

BRYOPHYTES OF NORTHERN KURIL ISLANDS (NORTH-WEST PACIFIC)
МОХООБРАЗНЫЕ СЕВЕРНЫХ КУРИЛ (СЕВЕРО-ЗАПАДНАЯ ПАЦИФИКА)

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Abstract

The bryophyte flora of two northern Kuril islands, Paramushir and Shumshu, is studied. The compiled list includes 97 species and 4 varieties of liverworts and 154 species and 1 variety of mosses. The flora is characterized with the considerable proportion of East-Asian species. There is a great difference between these two islands in species composition: Shumshu is characterized with a great number of heliophytes, while Paramushir – with mountain species, mainly epilithic ones. Contemporary volcanic activity considerably affects the flora of Paramushir Island, primarily, due to occasional ashfalls resulting in destruction and degradation of a some of plant communities, as well as in supplying unoccupied substrates.

Резюме

Изучена и проанализирована бриофлора двух северных островов Курильской гряды: Парамушир и Шумшу. Составленный список включает 97 видов и 4 разновидности печеночников и 154 вида и 1 разновидность мхов. Флора характеризуется значительным участием восточно-азиатских таксонов. В экологии видов наблюдаются существенные различия между двумя островами. Шумшу характеризуется большим количеством болотных таксонов, а Парамушир – эпилитов. Современная вулканическая деятельность оказывает значительное влияние на формирование бриофлоры, главным образом, благодаря вулканическим пеплопадам, вызывающим разрушение и деградацию некоторых растительных сообществ и появление незанятых субстратов.

INTRODUCTION

The islands of the Greater Kurils, stretch from Hokkaido, Japan up to the Kamchatka Peninsula (from 43° N to 51° N), and are the result of volcanic and tectonic processes within the “Pacific Fire Ring” (Luchinski, 1974). Most of them have volcanic peaks up to 1600-1800 m alt., the highest being the Alaid Volcano – 2300 m elev. The present study concerns the two northernmost islands – Paramushir and Shumshu. These two islands are contrastingly different: Paramushir has numerous mountains, including Chikurachki Volcano, 1816 m elev. and Fuss Volcano, 1772 m elev., while Shumshu is rather flat, reaching only 209 m elev.

Data on the bryophyte flora of the Kurils are fragmentary, and for the two northernmost islands, Paramushir and Shumshu, they are quite inadequate. Only four liverwort species were reported

from these two islands: *Conocephalum conicum* and *Marchantia polymorpha* (Horikawa, 1934) and *Lophozia excisa* and *L. wenzelii* (Noguchi, 1967); thus most of hepatic records are new. Mosses of both these islands were studied by Horikawa (1934) who recorded 7 species for Paramushir and 1 for Shumshu, Abramova (1960) – 3 species for Paramushir, Noguchi (1967) – 5 for Paramushir, Cherdantseva (1986) – 47 for Paramushir and 27 for Shumshu, Minami & al. (2001) – 47 for Paramushir. As a result, 78 taxa were recorded for Paramushir and 28 for Shumshu before the present study.

STUDY AREA AND VEGETATION

According to data from the meteorological station located on Vasilyev Cape, the southern most point on Paramushir Island, the coldest months are January and February with the mean temperature –5.5°C, and the warmest month is August:

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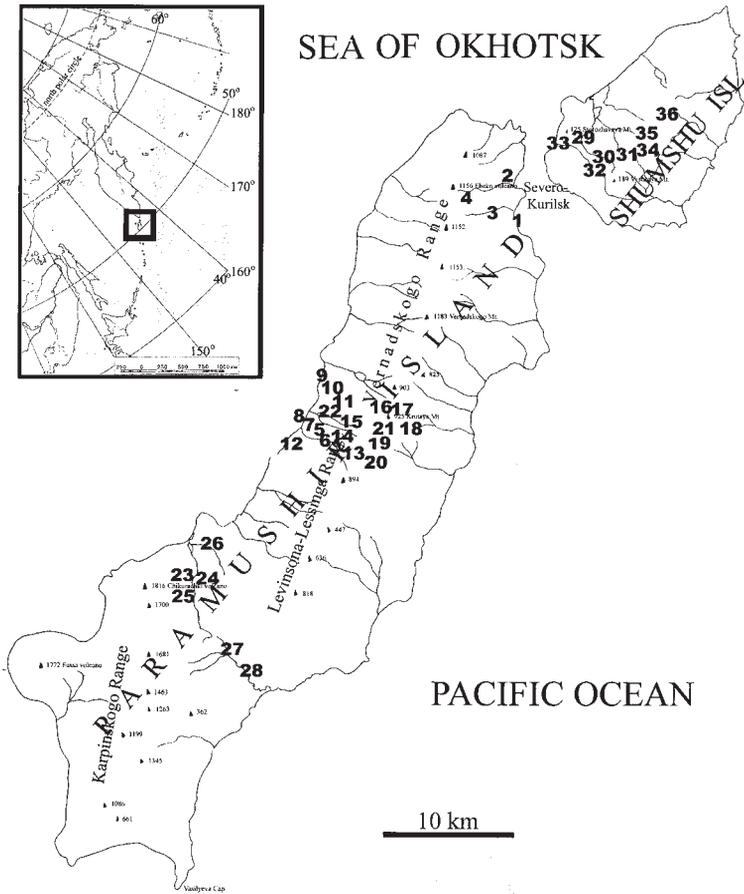


Fig. 1. Schematic map of the study area showing the collecting localities (the numbers correspond to those in the text and in Table 1).

+10°C. The absolute maximum registered on the islands is +23°C, while the mean of the absolute annual maxima is +19°C. The absolute minimum is -26°, while the mean absolute annual minimum is -14°C. The Pacific coast of the islands is affected by the cold Kamchatka Current, whereas the coast of Sea of Okhotsk is influenced by the warm Soya Current. Mean day temperature passes 0°C in the second half of November and near the end of April. The frost-free period consists of about 120 days; however frost was registered in some years in all months except August. The summer is very humid: sunny days are few and the air humidity is usually 90-97%. Mean annual precipitation is 1200 mm, with most occurring in the summer. Winters are very snowy (almost all local houses have an extra door on the roof, as the street level door is buried under snow several times a winter). The wind conditions on the island are very inclement with winds reaching up to 40 m/sec usually several days a month. The highest wind speed

recorded in the Kuriles was registered on Vassilyev Cape at 64 m/sec (Atlas..., 1967). The above data were obtained from sea level and there is no data for higher elevations in the Northern Kuriles. But in nearby Kamchatka the vertical temperature gradient is 5.5° per 1000m and snow accumulation increases by 300 mm per 100 m of elevation (Muraviov, 1985).

Due to the striking contrast between Paramushir and Shumshu their environments and vegetation is characterized separately.

PARAMUSHIR ISLAND

Paramushir Island is stretched from the north-east to the south-west for 101 km, its maximal width is 28 km and the mean width is 20-25 km. Three mountain ranges occur along the median part of the island: Vernadsky Range, Levinson-Lessing Range and Karpinsky Range (Fig. 1).

The mountains have sharp peaks, often reaching 600-1100 m elev., and two volcanoes are above

Table 1. COLLECTING LOCALITIES

Paramushir Island

1. Ocean coast 3 km south of Severo-Kurilsk. 50°39'N – 156°08'E.
2. Second maritime terrace 2 km north of Severo-Kurilsk. 50°38'N – 156°08'E.
3. Kuzminka River 4 km upstream from its mouth. 50°42'N – 156°08'E.
4. Kuzminka River 7 km upstream from its mouth. 50°42'N – 156°07'E.
5. 5 km north-west of Kokhmayuri River mouth 50°26'N – 155°45'E.
6. Right tributary of Kokhmayuri River 3 km upstream its mouth. 50°26'N – 155°45'E.
7. 4 km south-west of Kokhmayuri River mouth 50°25'N – 155°44'E.
8. 1 km north of Kokhmayuri River mouth along the ocean coast. 50°25'N – 155°44'E.
9. Antsiferovka Stream mouth (eastern slope of Antsiferov Mt.) 50°29'N – 155°46'E.
10. Antsiferovka Stream 2 km upstream from its mouth. 50°29'N – 155°47'E.
11. Antsiferov Mt. 50°29'N – 155°47'E.
12. 1.5 km south of Kokhmayuri River mouth. 50°28'N – 155°46'E.
13. The ridge divided the valleys of Kokhmayuri and Levaya Okhotnichya Rivers, ca. 4 km east from the coast. 50°28'N – 155°47'E.
14. Uppermost course of Levaya Okhotnichya River, ca. 5 km upstream from its mouth. 50°26'N – 155°49'E.
15. Upper course of Pravaya Okhotnichya River at the junction of its right and left head waters. 50°26'N – 155°49'E.
16. The top of Krutaya Mt. 50°26'N – 155°50'E.
17. North-eastern slope of a hill with the top 1.1 km east of Krutaya Mt. 50°26' – 155°51'E.
18. Uppermost course of Okeanskaya River. 50°27'N – 155°52'E.
19. The right tributary of Kokhmayuri River flowing from the southern slope of Krutaya Mt. 50°25'N – 155°51'E.
20. Uppermost course of the left tributary of Kokhmayuri River. 50°25'N – 155°51'E.
21. Krutaya Mt., southern slope. 50°25'N – 155°51'E.
22. Levaya Okhotnichya River, 2 km upstream from its junction with Pravaya Okhotnichya River. 50°25'N – 155°50'E.
23. the left slope to valley of the Taina River approximately 3 km east of the coast of the Sea of Okhotsk. 50°20'N – 155°31'E.
24. Right slope of the valley of Taina River ca. 5 km from the ocean (slope of Chikurachki Volcano). 50°20'N – 155°33'E.
25. Left slope of the valley of Taina River ca. 5 km from the ocean (slope of Chikurachki Volcano). 50°19'N – 155°31'E.
26. Overgrown road from Shimayur River to the coast. 50°21'N – 155°31'E.
27. Tukharka River ca. 8 km upstream from its mouth 50°15'N – 155°33'E.
28. Tukharka River ca. 6 km from its mouth, flood plain.. 50°13'N – 155°34'E.

Shumshu Island

29. Storozhevaya Mt., eastern slope. 50°43'N – 156°13'E.
30. The left head water of the Vesennyaya River. 50°42'N – 156°13'E.
31. The ruins of Shutovo Village. 50°41'N – 156°13'E.
32. Shutovaya River Valley between Baikovo and Shutovo, 3 km from the latter. 50°43'N – 156°12'E.
33. Baikovo Village. 50°42'N – 156°12'E.
34. Shutovskiye Lakes. 50°42'N – 156°15'E.
35. The right head water of Vesennyaya River. 50°42'N – 156°15'E.
36. Mayatskaya River, upper course. 50°44'N – 156°21'E.

1500 m elev. (Chikurachki – 1816 m, Fuss – 1772 m). River and creek water levels have usually rapid current and high seasonal fluctuations.

The main type of vegetation in Paramushir is thickets of *Alnus fruticosa* distributed from sea level up to the top of mountains not covered by recent volcanic deposits. These thickets reach up to 1100 m, forming very low, 30-50 cm shrubs. Below 600 m elev., *Alnus* grows as a more or less tall shrub, ca. 2 m. The herbaceous layer in the alder thickets is formed by *Calamagrostis langsdorfii*, *Dryopteris expansa*, *Aconitum septentrionale*, *Delphinium elatum*, *Senecio cannabifolia*, *Filipendula ka-*

mchatica, etc. The only liverwort species common in such thickets are *Ptilidium pulcherrimum* and *Lophozia ventricosa*, some others are found significantly rarer. Somewhat richer is the species diversity of mosses: *Mnium thomsonii*, *Polytrichastrum alpinum*, *Trachycystis ussuriensis*, etc. are on ground, *Dicranum fragilifoium*, *Hypnum palle-scens*, *Sanionia uncinata*, etc. – on tree trunks. Other species occurring within the alder thickets are associated with the places with disturbed ground cover, like stream banks, etc.

Pinus pumila (Pall.) Regel, the important dominant tree of the subalpine belt in North-East Asia,

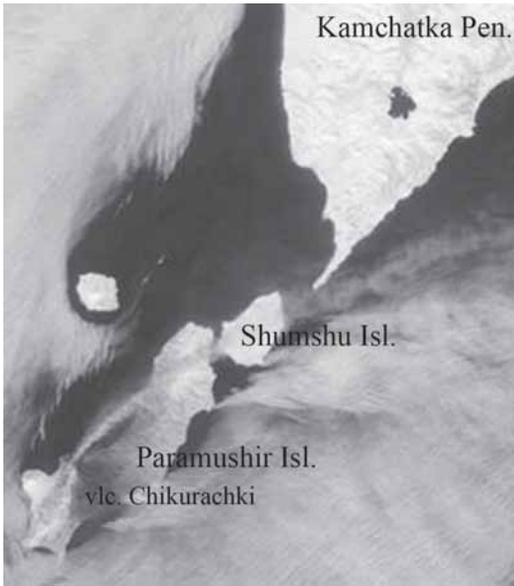


Fig. 2. The train of the volcanic ash of explosive eruption of Chikurachki Volcano in March of 2004.

(*Gymnomitrium apiculatum*, *Diplophyllum taxifolium*, etc.) and mosses (*Isopterygiopsis pulchella*, *Bartramia ithyphylla*, *Pogonatum urnigerum*, etc.).

Starting from 600-700 m elev. and above, the nival communities are widely distributed near late and permanent snow-beds. Bryophytes dominate in this type of habitat. The most frequent bryophytes are species of *Gymnomitrium*, *Schistochilopsis*, *Marsupella*, and *Nardia*. *Pleurocladula albescens*, *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Arctoa fulvella*, *Kiaeria starkei*, *Oligotrichum hercynicum* are usually involved in community formation.

Banks of streams have tundra and alpine meadow communities. Liverworts exhibit the greatest species diversity here: *Marsupella brevissima*, *Hygrobiella laxifolia*, *Aneura pinguis*, *Pleurocladula albescens*, *Anthelia julacea*, *Pellia neesiana*, *Conocephalum conicum*, *Cryptocoleopsis imbricata*, *Nardia compressa*, etc. Moss communities are formed by *Arctoa fulvella*, *Brachythecium uncinifolium*, *Oligotrichum hercynicum*, *Andreaea nivalis*, etc. In the lower mountain belt, bryophytes are quite diverse on rocks in streams and on bare soil at slope base along streams, species include: *Brachythecium rivulare*, *Bryum turbinatum*, *Calliergonella lindbergii*, *Pseudobryum cinclidioides*, *Cephalozia pachycaulis*, *Conocephalum conicum*, *Pellia neesiana*, etc.

Wet meadows are common in river flood plains near the ocean coast. However, tall-herbs (*Filipendula camtschatica* (Pall.) Maxim., *Senecio cannabifolus* Less., *Angelica ursina* (Rupr.) Maxim., some sedges and *Calamagrostis langsдорфii* (Link) Trin. are very dense leaving no space for bryophytes.

The tallest trees in Paramushir are *Salix udensis* Trautv. et C.A. Mey. and *Alnus fruticosa* Rupr., sometimes reaching 7-8 m high and forming forest-like vegetation in flood plains along only one river. Tall herbs and *Calamagrostis* are common in the herb layer, and rather few mosses were found here: *Bryhnia novae-angliae* is common on soil, and *Amblystegium serpens*, *Brachythecium reflexum*, *Ulota drummondii* occur on tree trunks.

occupies a relatively large area, but is far less common than the alder. Usually, it is developed on tops of watershed ridges between parallel rivers flowing down the mountain slopes from the central ridge. Growing in relatively dry and windy environment the thickets of *Pinus pumila* lack almost any herbs and bryophytes; *Ptilidium pulcherrimum* occurs here, but is rather rare.

Closer to mountain tops, 700-800 (-1100) m the *Alnus* elfin woods is replaced by meadows and tundra's. First the meadows and tundra patches occur on elevated places; gradually becoming the dominant type of vegetation (although in less dry and sheltered places alder reaches the tops). Along with the increasing of altitude and decreasing of soil humidity, meadows are replaced by heather tundra's composed of *Phyllodoce*, *Empetrum*, *Loiseleuria*, *Arctous* and other dwarf shrubs. These communities are the only type of zonal vegetation where liverworts play an important role in the vegetation composition. *Lophozia pellucida* var. *rubrigemma*, *Cephalozia bicuspidata*, *Sphenobolus minutus* occur upon mosses, and *Diplophyllum taxifolium* mixed with mosses form pure bryophyte carpets or grow under dwarf shrubs. Among the mosses common to dwarf shrub tundra's are *Dicranum spadiceum*, *Sanionia uncinata*, etc.

