), but neither observed in *S. papillosum* from other parts of Russia, nor mentioned in the published descriptions of *S. papillosum*. Further studies may show that these plants represent a separate species.

S. riparium Ångstr. – Sp; 1,3,5. Mostly in northern part of island, growing in wet depressions in mesotrophic *Sphagnum* mires, with *S. inexspectatum, S. jensenii, S lindbergii, S. teres*; once collected in Polovina Creek valley, with *S. fallax.*

S. rubellum Wilson – Sp; 3,5,8. On hummocks in mesotrophic mires in Poludennaja and Gladkovskaja Creek valleys, with *S. fallax,* and in oligotrophic sphagnous mire in Lodygynskaja Creek valley, with *S. balticum*.

S. russowii Warnst. – Fr; 1,3,5,6,8. In different types of mires (mostly sphagnous) and in moist tundra, mostly on hummocks, with *S. girgensohnii, S. papillosum, S. magellanicum, S. subsecundum.*

S. squarrosum Crome – Sp; 1,3,6. In various rich fens and sphagnous mires, including lowland mires in Gavanskaja River valley and eutrophic bogs with spring influence on slopes of Polovina, Poludennaja and Gladkovskaja Creeks, mostly in wet depressions, with *S. inexspectatum, S. jensenii, Helodium blandowii, Tomentypnum nitens, Scorpidium revolvens, Calliergon* spp., *Bryum pseudotriquetrum,* and on hummocks, with *S. warnstorfii, Paludella squarrosa, Aulacomnium palustre.* S+.

S. subsecundum Nees – Sp; 3,5,8. In moist depressions in mesotrophic sphagnous mires near the base of tablehill in Cape Severo-Zapadny vicinity, with *S. russowii, S. lindbergii,* and in Poludennaja and Gladkovskaja Creek valleys, with *S. teres, S. tenellum, S. capillifolium, S. riparium.* S+.

S. tenellum (Brid.) Pers. ex. Brid. – Rar; 5. Two collections from mesotrophic sphagnous mire in middle course of Poludennaja Creek valley, with *S. teres, S. subsecundum, S. papillosum.* S+.

S. teres (Schimp.) Ångstr. – Sp; 3,5,8. In different types of bogs (mainly mesotrophic and eutrophic), with *S. subsecundum, S. russowii, S. warnstorfii*; in wet tundra communities in upper courses of creeks and in places with late snow melting, with *S. papillosum, S. russowii, S. girgensohnii, Pleurozium schreberi, Polytrichum* spp., *Aulacomnium palustre, Sanionia uncinata*.

S. tescorum Flatberg – Rar; 3,6. On sphagnous mire westward from Nakoval'nya Mt., in lower course of Gavanskaja River valley, with *Parnassia palustris, Rubus stellatus, R. chamaemorus, Helodium blandowii, Sphagnum* spp.; among lakes in Lodygynskaja Creek valley, in similar conditions and communities; on saddle among hills on watershed gentle slope to Polovina Mt. valley, with *S. russowii* and *S. compactum*.

S. warnstorfii Russow – Sp; 3,5,6,8. In rich fens in Gavanskaja River valley and in Polovina, Poludennaja and Gladkovskaja Creek valleys, with *S. squarrosum, S. teres, Helodium blandowii, Aulacomnium palustre, Scorpidium revolvens, Tomentypnum nitens, Paludella squarrosa.*

Stereodon holmenii (Ando) Ignatov & Ignatova – Un; 8. Dwarf-shrub tundra on western slope of Steller Mt., with *Dicranum majus* and *Pleurozium schreberi*.

S. plicatulus Lindb. – Sp; 1,2,3,4,5,6,8. In hummocky dwarf-shrub tundra, with *Pleurozium schreberi, Dicranum majus, Polytrichastrum alpinum, Polytrichum juniperinum*; in rocky tundra and turf-covered rock outcrops, with *Polytrichum juniperinum, Hylocomiastrum pyrenaicum, Polytrichastrum alpinum, Dicranum acutifolium, D. spadiceum, Codriophorus fascicularis, Racomitrium lanuginosum,* on creek banks, with, *Hygrohypnella ochracea, Brachythecium frigidum, Niphotrichum muticum*.

S. revolutus Mitt. – Rar; 3. On dry cliff ledges on slopes of Nakoval'nya Mt., with *Didymodon insulanus, Tortula hoppeana, T. mucronifolia, Platydictya jungermannioides, Encalypta rhaptocarpa, Bryum* spp.

Straminergon stramineum (Dicks. ex Brid.) Hedenäs – Sp; 1,3,5,6,8. In various rich fens, including lowland mires, in Gavanskaja River valley and in eutrophic bogs with spring influence on slopes of Polovina, Poludennaja and Gladkovskaja Creeks, mostly in wet depressions, with *Sphagnum squarrosum, S. obtusum, S. warnstorfii, Helodium blandowii, Paludella squarrosa, Tomentypnum nitens, Scorpidium revolvens, Aulacomnium palustre, Calliergon spp., Bryum pseudotriquetrum.*

Syntrichia norvegica F. Weber – Fr; 1,3,4,5,8. The species is most abundant on dry rock outcrop on the crest of Cape Severo-Zapadny, where it grows on shaded ledges, with *Bryum* spp., *Pseudoleskeella rupestris* and *Amblystegium serpens*; it is also not rare on cliff ledges with bird colonies above steep costal slope in Commander Bay vicinity, with *Tortula mucronifolia, Amblystegium serpens, Bryum* spp. Somewhat rarer it occurs on cliff ledges in other localities, on turf-covered rock outcrops and near cliff bases, in rocky tundras and on steep rocky slopes, with *Tortula hoppeana, Sanionia uncinata, Rhytidiadelphus* spp., *Timmia* spp., *Heterocladium dimorphum.*

S. ruralis (Hedw.) F. Weber & D. Mohr – Fr; 1,3,4,5,6,7. Most abundant on sandy alluvium in coastal meadows, where it forms extensive pure mats or grows intermixed with *Pleurozium schreberi, Rhytidiadelphus squarrosus, Sanionia uncinata, Brachythecium* spp., *Pohlia wahlenbergii*. It also grows on steep humificated slopes in meadow communities, with *Pleurozium schreberi, Polytrichastrum alpinum, Hylocomiastrum pyrenaicum, Sanionia uncinata, Rhytidiadelphus squarrosus,* and in fern communities on hollow slopes, as an admixture to *Heterocladium dimorphum, Pleurozіopsis ruthenica,* in disturbed places at roadsides, with *Ceratodon purpureus, Bryum* spp., *Pohlia nutans, Rhytidiadelphus squarrosus, Brachythecium albicans,* on dry strips of creek banks, occasionally on turf-covered cliff bases. S+.

Tayloria lingulata (Dicks.) Lindb. – Un; 7. On moist ledge of cliff in Commander Bay vicinity, intermixed with *Fissidens osmundoides, Amblystegium serpens.*

T. tenuis (Dicks. ex With.) Schimp. – Rar; 3,4,8. On steep eroded creek bank in lower course of Bujan Creek, with *Timmia comata, Pohlia proligera, Rhizomnium gracile*; in depression among tablehills, in moist tundra;

on wet loamy sediments on lake shore in Dikaja Creek valley. S+.

Tetraplodon mnioides (Hedw.) Bruch et al. – Rar; 6,8. On moist organic remnants in tundra communities in Peresheek Creek valley on low watersheds southward from Gladkovskaja Creek valley and northward from Polovina Creek valley. S+.

Tetrodontium repandum (Funck) Schwägr. – Un; 1. On sandstone outcrops, locally on moist shaded cliff base on northern shore of Cape Severo-Zapadny, with *Bryoerythrophyllum recurvirostrum, Bryoxiphium norvegicum* and *Tortula edentula.* S+.

Thuidium assimile (Mitt.) A. Jaeger – Un; 5. On steep rocky slopes under rock outrops covered with tall herbage communities, near Poludennaja Creek mouth, with *Sciuro-hypnum uncinifolium, Bryhnia hultenii, Claopodium pellucinerve, Plagiomnium medium.*

Timmia austriaca Hedw. – Rar; 1. In shaded niche at cliff base and on the turf covered surface of sandstone outcrop on northern coast of Cape Severo-Zapadny, with *Tortula* spp., *Leptobryum pyriforme, Syntrichia norvegica*.

