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MOSSES OF THE CENTRAL PART OF KUZNETSKIY ALATAU (SOUTHERN SIBERIA)

МХИ ЦЕНТРАЛЬНОЙ ЧАСТИ КУЗНЕЦКОГО АЛАТАУ (ЮГ СИБИРИ)

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Abstract

Bryological investigations were carried out in central high-mountainous part of Kuznetskiy Alatau (northern spur of Altai-Sayan mountain system). 254 moss species are known now for the study area. The list of species and information about species frequency, altitudinal distribution, habitat preferences and sporophyte production are given.

Резюме

Бриологические обследования проводились в центральной высокогорной части Кузнецкого Алатау – северного отрога Алтае-Саянской горной системы. На обследованной территории выявлено 254 видов листостебельных мхов. Приводится список видов с указанием встречаемости, высотного и ценотического распределения, характерных местообитаний, а так же информация о наличии спорофитов.

INTRODUCTION

Investigations on structure and ecology of plant communities in high mountains of the Kuznetskiy Alatau were started by a group of Siberian botanists, on the permanent study area "Chemodan Mountain". Studying of the moss component of plant communities is a part of the program. There was a number of reasons for the choice of the study area. First, the territory is one of the most humid areas of the South Siberia. Second, the sequence of mountain belts here is well-expressed in a short altitude interval. Then, there were never indigenous people on the territory. Gold-diggers settles and stations specialized on laying-in of medical plants were not numerous and existed not for long. So, the territory may be considered as almost intact. Since 1989, due to the organization of the strictly protected area (zapovednik) "Kuznetskiy Alatau", there is no human activity on the territory.

The paper summarizes data on moss diversity on the permanent study area "Chemodan Mountain" and around it. In 1993 and 1994 N.N. Lashchinskiy, N.V. Demidenko and L.A. Gorshkova collected mosses for geobotanic releves in the area and kindly handed me the collection. The numerous bryophyte data from mire communities of Kuznetskiy Alatau were collected and published by Lapshina & Muldiyarov (1995, 2000), Muldiyarov & lapshina (1996), and Volkova & Muldiyarov (2000). The author carried out short-term bryological works in 1994, 1998 and 2000. The works were devoted to estimation of moss component of some plant community types (Pisarenko, 1996, 2000). The main aim of the summer 2003 investigations was to complete the study of moss species diversity. Doing this, the author paid less attention to mire communities, because they were already studied by E.Ya. Muldiyarov, E.D. Lapshina and I.I.Volkova. The collected material allows to make up the annotated list of mosses of the central part of Kuznetskiy Alatau.

STUDY AREA

The Kuznetskiy Alatau is the northwest part of the Altai-Sayan mountainous country. It is meridionally stretched within 53-56° N and 86-91° E limits. Kuznetskiy Alatau is a complex system of rounded mountain massifs. It is characterized by tier structure of the relief with

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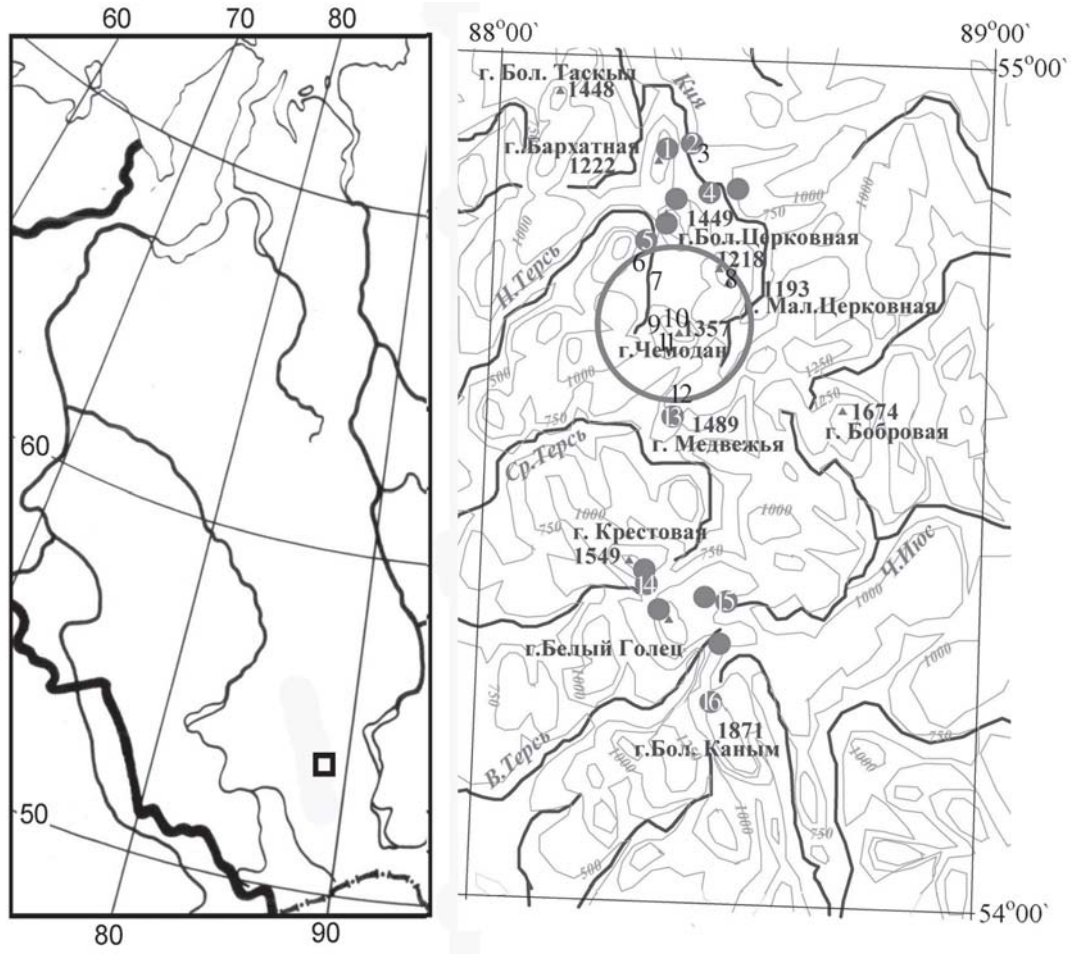