At the same altitudes alpine gravelly barrens occur. In crevices among stones, on fine-grained soil and volcanic ash there are some liverworts

Several small (20-100 sq. m) swamp-like communities were found in the upper most courses of streams. *Aulacomnium palustre*, *A. turgidum*, *Rhytidiadelphus squarrosus*, *Sphagnum girgensohnii*, *Cephalozia bicuspadata*, *Harpanthus flotovianus*, *Pellia neesiana* are typical to these habitats.

There are no bogs of significant extent in the island now. Judging from the old topographic map and discussions with the local people an extensive moss-dominated bog existed in the area of the Tukharka River's mouth. However, it has been buried by volcanic deposits from the Chukurachki Volcano eruption in 1986. In 2004 this place was represented by an extensive, ca. 3 x 5 km overmoistened field of pyroclastic deposits, where swamping process takes place. The vegetation cover of the field is represented by *Calamagrostis langsdorfii*, *Juncus* spp., *Carex*, in some places *Salix udensis*, *Alnus fruticosa*. Among the bryophytes are *Solenostoma koreanum*, *Plectocolea subelliptica*, *Plectocolea infusca* var. *ovalifolia*, *Aneura pinguis*, *Jungermannia pumila*, *Pellia neesiana*, *Scapania paludosa*, *Conocephalum japonicum* as well as *Dicranella palustris* and *Philonotis tomentella*.

The bryophyte flora of rocky ledges in the canyon is relatively rich. There are some marchantioid xerophilous hepatics: *Athalamia hyalina* and *Sauteria alpina*; as well as leafy ones: *Diplophyllum taxifolium*, *D. albicans*, *Radula complanata*. Among the mosses found in these habitats there are *Distichium capillaceum*, *Pohlia cruda*, *Oxytetus tenuirostris*, etc.

The rocks of maritime terraces mostly consist of volcanic tufa and are one of the habitats for bryophytes. There is sort of a peculiar altitude inversion and some species that are more typical of tundra's appear here. For example, *Anthelia juratzkana*, *Eremonothus myriocarpus*, *Herzogiella ascendens*, *Andreaea rupestris*, *Racomitrium fasciculare*, *Trachycystis flagellaris*, etc. can be found on the eroded substrate that forms long talus slopes to the ocean coast. Liverwort species include: *Aneura pinguis*, *Barbilophozia hatcheri*, *Diplophyllum taxifolium*, *Lophozia pellucida* var. *rubrigemma*, *Nardia geoscypus*, *Blepharostoma trichophyllum*, *Plectocolea subelliptica*, *Nardia scalaris*, etc.

There are three active volcanoes in Paramushir: Ebeko, Chukurachki and Fuss, the two

former erupted several times during the last 100 years (last eruption on Chukurachki was in 2004, Ebeko in 1999). Contemporary volcanic activity is obvious in the southern and northern parts of the island (thermal springs, fumaroles, and hydro-sulfataras). However ash falls (cf. Fig. 2) affect the whole territories of the island.

Recent eruptions resulted in formation of extensive scoria fields, very dry and recovering very slowly.

One can observe formation of «chimeric» communities formed by the plants that survived the ash fall (grown through the ash layer) and by actively intruding exploratory species. For example, peculiar communities composed of «grown through» *Empetrum nigrum* L. and *Pennellianthus frutescens* (Lamb.) occur, however colonization of these substrata is greatly complicated because volcanic scoria and ash are too dry. Very few bryophytes are able to colonize these substrates. On dry fields of pyroclastic deposits in micro-depressions of substratum one can find *Pohlia drummondii*, *Polytrichum piliferum*, *Racomitrium muticum*, *Marsupella*, etc. .

Another individual habitat is road sides. Along with the species typical to the habitats with disturbed vegetation cover, like *Cephaloziella* spp., *Isopaches bicrenatus*, there are also «riparian» species: *Plectocolea subelliptica*, *Nardia breidlerii*.

SHUMSHU ISLAND

Shumshu Island is characterized with flat relief, but it is surrounded by abrupt high slopes up to 50-70 m tall. It is only in the river mouths where slopes to the coast are gentle. The island is 29 km long and 21 km wide; maximal altitude 209 m alt. Rivers in the island have usually slow current, reaching up to 12-15 km long (e.g. Yuzhanka, Vesennyaya). The island is quite wet and more than half of its territory is occupied by swamps and shallow round -lakes, perhaps, of karst origin. There are no outcrops of crystalline rocks.

The watershed habitats are occupied with an alternation of elfin wood, *Dusheckia fruticosa*, rarer *Pinus pumila*, both rarely exceed 1.5 m tall) and meadow communities. There are no forests and forest-like communities. Meadows are composed of tall herbs species (*Filipendula kamtschatica*, *Angelica ursina*), however they do not reach

their common height but are limited to about 1 m high. Bryophytes in elfin woods are rarely found and are limited to *Ptilidium pulcherrimum* (on branches) and *Brachythecium spp.* on soil.

As we pointed out above, the swamps distributed there are a reason of the great floristic peculiarity of this island among the islands of the Kurile Range. The main type of mires are, peat-moss and sedge-peat-moss. There are a lot of paludal species missing on the other islands of the Kurile Archipelago, they are taxa growing in *Sphagnum* carpets and *Drosera*, on bare peat of hollows or among the mosses: *Orthocaulis binsteadii*, *O. quadrilobus*, *Saccobasis polita*, *Cladopodiella fluitans*, *Calliargon stramineum*, *Dicranum leioneoron*, *Scorpidium scorpioides*, etc.

The banks of rivers and sluggishly flowing streams are quite rich, but their richness is still much lower than that on Paramushir. Common are *Harpanthus flotovianus*, *Conocephalum conicum*, *Hygrohypnum bestii*, *Pohlia wahlenbergii*, *Pseudobryum cinclidioides*, *Racomitrium sudeticum*, etc., i.e. mostly widespread boreal species and almost no montane species.

While studying the vegetation of the island, one can get an impression that plants on Shumshu grow much slower than on Paramushir. Thus, the Japanese roads remaining on Paramushir since the Second World War have been overgrown with alder everywhere, whereas on Shumshu they are still quite suitable for walking. The flora of the roadsides on Shumshu is somewhat richer than that on Paramushir and includes *Blepharostoma trichophyllum*, *Blasia pusilla*, *Solenostoma koreanum*, *Brachythecium albicans*, *Dicranella palustris*, *Pohlia drummondii*, etc. A number of arcto-montane species were found only on the roadsides: *Anthelia juratzkana*, *Nardia breidlerii*, *N. scalaris*, etc.

On wet coastal cliffs composed of volcanic tufa, *Amphidium lapponicum*, *Brachythecium plumosum*, *Sanionia uncinata* and *Conocephalum japonicum* grow.

LIST OF SPECIES

As a result of our investigations, 97 species of liverworts has been found, including 50 species on Shumshu and 83 on Paramushir. Fourteen species were found on Shumshu only and 47 on Paramushir only. The correspondence number for

mosses are 154 species, 130 on Paramushir and 69 on Shumshu Island, 84 being only on Paramushir and 25 only on Shumshu.

In the following list, the nomenclature of hepatics follows Konstantinova & al. (1992), with some recent changes: Konstantinova & Vasiljev (1994), Bakalin (2001, 2003), Bakalin & al. (2001). The nomenclature of mosses mostly follows Iwatsuki (2004). Species name is followed by the indication of presence of sexual or asexual reproduction: ant. – antheridia, arch. – archegonia, per. – perianthia, spor. – sporophytes, gemm. – gemmae. Further are given altitudes/number of collecting localities – habitats and associated species. Information is presented separately for **PA** – Paramushir and **SH** – Shumshu). When the locality was significantly lower than the major altitudinal range, the isolated occurrence is shown in parentheses. In the end, few collecting numbers of Bakalin are cited (unless collector otherwise), and literature reference is given where available.. All specimens are kept in VLA (mosses and hepatics) and KPABG (hepatics).

HEPATICAE

- Aneura pinguis* (L.) Dumort. – **PA**: 10-70 m alt. / 1, 27 – In wet moss mats on cliffs along the seacoast; on fine-grained soil in wet shady crevices of rocks; on wet pyroclastic deposits on eroded slope to a stream. In pure mats or with *Conocephalum japonicum*, *Diplophyllum taxifolium*, *Hygrobriella laxifolia*, *Jungermannia pumila*, *Nardia geoscyphus*, *Pellia neesiana* and *Solenostoma koreanum*. K-75-6-04; K-114-1-04. – **SH**: 150-170 m alt. / 34, 36 – On peaty soil of overgrown hollows among hygrophilous mosses and sedges in moss-grass-dwarf-shrubs mires; on wet slopes to streams. Frequently with *Odontoschisma elongatum*, rarer with *Orthocaulis kunzeanus*, *Pleurocladula albescens* and *Saccobasis polita*. K-125-15-04; K-129-25-04.
- Anthelia julacea* (L.) Dumort. ant., arch. – **PA**: 10-310 m alt. / 1, 8, 12, 19 – On fine-grained soil in the cliff crevices and gravelly barrens along the seacoast, river canyons, alpine heathlands. In pure mats, once collected with *Pellia neesiana*. K-89-2-04; K-94-3-04.
- A. juratzkana* (Limpr.) Trev. per., spor., ant. – **PA**: (40)360-925 m alt. / 9, 15-18 – On fine-grained soil in shady, wet or dry crevices in cliffs along river canyons, streams in tundra belt; on fine-grained soil in snow-bed communities of alpine heathlands; on soil and boulders along streams in tundra belt. In pure mats of frequently with *Lophozia sudetica*, and rarer

- with *Blepharostoma trichophyllum*, *Cryptocoleopsis imbricata*, *Diplophyllum albicans*, *D. taxifolium*, *Gymnomitrium apiculatum*, *Marsupella emarginata*, *M. sprucei*, *Moerckia blyttii*, *Nardia geoscyphus*, *N. japonica*, *N. scalaris*, *Pleurocladula albescens*, *Schistochilopsis incisa* and *Sphenobolus minutus*. K-90-15-04; K-103-19-04. – **SH**: 98-170 m alt. / 29, 30, 34 – On fine-grained soil along roadside, on wet sliding slopes to streams in snow-bed habitats; on spots of fine-grained soil of cryogenic origin in dwarf-shrubs tundra. In pure mats or frequently with *Cephalozia bicuspidata*, *Lophozia sudetica*, *Nardia breidlerii*, rarer with *N. geoscyphus* and *N. japonica*. K-120-12-04; K-121-30-04.
- Athalamia hyalina* (Sommerf.) S. Hatt. – **PA**: 400 m alt. / 19 – In shady wet crevices of cliffs along stream in tundra belt. In pure mats. K-104-6-04.
- Barbilophozia hatcheri* (A.W. Evans) Loeske gemm. – **PA**: 40-88 m alt. / 12, 26 – Among borders of gravelly barrens sliding to a seacoast meadow; on pyroclastic deposits along roadside in *Alnus hirsuta* thickets. With *Cephalozia divaricata*, *Diplophyllum taxifolium*, *Lophozia excisa* and *Lophozia pellucida* var. *rubrigemma*. K-94-14-04; K-113-4-04. – **SH**: 103 m alt. / 32 – On fine-grained soil in hollow in lichen – dwarf-shrub tundra at low altitude. K-123-1-04.
- B. lycopodioides* (Wallr.) Loeske – **PA**: (40)650-789 m alt. / 11, 12, 17 – On fine-grained soil among dwarf-shrubs in dwarf-shrub tundra; in rocky habitats in moss-lichen community; between boulders of gravelly barrens sliding to a seacoast meadow. In pure mats or with *Tritomaria quinquedentata*. K-93-1-04; K-100-13-04.
- Blasia pusilla* L. – **SH**: 80-180 m alt. / 31, 33 – On clayey side of an old roads. In pure mats. K-122-10-04; K-127-5-04.
- Blepharostoma trichophyllum* (L.) Dumort. – **PA**: 10-789 m alt. / 1, 6, 8, 12, 17, 18 – In dry or wet shady cliff crevices in waterfall canyon, seacoast, mountain slopes; on volcanic ash deposits in the crevices of gravelly barrens in tundra belt. In pure mats or frequently with *Diplophyllum taxifolium*, rarer with *Anthelia juratzkana*, *Diplophyllum albicans*, *Eremonotus myriocarpus*, *Leiocolea heterocolpos*, *Lophozia sudetica*, *Plectocolea obovata*, *P. subelliptica*, *Pleurocladula albescens*, *Preissia quadrata*, *Scapania mucronata* and *Tritomaria quinquedentata*. K-89-6-04; K-100-10-04. – **SH**: 50-170 m alt. / 33, 34 – In the crevices of cliffs of caked metamorphosed tufa; on peaty bank of lake. With *Nardia geoscyphus* and *Plectocolea subelliptica*. K-124-4a-04; K-125-43-04.
- Calypogeia muelleriana* (Schiffn.) Mull.Frib. – **PA**: 40-310 m alt. / 10, 19 – On fine-grained soil along the slope to stream splashed by water in alder thickets, in full shade; on fine-grained soil in the crevices of gravelly barrens in a river canyon. With *Cephalozia bicuspidata*, *C. pachycaulis*, *Pellia neesiana*, *Riccardia aeruginosa* and *Scapania irrigua*. K-91-4-04; K-106-3-04. – **SH**: 158 m alt. / 36 – On smoothed peaty slope to river. With *Pellia neesiana*, *Plectocolea subelliptica* and *Schistochilopsis opacifolia*. K-129-20-04
- Cephalozia bicuspidata* (L.) Dumort. per., ant., spor. – **PA**: 40-728 m alt. / 2?4, 10, 15, 17, 19 – Among mosses and sedges in hollows of sedge-sphagnum mires; on eroded spots of fine-grained soil in subnival dwarf-shrub-lichen-moss tundras, on stones in snow-bed habitats and in streambeds of small streams and temporary springs; shady and wet cliff crevices; on wet decaying wood. Frequently with *Lophozia sudetica* and *Pellia neesiana*, rarer with *Calypogeia muelleriana*, *C. pleniceps*, *Diplophyllum taxifolium*, *Gymnomitrium apiculatum*, *Lophozia ventricosa* var. *ventricosa*, *Marsupella sphacelata*, *Moerckia blyttii*, *Nardia japonica*, *N. scalaris*, *Orthocaulis hyperboreus*, *Plectocolea obovata*, *P. subelliptica*, *Pleurocladula albescens*, *Prasanthus suecicus*, *Riccardia aeruginosa*, *Schistochilopsis incisa*, *Sphenobolus minutus* and *Tritomaria quinquedentata*. K-77-7-04; K-97-2-04. – **SH**: 98-170 m alt. / 29, 30, 34, 36 – On spots of fine-grained soil in dwarf-shrubs tundra; on stones along streams in dwarf-shrub-grass tundras; among mosses and sedges; on fine-grained soil along roadside. In pure mats or with *Anthelia juratzkana*, *Cephalozia leucantha*, *Lophozia silvicola*, *L. sudetica*, *Mylia anomala*, *Nardia breidlerii*, *N. geoscyphus*, *N. japonica*, *Orthocaulis kunzeanus*, *Pellia neesiana*, *Plectocolea obovata*, *Plectocolea subelliptica*, *Pleurocladula albescens*, *Scapania hyperborea*, *S. irrigua* and *Sphenobolus minutus*. K-125-26-04; K-120-15-04.
- C. leucantha* Spruce – **SH**: 158 m alt. / 36 – Among stems of sedges; on tussocks in sedge-moss floodplain mire. With *Cephalozia bicuspidata*, *Lophozia silvicola*, *Mylia anomala*, *Orthocaulis kunzeanus*, *Sphenobolus minutus*. K-129-1-04.
- C. lunulifolia* (Dumort.) Dumort. – **PA**: 50 m alt. / 5 – Among mosses in moss mats on a wet rocky slope on percolate water. With *Lophozia savicziae*. K-82-9-04.
- C. pachycaulis* R.M. Schust. per. – **PA**: 40, 360 m alt. / 10, 14 – On fine-grained soil along the slope to a stream splashed with water in alder thickets; on eroded spots of fine-grained soil in subnival dwarf-shrub-lichen-moss tundra, on a slope. With *Calypogeia*