T. bavarica Hessl. – Rar; 1,3. On shaded basaltoid cliff ledges covered with humus in vicinity of Cape Severo-Zapadny and Nakoval'nya Mt., with *Trachycistis flagellaris, Sciuro-hypnum reflexum, Eurhynchiastrum pulchellum*; on steep slope under sandstone cliffs on northern coast of Cape Severo-Zapadny, in tall-herbage community, with *Bryhnia hultenii*.

T. comata Lindb. & Arnell – Rar; 4,7. On steep rocky coastal slope to Bujan Bay, with *Bartramia ithyphylla, Dicranella subulata, Pohlia proligera, Bryoerythrophyllum recurvirostrum*; on moist shaded fine soil among boulders at base of waterfall between Polovina and Commander Bays, with *Philonotis fontana* and *Dichodontium pellucium.*

T. norvegica J.E. Zetterst. – Sp; 1,3,4,7,8. On turf covered rock outcrops, in soil niches near cliff bases, on steep rocky slopes, with *Bryoxiphium norvegicum, Trachycystis flagellaris, Eurhynchiastrum pulchellum, Pohlia cruda, Amphidium lapponicum.*

Tomentypnum nitens (Hedw.) Loeske – Rar; 5,6,8. In rich fens in Polovina, Poludennaja and Gladkovskaja Creek valleys, in depressions among hummocks, with *Helodium blandowii, Aulacomnium palustre, Scorpidium revolvens, Sphagnum subsecundum, S. papillosum, Calliergon richardsonii, Paludella squarrosa.*

Tortella alpicola Dixon – Un; 8. On southern slope of Steller Mt., on fine soil in rock crevice, with *Mnium lycopodioides, Amphidium lapponicum* and *Pohlia cruda*. P+.

T. fragilis (Hook. & Wilson) Limpr. – Rar; 8. Three collections from rather dry cliff ledges on western slope of Steller Mt., with *Mnium lycopodioides, Pohlia cruda, Brachythecium cirrosum.*

T. tortuosa (Hedw.) Limpr. – Rar; 8. In the same locality and similar but somewhat wetter habitats than previous species, with *Bryoxiphium norvegicum, Amphidium lapponicum, Bartramia* spp., *Schistidium papillosum, Lescuraea saxicola, Myurella julacea*.

Tortula cernua (Huebener) Lindb. – Un; 4. In lower course of Bujan Creek, on steep eroded creek bank, with *Dicranella crispa, Pohlia proligera, Pogonatum urnigerum.* S+.

T. edentula Ignatova & Ignatov – Fr; On northern shore of Cape Severo-Zapadny, on sandstone outcrops, locally abundant on moist cliff bases, where it grows in pure communities or mixed with *Hennediella heimii* and *Tortula hoppeana.* S+.

T. hoppeana (Schultz) Ochyra – Fr; 1,2,3,4,5. On soil rich in humus on steep rocky tundra slopes, on cliff ledges, turf covered rock outcrops, disturbed edges of slopes, in different soil niches, mostly with *Dicranella subulata, Pohlia* spp., *Eurhynchiastrum pulchellum, Hylocomiastrum pyrenaicum, Bartramia ithyphylla, Herzogiella adscendens, Polytrichum juniperinum, Polytrichastrum alpinum, Sanionia uncinata.* S+.

T. mucronifolia Schwägr. – Com; 1,2,3,4,7. On sandstone, basaltoid and sedimentary cliffs and other rock outcrops, mostly at low elevation. This is the only species growing on cliffs immediately at seashore in Commander Bay and on Cape Tolsty and being abundant there.Also it occurs on rock outcrops, with *Amblystegium serpens, Lescuraea* spp., *Bryoxiphium norvegicum, Didymodon insulanus, Pohlia* spp., *Schistidium* spp. Rarely it is found in rocky tundra and on steep rocky coastal slopes. S+.

T. muralis Hedw. – Un; 1. On moist shaded ledge at the sandstone cliff on northern coast of Cape Severo-Zapadny, with *Leptobryum pyriforme, Ceratodon purpureus, Pohlia nutans.* S+.

T. obtusifolia (Schwägr.) Mathieu – Un; 3; On upper surface of boulder at the base of western slope of Nakoval'nya Mt., in crevices, with *Ditrichum flexicaule,* growing in a compact pure tufts. The specimen is represented by dioicous plants, lacking sporophytes, but other gametophytic characters fit exactly to this species.

T. systylia (Schimp.) Lindb. – Rar; 1,3. On turf-covered basaltoid rock outcrops in the vicinity of Cape Zabijaka and on slope of Nakoval'nya Mt., with *Herzogiella adscendens* and *Syntrichia* cf. *norvegica*.

Trachycystis flagellaris (Sull. & Lesq.) Lindb. – Sp; 1,3. Relatively frequent on shaded turf covered ledges of basaltoid cliffs on the coast in ca. 4.5 km eastward from Cape Severo-Zapadny, with *Timmia norvegica, Sciuro-hypnum reflexum, Pohlia cruda, P. nutans, Bryum* sp, *Herzogiella adscendens, Plagiothecium cavifolium*; also it was found in similar habitats on Cape Zabijaka and Nakoval'nya Mt. and in rocky strips of coastal slope, with *Bartramia ithyphylla, Sanionia uncinata, Syntrichia ruralis.* P+.

Trematodon ambiguus (Hedw.) Hornsch. – Rar; 1. In creek hollow near road 2.4 km eastward from Cape Severo-Zapadny, in pioneer moss community on the bottom of dry lake, on moist silt, abundant, mostly mixed with *Psilopilum cavifolium* and *Pohlia* spp. S+.

Trichostomum crispulum Bruch – Un; 3. On eastern slope of Nakoval'nya Mt., on cliff ledge covered with fine soil, with *Encalypta rhaptocarpa* and *Eurhynchiastrum pulchellum*.

Ulota phyllantha Brid. – Rar; 1,8. On shore of Gladkovskaja Bay near Gladkovskaja Creek mouth, on dry surface of boulder, with *Tortula mucronifolia*, compact pure tuft; on cliff on slope of Emel'janovsky Creek, Coll. Mochalova 2.VIII.2000. P+.

Warnstorfia exannulata (Bruch et al.) Loeske – Sp; 1,3,6,7; S+. In rich fens and *Sphagnum* mires, at edges of flooded depressions and in pools, with *Sphagnum lindbergii, S. riparium, S. jensenii, Calliergon giganteum, Bryum pseudotriquetrum*; on the bottom of former bed of Polovina Creek, with *Calliergon giganteum*.

W. pseudostraminea (Müll. Hal.) Tuom. & T.J. Kop. – Rar; 5. In boggy valley of Poludennaja Creek in its middle course, on hummocks, with *Straminergon stramineum, Aulacomnium palustre, Sphagnum papillosum, Brachythecium* sp.

W. sarmentosa (Wahlenb.) Hedenäs – Sp; 3,6,8. In rich fen in Gavanskaja River valley, and in mountain fens on slopes of Polovina, Peresheek and Gladkovskaja Creeks, with *Scorpidium revolvens, S. scorpioides, Tomentypnum nitens, Calliergon richardsonii*.

W. trichophylla (Warnst.) Tuom. & T.J. Kop. – Un; 3. In wet depressions in mire in Lodygynskaja Creek valley, with *Sphagnum lindbergii* and *S. jensenii*.

Weissia controversa Hedw. – Un; 5. On rather dry soil rich in humus near rock bases on exposed rock outcrops, near Poludennaja Creek mouth, with *Herzogiella adscendens, Didymodon insulanus, Tortula mucronifolia, T. hoppeana*. S+.

Excluded species

Seligeria recurvata (Hedw.) Bruch et al. was cited for Bering Island by Fedosov (2010), but further the specimens were reidentified as *S. campylopoda*.

Trematodon longicollis Michx. was cited for Bering Island by Fedosov (2010), but further the specimens were reidentified as *T. ambiguus*.

* * *

Summarizing novelties in the studied flora, *Ditrichum zonatum* var. *scabrifolium*, is found in Russia for the first time; five taxa, *Bucklandiella macounii* ssp. *alpina, Didymodon vinealis, Lescuraea saviana, Philonotis capillaris*, and *Drepanocladus sordidus*, are new to the Russian Far East, and 224 species are new to the Commander Islands. Among 92 species published by Bakalin and Cherdantseva (2008) for the Medny Island, 88 are common with the Bering Island, and four are different: *Bryum capillare* Hedw., *Dicranum polysetum* Sw., *Loeskypnum wickesii* (Grout) Tuom., and *P. tomentella* Molendo. Totally 158 species are new to Aleutian Archipelago, so the number of species known for archipelago reaches 378. Thirty three species found on Bering Island do not occur on Kamchatka Peninsula.