Fig 1. Study area. Big open circle intensively studied area near Chemodan Mt. Biological Station; solic circles – points of short-term investigations; numerals (also listed below) – collecting localities of rarely found bryophytes. – Рис. 1. Район исследований. Контур круга – основной район работ стационара «Чемодан»; залитые круги – точки кратковременных маршрутных обследований; цифрами обозначены точки сборов единично отмеченных видов:

Localities	N	Latitude–Longitude	alt, m	Местонахождение
Barkhatnij ridge, nothern part	1	54°56'N-88°19'E	900-1100	хр. Бархатный, северное плечо.
Kija-valley, limestone outcrops	2	54°58'N-88°21'E	550	Долине р.Кия, обнажения известняков
Kija-valley, upstream of Bezimiannij Creek	3	54°55'N-88°22'E	550	Долина р.Кия выше устья р. Безымянный
Kija-valley, upstream of Tunkas Creek	4	54°51'N-88°24'E	560	Долина р.Кия выше устья р. Тункас
N.Ters-valley, limestone outcrops	5	54°48'N-88°18'E	750	Долина р.Н.Терсь, обнажения известняков
N.Ters-valley, upstream of B.Poludnevaja Creek	6	54°46'N-088°22'E	790-820	Долина р. Н. Терсь выше устья р. Б. Полудневая
B.Poludnevaja valley	7	54°44'N-88°18'E	820	долина р.Б. Полудневая
M.Zerkovnoje-lake surroundings	8	54°46'N-088°26'E	960-1155	окр. оз. М.Церковное,
Chemodan Mountain, northern spurs	9	54°42'N-088°21'E	940-970	северные отроги г. Чемодан
Chemodan Mountain, upper part	10	54°41'N-088°23'E	1100-1350	верхняя часть г.Чемодан
Valley of Kedrovij Creek	11	54°41'N-088°23'E	950-1050	долина р.Кедровый
Valleys of Krasnaja Rechka Creek and it's right-hand tributaries	12	54°40'N-088°27'E	700-900	долина р.Красная Речка и долины ее правых притоков
'Saddle' between Stanovoj Ridge and Medved Mountain	13	54°39'N-088°26'E	1200	седловина между хр.Становой и г.Медведь
Upper course of Krivaja Creek	14	54°24'N-088°19'E	1225	верховья р.Кривая
Upper course of Ch. Ijus	15	54°23'N-088°23'E	1250	верховья р. Ч.Июс
B. Kanim Mountain, northern slope	16	54°18'N-088°29'E	1600	г.Бол.Каным, северный склон

2-3 surfaces of peneplainization (Kashmenskaya, Kazakevich, Shvareva, 1969). Macro-slopes are asymmetric. The western macro-slope faced to the Kuznetskaya depression is steep and formed by a system of large ledges. The eastern macro-slope is gently downed to the Minusinskaya depression. Altitudes are 300-500 m in the northern part of the range and about 2000 m in its southern part. Rivers mainly belong to the Ob River basin, except of the southeast part, where they flow down in the Yenisei River basin.