- muelleriana*, *Lophozia ventricosa* var. *longiflora*, *Pellia neesiana*, *Scapania irrigua* and *Tritomaria quinqueidentata*. K-91-4-04; K-96-4-04. ? Besides typical plants, some forms transitional to *C. bicuspidata* were collected. The shoots of the later form are characterized by one row of dorsal cells (versus two), but uniform cells in stem cross-section (versus strong differentiation to cortical and inner cells in *C. bicuspidata*).
- C. pleniceps* (Aust.) Lindb. ant., arch. – **PA**: 50 m alt. / 5 – In dry crevices on slope in moss-grass community developed on slowly flowing percolate water along a stream. In pure mats or with *Cephalozia bicuspidata*, *Lophozia ventricosa* var. *ventricosa* and *Tritomaria quinqueidentata*. K-82-15-04.
- Cephaloziella arctica* Bryhn et Douin per., arch., spor. – **PA**: 88-103 m alt. / 26, 32 – On pyroclastic deposits along the side of an old road. In pure mats. K-113-2-04. – **SH**: 98 m alt. / 29 – On wet fine-grained soil of the side of an old road in forest; on spots of fine-grained soil of cryogenic origin in dwarf-shrublichen tundra. In pure mats or with *Jungermannia pumila*. K-120-8-04; K-123-2-04.
- C. arctogena* (R.M. Schust.) Konstantinova ant., arch., per. – **PA**: 88 m alt. / 26 – On pyroclastic deposits on an overgrown old road. In pure mats or with *Iso-pachys bicrenatus*. K-113-1-04, K-113-5-04, K-113-1a-04.
- C. divaricata* (Sm.) Schiffn. – **PA**: 88 m alt. / 26 – On pyroclastic deposits on a roadside in willow forest. With *Barbilophozia hatcheri* and *Lophozia excisa*. K-113-4-04. – **SH**: 98-170 m alt. / 29, 34, 36 – On wet fine-grained soil along the side of an old road, on peat in overgrown hollows in sedge-moss mires. Among mosses in pure mats or in mires with *Cladopodiella fluitans*, *Lophozia sudetica*, *Odontoschisma elongatum*, and on roadsides with *Scapania hyperborea*, *Conocephalum japonicum* and *Jungermannia pumila*. K-129-15-04, K-125-39a-04.
- Chiloscyphus fragilis* (A. Roth) Schiffn. – **PA**: 40-310 m alt. / 6, 12, 22 – In crevices in wet coastal cliff, on rocks along a riverbed occasionally splashed with water; on stones splashed with water along streams in alder thickets with *Fillipendula camtschatica*. In pure mats or with *Jungermannia exsertifolia*, *Plectocolea subelliptica* and *Scapania undulata*. K-94-2-04; K-84-7-04.
- C. rivularis* (Schrad.) Hazsl. – **SH**: 116 m alt. / 30 – On stones in stream bed along a slope with alder thickets. With *Jungermannia eucordifolia*. K-121-17-04.
- Cladopodiella fluitans* (Nees) H. Buch – **SH**: 158 m alt. / 36 – In overgrown peat hollows in sedge-moss flood-plain mire. With *Cephaloziella divaricata* and *Odontoschisma elongatum*. K-129-15-04.
- Conocephalum conicum* (L.) Underw. – **PA**: 60 m alt. / 6 – On sandy bank of the stream in alder thickets with *Fillipendula camtschatica*, in full shade. In pure mats. K-84-9-04. – **SH**: [Horikawa, 1934].
- C. japonicum* (Thunb.) Grolle – **PA**: 10-43 m alt. / 1, 28 – On wet fine-grained soil in shady crevice of cliffs along the seacoast; on wet volcanic deposits in the flood-plain of a river in hydrophilous conditions. With *Aneura pinguis*, *Jungermannia pumila*, *Pellia neesiana*, *Plectocolea infusca* var. *ovalifolia* and *Scapania paludosa*. K-75-14-04; K-115-5-04. – **SH**: 5-98 m alt. / 29, 33 – On wet fine-grained soil along the side of an old road; on wet tufa cliffs along the seacoast and, probably, occasionally splashed with salt water. In pure mats or on roadside with *Cephaloziella divaricata*, *Jungermannia pumila*, *Lophozia sudetica* and *Scapania hyperborea*. K-120-7-04; K-128-7-04.
- Cryptocoleopsis imbricata* Amakawa per. – **PA**: (50)360-728 m alt. / 2, 15, 18 – On fine-grained soil and volcanic ash in snow-bed and subnival habitats; on wet crumbled tufa cliffs along the seacoast on second terrace. In pure mats, rarer with admixture of *Anthelia juratzkana*, *Diplophyllum taxifolium*, *Lophozia sudetica* and *Pellia neesiana*. K-97-4-04; K-97-1-04. – It is a little known species, a representative of monotypic genus. Earlier it was known only from two localities on Hokkaido Island (Japan): the Rishiri Bay and the Daisetsu Mountains, and used to be considered as an endemic of Japan (Amakawa, 1959). Later it was revealed on Kamchatka at the distance of more than 1500 km from the earlier known (in Japan) part of the specific area to the north-east or at 12° to the north (Bakalin, 2005a). At the same time it was suggested that the findings on Kamchatka were hardly a result of accidental bringing and the connection between the population of Kamchatka and Japan was accomplished through the mountainous islands of the Kurile Range, and that it was possible to find this species there as well. This presumption was confirmed by our studies on the North Kuriles. So the area of this species can, probably, be characterized as Montane East-Asian.
- Diplophyllum albicans* (L.) Dumort. – **PA**: (50)728-925 m alt. / 2, 16?18 – On crumbled tufa cliffs along a stream-bed near the seacoast; on fine-grained soil in wet cliff crevices; on fine-grained soil and volcanic ash in crevices of gravelly barrens in dwarf-shrublichen tundras. In pure mats or with *Anthelia juratzkana*, *Blepharostoma trichophyllum*, *Lophozia sudetica*, *Nardia scalaris* and *Tetralophozia setiformis*. K-77-13-04; K-103-19-04.

- D. taxifolium* (Wahlenb.) Dumort. per., gemm. – **PA**: 10-728 m alt. / 1, 3, 8?10, 12, 14, 15, 18 – In the crevices in eroded slope of fine-grained soil along the seacoast and on moss mats; in shady, but more or less dry cliff crevices along streams, rivers, waterfall canyon; among stones gravelly barrens sliding to seacoast meadows; on a thin layer of fine-grained soil in crevices of gravelly barrens in lichen and dwarf-shrub tundras; on wet fine-grained soil along streambed and in snow-bed communities. In pure mats or frequently with *Blepharostoma trichophyllum*, rarer with *Aneura pinguis*, *Anthelia juratzkana*, *Barbilophozia hatcheri*, *Cephalozia bicuspidata*, *Cryptocoleopsis imbricata*, *Gymnomitrium concinatum*, *Leiocolea heterocolpos*, *Lophozia pellucida* var. *rubrigemma*, *L. sudetica*, *L. ventricosa* var. *longiflora*, *L. v.* var. *ventricosa*, *L. wenzelii*, *Moerckia blyttii*, *Nardia geoscyphus*, *N. japonica*, *N. scalaris*, *Pellia neesiana*, *Pleurocladula albescens*, *Scapania mucronata*, *Schistochilopsis incisa*, *Sphenolobus minutus* and *Tritomaria quinqueidentata*. K-75-8-04; K-92-11-04. – **SH**: 116-180 m alt. / 30, 31, 36 – On eroded fine-grained soil along slope to stream in snow-bed habitats; on the side of an old road. In pure mats, rarer with *Lophozia sudetica*, *Odontoschisma elongatum* and *Orthocaulis quadrilobus*. K-121-6-04; K-129-4-04.
- Eremonotus myriocarpus* (Carr.) Lindb. et Kaal. per., ant. – **PA**: (10-40)728-789 m alt. / 1, 12, 17, 18 – On eroded fine-grained soil and tufa in crevices of coastal cliffs; on fine-grained soil and volcanic ash in wet and shady cliff crevices and crevices in gravelly barrens in tundra belt. In pure mats, rarer with *Blepharostoma trichophyllum*, *Jungermannia pumila* and *Tritomaria quinqueidentata*. K-75-18-04; K-103-6-04.
- Gymnocolea inflata* (Huds.) Dumort. per. – **PA**: 50 m alt. / 3 – On fine-grained soil in shady wet crevices of cliff along river-bed. In pure mats. K-79-5-04.
- Gymnomitrium apiculatum* (Schiffn.) Mull.Frib. per., spor. – **PA**: 700-715 m alt. / 3, 17 – On spots of fine-grained soil in snow-bed habitats; on fine-grained soil in shady wet crevices in cliffs along a river-bed. In pure mats or with *Anthelia juratzkana*, *Cephalozia bicuspidata* and *Prasanthus suecicus*. K-101-5-04; K-79-4-04
- G. concinatum* (Lightf.) Corda per., spor. – **PA**: 700-925 m alt. / 3, 16, 18 – On fine-grained soil in shady cliff crevices along streams in tundra belt; on fine-grained soil and pyroclastic deposits in dry and slightly shaded crevices in gravelly barrens in dwarf-shrub-lichen tundras. In pure mats or with *Diplophyllum taxifolium* and *Gymnomitrium pacificum*. K-79-7-04; K-103-8-04.
- G. pacificum* Grolle per. – **PA**: 715-925 m alt. / 16, 17, 18 – On fine-grained soil and pyroclastic deposits in dry slightly shaded crevices in gravelly barrens in dwarf-shrub-lichen tundras; on stones of gravelly barrens in snow-bed habitats. In pure mats or with *Gymnomitrium concinatum*. K-99-12-04; K-101-7-04.
- Harpanthus flotovianus* (Nees) Nees arch. – **PA**: 60 m alt. / 5 – Among mosses in moss tussocks and hollows in sedge-peat-moss mires. In pure mats. K-83-13-04, K-83-14-04. – **SH**: 116 m alt. / 30 – On stones along a stream flowing down a slope with alder thickets. In pure mats. K-121-26-04.
- Hygrobiella laxifolia* (Hook.) Spruce per., ant. – **PA**: 40-310 m alt. / 6, 10, 19 – On stones in stream-bed of permanent and temporary streams. In pure mats or with *Aneura pinguis*, *Jungermannia pumila* and *Plectocolea subelliptica*. K-85-4-04; K-114-4a-04.
- Isopaches bicrenatus* (Schmid. ex Hoffm.) H. Buch – **PA**: 88 m alt. / 26 – On pyroclastic deposits of overgrown side of an old forest road. With *Cephaloziella arctogena*. K-113-1a-04.
- Jungermannia eucordifolia* Schljakov per., ant., spor. – **PA**: 50-310 m alt. / 1, 22, 24 – On stones at the base of seacoast cliffs permanently wetted with percolate water; on stones in a stream-bed; on wet pyroclastic deposits near a stream. In pure mats. K-78-1-04; K-111-6-04. – **SH**: 116 m alt. / 30 – On stones in stream-bed down a slope with alder thickets. With *Chiloscyphus rivularis*. K-121-17-04.
- J. exsertifolia* Steph. per., spor. – **PA**: 40-60 m alt. / 2, 6, 5, 8, 10 – On stones in stream-bed on meadows, in alder thickets; in the stream-bed of temporary streams by the seacoast and in tundra belt. In pure mats, once found with *Chiloscyphus fragilis*. K-77-2-04; K-92-13-04. – **SH**: 116 m alt. / 30 – On stones in a stream-bed down a slope with alder thickets. With *Chiloscyphus fragilis*. K-121-16-04. – It is a little known species indistinctly delimited from *Jungermannia eucordifolia*. It is known in Japan (Amakawa, 1960) and in the Russian Far East on the Chukotka (Afonina, Duda, 1993), Kamchatka (Bakalın, 2003) and the Commander Archipelago (Bakalın, 2005b). The finding partly fills the Japan-Kamchatka gap in the area of the species.
- J. polaris* Lindb. per., ant., spor., arch. – **PA**: 789 m alt. / 17 – On fine-grained soil in wet crevices in cliffs down the slope to a stream. With *Nardia geoscyphus* and *Preissia quadrata*. K-100-3-04.
- J. pumila* With. per., spor., ant., arch. – **PA**: 10-400 m alt. / 1, 6, 19 – On coastal cliffs wetted with percolate water; in shady cliff crevices along stream-bed shaded by willows, in a waterfall canyon; on wet

- pyroclastic deposits near a stream; on stones in a stream-bed; on wet volcanic deposits. In pure mats or with *Aneura pinguis*, *Conocephalum japonicum*, *Eremonotus myriocarpus*, *Hygrobiella laxifolia*, *Pellia neesiana*, *Plectocolea infusca* var. *ovalifolia*, *Plectocolea subelliptica*, *Scapania paludosa* and *Solenostoma koreanum*. K-75-15-04; K-115-5-04. – **SH:** 98 m alt. / 29 – On wet fine-grained soil along the side of an old road. With *Cephaloziella arctica*, *Cephaloziella divaricata*, *Conocephalum japonicum*, *Lophozia sudetica*, *Nardia geoscyphus*, *Plectocolea subelliptica*, *Scapania hyperborea*. K-120-2-04.
- Leiocolea heterocolpos* (Thed. ex Hartm.) H. Buch gemm. – **PA:** 40 m alt. / 12 – In shady and dry cliff crevices in a coastal cliff. With *Blepharostoma trichophyllum* and *Diplophyllum taxifolium*. K-94-8-04.
- Lophocolea heterophylla* (Schrad.) Dumort. per. – **PA:** 60 m alt. / 5 – On old horizontal part of alder trunk on the margin of a sedge-peat-moss mire in a flood-plain. In pure mats. K-83-15-04.
- Lophozia excisa* (Dicks.) Dumort. gemm., ant., arch. – **PA:** 88 m alt. / 26 – On pyroclastic deposits on a roadside in willow forest. With *Barbilophozia hatcheri* and *Cephaloziella divaricata*. K-113-4-04. [Noguchi, 1967].
- L. pellucida* R.M. Schust. var. *rubrigemma* (R.M. Schust.) Bakalin in Dulin et al. gemm., ant., arch. – **PA:** (40)925 m alt. / 12, 16 – In dry and slightly shaded crevices among stones in gravelly barrens among dwarf-shrub-lichen tundra; among stones in gravelly barrens sliding to a seacoast meadow. With *Barbilophozia hatcheri*, *Diplophyllum taxifolium*, *Nardia breidlerii* and *Orthocaulis kunzeanus*. K-99-15-04; K-94-21-04.
- L. savicziae* Schljakov gemm. – **PA:** 50 m alt. / 5 – On moss mats down a rocky slope with slightly flowing percolate water. With *Cephalozia lunulifolia*. K-82-9-04.
- L. silvicola* H. Buch – **SH:** 158 m alt. / 36 – Among mosses in tussocks in sedge-moss flood-plain mire. With *Cephalozia bicuspidata*, *Cephalozia leucantha*, *Mylium anomala*, *Orthocaulis kunzeanus* and *Sphenolobus minutus*. K-129-1-04. The plants in the specimens are represented by mod. *pachyderma*.
- L. sudetica* (Nees ex Huebener) Grolle var. *sudetica* gemm. – **PA:** (40-50)310-925 m alt. / 2, 4, 9, 11, 14?19, 22 – Among mosses on mossy meadows near the seacoast; on pyroclastic deposits and fine-grained soil among stones or on open places in alpine heathlands; in snow-bed habitats; in tundras of different types; in shady and sunny crevices of different degree of moistening on fine-grained soil or rocky substratum; on stones and fine-grained soil along riverbed and streams. In pure mats or with *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Marsupella sphacelata*, *M. sprucei*, *Moerckia blyttii*, *Pleurocladula albescens*, *Nardia japonica*, rarer with *Blepharostoma trichophyllum*, *Cryptocoleopsis imbricata*, *Diplophyllum albicans*, *D. taxifolium*, *Macrodiplrophyllum plicatum*, *Marsupella emarginata*, *Nardia breidlerii*, *N. scalaris*, *Schistochilopsis incisa*, *S. opacifolia*, *Sphenolobus minutus* and *Tritomaria quinquedentata*. K-101-6-04; K-99-10-04. – **SH:** 98-170 m alt. / 29, 30, 34?36 – On fine-grained soil along the side of an old road; on eroded fine-grained soil down the slope to a stream; on stones along streambed in meadows; on spots of fine-grained soil of cryogenic origin in dwarf-shrub tundra. In pure mats or with *Anthelia juratzkana*, *Nardia breidlerii*, rarer with *Cephalozia bicuspidata*, *Cephaloziella divaricata*, *Conocephalum japonicum*, *Diplophyllum taxifolium*, *Jungermannia pumila*, *Nardia geoscyphus*, *Nardia japonica*, *Pellia endiviifolia*, *Pleurocladula albescens*, *Scapania hyperborea* and *Scapania mucronata*. K-120-7-04; K-129-33-04.
- ? var. *anomala* (Schljakov) Schljakov per., ant. – **PA:** 400-789 m alt. / 3, 17 – On stones in stream-bed of a temporary spring in dwarf-shrub tundra; on fine-grained soil in wet crevices in a cliff wetted with percolate water down the slope to a river. With *Anthelia juratzkana* and *Nardia scalaris*. K-80-2-04; K-100-7-04.
- L. ventricosa* (Dicks.) Dumort. var. *ventricosa* gemm. – **PA:** 40-600 m alt. / 3, 5, 9, 10, 13, 19 – On bases of living trunks of the alder; on mosses down a slope among alder thickets; in stream-bed of a temporary stream in dwarf-shrub tundras, on cliffs of river canyon. In pure mats or with *Cephalozia bicuspidata*, *C. pleniceps*, *Diplophyllum taxifolium*, *Macrodiplrophyllum plicatum*, *Nardia japonica*, *N. scalaris*, *Ptilidium pulcherrimum*, *Sphenolobus minutus* and *Tritomaria quinquedentata*. K-95-2-04; K-90-18-04.
- ? var. *longiflora* (Nees) Macoun gemm., per. – **PA:** 360-728 m alt. / 14, 18 – On a thin layer of volcanic ash in the crevices of gravelly barrens and on moss tussocks in dwarf-shrub-lichen tundra; on eroded spots of fine-grained soil in snow-bed habitats. In pure mats or with *Cephalozia pachycaulis*, *Diplophyllum taxifolium*, *Moerckia blyttii*, *Pleurocladula albescens* and *Tritomaria quinquedentata*. K-103-15-04; K-96-4-04. – **SH:** 170 m alt. / 34 – On mosses in mesotrophic sedge-grass-dwarf-shrub-moss mire. With *Orthocaulis kunzeanus*. K-125-20-04.
- ? var. *guttulata* (Lindb. et Arnell) Bakalin – **SH:** 158 m alt. / 36 – On moss tussocks in sedge-moss flood-plain mire. With *Mylium anomala* and *Orthocaulis kunzeanus*. K-129-3-04.