Moss species diversity and phytogeography

In total, moss flora of Bering Island includes 312 species; this is the highest number among yet studied islands of the North Pacific area, excepting the much larger Sakhalin Island. The next richest islands in terms of moss species number are Kunashir (283), Iturup (233), and Shikotan (180) (Bakalin *et al.*, 2009). The high diversity of the moss flora of Bering Island can be explained by the superposition of subarctic and temperate species, enriched by species with oceanic and suboceanic and specifically the North Pacific distribution.

Interestingly, the moss flora of Bering Island includes many widespread rather xeric species, *e.g. Trichostomum crispulum* and *Aloina brevirostris*, which are absent in Kamchatka, Sakhalin and Kuril Islands, and even in some suboceanic regions of the mainland Russian Far East, for example in Upper Bureya River (Ignatov *et al.*, 2000). Within the Russian Far East, these species occur only in Chukotka, thus showing "pseudo-northern" relationship when the moss flora of Bering Island is compared with neighboring ones. As much as 21 species found in Bering Island on their southern limit in the Russian Far East, but only one of them, *Bryum teres*, has really northern distribution.

The most common in the moss flora of Bering Island are species of **wide distribution** (cf. Fig. 3), which is similar to floras of many regions of Holarctic. Many of these species are widespread in boreal ecosystems and therefore are considered as boreal, despite of a much broader range in the world. Examples of such wide distribution include *Brachythecium rivulare, Calliergon cordifolium, Hylocomium splendens, Plagiomnium medium, Pleurozium schreberi, etc.*, while more strict boreal distribution have *Rhytidiadelphus triquetrus, Sphagnum magellanicum, Rhizomnium magnifolium, etc.* Cosmopolitan species like *Barbula convoluta, B. unguiculata, Bryoerythrophyllum recurvirostrum, Bryum argenteum, B. creberrimum, Funaria hygrometrica, Leptobryum pyriforme etc.* are also rather numerous in the studied moss flora.

Only few species with mostly **Arctic** distribution (Fig. 4) occur in Bering Island, icluding *Drepanocladus arcticus, Psilopilum laevigatum, Rhizomnium andrewsianum*. Subarctic species are better represented: *Cinclidium subrotundum, Conostomum tetragonum, Dicranum elongatum, Meesia triquetra, Niphotrichum panschii, Scorpidium scorpioides, Paludella squarrosa.*

Arcto-montane and **montane** species (Fig. 3), common in mountain regions of Subarctic and Boreal zone, while almost absent in lowlands, are more numerous:

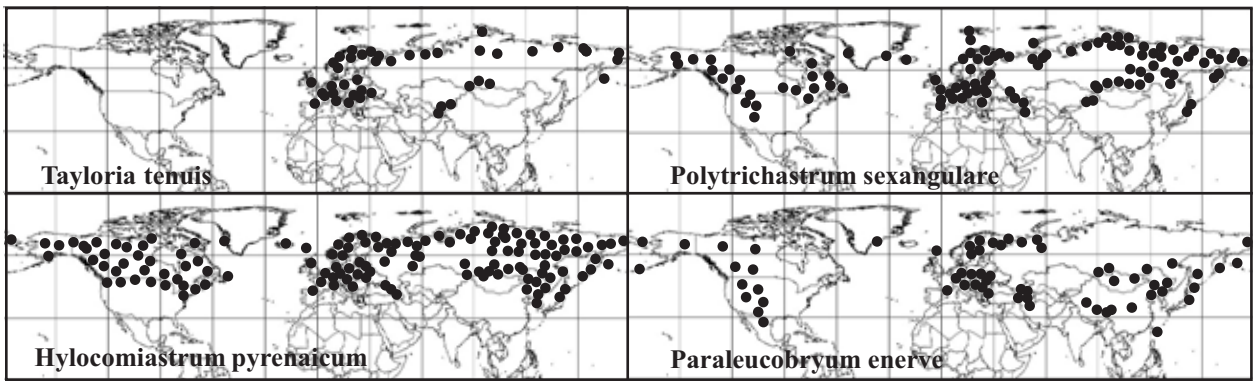


Fig. 3. Distribution of some widespread Arcto-montane and montane species occurring in Bering Island.

Andreaea rupestris, Aulacomnium turgidum, Hymenoloma crispulum, Racomitrium lanuginosum. Some of them are relatively rare in continental areas, but common in oceanic, for example *Arctoa fulvella, Bucklandiella microcarpa, B. sudetica, Kiaeria starkei, Lescuraea radicosa. L. saxicola, Niphotrichum ericoides, N. canescens, etc.*, representing distribution transitional to disjunctive "broad amphioceanic".

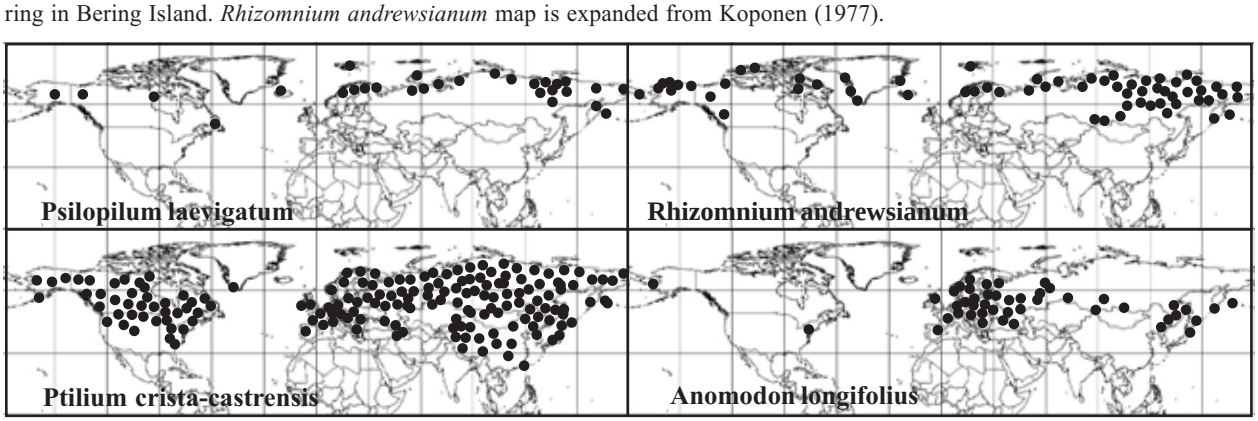
A rather high proportion of species have a highly disjunctive ranges, as, *e.g., Anomobryum julaceum, Dichelyma capillaceum, Grimmia alpestris, G. hartmanii, Heterocladium dimorphum, Philonotis capillaris, Plagiobryum zierii, Pseudohygrohypnum subeugyrium, Tetrodontium repandum, Tortula cernua, T. systylia, etc.*, including some little known species, for example *Bryum knowltonii*.

Amphioceanic species, *i.e.* having distribution more strictly confined to oceanic sectors of different continents (Fig. 5), are represented by *Bryoxiphium norvegicum, Bucklandiella macounii* ssp. *alpinum, Orthotrichum pylaisii, Pseudotaxiphylum elegans, Rhytidiadelphus loreus, Schistidium maritimum, Sphagnum tenellum, Trematodon ambiguus, Ulota phyllantha, etc.*, including newly recorded *Ditrichum zonatum* var. *scabrifolium.* Although a rather little known, the latter taxon represents apparently the same distribution pattern (see also Ignatova & Fedosov, 2012).

Species with the **North-Pacific** range (Fig. 6, 7) include mostly those growing in rather cold environments (*Codriophorus corrugatus, Didymodon brachyphyllus, Herzogiella adscendens, Philonotis americana, Gollania turgens, Sciuro-hypnum uncinifolium, Sphagnum inexspectatum,* and mainly Beringian *Sphagnum tescorum* [Flatberg, 2007]), albeit many of them occur quite far to the south: *Bartramiopsis lescurii, Claopodium bolanderi, Codriophorus mollis, Niphotrichum muticum, Pleuroziopsis ruthenica, Hygrohypnella bestii, Iwatsukiella leucotricha, Lescuraea baileyi, Pogonatum contortum*, Rhytidiadelphus japonicus*, Trachycystis flagellaris*, Echinophyllum sachalinense, Bryhnia hultenii*, Claopodium pellucinerve*, Oligotrichum aligerum*, O. parallelum.* Asterisk marks species which sometimes grow in north-temperate mixed and broad-leaved forests in Russian Far East and some of them also in China.