The investigated area is located on the western macro-slope in the central part of Kuznetskiy Alatau. The main studies were done in area of about 300 sq. km. in upper courses of rivers Kija, Niznaja Ters and right-hand tributaries of Sredniaja Ters (Fig. 1). Two surfaces of peneplainization could be distinguished. The upper surface is represented by flatten mountain tops (1448 m – mountain Medvezja, 1449 m – Bolshaja Tzerkovnaja, 1357 m – Chemodan, 1347 m – Pestraja and others). The lower surface of peneplainization covers the most area. It is represented by flat accumulative plains and flat watersheds bounders on altitude about 900 m. Transition to the upper surface characterized by sharp increasing of slope steepness and an abundance of talus. The total elevation interval from rivers level to the highest peaks is about 600-700 m.

The territory has a complicated geological structure. Various metamorphic rocks are broken through by intrusions of different age and different composition. The most widespread rocks are gabbros, granodiorites, granites, gneisses, serpentinites, argillaceous and crystalline slates, aleurolites and limestones. On flat and slightly inclined surfaces bedrocks are covered by quaternary sediments. The bedrocks petrographic structure determines a trend of the modern relief development. Watersheds are mostly formed by steady to weathering igneous and intrusive rocks. River valleys and depressions are mainly connected with shale or limestone thicknesses.

Climate data of Kuznetskiy Alatau are scarce. Meteorological stations are not numerous and located mainly on mountain foothills. In high mountains there are only two meteorological stations – "Nenastnaja" and "Goletz Podlunnij". They are situated on the eastern macro-slope,which has less precipitation,than western one. Data of the meteorological stations and data of episodic meteorological observations (Shpin, 1980, Demidenko, 1999; unpublished materials of N.N. Lashchinskiy & N.V. Demidenko) allow to give only a rough characteristic of climatic conditions for the territory. An average annual temperature is slightly below zero, about -1^{o} C (Spravochnik..., 1969). Mean annual precipitation in different data varies from 1200-1500 up to 3000-3500 mm. The snow cover lies up to 6-9 months per year depending on altitude of a plot. Temperature- and moisture- conditions of various elements of the relief considerably depend on snow redistribution. So, in high mountains, at flat tops the depth of snow is about 20-40 cm. At the same time on altitudes 1100-1200 m, where tall-herb meadows grow, the depth of snow is almost 10 times more – about 190-200 cm. In places with more than 150 cm snow thickness soils do not freez during all winter; the temperature on a soil surface is about $+0.5–+1^{o}$ C. In forest belt maxim snow depth is about 80-100 cm.

Vegetation

There are three mountain belts in the vegetation of the territory: forest-belt, tall-herb belt and tundra-belt.

Forest communities occupy the most part of the area. There are only few tree species on the territory. The only common tree species is *Abies sibirica*. *Pinus sibirica* is moderately common: it frequently presents in small abundance in the forests of lower parts of the slopes, but sometimes dominates on well-drained sites and near the timberline. *Betula alba s.l.* constantly presents in a small abundance; it forms monodominant communities near the timberline and in wet habitats with weakly flowing moistening. *Sorbus sibirica* belongs to tree species in these conditions; it constantly occurs in forest communities. *Picea obovata* occurs mainly in river valleys. *Larix sibirica, Pinus sylvestris,* and *Populus tremula* are very rare within the study area.

Forests of *Abies sibirica* have a rich tall herbs layer. The herbs cover varies from 40 up to 70% depending on density of the canopy. *Calamagrostis obtusata* usually dominates in the herb layer of *Abies* forests in lower parts of the slopes. Very common are species cahracterisic

for subalpine meadows (*Aconitum septentrionale*, *Euphorbia lutescens*, *Lathyrus gmelinii*, *Geranium albiflorum*, *Trollius asiaticus*, *Cirsium helenioides,* etc.). *Cerastium pauciflorum*, *Myosotis krylovii*, *Paris quadrifolia*, *Stellaria bungeana*, *Viola biflora* are widespread in the second herb sub-layer. Ephemeroides synusia includes: *Anemonoides altaica*, *A.caerulea*, *Corydalis bracteata*, *Erythronium sibiricum*. Fern-species are diverse: *Athyrium filix-femina*, *A. distentifolium*,*Dryopteris filix-mas*,*Diplazium sibiricum, Gymnocarpium dryopteris, Phegopteris connectilis. Oxalis acetosella, Linnaea borealis, Trientalis europaea, Vaccinium myrtillus* occur on soil under close tree canopy and on logs. *Athyrium distentifolium* becomes a dominant in herb layer in upper part of slopes.