- L. wenzelii* (Nees) Steph. – **PA:** 360 m alt. / 15 – On wet fine-grained soil along a stream in snow-bed habitats in dwarf-shrub(*Filodoce*)-grass-lichen tundra. With *Diplophyllum taxifolium* and *Nardia scalaris*. K-98-7-04 26.VII.2004. [Noguchi, 1967]
- Macrodiplophyllum plicatum* (Lindb.) H. Pers. – **PA:** (40)728 m alt. / 9, 18 – On volcanic ash in the crevices of gravelly barrens in lichen-dwarf-shrub tundras; on dry rocks along a stream. In pure mats or mixed with *Lophozia sudetica*, *L. ventricosa*, *Ptilidium ciliare*, *P. pulcherrimum*, *Sphenolobus minutus* and *Tritomaria quinquedentata*. K-103-5-04; K-90-5-04.
- Marchantia alpestris* (Nees) Burgeff – **PA:** 40 m alt. / 12 – On stones along a stream-bed on the slope of a coastal cliff. In pure mats. K-94-1-04.
- M. polymorpha* L. gemm. – **PA:** [Horikawa, 1934]. – **SH:** 50 m alt. / 33 – Among *Juncus* on water-logged meadow. In pure mats. K-124-11-04.
- Marsupella alpina* (Gottsche ex Limpr.) H. Bern per., ant., arch., spor. – **PA:** 360-925 m alt. / 15, 16, 18 – On fine-grained soil and pyroclastic deposits of eroded slopes in tundra belt; along streams in snow-bed habitats; on spots of fine-grained soil and ponds of cryogenic origin in dwarf-shrub-lichen tundra. In pure mats. K-97-9-04; K-99-4-04.
- M. boeckii* (Austin) Lindb. ex Kaal. arch. – **PA:** 400 m alt. / 4 – On pyroclastic deposits in snow-bed habitats. In pure mats. K-81-14-04
- M. brevissima* (Dumort.) Grolle per., ant., spor. – **PA:** 646 m alt. / 18 – On fine-grained soil along a nival stream. In pure mats. K-102-5-04.
- M. emarginata* (Ehrh.) Dumort. per., ant. – **PA:** (40)646-728 m alt. / 10, 18, 19
- On stones splashed with water along a stream-bed in alder thickets; along banks of a nival stream. In pure mats or with *Anthelia juratzkana*, *Lophozia sudetica*, *Moerckia blyttii*, *Nardia japonica*, *Pleurocladula albescens* and *Schistochilopsis incisa*. K-91-2-04; K-102-3-04.
- M. sphacelata* (Gieseke ex Lindenb.) Dumort. per., ant., arch., spor. – **PA:** (60) 300-400 m alt. / 3, 4, 6, 15 – On fine-grained soil in the stream-bed of a temporary spring in dwarf-shrub tundra; on pyroclastic deposits in alpine heathland; on stones splashed with water along a stream-bed in alder thickets; on wet fine-grained soil along a stream-bed in dwarf-shrub(*Filodoce*)-grass-lichen tundra. In pure mats, rarer (forms in shaded places) with *Cephalozia bicuspidata*, *Lophozia sudetica* and *Pleurocladula albescens*. K-80-4-04; K-98-3-04.
- M. sprucei* (Limpr.) H. Bern. per., spor., ant. – **PA:** 88(on volcanic ash) 400-925 m alt. / 4, 16, 18, 25 – On pyroclastic deposits in snow-bed habitats and fine-grained soil along nival streams; on fine-grained soil in dry and slightly shaded crevices among stones in gravelly barrens in dwarf-shrub-lichen tundra; on caked volcanic deposits. In pure mats, rarer with *Anthelia juratzkana* and *Lophozia sudetica*. K-81-13-04; K-112-1-04.
- Moerckia blyttii* (Moerck) Brockm. ant., arch. – **PA:** 360-728 m alt. / 14, 17, 18 – On eroded spots of fine-grained soil in snow-bed habitats in subnival dwarf-shrub-lichen-moss tundra; along nival streams; on pyroclastic deposits in the crevices of gravelly barrens in lichen-dwarf-shrub tundra. Commonly mixed, frequently with *Lophozia sudetica*, as well as with *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Diplophyllum taxifolium*, *Lophozia ventricosa* var. *longiflora*, *Marsupella emarginata*, *Nardia japonica*, *Orthocaulis hyperboreus*, *Pleurocladula albescens* and *Schistochilopsis incisa*. K-96-10-04; K-103-9-04.
- Mylia anomala* (Hook.) S. Gray gemm. – **SH:** 158 m alt. / 36 – Among mosses and stems of sedges; on tussocks in sedge-moss flood-plain mire. With *Cephalozia bicuspidata*, *C. leucantha*, *Lophozia silvicola*, *Lophozia ventricosa* var. *guttulata*, *Orthocaulis binsteadii*, *O. kunzeanus*, *Sphenolobus minutus*. K-129-3-04.
- Nardia breidleri* (Limpr.) Lindb. per., spor., ant. – **PA:** 360-925 m alt. / 4, 14, 16, 18, 19, 21 – On fine-grained soil along streams in alpine heathlands; on eroded fine-grained soil in snow-bed communities and along stream-bed of nival streams; on fine-grained soil in shaded and wet cliff crevices in rocky banks of rivers; in dry and slightly shaded crevices among stones on gravelly barrens in dwarf-shrub-lichen tundras. In pure mats or with *Lophozia pellucida* var. *rubrigemma*, *L. sudetica*, *Nardia geoscyphus*, *N. japonica*, *Pleurocladula albescens*. K-81-3-04; K-99-15-04. – **SH:** 116-170 m alt. / 30, 34, 36 – On eroded fine-grained soil down a slope in snow-bed habitats in flood-plain with dwarf-shrub-herb tundra; on the clayey side of an old road; on spots of fine-grained soil of cryogenic origin in dwarf-shrub tundra. With *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Lophozia sudetica*, *Nardia geoscyphus*, *Pleurocladula albescens*. K-121-30-04; K-125-26-04.
- Nardia compressa* (Hook.) S. Gray – **PA:** 360 m alt. / 15 – On wet fine-grained soil along a stream-bed in nival habitats in dwarf-shrub(*Filodoce*)-grass-lichen tundra. With *Schistochilopsis opacifolia*. K-98-6-04.
- N. geoscyphus* (De Not.) Lindb. per., ant., spor. – **PA:** 10-789 m alt. / 1, 12, 17, 19 – On fine-grained soil in shady crevices in a coastal cliff; on fine-grained

- soil in wet cliff crevices along rivers and rocky slopes of mountains; on eroded fine-grained soil along the banks of rivers and streams. In pure mats or with *Aneura pinguis*, *Anthelia juratzkana*, *Diplophyllum taxifolium*, *Jungermannia polaris*, *Nardia breidleri*, *Pellia neesiana*, *Preissia quadrata*, *Tritomaria quinquentata*. K-94-6-04; K-75-6-04. – **SH**: 50-180 m alt. / 29, 30, 31, 33, 34 – On wet fine-grained soil along the side of an old road and on eroded roadside; on wet cliffs composed of caked tufa along the seacoast; on eroded fine-grained soil along the slope to snow-bed place; on spots of fine-grained soil of cryogenic origin in dwarf-shrub tundra. With *Anthelia juratzkana*, *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Jungermannia pumila*, *Lophozia sudetica*, *Nardia breidleri*, *N. japonica*, *Pellia endiviifolia*, *Plectocolea infusca* var. *ovalifolia*, *P. obovata*, *Pleurocladula albescens*, *S. hyperborea*, *S. irrigua*, *S. mucronata* and *Schistochilopsis incisa*. K-120-11-04; K-125-26-04.
- N. japonica* Steph. per. – **PA**: 150-728 m alt. / 3, 4, 10, 11, 14, 15, 17?19 – On fine-grained soil along streams and submerged in the stream; on pyroclastic deposits of volcanic field; fine-grained soil spots of cryogenic origin in alpine heathlands, in snow-bed habitats. In pure mats or with *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Diplophyllum taxifolium*, *Lophozia sudetica*, *L. ventricosa* var. *ventricosa*, *Marsupella emarginata*, *Moerckia blyttii*, *Nardia breidleri*, *N. scalaris*, *Pellia neesiana*, *Plectocolea subelliptica*, *Pleurocladula albescens*, *Scapania paludicola*, *Schistochilopsis incisa* and *S. opacifolia*. K-101-2-04; K-98-8-04. – **SH**: 116 m alt. / 30 – On eroded fine-grained soil along the slope to a stream. With *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Lophozia sudetica*, *Nardia geoscyphus*, *Pellia endiviifolia* and *Pleurocladula albescens*. K-121-3-04.
- N. scalaris* S. Gray ant., arch. – **PA**: (10)300-925 m alt. / 1, 3, 14?17, 19 – On eroded fine-grained soil in cliff crevices along the seacoast; on eroded spots of fine-grained soil in snow-bed slope in subnival dwarf-shrub-moss-lichen tundra; on wet fine-grained soil along a stream-bed and slowly flowing rivers; in temporary streams. Commonly with *Pellia neesiana*, *Nardia japonica* and *Lophozia sudetica*, rarer with *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Diplophyllum albicans*, *D. taxifolium*, *Lophozia ventricosa* var. *ventricosa*, *L. wenzelii*, *Pleurocladula albescens* and *Schistochilopsis opacifolia*. K-75-10-04; K-99-14-04. – **SH**: 98-158 m alt. / 29, 36 – On wet fine-grained soil along the side of an old road; on peaty ground along the slope to a river. In pure mats. K-120-16-04; K-129-23-04.
- Odontoschisma elongatum* (Lindb.) A. W. Evans – **SH**: 158-170 m alt. / 34, 36 – On peat of overgrown hollows in sedge-moss flood-plain mire. With *Aneura pinguis*, *Cephalozia divaricata*, *Cladopodiella fluitans*, *Diplophyllum taxifolium*, *Orthocaulis quadrilobus*, *Pleurocladula albescens*, *Saccobasis polita*, *Scapania hyperborea*, *Scapania paludicola*, *Sphenolobus minutus*. K-125-9-04; K-129-15-04
- Orthocaulis binsteadii* (Kaal.) H. Buch – **SH**: 158 m alt. / 36 – Among mosses on tussocks in sedge-moss flood-plain mire. With *Mylia anomala*. K-129-7-04.
- O. floerkei* (F. Web. et Mohr) H. Buch – **PA**: 360-728 m alt. / 14, 18 – On eroded spots fine-grained soil in subnival dwarf-shrub-lichen-moss tundra. In pure mats. K-96-12-04; K-103-18-04.
- O. hyperboreus* (R.M. Schust.) Konstantinova – **PA**: 360 m alt. / 14 – On eroded spots fine-grained soil in subnival dwarf-shrub-lichen-moss tundra on the slope to the glacier. With *Cephalozia bicuspidata*, *Lophozia sudetica* and *Moerckia blyttii*. K-96-10-04
- O. kunzeanus* (Huebener) H. Buch – **PA**: 40 m alt. / 12 – Among wet stones in gravelly barrens sliding to a seacoast meadow. With *Lophozia pellucida* var. *rubrigemma*. K-94-21-04. – **SH**: 158-170 m alt. / 34, 36 – Among mosses and stems of sedges of tussocks in sedge-grass-dwarf-shrub-moss mesotrophic mires. With *Aneura pinguis*, *Cephalozia bicuspidata*, *C. leucantha*, *Lophozia silvicola*, *L. ventricosa* var. *longiflora*, *L. ventricosa* var. *guttulata*, *Mylia anomala*, *Saccobasis polita* and *Sphenolobus minutus*. K-125-16-04; K-129-3-04.
- O. quadrilobus* (Lindb.) H. Buch – **SH**: 158 m alt. / 36 – Among mosses in hollows in sedge-moss flood-plain mire. With *Diplophyllum taxifolium* and *Odontoschisma elongatum*. K-129-4-04.
- Pellia endiviifolia* (Dicks.) Dumort. per., spor. – **PA**: 50 m alt. / 2 – On wet fine-grained soil originated from eroded tufa cliffs near the stream. In pure mats. K-77-12-04. – **SH**: 116-170 m alt. / 30, 34 – On eroded fine-grained soil along the slope to a stream in dwarf-shrub-grass tundra. Among and on mosses. With *Lophozia sudetica*, *Nardia geoscyphus*, *N. japonica* and *Pleurocladula albescens*. K-121-29-04; K-125-28-04.
- P. neesiana* (Gottsche) Limpr. ant., arch., per., spor. – **PA**: 10-728 m alt. / 1, 5, 10?12, 14, 15, 17, 19 – On wet fine-grained soil in shady cliff crevices along the seacoast, canyon near rivers; among mosses on sedge-peat-moss mires at the sources of streams; on wet fine-grained soil in snow-bed habitats; on fine-grained soil and stones along streams and rivers in tundras, meadows and alder thickets. Commonly among and on leafy hepatic mats: *Anthelia julacea*,