Only few species with rather wide **temperate** distribution have been recorded: *Anomodon longifolius,* mainly associated with broad-leaved forests, and *Brachymenium nepalense,* species with wide distribution in subtropic and tropic areas of Eastern Hemisphere. **East Asiatic** species occurring mostly in more southern regions (Fig. 8) are more numerous: *Bryoerythrophyllum brachystegium, Bucklandiella laeta, Codriophorus brevisetus, Eurhynchiadelphus eustegia, Rigodiadelphus robustus, Tortula edentula*. These and some other species form a relatively large group of 48 species, or ca. 15% of the total flora, not occurring in Russian Far East north of Commander Islands. Comparatively with "pseudo-northern" elements, the species of this group are mainly species of temperate zone.

Fig. 4. Distribution of mainly arctic (*Psilopilum* and *Rhizomnium*), boreal (*Ptilium*) and nemoral (*Anomodon*) species occurring in Bering Island. *Rhizomnium andrewsianum* map is expanded from Koponen (1977).



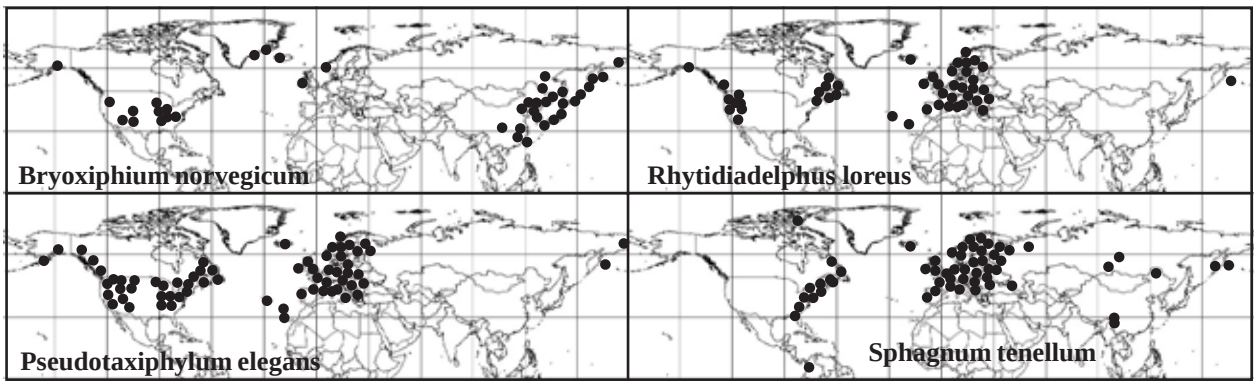
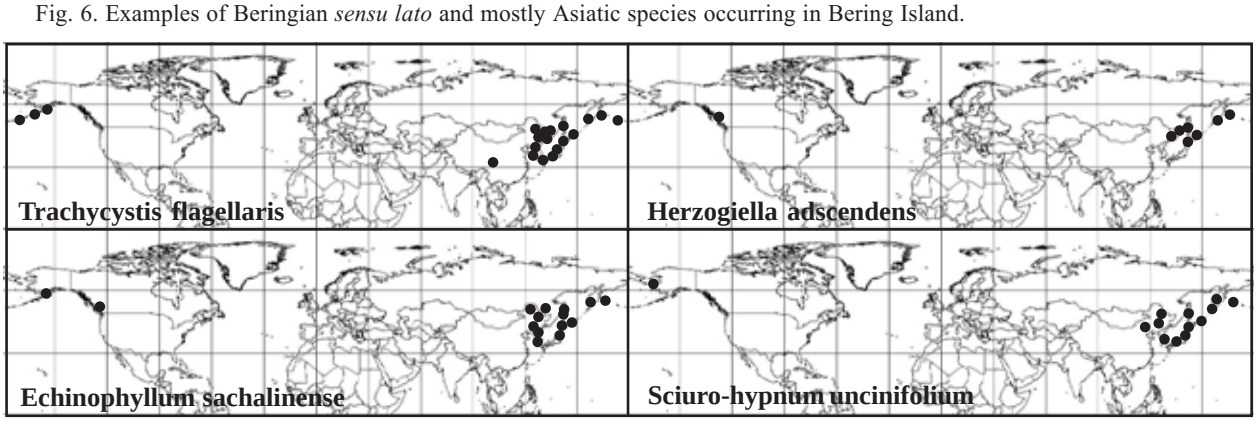


Fig. 5. Examples of amphioceanic disjunctive species occurring in Bering Island.

One of aims of the present exploration was finding of additional species known in Pacific North America but still not found in Asia. Some of them reach the Attu Island (ca. 53°N, 172°E), the closest among Aleutians to the Commander Islands, at the distance of 425 km. The Attu moss flora includes 7 species, which do not occur in the Russian Far East. Among them 6 species are known in Europe, having "west-western" disjunction (Schofield, 1988): *Antitrichia californica* Sull., *A. curtipendula* (Hedw.) Brid., *Bucklandiella heterosticha* (Hedw.) Bednarek-Ochyra & Ochyra, *Grimmia ramondii* (Lam. & DC.) Margad., *Plagiothecium piliferum* (Sw.) Bruch et al., and *Sphagnum subnitens* Russow & Warnst. One species, *Plagiomnium insigne* (Mitt.) T.J. Kop., is unknown in Eurasia. Totally, 66 species known for the Aleutian Archipelago were not found on Bering Island; they include characteristic western species *Anoectangium aestivum* (Hedw.) Brid., *Bucklandiella affinis* (F. Weber & D. Mohr) Bednarek-Ochyra & Ochyra, *B. lawtoniae* (R.R. Ireland) Bednarek-Ochyra & Ochyra, *Codriophorus acicularis* (Hedw.) P. Beauv., *Fontinalis neomexicana* Sull. & Lesq., *Hypnum circinale* Hook., *H. imponens* Hedw., *Plagiomnium affine* (Blandow ex Funck) T.J. Kop., *Rhizomnium glabrescens* (Kindb.) T.J. Kop., *Scleropodium cespitans* (Müll. Hal.) L.F. Koch, *Taxiphyllum deplanatum* (Bruch & Schimp. ex Sull.) M. Fleisch., as well as species listed for Attu Island. Thus 18 western species known in the Aleutians are absent in East Asia, including 11 west-western and 7 American species. In addition, there are many widespread species in the western coast of North America (*Claopodium crispifolium* Reimers, *Hookeria lucens* (Hedw.) Sm., *Isothecium myosuroides* Brid., *Kindbergia praelonga* (Hedw.) Ochyra, *Roellia roellii* (Broth.) A.L. Andrews ex H.A. Crum), which are totally absent in NE Asia. This fact illustrates rather sharp replacement of "western" and "eastern" moss floras in the North Pacific. Although Aleutians are still awaiting a thorough exploration of its moss flora, the available data agree with the sharpness of Tatewaki line between Attu and Bering Islands, which separates western and eastern floras of liverworts (Bakalin & Cherdantseva, 2008) and vascular plants (Tatewaki, 1963). Only few species with western distribution were found in Medny and Bering Islands (*Brachythecium frigidum, Claopodium bolanderi, Lescuraea baileyi, Rhytidiadelphus loreus, Bucklandiella macounii* ssp. *alpina, Didymodon vinealis, Lescuraea saviana,* see also Cherdantseva, 2010), but they do not reach even nearby Kamchatka. Similarly, *Plagiothecoium undulatum* was found in a very limited area in Chukotka (Afonina, 2004).

This limit can be explained by difficultly of migration due to a broad and deep gully and also by sharp climatic change between Attu and Bering Islands. The decrease of annual precipitation is especially sharp: 470 mm in Bering, 790 mm in Medny, 1520 mm in Attu, and 1780 mm in Amchitka (ca. 400 km to SEE from Attu). This decline is caused by the replacement of warm Aleutian Current in the West to the cold Kamchatian Current

Fig. 6. Examples of Beringian *sensu lato* and mostly Asiatic species occurring in Bering Island.