The moss cover in *Abies* forests varies from 30 to 80 % and is in negative correlation with the herbage cover. On soil the moss cover is formed by wefts of *Brachythecium reflexum, B. salebrosum, B.oedipodium, B.starkei, Cirriphyllum piliferum, Hylocomiastrum pyrenaicum, Rhytidiadelphus subpinnatus,* often with admixture of *Hylocomiastrum umbratum* and *Brachythecium ornellatum*. Turfs of *Mnium spinosum* are common in more moist habitats. In shaded sites with poor or absent forest litter *Plagiothecium denticulatum* and *P. laetum* expand. *Hylocomium splendens*, *Pleurozium schreberi, Ptilium crista-castrensis* also occur on forest litter, but they are rather more abundant on old-age fallen logs. Epiphytic vegetation is practically absent. Mosses do not rise more than 20-30 cm above the ground on trunks of coniferous trees. These trunk bases are inhabited by few non-specific species, *Brachythecium reflexum* being the most common. Only on *Sorbus* trunks mosses grow up to heights of two and more meters above the ground: *Orthotrichum speciosum, O. obtusifolium, Ulota rehmannii*.

The forest usually does not exceed 1100 m and this limit is called here "timberline". Timberline in used hire in sense different from treeline: scattered groups of *Abies, Pinus sibirica*, *Betula alba var. tortuosa* (twisted birch) and thickets of dwarf *Abies* ("trees-in-skirts") occur at places above this elevation, but very rare.

At 1100-1250 m tall-herb communities prevail and occupy here all diversity of habitats from well-drained sites on stony soils of prominent relief elements to wet sites on loamy soils in depressions. In the forest-belt the meadows also occur, but they take small areas; they grow at periphery of mires and among forest massifs; occur on well-developed flood plains. The detailed characteristic of tall-herb meadows of the territory was made by Latchinskiy & Gorshkova (1995) and Latchinskiy (1996). In most cases these communities are polydominant. The most abundant species are *Calamagrostis langsdorfii, Veratrum lobelianum, Carex altaica, Rhaponticum carthamoides, Saussurea latifolia, Cirsium heterophyllum, Euphorbia lutescens, Aconitum septentrionale, Geranium albiflorum*. In the second sublayer *Geranium albiflorum, Viola biflora, Rumex alpestris, Poa insignis, Bistorta major* etc. are common. On soil and forest litter under the canopy of tall-herb meadows mosses grow by separate mostly monospecific groups. However their abundance may be significant. *Brachythecium velutinum* is the most constant and abundant species. *Brachythecium reflexum, Mnium spinosum, Rhodobryum roseum, Fissidens bryoides* are common.

High-mountainous tundras and nival communities occupy relatively small areas; they occur mainly on flat tops of the upper surface of peneplainization. The high-mountain tundras are presented by small isolated areas, and they are rather diverse. The most constant and common species of vascular plants in tundra communities are *Betula rotundifolia,Juniperus sibirica, Vaccinium myrtillus, Dryas octopetala, Empetrum nigrum, Hierochloe alpina, Festuca ovina, Luzula sibirica, Bistorta vivipara*; of mosses – *Hylocomium splendens*, *Dicranum spadiceum, Aulacomnium turgidum, Rhytidium rugosum, Polytrichum piliferum, Pleurozium schreberi*. Near permanent snow beds occur *Kiaeria starkei, Polytrichum sexangulare, Pohlia drummondii,* usually forming close carpets up to several tens square meters.

Mires are represented in all mountain belts and are very diverse. Smooth forms of relief, a huge amount of precipitation and a cold climate promote mires development. Lapshina & Muldiyarov (1995, 2000), Muldiyarov & lapshina (1996), and Volkova & Muldiyarov (2000) published detailed description of mires

of Kuznetskiy Alatau.According to position in the relief these scientists distinguish eigth types of mires. In forest-belt and in lower parts of tall-herb belt they distinguish: mires of large intermountain depressions, mires of river valleys, mires on bottoms of hillsides, mires of intermountain saddles, mires of gullies of mountain slopes; in tall-herb belt and in tundra-belt: mires of mountain terraces, mires of concave slopes, mires of plateaus.

Rocky substrata are widespread on the territory. In high-mountains rock fields occupy vast areas. Channels and banks of streams are often but not always rocky. Boulders occur everywhere on slopes of the mountains. Large rock outcrops are not too often; they are located mainly in the river valleys, on the mountain peaks and on the abrupt slopes. Vegetation of rocky plots varies in dependence of a slope inclination and conditions of moistening and sunlight. Old rock fields are usually covered by shrublets of *Betula rotundifolia, Juniperus sibirica, Pentaphylloides fruticosa, Salix glauca*. Among mosses, *Racomitrium sudeticum, Lescuraea saxicola, Hylocomiastrum pyrenaicum, Dicranoweisia crispula* are common on rocks in a wide spectrum of ecological conditions. On rocks in and near water, *Fontinalis antipyretica, Schistidium rivulare, Brachythecium rivulare* and *Hygrohypnum ochraceum* often occur.