- Calypogeia muelleriana*, *Cephalozia bicuspidata*, *C. pachycaulis*, *Cryptocoleopsis imbricata*, *Diplophyllum taxifolium*, *Jungermannia pumila*, *Lophozia sudetica*, *Nardia geoscyphus*, *N. japonica*, *N. scalaris*, *Pleurocladula albescens*, *Scapania irrigua*, *Schistochilopsis incisa*, *Tritomaria quinquentata*, as well as with thallose ones *Aneura pinguis*, *Conocephalum japonicum* and *Riccardia aeruginosa*. K-75-5-04; K-98-9-04. – **SH**: 98-170 m alt. / 29, 30, 34, 36 – On fine-grained soil along the wet side of an old road; on wet soil along a stream in dwarf-shrub-grass tundra; on spots of fine-grained soil of cryogenic origin in dwarf-shrub tundra; on peaty river bank. In pure mats or among or on leafy hepatics: *Calypogeia muelleriana*, *Cephalozia bicuspidata*, *Plectocolea obovata*, *P. subelliptica*, *Pleurocladula albescens*, *Scapania hyperborea*, *Schistochilopsis incisa*, *S. opacifolia*. K-120-9-04; K-129-24-04.
- Plectocolea infusca* Mitt. var. *ovalifolia* Amakawa per., ant. – **PA**: 43 m alt. / 28 – On overgrown volcanic deposits in a flood-plain. With *Conocephalum japonicum*, *Jungermannia pumila* and *Scapania paludosa*. K-115-5-04. – **SH**: 50 m alt. / 33 – In cliff crevices composed of caked metamorphic tufa. With *Nardia geoscyphus*. K-124-4b-04.
- P. obovata* (Nees) Lindb. per., ant., arch., spor. – **PA**: 10-310 m alt. / 1, 6, 10, 19, 24 – On eroded fine-grained soil on cliffs splashed with water near the seacoast; in cliff crevices of river canyons; on stones splashed with water along a stream in alder thickets; on stones in flood-plain; on wet volcanic deposits near a stream. In pure mats or with *Blepharostoma trichophyllum*, *Cephalozia bicuspidata* or among the thalli of *Preissia quadrata*. K-75-17-04; K-86-6-04. – **SH**: 98-158 m alt. / 29, 30, 36 – On wet fine-grained soil along the side of an old road; on stones along slowly flowing stream in dwarf-shrub-grass tundra; on peaty soil along a river-bed. In pure mats or with *Cephalozia bicuspidata*, *Nardia geoscyphus*, *Pellia neesiana*, *Scapania irrigua*, *S. paludosa*. K-120-11-04; K-129-24-04.
- P. subelliptica* (Lindb. ex Kaal.) A.W. Evans per., ant., arch. – **PA**: 10-310 m alt. / 1, 6, 10, 19, 22, 27 – On wet eroded ground in cliff crevices along the seacoast; on stones and cliff along rivers or streams in open places or in alder thickets; on stones in the stream-bed of a small stream. In pure mats or with *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Chiloscyphus fragilis*, *Hygrobiella laxifolia*, *Jungermannia pumila*, *Nardia japonica* and *Scapania undulata*. K-75-13-04; K-114-4-04. – **SH**: 80-170 m alt. / 29, 34, 33, 36 – On wet fine-grained soil and clay ground along the side of an old road; on peaty banks of lakes and rivers. In pure mats or with *Blepharostoma trichophyllum*, *Calypogeia muelleriana*, *Cephalozia bicuspidata*, *Jungermannia pumila*, *Pellia neesiana*, *Scapania irrigua*, *S. mucronata* and *Schistochilopsis opacifolia*. K-120-2-04; K-129-20-04.
- Pleurocladula albescens* (Hook.) Grolle – **PA**: 360-789 m alt. / 4, 14, 15, 17, 18 – On wet fine-grained soil along a small stream originated from glacier in dwarf-shrubs (*Fillodoce*)-grass-lichen tundra; on eroded spots of fine-grained soil in snow-bed habitats; in margin of sphagnum mat on a rocky slope wetted with percolate water; on thin layer of wet volcanic ash in the crevices of gravelly barrens in lichen-dwarf-shrub tundra; on fine-grained soil along streams in alpine heathlands and in snow-bed communities. In pure mats, but more common with *Anthelia juratzkana*, *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Diplophyllum taxifolium*, *Lophozia sudetica*, *L. ventricosa* var. *longiflora*, *Marsupella emarginata*, *M. sphacelata*, *Moerckia blyttii*, *Nardia breidlerii*, *N. japonica*, *N. scalaris*, *Pellia neesiana*, *Schistochilopsis incisa*, *Sphenobolus minutus* and *Tritomaria quinquentata*. K-100-14-04; K-98-9-04. – **SH**: 116-170 m alt. / 30, 34, 36 – On eroded wet fine-grained soil along the slope to a stream in dwarf-shrub-grass tundra; on spots of fine-grained soil of cryogenic origin in dwarf-shrub tundra; on stones along streams and on the peaty bank of a river. In pure mats or with *Aneura pinguis*, *Cephalozia bicuspidata*, *Lophozia sudetica*, *Nardia breidlerii*, *N. geoscyphus*, *N. japonica*, *Odontoschisma elongatum*, *Pellia endiviifolia*, *P. neesiana*, *Schistochilopsis incisa*. K-121-33-04; K-129-25-04.
- Prasanthus suecicus* (Gottsche) Lindb. – **PA**: 600 m alt. / 3 – On fine-grained soil in shady wet crevices of cliffs along a stream in alpine heathland. With *Cephalozia bicuspidata* and *Gymnomitrium apiculatum*. K-79-4-04.
- Preissia quadrata* (Scop.) Nees spor. – **PA**: 60-789 m alt. / 6, 17, 19 – On fine-grained soil and in shady cliff crevices in canyons and stream-beds. Among and on leafy hepatics: *Blepharostoma trichophyllum*, *Jungermannia polaris*, *Sauteria alpina*, *Nardia geoscyphus* and *Plectocolea obovata*. K-86-6-04; K-104-5-04.
- Ptilidium californicum* (Austin) Pears. – **PA**: 60 m alt. / 5 – On horizontal part of the living trunk of an alder along the margin of sedge-peat-moss mire. In pure mats. K-83-18-04.
- P. ciliare* (L.) Hampe – **PA**: 40 m alt. / 9 – On flat well-exposed and dry rock. With *Macrodictyophyllum plicatum* and *Sphenobolus minutus*. K-90-20-04. – **SH**: 103 m alt. / 32 – Among lichens and *Empetrum* in

- dwarf-shrub-lichen tundra along the terraced slope to a river. In pure mats K-123-3-04.
- P. pulcherrimum* (G. Web.) Vainio – **PA:** 40-100 m alt. / 9, 13 – On the base of trunks of the alder and the Japanese stone pine in subalpine dwarf forests. Once with *Lophozia ventricosa*. K-95-1-04; K-90-18-04.
- Radula complanata* (L.) Dumort. – **PA:** 60 m alt. / 6 – In shady cliff crevices of river canyon. In pure mats and on moss mats. K-86-5-04.
- Riccardia aeruginosa* Furuki – **PA:** 310 m alt. / 19 – On fine-grained soil in the crevices of gravelly barrens along river canyon. With *Calypogeia muelleriana*, *Cephalozia bicuspidata*, *Pellia neesiana*. K-106-3-04. – **SH:** 170 m alt. / 34 – Among mosses and hepatics in sedge-grass-dwarf-shrub-moss mesotrophic mire near lake. With *Scapania irrigua*, *Scapania paludicola*. K-125-22-04. – It a lately described species (Furuki, 1991), its distribution has yet been poorly studied. It used to be considered (l.c.) as an endemic of Japan, but in the recent years we found it on Mednyj Island (the Commander Archipelago, Bakalin, unpublished data) and on the North Kuriles. In its distribution it is associated with rocky substrata in the mountain regions or grows in paludal communities of the lower altitude levels. According to the description by T. Furuki (1991) the landscape characteristics of this species in Japan is similar to that in our country, but there it is found on the southern islands where the zonal vegetation is represented with broad-leaved and dark-coniferous forests in the collection locations, but not with tundras and Japanese stone pine crooked forests like in Russia.
- Saccobasis polita* (Nees) H. Buch – **SH:** 158-170 m alt. / 34, 36 – Among mosses in sedge-grass-dwarf-shrub-moss mesotrophic mire near lake; on peat in overgrown hollows in sedge-moss flood-plain mire. With *Aneura pinguis*, *Odontoschisma elongatum*, *Orthocaulis kunzeanus*. K-125-18-04.
- Sauteria alpina* (Scop.) Nees – **PA:** 400 m alt. / 19 – In shady and wet crevices of cliffs along a stream. In pure mats or with *Preissia quadrata*. K-104-2-04.
- Scapania hyperborea* Joerg. per., gemm. – **SH:** 98-180 m alt. / 29, 31, 34 – On wet fine-grained soil along roadside. With *Cephalozia bicuspidata*, *Cephalozia divaricata*, *Conocephalum japonicum*, *Jungermannia pumila*, *Lophozia sudetica*, *Nardia geoscyphus*, *Odontoschisma elongatum* and *Pellia neesiana*. K-120-1-04; K-122-6-04.
- S. irrigua* (Nees) Nees ant. – **PA:** 10-50 m alt. / 1, 5, 10 – On moss mats in coastal cliff crevices; among mosses in moss-grass community; on a rocky slope wetted with percolate water; on fine-grained soil down a slope splashed with water in full shade of alder thickets. In pure mats or with *Calypogeia muelleriana*, *Cephalozia pachycaulis*, *Pellia neesiana*. K-75-7-04; K-91-4-04. – **SH:** 98-170 m alt. / 29, 34 – On wet fine-grained soil along the side of an old road. With *Cephalozia bicuspidata*, *Nardia geoscyphus*, *Plectocolea obovata*, *P. subelliptica*, *Riccardia aeruginosa*, *Scapania paludicola*. K-120-10-04; K-125-22-04.
- S. lingulata* H. Buch gemm., per. – **SH:** 180 m alt. / 31 – On the eroded side of an old road. In pure mats. K-122-1-04.
- S. mucronata* H. Buch – **PA:** 40-60 m alt. / 2, 8, 9 – In dry and shady cliff crevices of a waterfall and river canyons; on decaying wood near entrance into an old tunnel. In pure mats or mixer with *Blepharostoma trichophyllum* and *Diplophyllum taxifolium*. K-77-6-04; K-90-2-04. – **SH:** 80-180 m alt. / 31, 33, 36 – On the wet clayey side of an old road. In pure mats or with *Lophozia sudetica*, *Nardia geoscyphus*, *Plectocolea subelliptica*, *Schistochilopsis incisa*. K-127-2-04; K-122-9-04.
- S. paludicola* Loeske et Mull. Frib. ant. – **PA:** 50-200 m alt. / 2, 19 – Among wet mosses on mossy meadow patches between thickets of old alders; on stones covered by fine-grained soil along a slowly flowing tributary of a river. In pure mats, once with *Nardia japonica* mod. *laxifolia-viridis*. K-77-4-04; K-105-1-04. – **SH:** 158-170 m alt. / 34, 36 – On the peaty bank of a lake; among mosses of overgrown hollows in sedge-moss flood-plain and flood-lake mires. In pure mats or with *Odontoschisma elongatum*, *Riccardia aeruginosa*, *Scapania irrigua* and *Sphenobolus minutus*. K-125-42-04; K-129-13-04.
- S. paludosa* (Mull. Frib.) Mull. Frib. – **PA:** 43-400 m alt. / 2, 15, 19, 28 – On very moist coastal cliffs wetted with percolate water; among mosses in moss tussocks and hollows in sedge-moss mire in the flood-plain of a stream; on wet slopes to streams; on wet overgrown pyroclastic deposits; in anthropogenic habitats: on the wet walls of blocks at entrance into an old tunnel. In pure mats or (on pyroclastic deposits) with *Conocephalum japonicum*, *Jungermannia pumila* and *Plectocolea infusca* var. *ovalifolia*. Besides the typical modifications, mod. *violacea* and mod. *viridis* were found as well. K-77-9-04; K-115-5-04. – **SH:** 116-158 m alt. / 30, 36 – On wet soil along a stream in a flood-plain covered with dwarf-shrub-grass tundra; on eroded fine-grained soil on the slope to a stream. With *Plectocolea obovata*. K-121-11-04; K-129-26-04.
- S. subalpina* (Nees ex Lindenb.) Dumort. gemm. – **PA:** 43-70 m alt. / 25, 27, 28 – On stones in a stream-bed;

among mosses and stems of sedges in sedge-peat-moss tundra in stream flood-plain; on fine-grained soil and pyroclastic deposits of eroded slope in a stream canyon; on overgrown wet pyroclastic deposits field. In pure mats. K-77-1-04; K-115-8-04.

S. undulata (L.) Dumort. ant., gemm. – **PA:** 60 450 m alt. / 6, 20 – On stones along a stream in full shade in alder thickets with *Fillipendula camtschatica*. In pure mats or with *Chiloscyphus fragilis* and *Plectocolea subelliptica*. K-84-1-04; K-107-2-04.

Schistochilopsis incisa (Schrud.) Konstantinova – **PA:** 646-728 m alt. / 17?19 – On eroded wet fine-grained soil along small streams in tundra belt and in snow-bed habitats; on spots of fine-grained soil in snow-bed habitats. In pure mats or with *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Diplophyllum taxifolium*, *Lophozia sudetica*, *Marsupella emarginata*, *Moerckia blyttii*, *Nardia japonica*, *Pellia neesiana*, *Pleurocladula albescens*. K-105-8-04; K-102-3-04. – **SH:** 116-180 m alt. / 30, 31 – On stones along a stream-bed in stream valley covered with dwarf-shrub-grass tundra; on wet sliding roadside. With *Nardia geoscyphus*, *Pellia neesiana*, *Pleurocladula albescens*, *Scapania mucronata*. K-121-20-04; K-122-9-04.

S. opacifolia (Culm. ex Meyl.) Konstantinova per., spor. – **PA:** 200-715 m alt. / 3, 14, 15, 17, 19 – In the stream-bed of a temporary stream in dwarf-shrub tundra; on eroded spots of fine-grained soil in sub-nival dwarf-shrub-lichen-moss tundra, on the slope to the glacier; on sliding fine-grained soil along slowly flowing tributary of a river in alder thickets; streams in dwarf-shrub(*Fillodoce*)-grass-lichen tundra. In pure mats or with *Lophozia sudetica*, *Nardia compressa*, *Nardia japonica* and *Nardia scalaris*. K-80-6-04; K-96-6-04. Besides the shoots with typical coloration, the shoots with black pigmentation were found. – **SH:** 158 m alt. / 36 – On the peaty wet slope to a river. With *Calypogeia muelleriana*, *Pellia neesiana*, *Plectocolea subelliptica*. K-129-20-04.

Solenostoma koreanum Steph. per., ant. – **PA:** 43-88 m alt. / 24, 27, 28 – On wet deposits down the slopes to a stream; on wet pyroclastic deposits. In pure mats, considerably rarer with *Aneura pinguis* and *Jungermannia pumila*. K-111-2-04; K-115-7-04. – **SH:** 80 m alt. / 33 – On clayey roadside. In pure mats. K-127-3-04. – It is a little known species with poorly studied distribution and taxonomic connections (due to its being close to *Solenostoma fusiforme* (Steph.) R.M. Schust.). According to the literary data it is distributed on exposed rocks in the mountain regions of Korea and Japan at altitudes mostly exceeding 600 m a.s.l. If *S. koreanum* is to be considered as synonym of *S. fusiforme*, the species is also known on

Kamchatka (Bakalin, 2003). The present finding makes the area and ecology of the species significantly clearer. The species was found on volcanic pyroclastic deposits and on a road side in the lower altitude zones. However, the vegetation in the areas of collection was represented with inversive tundras.

Sphenolobus minutus (Schreb.) Berggr. – **PA:** 40-715 m alt. / 9, 17 – In shady dry cliff crevices along a stream-bed; on sphagnum tussock in a snow-bed habitat. With *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Diplophyllum taxifolium*, *Lophozia sudetica*, *Lophozia ventricosa*, *Macrodiplrophyllum plicatum*, *Pleurocladula albescens*, *Ptilidium pulcherrimum*. K-101-9-04; K-90-5-04. – **SH:** 158 m alt. / 36 – On mosses in tussocks in sedge-moss flood-plain mire. With *Cephalozia bicuspidata*, *Cephalozia leucantha*, *Lophozia silvicola*, *Mylia anomala*, *Odontoschisma elongatum*, *Orthocaulis kunzeanus* and *Scapania paludicola*. K-129-2-04.