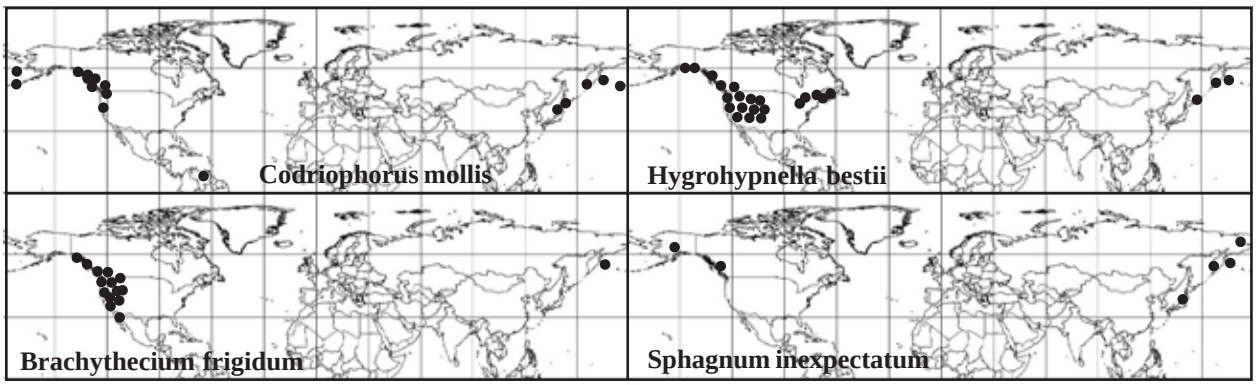


Fig. 7. Examples of Beringian *sensu lato* and mostly American species occurring in Bering Island.

between Attu and Commaner Islands (Kursanova & Savchenko, 1966). Obviously, this contrast precludes migration of rather temperate-oceanic species of the Western North America to windy and forestless Commander Islands. An additional reason of significant difference among the moss floras is a modern volcanic activity, providing pyroclastic deposits on Aleutians and, correspondingly, a habitat for acidophilic species such as *Blindia acuta, Grimmia torquata, Polytrichastrum sphaerothecium*.

* * *

At moment there are a number of moss floras published for the area of NE Asia, so the comparative analysis is possible in order of more objective evaluation of phytogeography, including the position of Commander Islands within vegetation zones. The latter is an intriguing point, as some authors considered them as a hypoarctic territory (Tatewaki, 1963; Yurtsev, 1966, 1994, Krestov, 2004), whereas Hulten (1926-1930, 1960) and Vasiljev (1957) wrote that flora and vegetation here are composed of montane species, mostly confined to boreal zone of Pacific sector, being most close to the southern Kamchatka and the Northern Kurils.

Species composition and rate of families (%) of the moss flora of Bering Island were compared with all the relatively well-studied moss floras of the region (listed in Table 1). In case of rates of families, the percent which species of the given family have in each of compared floras were used as an input data.

Both comparisons were made by cluster analysis (Statistica 8.0, Euclidean distance, Ward's method of clusterization) and similarity in species composition was also tested by Sörensen coefficient (Ks = $2\tilde{n}/a+b$ with a & b – number of species in two compared floras and $\tilde{n}$ – number of species common for both floras, Sörensen, 1948).

Ks values (Fig. 9) show that the moss flora of Bering Island is most similar to that of southern Kamchatka, thus corresponding better to understanding of the Commander Islands as a boreal territory (in terms of flora, but not of vegetation), thus supporting Hulten and Vasiljev positions.

Naturally, Kamchatka is the closest to Bering Island, being the main sourse of diaspores reaching the island. At the same time, Klyuchevskoy Nature Park situated at almost the same latitude with Bering Island and being closest to the latter, differ from it in terms of moss flora considerably (Ks=59). The explanation for this phenomenon relates to the high-mountain relief in Klyuchevskoy Park and to the strong influence of recent volcanic activity in this area (which stopped in the Commander Islands in late Pliocene), mostly acidic pyroclastic rocks, as well as the presence of extensive forests. Contrary, the southern Kamchatka appeared to be most similar to Bering Island (Ks=67), because it is similar to Bering Island in oceanic climate with high humidity and low annual temperature, and in poorly developed forest vegetation. Another rather high Ks value (66) is found for the pair of Bering Island and Bystrinsky Nature Park. This fact

Fig. 8. Examples of East Asiatic species occurring in Bering Island.

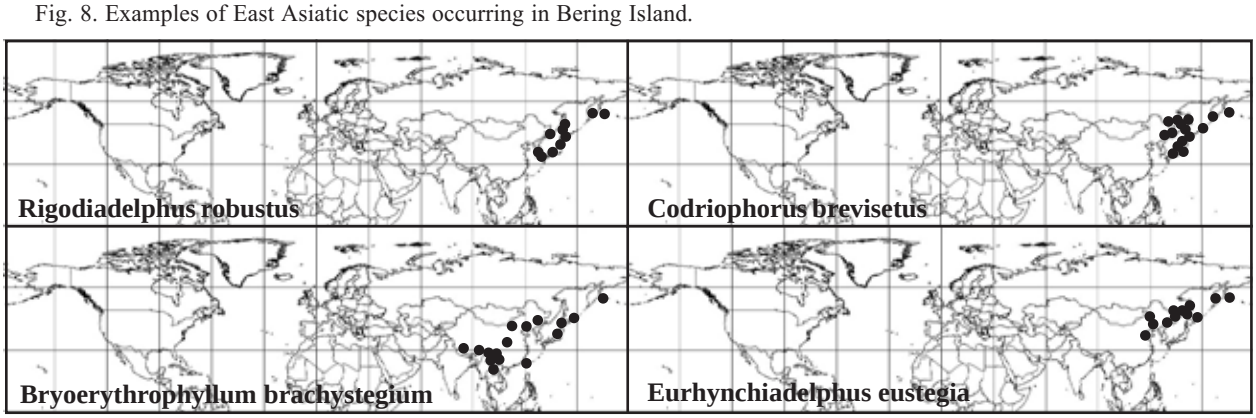


Table 1. Moss floras used for comparison with flora of Bering Island

Locality	number of species	reference
Floras used for comparison by species composition (selected by comparable study area and level of exploration) and by family rates		
Vrangel Island	235	Afonina, 2004
Koryakia	290	Kuzmina, 2003; Czernyadjeva, 2012; Bakalin *et al.*, 2012
Klyuchevskoy Nature Park	274	Czernyadjeva & Ignatova, 2007
Bystrinskyj Nature Park	292	Czernyadjeva & Ignatova, 2008
West Kamchatka	238	Czernyadjeva, 2012
South Kamchatka	291	Czernyadjeva, 2012
Kunashir Island	283	Bakalin *et al.*, 2009
Iturup Island	233	Bakalin *et al.*, 2009
Aleutians (& Tuxedni Wilderness Area)	300	(Bartram, 1938; Bednarek-Ochyra, 2006; Bednarek-Ochyra *et al.*, 2010; Frisvoll, 1988; Persson, 1946, 1947, 1952, 1962, 1963, 1968; Schofield *et al.*, 2002; Schofield, 2004).
Floras used for comparison only by family rates (selelcted by the maximal number of known species)		
Beringian Chukotka	371	Afonina, 2004
Sakhalin Island	438	Pisarenko *et al.*, 2012
Kurils	406	Bakalin & Cherdantseva, 2006; Nyushko *et al.*, 2008; Bakalin *et al.*, 2009
Kamchatka	533	Czernyadjeva, 2012; author's data

can be explained by the wide distribution of mountain tundra, absence of recent volcanic activity, and also by wide distribution in of basaltoids in Bystrinsky Park occurring also in the northern part of Bering Island. Moss flora of the Aleutians is more distant from that of Bering Island (Ks = 62). Similar result was found by Bakalin (2009) for the hepatic flora of Commander Islands: north Kurils and Middle Kamchatka were found to be most similar to the Commander Islands, while eastern Kamchatka differed strongly from the latter.

The cluster analysis of the moss floras also brings Bering Island with Kamchatkan floras (Fig. 10A), but the topology varies, depending on algorithm. So the analysis of rate of species was performed, as it is known to be less sensitive to number of species in compared floras (Tolmachev, 1974; Schmidt, 1980).