List of species

Specimens are in the herbarium of the laboratory of Population Ecology of Plants, Central Siberian Botanical Garden, in Novosibirsk. For each species occurrence is shown: Un – the species collected only once; Rar – collected 2-5 times; Spar – recorded 6-15 times; Com – 16-25; Wid – more than 25 records. For species that were collected not more than three times, collecting points according to Fig. 1 are given in square brackets. Then a characteristic of habitats is given. The presence of the sample with sporophyte in herbarium is marked by S+. All species that were recorded by Muldiyarov, Lapshina and Volkova have the corresponding citation.

Abietinella abietina (Hedw.) Fleisch. – Spar. – on dry rocks in cracks and on soil covered surfaces; also on detritus spots in tundra. S-.

Amblystegium serpens (Hedw.) B.S.G. – Rar. – in lower part of forest belt only, on rotten logs; once – on soil that covered flat boulder; in small quantities. S+.

A. varium (Hedw.) Lindb. – Rar. – on rotten logs in forests; also reported on *Betula* trunks in twisted birch stands and in mires of forest-belt (Volkova, Muldiyarov, 2000). S-.

Amphidium lapponicum (Hedw.) Schimp. – Rar. – on rock outcrops on vertical faces and under overhangs, in shade. S+.

Anacamptodon latidens (Besch.) Broth. – Un. – on *Betula* trunk in *Abies* forests with dominance of *Athyrium distentifolium*; alt. 940 m. [9]; determined by Ignatov. S+.

Andreaea rupestris Hedw. – Cm. – on rocky substrates: on surfaces and in cracks of rock outcrops, on rock-fields and on separate boulders; most abundant above 1000 m alt. Some specimens have tall papillae on dorsal leaf surface and can be identified as *A. rupestris* Hedw. *var. papillosa* (Lindb.) Podp. S+.

Anomodon longifolius (Brid.) Hartm. – Rar. – on shaded rocks: on boulderes under closed canopy of tall-herb meadows and in recesses of rocks; at 700-1000 m alt. S-.

A. rugelii (C.Muell.) Keissl. – Spar. – on wet shaded rocks: on boulderes and small rock fields under canopy of tall-herb meadows, at 900-1200 m alt.; once also on moist boulder in closed *Abies* forest; some specimens checked by Ignatov. S-.

Atrichum flavisetum Mitt. – Spar. – on bare soil: along roads, on ground at roots of fallen trees, on fine soil among rocks and on stream banks, sometimes on rotten wood; only in forest belt. S+.

Aulacomnium palustre (Hedw.) Schwaegr. – Com. – all over profile in different types of wet habitats; the most constant on ridges of ridge-hollow bogs of intermountain depressions, in small abundance; little bit less often grows in different bogs in tall-herb belt (Muldiyarov, Lapshina, 1996). S-.

A. turgidum (Wahlenb.) Schwaegr. – Cm. – only above timberline: common in ground cover in different tundras (bushy, spotty, boggy ets.) and in bogs of tundra belt (Muldiyarov, Lapshina, 1996), rarely occurs in open tree stands on rocky ground. S+.

Bartramia ithyphylla Brid. – Spar. – on fine soil among rocks on rocky fields, in cracks and crevices of rocky outcrops; mainly above timberline. S+.

Bartramia pomiformis Hedw. – Un. – on fine soil in cracks and crevices of limestone outcrops, 750 m alt. [5]. S+.

Brachythecium cirrosum (Schwaegr.) Schimp. (= *Cirriphyllum cirrosum* (Schwaegr.) Grout) – Un. – on fine soil in cracks and crevices of limestone outcrops, 750 m alt. [5]. S-.

B. erythrorrhison B.S.G. ssp. *asiaticum* Ignatov – Wid. – all over profile. Common and abundant in

Abies forests with dominance of *Calamagrostis obtusata* or *Athyrium distentifolium* in herb layer; here it grows on logs and forest litter. Occurs in moss cover in open tree stands, on ground and litter on tall-herb meadows, on fine soil on taluses and rock outcrops. Also reported for forest island in big bog system «Krestovskije»; in *Sphagnum*-turf (Volkova, Muldiyarov, 2000). S-.

B. oedipodium (Mitt.) Jaeg. – Spar. – in *Abies* forests, on logs and litter, in small abundance. Also reported for community with dominance of *Betula tortousa, Carex altaica, Veratrun lobelianum* in big bog system «Krestovskije» (Volkova, Muldiyarov, 2000). S+.

B. ornellatum (Mol.) Vent.et Bott. – Cm. – in *Abies* forests on logs and litter; sometimes codominate in moss cover. Several times collected on soil under canopy of tall-herb communities; all collections below 1100 m. S+.