Tetralophozia setiformis (Ehrh.) Schljakov – **PA:** 728 m alt. / 18 – On pyroclastic deposits in the crevices of gravelly barrens in lichen-dwarf-shrub tundra. With *Diplophyllum albicans*. K-103-7-04.

Tritomaria quinquedentata (Huds.) H. Buch – **PA:** (10-60)360-789 m alt. / 1, 5, 9, 11, 12, 14, 15, 17 – On sliding wet fine-grained soil in cliffs along the sea-coast; in dry and wet cliff crevices in tundra belt along river canyons; on soil among dwarf shrubs in dwarf shrub tundras; on spots of sliding fine-grained soil in snow-bed dwarf-shrub-moss-lichen communities; along a stream-bed of glacier streams. In pure mats or, more frequent, with *Barbilophozia lycopodioides*, *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Cephalozia pachycaulis*, *Cephalozia pleniceps*, *Diplophyllum taxifolium*, *Eremonotus myriocarpus*, *Lophozia sudetica*, *L. ventricosa* var. *longiflora* and var. *ventricosa*, *Macrodiplrophyllum plicatum*, *Nardia geoscyphus*, *Pellia neesiana* and *Pleurocladula albescens*. K-100-10-04; K-75-9-04.

MUSCI

Amblystegium serpens (Hedw.) Bruch & Schimp. in Bruch et al. – **PA:** 40 m alt. / 23 – On the trunks of the willow at the height of 1.5 m, in a flood-plain willow forest. K-110-4 -04. [Minami et al., 2001] – **SH:** 5 m alt. / 33 – On tufa rocks. K- 128-1-04.

A. jurazkanum Schimp. – **PA:** This species is published by Y. Minami et al. (2001).

A. varium (Hedw.) Mitt. – **PA:** This species is published by Minami et al. (2001).

Amphidium lapponicum (Hedw.) Schimp. – **SH:** 5 m alt. / 33 – On moist coastal cliffs. K-128-5 04. [Cherdantseva, 1986]

- Andreaea nivalis* Hook. – **PA:** 450-800 m alt. / 4, 20 – On fine-grained substratum along the bank of a stream, in alpine heathland, formed by stones and volcanic ashes; on rocks sprinkled by waterfall splashes. K-81-6-04; K-107-1-04. [Minami et al., 2001]
- A. rupestris* Hedw. – **PA:** (10)789 m alt. / 3, 8, 17 – On stones and rocky cliffs along the banks of waterways and on a ground water leakage. K-79-8-04; K-100-9-04.
- Anomobryum filiforme* (Griff.) A. Jaeger var. *concinatum* (Spr.) Loeske – **SH:** 50 m alt. / 33 – On the quartz of an old monument. K-124-7-04.
- Arctoa fulvella* (Dicks.) Bruch & Schimp. in Bruch et al. – **PA:** 800 m alt. / 4 – On fine-grained substratum along the bank of a stream and on nival glades in alpine heathland, formed by stones and volcanic ashes. K-81-1-04. [Minami et al., 2001]
- Aulacomnium palustre* (Hedw.) Schwagr. – **PA:** 50 m alt. / 5 – In a moss and herb community on a weak ground water leakage. With *Hylocomium splendens*. K-82-6-04. [Noguchi, 1967; Minami et al., 2001] – **SH:** 116-158 m alt. / 30, 36 – On stones along the bank of a stream; on tussocks in a sedge and moss flood-plain swamp. With *Hylocomiastrum pyrenaicum*, *Racomitrium canescens*, *Sanionia uncinata*, *Tomentypnum nitens*. K-121-27-04; K-129-8-04. [Cherdantseva, 1986]
- A. turgidum* (Wahlenb.) Schwagr. – **PA:** 50 m alt. / 5 – In a moss and herb community on a weak ground water leakage. K-82-1-04.
- Bartramia ithyphylla* Brid. – **PA:** 728-926 m alt. / 16, 18 – In dry and weakly shaded crevices, on a thin layer of fine-grained soil in rocky tundras with dwarf shrubs and lichens. K-99-7-04; K-103-4-04.
- Brachydontium olympicum* (E.G. Britton) McIntosh & Spense (*Grimmia olympica* E.G. Britton.) – **PA:** This species is published by Minami et al. (2001).
- Brachythecium albicans* (Hedw.) Bruch & Schimp. in Bruch et al. – **SH:** 50-98 m alt. / 29, 33 – On fine-grained substratum on the side of an old road; on decaying logs along the left slope of the Baikovsky Stream. With *Pogonatum urnigerum*. K-120-6-04; K-124-14-04.
- B. populeum* (Hedw.) Bruch & Schimp. in Bruch et al. – **PA:** This species is published by Minami et al. (2001).
- B. plumosum* (Hedw.) Bruch & Schimp. in Bruch et al. – **SH:** 50 m alt. / 33 – On the vertical walls of a rock, formed by caked metamorphized tufa. K-124-2-04.
- B. reflexum* (Starke) Bruch & Schimp. in Bruch et al. – **PA:** 40-600 m alt. / 3, 5, 23 – On the trunks of the alder and the willow in an alder thicket and flood-land willow forest; among the brush of *Fillodoce* in dwarf shrub tundra. With *Sanionia uncinata*. K-83-17-05; K-80-7-04. [Cherdantseva, 1986] – **SH:** 116 m alt. / 30 – On sliding fine-grained substratum down the slope on the place of melted snowfield. K-121-38-04.
- B. rivulare* Bruch & Schimp. in Bruch et al. – **PA:** 50-100 m alt. / 1, 6, 7 – On moist stones splashed with water, at the base of a coastal cliff; on stones on the banks and in the stream-beds. K-78-04; K-88-1-04.
- B. starkei* (Brid.) Bruch & Schimp. in Bruch et al. – **PA:** 88 m alt. / 25 – On volcanic pyroclastic deposits of a pyroclastic deposits field being overgrown with the alder. K-112-2-04.
- B. uncinifolium* Broth. & Paris (*Cratoneurella uncinifolia* (Broth & Paris) H. Rob.) – **PA:** 715-728 m alt. / 15, 17, 18 – In a shady crevice of a rocky slide slope layered with fine-grained and in the niche under a stone of rocky placer in subnival and nival habitats; among the lichen cover in lichen and dwarf shrub tundra. K-97-8-04; K-103-22. [Minami et al., 2001]
- Bryhnia novae-angliae* (Sull. & Lesq.) Grout – **PA:** 50 m alt. / 2, 24 – On soil in alder thicket and in a willow forest with tall-herbs. 28.VII.1997; 7.VIII.1997. Coll. V.P. Verkholat. [Cherdantseva, 1986] – **SH:** This species is published by Cherdantseva (1986).
- Bryoerythrophyllum recurvirostrum* (Hedw.) P.C. Chen – **PA:** 10 m alt. / 1 – In crevices among boulders lying at the base of a cliff. With *Pohlia drummondii*. K-75-3-04. – **SH:** This species is published by Cherdantseva (1986).
- Bryoxiphium norvegicum* (Brid.) Mitt. ssp. *japonicum* (Berggr.) A.Love & D. Love (*B. savatieri* (Husn.) Mitt.) – **PA:** This species published by Cherdantseva (1986). – **SH:** This species is published by Cherdantseva (1986).
- Bryum amblyodon* Mull. Hal. (*B. inclinatum* (Brid.) Bland.) – **SH:** 5 m alt. / 33 [Cherdantseva, 1986] – On moist coastal cliffs formed by tufas. K-128-4-04.
- B. argenteum* Hedw. – **PA:** 150 m alt. / 6 – In crevices of a rocky ledge shaded by riverside willow forest. K-86-2-04.
- B. creberrimum* Taylor – **PA:** This species is published by Cherdantseva (1986).
- B. mayrii* Broth. – **PA:** 50 m alt. / 24 – On soil in an alder thicket. 6.VIII.1997. Coll. Verkholat, det. R.N. Schljakov.
- B. turbinatum* (Hedw.) Turner (= *B. schleicheri* Schwagr.) – **PA:** 400 m alt. / 19 – On stones covered

- with fine-grained substratum, along the bank of a cutoff meander. K-105-3-04. [Minami et al., 2001]
- Calliergon cordifolium* (Hedw.) Kindb. – **PA**: 30 m alt. / 1 – On the bank of a stream by the sea. 11.VIII.1997. Coll. Verkholat. [Cherdantseva, 1986; Minami et al., 2001] – **SH**: This species is published by Cherdantseva (1986).
- C. richardsonii* (Mitt.) Kindb. – **PA**: This species is published by Cherdantseva (1986), Minami et al. (2001). – **SH**: This species is published by Cherdantseva (1986).
- C. stramineum* (Brid.) Kindb. – **PA**: 60 m alt. / 5 – On moss tussocks and small cavities, on sedge-sphagnum bog in flood-lands of the upper reaches of a stream. K-83-8-04. – **SH**: 158 m alt. / 36 – In overgrown hollows in sedge and moss flood-land bog. K-129-12-04.
- Calliergonella lindbergii* (Mitt.) Hedenäs – **PA**: (10)100-500 m alt. / 6, 8, 14, 19 – On stones on the banks of streams and occasionally drying waterways. K- 84- 8-04; K-105-11 04. – **SH**: 170 m alt. / 34 – On mesotrophic swamp with sedges, herbs, dwarf shrubs and mosses, among lakes. With *Aulacomnium palustre* and *Sphagnum warnstorffii*. K-125-3-04.
- Campylium protensum* (Brid.) Kindb. – **SH**: 170 m alt. / 34 – On mesotrophic swamp with sedges, herbs, dwarf shrubs and mosses, among lakes. With *Paludella squarrosa*, *Limprihtia revolvens*. K- 125-23-04; K-125-24-04 .
- Ceratodon purpureus* Hedw. – **PA**: 15-150 m alt. / 23, 24 – On soil among the thickets of *Alnus fruticosa*; on the plates of the former aerodrome. 7.VIII.1997; 1.VIII.2000. Coll. Verkholat. [Minami et al., 2001] – **SH**: 50-180 m alt. / 31, 33 – On the crumbled wall of an old road gauge; on a decaying log; on clayey moist soil along the side of a road. K-122-2-04; K-127-1-04. [Cherdantseva, 1986]
- Cirriphyllum piliferum* (Hedw.) Grout – **PA**: 10 m alt. / 28 – On soil in alder thickets. 21.VIII.2001. Coll. Verkholat.
- Climacium dendroides* (Hedw.) F. Weber et D. Mohr – **PA**: 10 m alt. / 8 – In a herb and moss meadow-like community on the slope to the river bed. With *D. majus* var. *orthophyllum*, *Rhytidiadelphus squarrosus*. K- 89-9- 04. – **SH**: 60 m alt. / 23 – Vicinities of Chukurachki Volcano, willow forest in the valley of the Taina River, on soil. 3.VIII. 2000. Coll. Verkholat.
- Cratoneuron filicinum* (Hedw.) Spruce – **PA**: (10)310 m alt. / 1, 19 – On fine-grained substratum of cliffs sprinkled by a brook; on stones in the bed of a small stream. K-75-20-04; K-106-12 04. – **SH**: 5 m alt. / 33 – On moist coastal cliffs formed by tufas, to the south of the mouth of the Baikovsky Stream. K- 128-2-04.
- Cyrtomnium hymenophyllum* (Bruch & Schimp. in Bruch et al.) Holmen – **PA**: This species is published by Minami et al. (2001).
- Dichodontium pellucidum* (Hedw.) Schimp. – **PA**: 50-400 m alt. / 1, 19 – On moist stones of coastal cliffs splashed with water; on a stone in the splash zone of a waterfall. K-78-2-04; K-104-9-04. – **SH**: 50-98 m alt. / 29, 33 – On fine-grained substratum along the side of a road; on a water-logged small meadow, among rushes, K-120-4-04; K-124-10-04.
- Dicranella palustris* (Dicks.) Crundw. ex E. Warb. – **PA**: 43-150 m alt. / 6, 24, 28 – On moist soil and volcanic pyroclastic deposits down the slope near a stream and a water-logged pyroclastic deposits field. In pure mats or with *Philonotis fontana*. K-85-3-04; K-111-7-04; K-115-2-04. – **SH**: 116 m alt. / 30 – On fine-grained substratum along the side of a road. K-121-36-04.
- Dicranella subulata* (Hedw.) Schimp. – **PA**: 40 m alt. / 1 – On stones with soil, 4.VIII.1978. Coll. A.I. Zavorotny. – **SH**: 180 m alt. / 31 – On the crumbled wall of an old road gauge. K-122-3-04.
- Dicranoweisia crispula* (Hedw.) Milde – **PA**: (10)789 m alt. / 8, 17 – On stones in the bed of a dry stream; on an exposed and dry cliff ledges wetted by ground waters. K-89-14-04; K-100-2 -04. [Cherdantseva, 1986; Minami et al., 2001]
- Dicranum flexicaule* Brid. – **PA**: 50 m alt. / 5 – In a moss and herb community on a weak ground water leakage. K-82-4-04. – **SH**: 103 m alt. / 32 – On tussocks among lichens and crowberry in dwarf shrub and lichen tundra. K-123-7-04
- D. fragilifolium* Lindb. – **PA**: 60 m alt. / 5 – On the trunk of the alder on the edge of a sedge and *Sphagnum* bog in flood-lands of the upper reaches of a stream. K- 83-16-04. The specimens assigned to *D. viride* (Sull. & Lesq.) Lindb. (Minami et al., 2001) belong in this species.
- D. fuscescens* Turner – **PA**: This species is published by Minami et al. (2001).
- D. hamulosum* Mitt. – **PA**: This species is published by Minami et al. (2001).
- D. laevidens* R.S. Williams – **SH**: The specimens assigned to *D. angustum* Lindb. (Cherdantseva, 1986) belong in this species.
- Dicranum leioneuron* Kindb. – **SH**: 170 m alt. / 34 – On mesotrophic swamp with sedges, herbs, dwarf shrubs and mosses among lakes. With *Paludella squarrosa*. K-125-34-04.