Among 55 families (according to Ignatov, Afonina, Ignatova *et al.*, 2006) of compared moss floras, 42 were revealed in Bering Island moss flora. Ten families with maximal number of species in Bering Island include: Pottiaceae (29 species); Grimmiaceae (23); Sphagnaceae (23); Dicranaceae (19); Bryaceae (18); Brachytheciaceae (17); Polytrichaceae (17); Amblystegiaceae (15); Mielichhoferiaceae (14); Mniaceae (14); the ratio Pottiaceae to Dicranaceae s.l. (incl. Rhabdoweisiaceae) being 0.85.

Among other moss floras used for comparison, only those of Vrangel Island and the Beringian Chukotka also have Pottiaceae on the first position. Four families of the moss flora of Bering Island have the highest rate among compared floras: the Pottiaceae, Hylocomiaceae, Leskeaceae, Pseudoleskeaceae, while the Aulacomniaceae, Hypnaceae, Plagiotheciaceae and Pylaisiaceae have in the studied flora the least rate compared with other floras. This result corresponds to oceanic conditions, lack of forest vegetation and abundance of disturbed microhabitats with bare soil and rock outcrops. High level of Pottiaceae, Grimmiaceae and Mielichhoferiaceae can be caused by the abundance of more or less open habitats which are needed for pioneer mosses. Abundant rock outcrops also favour these groups. This position of Pottiaceae is rather unexpected in suboceanic moss flora; it can be associated with relatively xeric conditions in the upper part of altitudinal range (Bakalin, 2005), which can be caused by strong winds.

In the clusterogram of the compared moss floras based on family rates, three clusters appear (Fig. 10B): southern (Aleutians, South Kamchatka, Kurils & Sakhalin Island), "boreal" Kamchatkan (Klyuchevskoy & Bystrinskyj Nature Parks and Bering Island & whole Kamchatka) and subarctic (Koryakia, Bering Chukotka and Vrangel Island). This result does not correspond to the analysis of vascular flora of the Commander Islands published by Schmidt (1975). He found that the Commander Islands are closer to Kamchatka in species composition, while the family rate analysis joints the former with the Aleutians. Strong difference in humidity among Bering Island and the Aleutians is likely the cause of substitution of the rather boreal NE Asian and more temperate 'western' floras.

At the same time, the principal component scatterplot (Fig. 11) demonstrates somewhat different result, arranging studied floras in a rather exact correspondence with their geographic position. Moss floras of Far East follow from South to North along component 1 with one

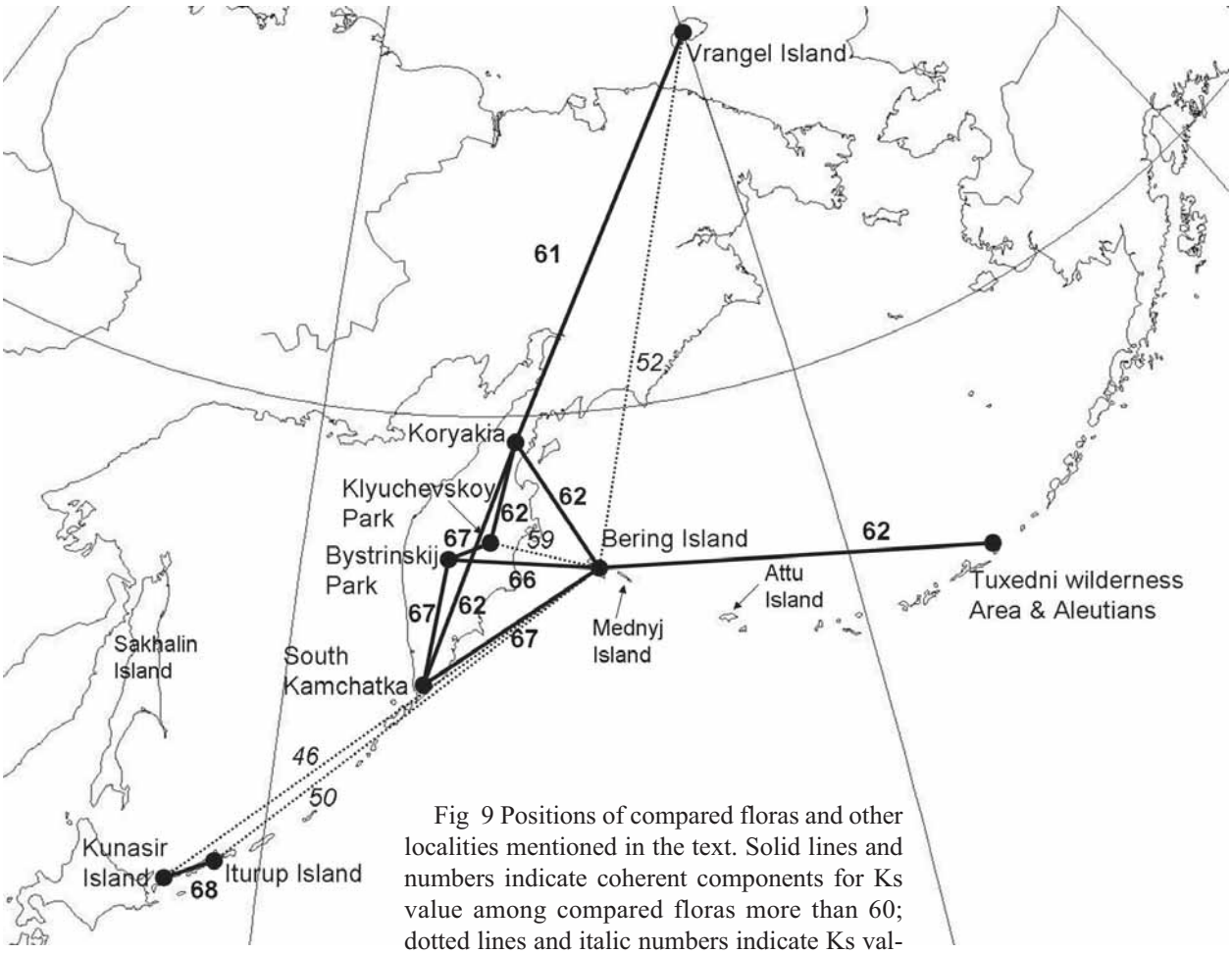
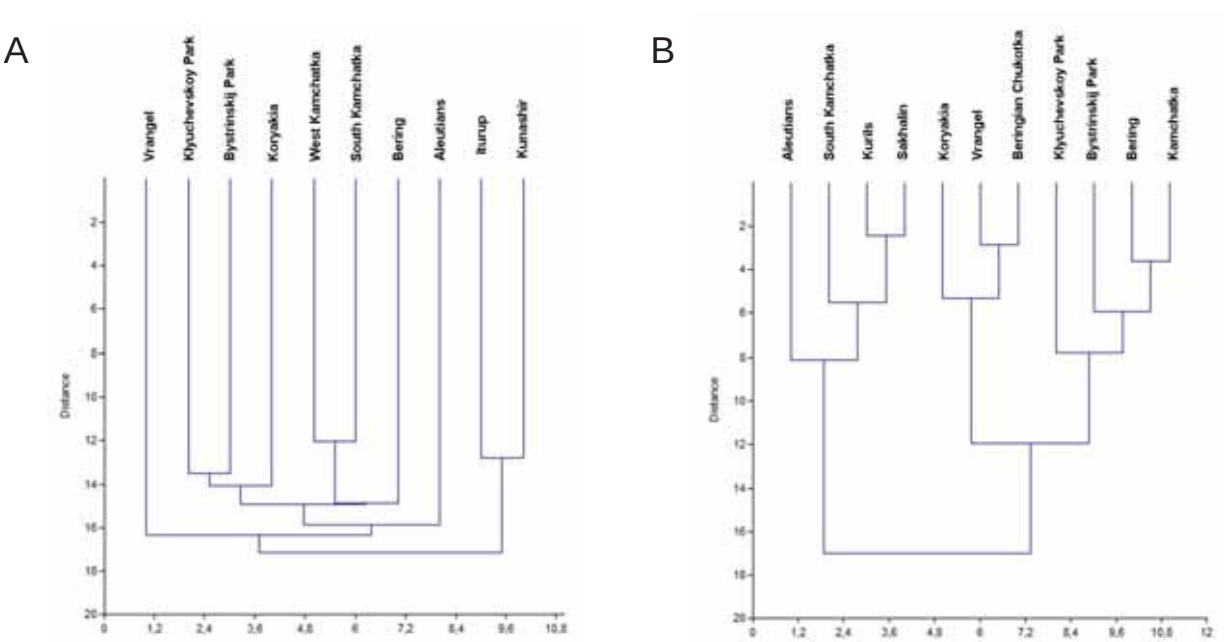


Fig 9 Positions of compared floras and other localities mentioned in the text. Solid lines and numbers indicate coherent components for Ks value among compared floras more than 60; dotted lines and italic numbers indicate Ks values between Bering Island and other areas, which are less than 60. See also Table 1.