B. plumosum (Hedw.) B.S.G. – Rar. – in cracks of rock outcrops, alt. 1155 m and 1050 m [8; 11]. S+.

B. populeum (Hedw.) B.S.G. – Spar. – occurs on rocks under closed canopy of tall-herb meadows, on wet shady rock outcrops, in recesses in taluses; mainly in forest belt. Reported also for ridges of complex ridge-hollow bogs bogs (Muldiyarov & Lapshina, 1996). S+.

B. reflexum (Starke) B.S.G. – Wid. – the most common and abundant species of *Brachythecium*. It is constant and often codominates in moss cover in *Abies* forests on soil, forest litter, fallen logs and at base of tree trunks. Common also on soil and litter in tall-herb meadows, in moss cover of open *Abies* and *Pinus sibirica* stands, and in open twisted birch stands. Occurs in recesses on rock fields, on fine soil in cracks and crevices of rock outcrops. Reported also for bogs of gullies of mountain slopes (Muldiyarov, Lapshina, 1996). The species is represented by two forms: with apressed and with squarrose leaves. S+.

B. rivulare B.S.G. – Com. – all over profile in wet habitats – on stream and river banks on moist and flooded sites; on temporary floods on meadows. Reported also for bogs of gullies of mountain slopes (Muldiyarov & Lapshina, 1996). S-.

B. rotaeanum De Not. – Rar. – on fallen logs in *Abies* forest and on fine soil in cracks and crevices of limestone outcrops [1; 5]. S-.

B. salebrosum (Web. et Mohr) B.S.G. – Wid. – in forests and open tree stands on forest litter, logs and base of trees trunks; sometimes in small abundance grows on soil, litter and rocks under canopy of tall-herb communities; occurs on fine soil in crevices of rock outcrops and in recesses on taluses. S+.

B. starkei (Brid.) B.S.G. – Spar. – in *Abies* forests on litter and logs, sometimes in small abundance on soil and litter under canopy of tall-herb communities. S+.

B. velutinum (Hedw.) B.S.G. – Com. – common and often abundant on soil and litter under canopy of tall-herb communities; occurs on fine soil in recesses on taluses and in cracks and crevices of rock outcrops; sometimes grows on litter and logs in *Abies* forests. S+.

Bryoerythrophyllum recurvirostrum (Hedw.) Chen – Rar. – on fine soil in cracks of rock outcrops; occasionally in forests on rotten wood. S+.

Bryum argenteum Hedw. – Rar. – in sites with disturbed soil cover: along roads, on ground on roots of fallen trees; also on fine soil among rocks. S-.

B. bimum (Schreb.) Turn. – reported by Volkova & Muldiyarov (2000): one record on small mire on Stanovoj ridge; in community with dominance of *Carex altaica*, *Veratrum lobelianum*, *Betula rotundifolia* and *Salix* spp. S-.

B. capillare Hedw. – Rar. – on fine soil in cracks of boulders under canopy of tall-herb communities. S-.

B. elegans Nees ex Brid. – Spar. – on fine soil on rocks, in cracks of rock outcrops, in recesses on rock fields. S-.

B. laevifilum Syed – Un. – on peat outcrop on bank of N.Ters River, alt. 790 m. [6]. S-.

B. pallescens Schleich. ex Schwaegr. – reported by Volkova & Muldiyarov (2000): one record on small mire on Stanovoj ridge; in community with dominance of *Carex altaica, Schultzia crinita* and bryophytes.

B. pseudotriquetrum (Hedw.) Gaertn. et al. – Com. – all over profile in wet eutrophic habitats. Common on boggy banks of streams and rivers, along of temporary floods on tall-herb meadows, in hollows in wet valley forests. Common and abundant on mires of tall-herb belt, occurs on mires of gullies of mountain slopes (Muldiyarov & Lapshina, 1996). S+.

B. schleicheri Schwaegr. – Un. – between rocks along small river, alt. 820m [7]. S-.

B. weigelii Spreng. – Spar. – on mires on the basis of hillsides and near to rives channels; in communities with dominance of *Salix* and *Carex* species; also in boggy forests in river valleys. S-.

Callicladium haldanianum (Grev.) Crum – Rar. – in lower part of forest belt only (alt 650-700m), in herbaceous *Abies* forests, on logs and on *Sorbus sibirica* trunks. S+.

Calliergon cordifolium (Hedw.) Kindb. – Spar. – in wet eutrophic habitats – in hollows in swamp forests in river valleys, on flat rivers banks, in wet crook-stem birch forests. Sometimes abundant in bogs of gullies of mountain slopes (Muldiyarov & Lapshina, 1996). Never found above 1100 m. S-.