- D. majus* Turner var. *majus* – **PA**: This species is published by Abramova (1960), Noguchi, (1967), Cherdantseva (1986), Minami et al. (2001). – **SH**: This species is published by Cherdantseva (1986).
- D. majus*. var. *orthophyllum* A. Braun ex Milde – **PA**: (10)100-789 m alt. / 6, 8, 14, 17 – On the sandy bank of a stream in a thick shade among the thickets of the alder with the meadowsweet; among dwarf shrubs (mostly *Fillodoce*) in subnival tundra with dwarf shrubs, lichens and mosses; in herb-moss meadow-like and moss-lichen communities on the slope to a stream bed and at the base of a rocky ledge. With *Sanionia uncinata*, *Rhytidadelphus squarrosus*, *Climacium dendroides*. K- 84-11-04; K-100-12-04. – **SH**: 170 m alt. / 34 – On mesotrophic swamp with sedges, herbs, dwarf shrubs and mosses among lakes. K-125-1-04; K-125-5 -04.
- D. nipponense* Besch. – **PA**: 88 m alt. / 18 – On volcanic pyroclastic deposits shaded by alder thickets. K-112-4-04.
- D. scoparium* Hedw. – **PA**: This species is published by Cherdantseva (1986) and Minami et al. (2001).
- D. spadiceum* J.E. Zetterst. – **PA**: 728 m alt. / 18 – Among the lichen cover in lichen and dwarf shrub tundra. K-103-24-04; K-103-25-04.
- D. undulatum* Schrad. ex Brid. (= *D. bergeri* Blandow) – **SH**: 158 m alt. / 36 – On tussocks in sedge and moss flood-land bog. K-129-5-04.
- Distichium capillaceum* (Hedw.) Bruch & Schimp. in Bruch et al. – **PA**: 10 m alt. / 8, 12 – In rather dry and shady rock crevices in the walls of a canyon; on weakly moistened rock. K-89-1-04; K-94-5-04. [Cherdantseva, 1986] – **SH**: This species is published by Cherdantseva (1986).
- Ditrichum heteromallum* (Hedw.) Britt. – **PA**: This species is published by Minami et al. (2001).
- Drepanocladus aduncus* (Hedw.) Warnst. – **SH**: 50 m alt. / 33 – On a water-logged small meadow, among rushes; on an old overgrown road. K- 124-8-04.
- Funaria hygrometrica* Hedw. – **PA**: 10 m alt. / 23 – On soil. 6.VIII.1997. Coll. Verkholat. [Cherdantseva, 1986; Minami et al., 2001] – **SH**: 5 m alt. / 33 – On moist coastal cliffs formed by tufas. K-128-3-04.
- Helodium blandowii* (F. Weber & D. Mohr) Warnst. – **PA**: 30 m alt. / 25 – On the water-logged banks of a shallow lake. 2.VIII.2000. Coll. Verkholat.
- Herzogiella adscendens* (Lindb.) Z. Iwats. & W.B. Schofield – **PA**: 10-40 m alt. / 8, 9, 12 – In rather dry and shaded crevices in the walls of a canyon and rocky expositions; on the exposed side of the vertical wall of a coastal cliff. K-89-4-04; K- 94-17-04.
- H. turfacea* (Lindb.) Z. Iwats. – **PA**: This species is published by Minami et al. (2001).
- Hygrohypnum bestii* (Renauld & Bryhn) Holz. – **PA**: 88 m alt. / 24 – On a stone in the bed of a waterfall. K-111-9-04. – **SH**: 116-159 m alt. / 30, 36 – On stones in the a stream- bed and on the bottom of a river. K-121-18-04; K-129-18-04.
- H. duriusculum* (De Not.) D.W. Jamieson – **PA**: 400 m alt. / 19 – On submerged stones in the bed of a waterfall. K-104-13-04.
- H. ochraceum* (Turner ex Wilson) Loeske – **PA**: 88 m alt. / 24 – On a stone in the bed of a waterfall. K-111-8-04. [Cherdantseva, 1986]
- H. smithii* (Sw. in Lilj.) Broth. – **PA**: 10 m alt. / 1 – On vertical cliffs wetted by a brook. K-75-21-04.
- Hylocomiastrum pyrenaicum* (Spruce) M. Fleisch. ex Broth. – **PA**: 360-650 m alt. / 11, 14 – On soil among dwarf shrubs in dwarf shrub and subnival dwarf-shrub-lichen-moss tundras. K-93-2-04; K- 96-15-04. – **SH**: 158-170 m alt. / 34, 36 – On tussocks in sedge-herb-dwarf-shrub-moss mesotrophic and sedge-moss flood-land swamps. With *Aulacomnium palustre*, *Calliergonella lindbergii*, *Racomitrium canescens*, *Sanionia uncinata*, *Sphagnum warnstorffii*, *Tomentypnum nitens*. K-125-33-04; K- 129-8-04.
- Hylocomium splendens* (Hedw.) Bruch & Schimp. in Bruch et al. – **PA**: 50-360 m alt. / 5, 14 – In a moss and herb community on a weak ground water leakage; among dwarf shrubs (mostly *Fillodoce*) in subnival dwarf-shrub-lichen-moss tundra on the slope to the snowfield. In pure mats or with *Aulacomnium palustre*. K-82-6-04; K-96-15-04. [Cherdantseva, 1986]
- Hypnum pallescens* (Hedw.) P. Beuv. – **PA**: 150 m alt. / 3 – On the base of the trunk of the alder in thickets of the alder. 13.VIII.1997. Coll. Verkholat.
- H. plicatum* (Lindb.) A. Jaeger & Saurb. – **P**: 40-728 m alt. / 9 – In shaded but rather dry crevices of rock expositions; on tundra areas among the lichen cover. With *Sanionia uncinata*. K-90-4-04; K-103-21-04. – **SH**: 103 m alt. / 32 – On tussocks among lichens and crowberry, in dwarf shrub and lichen tundra. K-123-6-04.
- Isopterygiopsis pulchella* (Hedw.) Z. Iwats. – **PA**: 728 m alt. / 18 – In shaded crevices of rocky mountains, on a thin layer of fine-grained soil. With *Pohlia cruda*. K-103-12-04.
- Kiaeria glacialis* (Beggr.) I.Hagen – **SH**: 103-158 m alt. / 36 – On tussocks and at their bases in dry tussock dwarf shrub and lichen tundras. K-123-7-04; K-129-29-04.
- K. falcata* (Hedw.) I. Hagen – **PA**: This species is published by Minami et al. (2001).

- K. starkei* (F. Weber et D. Mohr) I. Hagen – **PA**: 500-800 m alt. / 4, 10 – On fine-grained substratum along the bank of a stream; on stones and among them on the stony bottom of a nival valley. K-81-8-04; K-92-3-04. The specimens assigned to *Dicranodontium denudatum* (Brid.) Britt. ex R.S. Williams (Cherdantseva, 1986) belong in this species. [Minami et al., 2001] – **SH**: 116 m alt. / 30 – On sliding fine-grained substratum down the slope on the place of melted snowfield. K-121-2-04.
- Lescuraea saxicola* (Bruch & Schimp.) Milde – **PA**: 500 m alt. / 10 – On stones and among them on the stony nival valley. K-92-7-04.
- Leskea polycarpa* Ehrh. ex Brid. – **PA**: This species is published by Cherdantseva (1986).
- Limprichtia revolvens* (Sw.) Loeske – **SH**: 158-170 m alt. / 34, 36 – On tussocks in sedge - herb - dwarf-shrub - moss mesotrophic and sedge-moss flood-land swamps; on a moist peat slope of a river. With *Sarmentypnum sarmentosum*, *Paludella squarrosa*. K-125-24-04; K-129-27-04.
- Mnium stellare* Hedw. – **PA**: This species is published by Minami et al. (2001).
- Mnium thomsonii* Schimp. – **PA**: 150 m alt. / 10 – On fine-grained substratum in thickets of the alder down the slope of the left bank, overflowed with high waters. K-91-6-04.
- Oligotrichum aligerum* Mitt. – **PA**: This species is published by Minami et al. (2001).
- O. hercynicum* (Hedw.) Lam. & Cand. – **PA**: 800 m alt. / 4 – On fine-grained substratum along the bank of a stream and nival glades. K-81-2-04. [Cherdantseva, 1986] – **SH**: 180 m alt. / 31 – On the crumbled wall of an old road gauge. K-122-7-04.
- O. parallelum* (Mitt.) Kindb. – **PA**: 50-400 m alt. / 2, 15 – On the moist stone wall of the blocks by the entrance into an old tunnel; on fine-grained substratum in subnival habitats. K-77-11-04; K-97-6-04. [Cherdantseva, 1986] – **SH**: 116 m alt. / 30 – On sliding fine-grained substratum down the slope on the place of melted snowfield. K-121-37-04.
- Oncophorus virens* (Hedw.) Brid. – **SH**: 116-158 m alt. / 30, 36 – On stones along the bank of a small stream; on tussocks in sedge and moss flood-land bog; at the base of tussocks in a dry tussock dwarf shrub and lichen tundra. With *Aularomnium palustre*, *Hylocomiastrum pyrenaicum*, *Racomitrium canescens*, *Sanionia uncinata*, *Sphagnum warnstorffii*, *Tomentypnum nitens*. K-121-27-04; K-129-30-04.
- Orthotrichum sordidum* Sull. & Lesq. in Austin – **PA**: This species is published by Cherdantseva (1986).
- Oxystegus tenuirostris* (Hook. & Taylor) A.J.E. Smith – **PA**: 150-728 m alt. / 6, 18 – On a thin layer of fine-grained soil in shaded crevices of a river's canyon and gravelly barrens in tundra belt. K-86-1-04; K-103-10-04.
- Paludella squarrosa* (Hedw.) Brid. – **SH**: 158-170 m alt. / 34, 36 – On mesotrophic swamp with sedges, herbs, dwarf shrubs and mosses among lakes; on a moist peat slope of a river. With *Campylium protensum*, *Dicranum leioneuron*, *Limprichtia revolvens*. K-125-23-04; K-129-27-04. [Cherdantseva, 1986]
- Philonotis fontana* (Hedw.) Brid. – **PA**: 150 m alt. / 6 – On soil down the slope, on a spring leakage. With *Dicranella palustris*. K-85-1-04; K-85-3-04. [Horikawa, 1934; Cherdantseva, 1986; Minami et al., 2001] – **SH**: 98 m alt. / 29 – On fine-grained substratum along the side of a road. K-120-5-04. [Cherdantseva, 1986]
- P. tomentella* Molendo in Lorentz – **PA**: 43 m alt. / 28 – On a water-logged overgrown pyroclastic deposits field. K-115-2-04; K-115-3-04.
- P. yezoana* Besch. & Cardot – **PA**: 150 m alt. / 6 – On soil down the slope to the river, on a spring leakage. K-85-2-04.
- Plagiomnium acutum* (Lindb.) T.J. Kop. – **PA**: This species is published by Minami et al. (2001).
- P. medium* (Bruch & Schimp.) T.J. Kop. – **PA**: This species is published by Cherdantseva (1986).
- Plagiothecium cavifolium* (Brid.) Z. Iwats. – **PA**: 50 m alt. / 5 – In rather dry niches in a moss and herb community on a weak ground water leakage. K-82-12-04. [Minami et al., 2001]
- P. denticulatum* (Hedw.) Bruch & Schimp. in Bruch et al. – **PA**: 50-60 m alt. / 2, 5 – On the crumbled vertical moist ledges to the stream bed, formed by metamorphized tufa-like sediments; on the trunk of the alder on the edge of sedge-sphagnum swamp. K-77-16-04; K-83-20-04. [Cherdantseva, 1986].
- P. nemorale* (Mitt.) A. Jaeger – **PA**: 50 m alt. / 1 – On moist thickly shaded soil in thickets of the alder. K-76-1-04.
- Pleurozium schreberi* (Brid.) Mitt. (*Calliergonella schreberi* (Brid.) Grout) – **PA**: 50 m alt. / 5 – In a moss and herb community on a weak ground water leakage. K-82-7-04; K-82-8-04. [Noguchi, 1967; Minami et al., 2001] – **SH**: 103-170 m alt. / 32, 34 – On tussocks among lichens and crowberry in dwarf shrub and lichen tundra; on mesotrophic swamp with sedges, herbs, dwarf shrubs and mosses among lakes. With *Sanionia uncinata*, *Sphagnum squarrosom*. K-123-5-04; K-125-36-04. [Cherdantseva, 1986]
- Pogonatum dentatum* (Brid.) Brid. (*P. capillare* (Michx.) Brid.) – **PA**: 10 m alt. / 1 – On soil in a

- sparse alder thicket. 27.VII.1997. Coll. Verkholat. [Cherdantseva, 1986; Minami et al., 2001] – **SH**: 158 m alt. / 34 – At the base of tussocks, in a dry tussock dwarf shrub and lichen tundra. K-129-28-04. [Cherdantseva, 1986]
- P. japonicum* Sull. & Lesq. – **PA**: 10 m alt. / 1 – On soil in an alder thicket. 11.VIII.1997. Coll. Verkholat.
- P. sphaerothecium* Besch. (*Polytrichum sphaerothecium* (Besch) Mull. Hal.) – **PA**: This species is published by Cherdantseva (1986), Minami et al. (2001).
- P. urnigerum* (Hedw.) P. Beauv. – **PA**: (10)40-728 m alt. / 1, 18, 25 – On a thin layer of fine-grained soil in shaded crevices of gravelly barrens and among boulders, lying at the base of a cliff; on volcanic pyroclastic deposits shaded by alder thickets. K-75-2-04; K-112-5-04. [Cherdantseva, 1986; Minami et al., 2001] – **SH**: 98-180 m alt. / 29. 31 – On fine-grained substratum along the side of a road; on the crumbled wall of an old road gauge. With *Brachythecium albicans*. K-120-6-04; K-122-8-04.
- Pohlia cruda* (Hedw.) Lindb. – **PA**: (10)728 m alt. / 8, 18 – On a thin layer of fine-grained soil in rather dry and shaded crevices of gravelly barrens and in the walls of a canyon. With *Isopterygiopsis pulchella*. K-89-5-04; K-103-12-04. [Cherdantseva, 1986]
- P. drummondii* (Mull. Hal.) A.L. Andrews – **PA**: 10-40 m alt. / 1, 25 – In crevices among boulders, lying at the base of a cliff; on pyroclastic deposits shaded by alder thickets. With *Bryoerythrophyllum recurvirostre*, *Polytrichum piliferum*. K-75-3-04; K-112-3-04. – **SH**: 98 m alt. / 29 – On fine-grained substratum along the side of a road. K-120-3-04.
- P. nutans* (Hedw.) Lindb. – **PA**: This species is published by Noguchi (1967), Minami et al. (2001). – **SH**: 180 m alt. / 31 – On the crumbled wall of an old road gauge. K-122-5-04.
- P. wahlenbergii* (F. Weber & D. Mohr) A.L. Andrews in Grout – **PA**: 100 m alt. / 6 – On the sandy bank of a stream in thickets of the alder with meadowsweet. K-84-11-04. [Minami et al., 2001] – **SH**: 116 m alt. / 30 – On moist soil along the bank of a small stream – a tributary of the Vesennyaya River. K-121-28-04.
- Polytrichastrum alpinum* (Hedw.) G.L. Sm. (*Polytrichum alpinum* Hedw.) – **PA**: 70 m alt. / 27 – On a fine-grained soil slope in a thick shade produced by alder thickets and herbs. K-114-8-04. [Abramova, 1960; Cherdantseva, 1986; Minami et al., 2001]
- P. formosum* (Hedw.) G.L. Sm. (*Polytrichum formosum* Hedw.) – **PA**: This species is published by Minami et al. (2001).
- P. longisetum* (Sw. ex Brid.) G.L. Sm. (*Polytrichum gracile* Dicks. in Menz.) – **PA**: 60 m alt. / 5 – On tussocks and in small depressions on sedge-sphagnum bog in flood-lands of the upper reaches of a stream. With *Sphagnum fallax*, *S. squarrosum*. K-83-6-04 [Cherdantseva, 1986].
- Polytrichum commune* Hedw. – **PA**: 10 m alt. / 1 – Under the canopy of the Japanese stone pine. 29.VII.1997. Coll. Verkholat. – **SH**: This species is published by Cherdantseva (1986). [Cherdantseva, 1986]
- P. jensenii* I. Hagen – **PA**: This species is published by Cherdantseva (1986).
- P. juniperinum* Willd. ex Hedw. – **PA**: 925 m alt. / 16 – Among lichens in a dwarf shrub and lichen tundra. K-99-2-04. [Minami et al., 2001]
- P. strictum* Brid. (*P. alpestre* Hoppe.) – **PA**: This species is published by Noguchi (1967), Cherdantseva (1986).
- P. piliferum* Hedw. – **PA**: 40 m alt. / 25 – On a pyroclastic deposits field overgrown with the alder. K-112-2-04. [Minami et al., 2001]
- P. sexangulare* Brid. – **PA**: This species is published by Cherdantseva (1986), Minami et al. (2001).
- Pseudobryum cinclidioides* (Hueb.) T.J. Kop. (*Mnium cinclidioides* Hueb.) – **PA**: 100 m alt. / 6 – On the sandy bank of a stream in thickets of the alder with meadowsweet. K-84-11-04. – **SH**: 116 m alt. / 30 – On moist soil along the bank of a small stream – a tributary of the Vesennyaya River. K-121-28-04. [Horikawa, 1934]
- Ptilium crista-castrensis* (Hedw.) De Not. – **PA**: 50 m alt. / 5 – In a moss and herb community on a weak ground water leakage. K-82-7-04.
- Racomitrium brevisetum* Lindb. – **PA**: 100 m alt. / 6 – On stones on the banks of stream. K-84-6-04. The specimens assigned to *R. aquaticum* (Brid. ex Schard.) Brid. (Cherdantseva, 1986) belong in this species. [Cherdantseva, 1986] – **SH**: 116 m alt. / 30 – On stones along the bank of a small stream. K-121-22-04.
- R. canescens* (Hedw.) Brid. – **PA**: 15 m alt. / 24 – On concrete plates of the former aerodrome. 7.VIII.1997. Coll. Verkholat. [Cherdantseva, 1986; Minami et al., 2001] – **SH**: 158 m alt. / 36 – On tussocks in sedge and moss flood-land bog; at the base of tussocks in a dry tussock dwarf shrub and lichen tundra on a streamside terrace. With *Aulacomnium palustre*, *Hylacomiastrum pyrenaicum*, *Sanionia uncinata*, *Tomentypnum nitens*.
- R. fasciculare* (Hedw.) Brid. – **PA**: 10 m alt. / 1 – On stones on vertical and subvertical «column» cliff. K-75-4-04. [Cherdantseva, 1986]