Fig. 10. Clusterogram of compared moss floras by species composition (A) and family rates (B). See also Table 1.



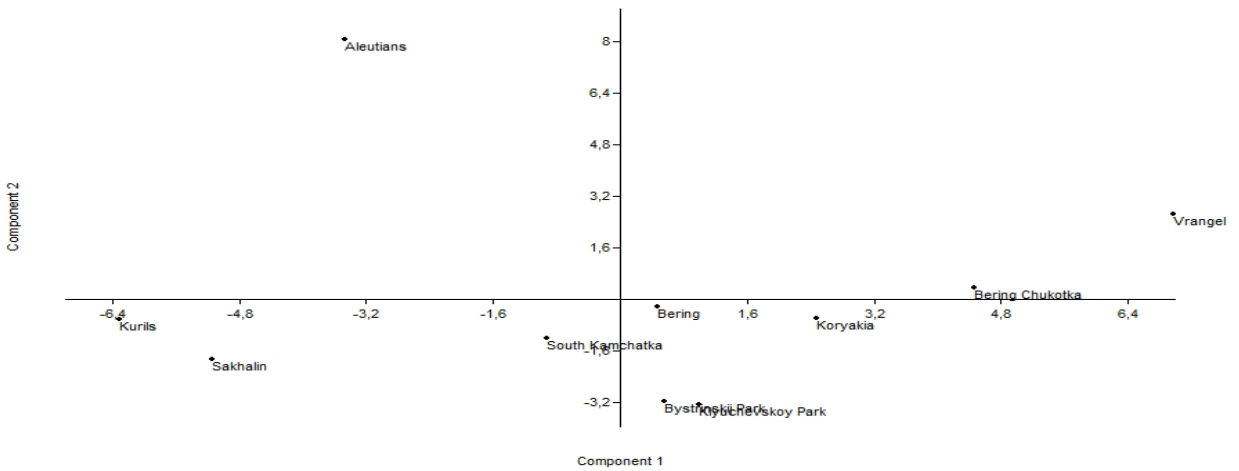


Fig. 11. Biplot of moss floras compared by family composition (principal component analysis).

noticeable interruption between boreal Kamchatka and generally temperate Kuril Islands and Sakhalin. Aleutians & Tuxedni Wilderness area (coastal Alaska) is very distant from all East Asiatic floras along the component 2. This can likely be explained by the presence of two families unknown in other floras, Antitrichiaceae and Oedipodiaceae, and by outstanding number of species (within the set of compared floras) in the families Andreaeaceae, Hylocomiaceae, and Orthotrichaceae, that are generally better represented in 'Western' than in 'Eastern' floras of the Holarctic.

Summing up, the moss flora of Bering Island can be characterized as mainly boreal-montane. Despite of presence of tundra-like vegetation and numerous late snow beds in the island, many characteristic arctic species were not found there, *e.g. Aplodon wormskjoldii, Plagiothecium berrgrenianum, Pseudocalliergon brevifolium*; some other arctic species were found in 1-3 localities only (*Bryum teres, Drepanocladus arcticus, Psilopilum cavifolium, P. laevigatum*). Subarctic species are relatively rare in the island, being concentrated in rich fens, rocky mountain tundra and around snow beds, while in most widespread plant communities boreal and boreal-mountain species dominate. On the other hand, southern elements are represented not only by species being characteristic for broad-leaves forests *(Anomodon longifolius, Eurhynchiadelphus eustegia, Rigodiadelphus robustus, Trachycystis flagellaris)* but occurring in much more southern areas (*Brachymenium nepalense)*.

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LITERATURE CITED

[AFONINA, O.M.] АФОНИНА О.М. 2004. Конспект флоры мхов Чукотки. – [Moss Flora of Chukotka] *СПб, БИН РАН [Sankt-Petersburg, Bot. Inst. RAS], 260 pp.*

ARNELL, H.W. 1917. Die Moose der Vega-Expedition. – *Arkiv for Botanik* **15***: 1-111*.

BAKALIN, V.A. 2005. The liverwort flora of Bering Island (north-west Pacific, Russia). – *Lindbergia* **30**: *79-92*.

[BAKALIN, V.A.] БАКАЛИН В.А. 2009. Флора и фитогеография печеночников Камчатки и прилегающих островов. – [Flora and phytogeography of hepatics of Kamchatka and adjacent islands] *M., KMK [Moscow, KMK-Press], 367 pp.*

BAKALIN, V.A. & V.YA. CHERDANTSEVA 2006a. Bryophytes of Northern Kuril Island (North-west Pacific). – *Arctoa* **15**: *131-153*.

[BAKALIN, V.A. & V.YA. CHERDANTSEVA] БАКАЛИН В.А., ЧЕРДАНЦЕВА В.Я. 2006b. Новые материалы к познанию бриофлоры Командорских островов. – [New contribution to the knowledge of moss flora of Commander Islands] *Биоразнообразие растительного покрова Крайнего Севера: инвентаризация, мониторинг, охрана [Bioraznoobrazie rastitel'nogo pokrova krajnego severa, inventarizatsija, monitoring, okhrana. Сыктывкар [Syktyvkar]: 4-6.*

[BAKALIN, V.A. & V.YA. CHERDANTSEVA] БАКАЛИН В.А., В.Я. ЧЕРДАНЦЕВА 2008. Бриофлора острова Медный и бриогеография Алеут (Северная Пацифика). – [Bryophyte flora of Medny Island and bryogeography of Aleutians (North Pacific)]. *Сохранение биоразнообразия Камчатки и прилегающих морей [Sohranenie bioraznoobrazija Kamchatki i prilegayuschikh morey] Петропавловск-Камчатский [Petropavlovsk-Kamchatskyj]: 36–56.*

[BAKALIN, V.A., V.YA. CHERDANTSEVA & T.O. CHIBIRYAK] БАКАЛИН В.А., В.Я. ЧЕРДАНЦЕВА, Т.О. ЧИБИРЯК 2012. Бриофлора о. Карагинский (северо-западная Пацифика). – [Bryophyte flora of Karaginskyj Island (North-West Pacific)] *Вестник СВНЦ ДВО РАН [Vestnik SVNTS DVO RAN]* **1**: *82-92.*

BAKALIN, V.A., V.YA. CHERDANTSEVA, M.S. IGNATOV, E.A. IGNATOVA & T.I. NYUSHKO 2009. Bryophyte flora of the South Kuril Islands (East Asia). – *Arctoa* **18:** *69-114*.

BARTRAM, E.B. 1938. Mosses of the Aleutian Islands, Alaska. – *Botaniska Notiser* **3**: *244-256*.

BEDNAREK-OCHYRA, H. 2006. A taxonomic monograph of the moss genus *Codriophorus* P. Beauv. (Grimmiaceae). – *Krakow, W.Szafer Inst. of Botany, Polish Acad. Sci., 276 pp.*

BEDNAREK-OCHYRA, H., R.D. SEPPELT & R. OCHYRA 2010. *Niphotrichum muticum* (Musci, Grimmiaceae), an addition to the moss flora of the Aleutian Islands. – *Botany* **88** (4): *389-396.*

[CHERDANTSEVA, V.YA.] ЧЕРДАНЦЕВА В.Я. 2010. Новые и редкие для России виды мхов с острова Медный (Командорские острова). – [Moss species new and rare to Russia from Medny island (Commander Islands)] *Бот. Журн. [Bot. Zhurn.]* **95**(1): *85-92.*

[CZERNYADJEVA, I.V.] ЧЕРНЯДЬЕВА И.В. 2012. Мхи полуострова Камчатка. – [Mosses of Kamchatka Peninsula] *СПб [Sankt-Petersburg]: 458 pp.*

[CZERNYADJEVA, I.V. & E.A. IGNATOVA] ЧЕРНЯДЬЕВА И.В., Е.А. ИГНАТОВА 2007. Мхи природного парка «Ключевской» (Камчатка, Дальний Восток). – [Mosses of park "Kljuchevskoi" (Kamchatka, Far East)] *Бот. Журн. [Bot. Zhurn.]* **92**(11): *1663-1682.*

CZERNYADJEVA, I.V. & E.A. IGNATOVA 2008. Mosses of Bystrinsky Nature Park (Kamchatka Peninsula, Russian Far East). – *Arctoa* **17**: *49-62*.