C. giganteum (Schimp.) Kindb. – reported by Volkova & Muldiyarov (2000): one record in forest belt, on

bog «Startovij» in a valley of tributary stream of Kija river, in community with dominance of *Equisetum spp.*, *Carex limosa* and bryophytes. S-.

C. stramineum (Brid.) Kindb. – Wid. – all over profile in wet habitats. The most constant and often abundant on mires on bottoms of hillsides (Muldiyarov, Lapshina, 1996). Also common in other types of mires both in forest-belt and tall-herb belt; occurs in wet twisted birch stands, in swampy meadows, in nival communities. S-.

Campylium chrysophyllum (Brid.) J.Lange – Spar. – on soil and litter under canopy of tall-herb meadows and on sedge glades (*C.altaica*) in twisted birch stands; on soil between fern bunches in *Abies* forests with dominance of *Athyrium distentifolium*. S+.

C. halleri (Hedw.) Lindb. – Un. – on fine soil in cracks and crevices of limestone outcrops, alt. 600 m. [2]. S-.

C. polygamum (B.S.G.) C.Jens. – Spar. – occurs both in forest and in tall-herb belts: in mires on the basis of hillsides, in swampy crook-stem birch forests, in grassy mires (Volkova & Muldiyarov, 2000). Also recorded in swampy forests in valleys and on soil in tall-herb meadows. S-.

C. protensum (Brid.) Kindb. – Spar. – common and sometimes abundant in mires in tall-herb belts; more rarely in mires of gullies of mountain slopes (Muldiyarov & Lapshina, 1996). S-.

C. radicale (P.Beauv.) Grout – Spar. – in small abundance occurs in bogs of gullies of mountain slopes (Muldiyarov & Lapshina, 1996); in moss cover in wet twisted birch stands. S-.

C. sommerfeltii (Myr.) J.Lange – Rar. – on rotten wood in grassy *Abies* forests with of *Pinus sibirica*. Was not collected above 800 m. S+.

C. stellatum (Hedw.) C.Jens. – Rar. – in forest belt only: on rocks, cobbles, alluvium, sometimes on covered alluvium logs along rivers and streams banks. S-.

Ceratodon purpureus (Hedw.) Brid. – Cm. – all over profile: in forests (including swampy forests and open tree stands) on rotten wood; on fine soil between rocks and in recesses on taluses, in cracks and crevices of rock outcrops; on soil in tall-herb meadows and tundras; in disturbed places along of paths and near huts. S+.

Cirriphyllum piliferum (Hedw.) Grout – Spar. – in *Abies* forests on soil and logs, sometimes on soil under canopy of tall-herb communities; also on fine soil in cracks of small rock outcrops. S-.

Climacium dendroides (Hedw.) Web. et Mohr – Rar. – on soil and forest litter in wet forests in river valleys. S-.

Cratoneuron filicinum (Hedw.) Spruce – Rar. – in eutrophic habitats with flowing water, along small river and stream banks in forest-belt. S-.

Cynodontium polycarpon (Hedw.) Schimp. – Rar. – only two specimens from the same locality: on fine soil in cracks of rocks near small lake and on rock outcrops [8]. S+.

C. strumiferum (Hedw.) Lindb. – Rar. – on fine soil in cracks of rocks and rock outcrops in forest-belt and on fine soil on stony spots in tundras. S+.

C. tenellum (B.S.G.) Limpr. – Rar. – only two samples from the same point: on fine soil in cracks of rocks and on rock outcrops; in forest-belt [8]. S+.

Cyrtomnium hymenophylloides (Hueb.) Nyh. ex T.Kop. – Rar. – on fine soil in shaded cracks and crevices of rock outcrops (twice – on limestones). S-.

Desmatodon latifolius (Hedw.) Brid. (= *Tortula euryphylla* Zander) – Rar. – on soil in *Dryas* tundras and on fine soil on ledges of dry rock outcrops on steep bushy slope in forest-belt [10; 12]. S+.

Dichelyma falcatum (Hedw.) Myr. – Un. – on bank of small lake, on rocks with flowing water, alt. 940m. [8]. S-.

Dichodontium pellucidum (Hedw.) Schimp. – Spar. – on rocks, cobbles, alluvium along of river and stream banks; mainly in forest belt, up to 1200 m. S+.

Dicranella cerviculata (Hedw.) Schimp. – Un. – low cliff bank of N.Ters River, on vertical wall of peat outcrops, alt. 790 m. [6]. S+.

D. heteromalla (Hedw.) Schimp. – Rar. – on bare soil in forests with dominance of *Abies sibirica* and *Pinus sibirica*; also on bare soil along stream banks. S+.