- R. lanuginosum* (Hedw.) Brid. – **PA**: 40 m alt. / 9 – On a flat step of a ledge of rocky exposition 1-2m high, in well-lit and dry plot of northern exposition of a flat step of a cliff. K-90-17-04. – **SH**: 103 m alt. / 32 – On tussocks among lichens and crowberry in dwarf shrub and lichen tundra. K-123-4-04. [Cherdantseva, 1986]
- R. muticum* (Kindb. in Macoun) Frisvoll – **PA**: 40-500 m alt. / 10, 14, 25 – On stones and among them on the stony nival valley; among dwarf shrubs (mostly *Fillogoce*) in dwarf-shrub - lichen - moss tundra; on a pyroclastic deposits field overgrown with the alder. K-92-4-04; K-112-6-04.
- R. sudeticum* (Funck) Bruch & Schimp. in Bruch et al. (*R. heterostichum* (Hedw.) Brid. var. *sudeticum* (Funck) Bauer) – **PA**: 300- 925 m alt. / 3, 10, 16 – On fine-grained substratum in shaded wet niches; on stones and among them on the stony bottom of a nival valley; on the open surface of a stone and in dry and weakly shaded crevices among stones in dwarf shrub and lichen tundra. K-79-2-04; K-99-6-04. The specimens assigned to *R. heterostichum* (Hedw.) Brid. (Minami et al., 2001) belong in this species. [Cherdantseva, 1986] – **SH**: 116 m alt. / 30 – On stones along the bank of a small stream. K-121-27-04.
- Rhizomnium nudum* (Britt. & R.S. Williams) T.J. Kop. – **PA**: 100- 360 m alt. / 10, 14, 19 – On fine-grained substratum in thickets of the alder down the slope of the left bank of a stream; among dwarf shrubs (mostly *Fillogoce*) in subnival dwarf-shrub - lichen - moss tundra; on shady slope overgrown with the alder descending to a stream. K-105-10-04. – **SH**: This species is published by Cherdantseva (1986).
- R. pseudopunctatum* (Bruch & Schimp.) T.J. Kop. (*Mnium pseudopunctatum* Bruch & Schimp.) – **PA**: This species is published by Horikawa (1934).
- Rhytidadelphus squarrosus* (Hedw.) Warnst. (= *R. subpinnatus* (Lindb.) T.J. Kop.) – **PA**: 10-50 m alt. / 5, 8 – In a wet moss-herb and herb-moss meadow-like communities on the slope faced to a stream. With *Climacium dendroides*, *Dicranum majus* var. *orthophyllum*. K-82-10-04; K-89-10-04. [Cherdantseva, 1986; Minami et al., 2001] – **SH**: 158 m alt. / 36 – On a moist peat slope to a river. K-129-22-04.
- Rigodiadelphus robustus* (Lindb.) Nog. – **PA**: 650 m alt. / 11 – On soil among dwarf shrubs in dwarf shrub tundra. K-93-8-04. – **SH**: This species is published by Cherdantseva (1986).
- Sanionia uncinata* (Hedw.) Loeske (*Drepanocladus uncinatus* (Hedw.) Warnst.) – **PA**: (10)60-728 m alt. / 5, 6, 12, 18 – On the trunk of the alder on the edge of a sedge-sphagnum bog; on the sandy bank of a stream in thickets of the alder with meadowsweet; among the stones of a rocky placer sliding down to a maritime meadow; among the lichen cover in lichen and dwarf shrub tundra. With *Brachythecium populenum*, *Dicranum majus* var. *orthophyllum*, *Hypnum plicatulum*, *Tortula ruralis*. K-83-17-05; K-103-21-04. [Abramova, 1960; Cherdantseva, 1986; Minami et al., 2001] – **SH**: 50-170 m alt. / 32, 33, 36 – On tussocks in dwarf shrub and lichen tundra in floodlands of the upper reaches of a stream; on vertical walls of rocks formed by caked metamorphized tufa; on tussocks in sedge and moss flood-land bog. With *Aulacomnium palustre*, *Hylocomiastrum pyrenaicum*, *Pleurozium schreberi*, *Racomitrium canescens*, *Tomentypnum nitens*. K-123-5-04; K-129-8-04. [Cherdantseva, 1986]
- Sarmentypnum sarmentosum* (Wahlenb.) Tuom. & T.J. Kop. – **SH**: 158-170 m alt. / 34, 36 – On tussocks in sedge-herb-dwarf-shrub-moss mesotrophic and sedge-moss flood-land swamps. With *Limprichtia revolvens*. K-125-37-04; K-129-9-04.
- Schistidium papillosum* Culm. – **PA**: This species was wrongly identified as *S. apocarpum* (Cherdantseva, 1986).
- S. platyphyllum* (Mitt.) Pers. – **SH**: 5 m alt. / 33 – On moist coastal cliffs formed, to the south of the Baikovsky Stream. K-128-6-06.
- S. rivulare* (Brid.) Podp. – **PA**: 150 m alt. / 6 – In shaded rock crevices. K-86-3-04.
- Scorpidium scorpioides* (Hedw.) Limpr. – **SH**: 170 m alt. / 34 – On mesotrophic swamp with sedges, herbs, dwarf shrubs and mosses, among lakes. K-125-4-04.
- Sphagnum angustifolium* (Russow) C.E.O. Jensen – **PA**: This species is published by Noguchi (1967).
- S. capillifolium* (Ehrh.) Hedw. – **PA**: This species is published by Horikawa (1934).
- S. centrale* C.E.O. Jensen – **SH**: This species is published by Cherdantseva (1986).
- S. compactum* DC. in Lam. & DC. – **PA**: 650-728 m alt. / 11, 18 – On soil among dwarf shrubs and lichens in dwarf shrub and lichen – dwarf-shrub tundras. K-93-7-04; K-103-23-04. [Cherdantseva, 1986] – **SH**: 170 m alt. / 34 – Among dwarf shrubs in dwarf shrub tundra. K-125-30-04.
- S. contortum* Schultz – **PA**: 60 m alt. / 5 – On tussocks and in small depressions on a flat sedge-sphagnum bog in flood-lands of the upper reaches of a stream. K-83-10-04.
- S. fallax* (H. Klinggr.) H. Klinggr. – **PA**: 60 m alt. / 5 – On tussocks and in small depressions on sedge-sphagnum bog in flood-lands of the upper reaches of a

- stream. With *Polytrichastrum longisetum*, *Sphagnum squarrosum*. K-83-6-04.
- S. fimbriatum* Wilson in Hook – **PA**: This species is published by Cherdantseva (1986).
- S. girgensohnii* Russow – **PA**: 50-500 m alt. / 5, 10, 15 – In a moss and herb community on a weak ground water leakage; on stones and among them on the stony nival valley; on fine-grained substratum in subnival habitat. K-82-3-04; K-97-5-04.
- S. lindbergii* Schimp ex Lindb. – **PA**: This species is published by Cherdantseva (1986).
- S. papillosum* Lindb. – **PA**: This species is published by Horikawa (1934).
- S. quinquefarium* (Lindb.) Warnst. – **SH**: 158 m alt. / 36 – On tussocks in sedge and moss flood-land bog. Growing along with *Sphagnum subsecundum*. K-129-6-04.
- S. riparium* Aongstr. – **PA**: This species is published by Cherdantseva (1986).
- S. russowii* Warnst. – **PA**: This species is published by Cherdantseva (1986).
- S. squarrosum* Crome in Hoppe – **PA**: 60 m alt. / 5 – On tussocks and in small depressions on sedge-*sphagnum* bog in flood-lands of the upper reaches of a stream. With *Polytrichastrum longisetum*, *S. fallax*. K-83-6-04. – **SH**: This species is published by Cherdantseva (1986).
- S. subsecundum* Nees in Sturm – **SH**: 158-170 m alt. / 34, 36 – On tussocks in sedge-herb-dwarf-shrub-moss mesotrophic and sedge-moss flood-land swamps. With *Sphagnum quinquefarium*, *S. warnstorffii*. K-125-21-04; K-129-6-04.
- S. tenellum* Ehrh. ex Hoffm. (*S. molluscum* Bruch) – **PA**: This species is published by Horikawa (1934).
- S. teres* (Schimp.) Angstr. in Hartm. – **SH**: 158 m alt. / 35, 36 – In a dwarf-shrub-sedge-Sphagnum swamp in a river valley. In a sedge and moss flood-land bog. 22.VIII. 1978. Coll. A.I. Zavorotny. K-129-11-04.
- S. warnstorffii* Russow – **SH**: 170 m alt. / 34 – On mesotrophic swamp with sedges, herbs, dwarf shrubs and mosses among lakes. With *Aulacomnium palustre*, *Oncophorus virens* and *Calliergonella lindbergii*. K-125-2-04.
- Tetraplodon mnioides* (Hedw.) Bruch & Schimp. in Bruch et al. – **PA**: 728 m alt. / 18 – Among the lichen cover in lichen and dwarf shrub tundra. K-103-28-04. [Cherdantseva, 1986] – **SH**: 170 m alt. / 34 – On a lying wing of a crashed airplane. K-125-31-04. [Cherdantseva, 1986]
- Tomentypnum nitens* (Hedw.) Loeske – **SH**: 158-170 m alt. / 34, 36 – On a sedge-herb-dwarf-shrub-moss mesotrophic and sedge-moss flood-land swamps. With *Aulacomnium palustre*, *Hylocomiastrum pyrenaicum*, *Racomitrium canescens*, *Sanionia uncinata*. K-125-35-04; K-129-8-04 .
- Tortula norvegica* (F. Weber) Lindb. – **PA**: 70 m alt. / 27 – On a fine-grained soil slope in a full shade produced by alder thickets and herbs. K-114-6-04.
- T. ruralis* (Hedw.) Gaertn., Meyer & Schreb. – **PA**: 10 m alt. / 12 – Among the stones of rocky placer sliding to a maritime meadow. With *Sanionia uncinata*. K-94-11-04.
- Trachycystis flagellaris* (Sull. & Lesq.) Lindb. – **PA**: 40 m alt. / 9 – In shaded but rather dry crevices of rock expositions. K-90-9-04.
- T. ussuriensis* (Maack & Regel) T.J. Kop. – **PA**: 5 m alt. / Severo-Kurilsk, The Black Lakes – On soil in a alder thicket with tall herbs. 22.VII.1997. Coll. Verkholat.
- Ulota drummondii* (Hook. & Grev.) Brid. – **PA**: 30 m alt. / 23 – On the trunks of the willow at the height of 1.5 m, in a flood-plain willow forest with trees up to 10m high. K-110-1-04.
- Warnstorfia exannulata* (Schimp.) Loeske (*Drepanocladus exannulatus* (Bruch & Schimp.) – **SH**: This species is published by Cherdantseva (1986)
- W. fluitans* (Hedw.) Loeske (*Drepanocladus fluitans* (Hedw.) Warnst.) – **PA**: 10 m alt. / 1 – On waterlogged sites in a alder thicket with reed-grass. 27.VII.1997. Coll. Verkholat. [Cherdantseva, 1986]

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LITERATURE CITED

- [ABRAMOVA, A.L.] АБРАМОВА А.Л. 1960. О мхах Курильских островов. – [About mosses of Kurile Islands] *В сб.: Материалы по природным ресурсам Камчатки и Курильских островов. Магадан.* [In: *Materialy po prirodnyum resursam Kamchatki i Kurilskikh Ostrovov. Magadan*]: 87-97.
- [AFONINA, O. M. & J. DUDA] АФОНИНА О.М., Й. ДУДА 1993. Печеночники Чукотки. – [Hepatics of Chukotka] *Бот. журн.* [Bot. Zhurn.] **78**(3): 77-93.
- АМАКАВА, Т. 1959. Family Jungermaniaceae of Japan. I. – *J. Hattori Bot. Lab.* **21**: 248-291.
- АМАКАВА, Т. 1960. Family Jungermaniaceae of Japan. II. – *J. Hattori Bot. Lab.* **22**: 1-90.
- [ATLAS OF SAKHALINSKAYA PROVINCE] АТЛАС САХАЛИНСКОЙ ОБЛАСТИ 1967. – Москва, ГУГК [Moscow, GUGK]: 135.
- БАКАЛИН, В. А. 2001. Notes on Lophozia III. Some taxonomic problems in Lophozia sect. Lophozia. – *Arctoa* **10**: 207-218.
- [БАКАЛИН, В.А., Н.И. МОЛОКОВА, Т.Н. ОТНЮКОВА] БАКАЛИН В.А., Н.И. МОЛОКОВА, Т.Н. ОТНЮКОВА 2001. Печеночники Тоджинской котловины (республика Тува, Южная Сибирь) - [On the liverworts flora of Todzha Valley (Tuva Republic, South Siberia)] *Arctoa* **10**:19-26.
- БАКАЛИН, В.А. 2003. A Preliminary Check-List of the Hepaticae of Kamchatka Peninsula (Russian Far East). – *Arctoa* **12**: 83-90.
- [БАКАЛИН, В.А.] БАКАЛИН В.А. 2005a. Schofieldia Godfrey и Cryptocoleopsis Amakawa -новые роды печеночников (Hepaticae) для флоры России – [Schofieldia Godfrey and Cryptocoleopsis Amakawa, the new genera of liverworts (Hepaticae) to the flora of Russia] *Бот. журн.* [Bot. Zhurn.] **90**(4): 594-603.
- БАКАЛИН В.А. 2005b. The liverwort flora of Bering Island (North-West Pacific, Russia). – *Lindbergia*. **30**(2): 79-92.
- [CHERDANTSEVA, V.Ya.] ЧЕРДАНЦЕВА В.Я. 1986. О бриофлоре северных островов Курильского архипелага – [On the bryoflora of the northern islands of Kurile archipelago] *Флора и систематика споровых растений Дальнего Востока* [Flora i Sistematika Sporovykh Rastenij Dal'nego Vostoka] Владивосток, Дальнаука [Vladivostok, Dal'nauka]: 152-162.
- FURUKI, T. 1991. A taxonomical revision of the Aneuraceae (Hepaticae) of Japan. – *J. Hattori Bot. Lab.* **70**: 293-237.
- HORIKAWA, Y. 1934. The bryological flora of the Northern Kuriles Islands. – *Bull. Biogeogr. Soc. Jap.* **4**: 335-337.
- IWATSUKI, Z. 2004. New catalog of the mosses of Japan. – *J. Hattori Bot. Lab.* **96**: 1-182.
- KONSTANTINOVA, N.A., A.D. POTEKIN & R.N. SCHLJAKOV 1992. Check-list of the Hepaticae and Anthocerotae of the former USSR – *Arctoa* **1**: 87-127.
- KONSTANTINOVA, N.A. & A.N. VASILJEV 1994. On the hepatic flora of Sayan Mountains (South Siberia) – *Arctoa* **3**: 123-132.
- [LUCHINSKY, I.V. (ed.)] ЛУЧИНСКИЙ И.В. (ред.) 1974. Камчатка, Курильские и Командорские острова – [Kamchatka, the Kurile and Commander Islands] *М., Наука* [Moscow, Nauka]: 439.
- MINAMI, YO., S. OKITSU, H. KANDA, V.Ya. CHERDANTSEVA & S.YU. GRISHIN 2001. Occurrence of bryophytes on Paramushir Island, northern Kuriles, Far East Russia. – *Memoirs of Nat. Inst. Polar Res., Spec. Issue* **54**: 487-493.
- [MURAVIOV, Ya.D.] МУРАВЬЕВ Я.Д. 1985. Снежный покров в горных районах Камчатки – [Snow cover in mountain regions of Kamchatka] *Вопросы географии Камчатки* [Voprosy geografii Kamchatki] **9**: 30-40.
- NOGUCHI, A. 1967. A small collection of bryophytes made by Dr. S.Bergman in the Kuriles. – *J. Jap. Bot.* **42**: 85-89.