FEDOSOV, V. E. 2010. New moss records from Kamchatkaya Province. 5. – *Arctoa* **19**: *279-280*.

FLATBERG, K.I. 2007. *Sphagnum tescorum* (Bryophyta), a new species in sect. Acutifolia from Beringian Region. – *Lindbergia* **32** (3): *99-110*.

FRISVOLL, A.A. 1988. A taxonomic revision of the *Racomitrium heterostichum* group (Bryophyta, Grimmiales) in N. and C. America, N. Africa, Europe and Asia. – *Gunneria* **59**: *5-289*.

FRYE T.C. & L. CLARK 1946. Attu Island Bryophytes Collected by Hardy. – *Bryologist* **49** (2): *59-65*.

HARVILL, A.M. 1947. Notes on the moss flora of Alaska. I. The mosses of Attu Island collected by Margaret Bell Howard and George B. van Schaack. – *Bryologist* **50** (2): *169-177*.

HULTEN, E. 1926-1930. Flora of Kamtchatka and adjacent islands. – *Kungl. Sv. Vet. Akad. Handl. Ser. 3. 1135 pp.*

HULTEN, E. 1960. Flora of the Aleutian Islands and Westernmost of Alaska Peninsula with notes on the flora of Commander Islands (2nd ed.). – *Weinsh. Bergstr., 376 pp*.

IGNATOV, M.S., O.M. AFONINA, E.A. IGNATOVA *et. al.* 2006. Checklist of mosses of East Europe and North Asia. – *Arctoa* **15**: *1-130*.

IGNATOV, M.S., B.C. TAN, Z. IWATSUKI & E.A. IGNATOVA 2000. Moss flora of the Upper Bureya River (Russian Far East). – *J. Hattori Bot. Lab*. **88**: *147-178*.

IGNATOVA, E.A., H.H. BLOM, D.V. GORYUNOV & I.A. MILYUTINA 2010. On the genus *Schistidium* (Grimmiaceae, Musci) in Russia. – *Arctoa* **19**: *113-138*.

IGNATOVA, E.A. & V.E. FEDOSOV 2012. *Ditrichum zonatum* var. *scabrifolium* in Russia. – *Arctoa*, **21**: *165-168.*

KOPONEN, T. 1977. Miscellaneous notes on Mniaceae (Bryophyta). II. – *Ann. Bot. Fennici* **14**: *62-64.*

[KRESTOV, P.V.] КРЕСТОВ П.В. 2004. Растительный покров Командорских островов. – [Flora and vegetation of Commander Islands] *Бот. Журн. [Bot. Zhurn.]* **89**(11): *1740-1762*.

[KURSANOVA, I.A. & V.G. SAVCHENKO] КУРСАНОВА И.А., В.Г.САВЧЕНКО 1966. Климат Командорских островов. – [Climate of Commander Islands] *Вопросы географии Камчатки [Voprosy Geografii Kamchatki]* **4**: *11-22*.

[KUZ'MINA, E.YU.] КУЗЬМИНА Е.Ю. 2003. Флора листостебельных мхов Корякского нагорья. – [Moss flora of Koryak Upland] Дисс. на соиск. уч. ст. к-та биол. Наук [PhD. Thesis]. *[Saint Petersburg]: 234 pp.*

MAKSIMOV, A.I. 2007. *Sphagnum imbricatum* complex (Sphagnaceae, Bryophyta) in Russia. – *Arctoa* **16**: *25-34*.

MOCHALOVA, O.A. & V.V. YAKUBOV 2004. Флора Командорских островов. – [Flora of Commander Islands] *Владивосток [Vladivostok]: 120 pp.*

NYUSHKO, T.I., E.A. IGNATOVA & M.S. IGNATOV 2008. Contribution to moss flora of the Kuril Islands (Russian Far East). – *Arctoa* **17**: *165-168*.

PERSSON, H. 1946. Some Alaskan and Yukon Bryophytes. – *Bryologist* **49** (2): *41-58*.

PERSSON, H. 1947. Further notes on Alaskan-Yukon Bryophytes. – *Bryologist* **50 (**3): *279-310*.

PERSSON, H. 1952. Critical or otherwise interesting bryophytes from Alaska-Yukon. – *Bryologist* **55** (1): *1-25*.

PERSSON, H. 1962. Bryophytes from Alaska collected by E. Hulten and others. – *Svensk Bot. Tidskr.* **56** (1): *1-35*.

PERSSON, H. 1963. Bryophytes of Alaska and Yukon Territory collected by Hansford T. Shacklette. – *Bryologist* **66** (1): *1-26*.

PERSSON, H. 1968. Bryophytes from the Aleutian Islands, Alaska, collected mainly by Hansford T. Shacklette. – *Svensk Botanisk Tidskrift.* **62** (2): *369-387*.

[PISARENKO, O.YU., M.S. IGNATOV, V.YA. CHERDANTSEVA & E.A. IGNATOVA] ПИСАРЕНКО О.Ю., М.С. ИГНАТОВ, В.Я. ЧЕРДАНЦЕВА, Е.А.ИГНАТОВА 2012. Конспект мхов. – [Conspectus of moss flora] *В кн.: Бакалин В.А. и др. Бриофлора Сахалина, Владивосток, Изд-во Морского гос. ун-та [In: Bakalin, V.A. et al. Bryophytes of Sakhalin, Vladivostok, Marine State Univ. Publishing House]: 123-268.*

[SCHMIDT, V.M.] ШМИДТ В.М. 1975. Сравнение систематической структуры флор Хоккайдо, Сахалина, Камчатки, Курильских, Командорских и Алеутских островов. – [Comparison of taxonomic patterns of Hokkaido Island, Sakhalin Island, Kamchatka Peninsula, Kurils, Commanders, and Aleutians] *Бот. журн. [Bot. Zhurn.]* **60** (9): *1225-1237*.

[SCHMIDT, V.M.] ШМИДТ В.М. 1980. Статистические методы в сравнительной флористике. – [Statistic methods in comparative floristics] *Л. [Leningrad]: 176 pp.*

SCHOFIELD, W.B. 1988. Bryophyte disjunction in Northern Hemisphere: Europe and North America. – *Bot. J. Linnean Soc*. **98**(3): *211-224*.

SCHOFIELD, W.B. 2004. Endemic genera of bryophytes of North America (north. of Mexico). – *Preslia* **76**: *255-277*.

SCHOFIELD, W.B., S.S. TALBOT & S.L. TALBOT 2002. Bryophytes from Tuxedni Wildeness Area, Alaska. – *J. Hattori Bot. Lab.* **92**: *91-123*.

SÖRENSEN, T. 1948. A method of establishing groups of equal amplitude in plant sociology based on similarity of species content. – *Kongelige Danske Videnskabernes Selskab. Biol. krifter. Bd V.* **4**: *1-34*.

TATEWAKI, M. 1963. The Hultenia. – *J. Fac. Agr. Hokkaido Univ.* **3** (2): *131-199*.

[TOLMACHEV, A.I.] ТОЛМАЧЁВ А.И. 1974. Введение в географию растений. – [Introduction into the plant geography] *Л. [Leningrad]: 244 pp.*

[VASILJEV, V.N.] ВАСИЛЬЕВ В.Н. 1957. Флора и палеогеография Командорских островов. – [Flora and palaeogeography of Commander Islands] *М. [Moscow]: 402 pp.*

[YURTSEV, B.A.] ЮРЦЕВ Б.А. 1966. Гипоарктиеский флористический пояс и происхождение его флоры. – [Hypoarctic floristic belt and origin of its flora] *СПб. [Saint-Petersburg]: 94 pp.*

YURTSEV, B.A. 1994. Floristic division of the Arctic. – *J. Veget. Sci.* **5** (6): *765-776*.