D. rufescens (Dicks.) Schimp. – Rar. – in forest-belt in sites with disturbed soil cover: along roads and stream banks. S+.

D. varia (Hedw.) Schimp. – reported by Volkova & Muldiyarov (2000): one record on mire-system «Krestovskije», in open tree stands from *Betula alba var. tortuosa* and *Abies sibirica*; on peat outcrops.

Dicranodontium denudatum (Brid.) Britt. – Rar. – in lower part of forest belt only, in valley grassy conifers forests (with dominance of *Abies sibirica*, *Pinus sibirica* or *Picea obovata* in tree layer), on rotten wood. S-.

Dicranoweisia crispula (Hedw.) Milde – Com. – on taluses, rock outcrops and boulders; in crakes and directly on rock surface; mostly in exposed sites above timberline. S+.

Dicranum bergeri Bland. ex Hoppe – Rar. – mainly above timberline: in moss cover of mossy *Betula rotundifolia* shrublets and thickets of dwarf *Abies* "trees-in-skirts". S-.

D. bonjeanii De Not. – Spar. – in bogs of tundra-belt (Muldiyarov & Lapshina, 1996), in bushy tundras; also collected in *Dryas* and lichen tundras and once – on rotten wood in *Abies* forest near timberline. S-.

D. brevifolim (Lindb.) Lindb. – Rar. – few collections in different habitats at altitudes from 700 to 1300 m: on rotten wood in *Abies* forest; on fine soil near rock on tall-herb meadow; in moss cover in *Betula rotundifolia* shrublets. S-.

D. cf. laevidens Williams – Un. – one sample was preliminary attribute to the species due to tubular leaves and elongated incrassate porose leaf cells (Nyholm, 1986). On soil in tundra community with dominance of *Festuca ovina* and *Empetrum nigrum,* alt. 1200 m. [10]. S-.

D. elongatum Schleich. ex Schwaegr. – Rar. – in tundra-belt only: in moss cover of bushy tundras and in community with dominance of *Anemonastrum crinitum* and lichens; also on fine soil in recesses on taluses. S-.

D. flexicaule Brid. (= *D. congestum* Brid.) – Spar. – in forest belt occurs in mires on the basis of hillsides on rotten wood and bases of tree trunks (Volkova & Muldiyarov, 2000); occasionally grows on ledges of bedrocks. In the same habitats occurs in open tree stands. Above timberline occurs in moss cover in *Betula rotundifolia* shrublets and in different tundra-communities; on fine soil in recesses on taluses. S+.

D. fragilifolium Lindb. – Rar. – in forest belt only; in *Abies* forests on rotten wood and bases of tree trunks. S-.

D. fuscescens Turn. – Com. – mainly in forest belt: common in different forests on rotten wood and bases of tree trunks; also in scattered tree stands, and once on fine soil on ledges of rock outcrops near timberline. S+.

D. majus Sm. – Rar. – in recesses on taluses, on rotten wood in grassy forest with *Abies sibirica, Pinus sibirica* and *Picea obovata* in tree layer. Volkova & Muldiyarov (2000) reported this species for mire systems in the bases of hillsides, in boggy forests on litter and rotten wood. S-.

D. cf. *polysetum* Sw. – Rar. – only 4 specimens found in moss cover of tundra communities. The plants were under-developed, thus distinguishing features from *D.scoparium* and *D.bonjeanii* were not very clearly observed. S-.

D. scoparium Hedw. – Wid. – all over profile. The most common and abundant species of *Dicranum*. Common in forests on logs and bases of tree trunks, sometimes on forest litter. Also grows on soil covered rocks in shaded to exposed sites, in cracks of rock outcrops; occasionally in moss cover in tundras, *Betula rotundifolia* shrublets and nival communities. In small abundance occurs on ridges of ridge-hollow mires of intermountain depressions (Muldiyarov & Lapshina, 1996). S+.

D. spadiceum Zett. – Com. – the most common above timberline – in moss cover in tundras and *Betula rotundifolia* shrublets; on fine soil between rocks and in recesses on rock fields; occasionally occurs on logs in forests and open tree stands. S-.

Didymodon rigidulus Hedw. – Rar. – on fine soil in cracks and crevices of limestone outcrops [2, 5]. S-.

Distichium capillaceum (Hedw.) B.S.G. – Spar. – all over profile on fine soil in recesses taluses, in cracks of rock outcrops and on ground in bases of cliffs. S+.

Ditrichum cylindricum (Hedw.) Grout – Un. – in sites with disturbed soil cover along a road, alt. 950 m. [9]. S-.

D. flexicaule (Schwaegr.) Hampe – Spar. – on fine soil in cracks and crevices of limestone outcrops; occasionally on rotten wood in forests. S+.

D. heteromallum (Hedw.) Britt. – Un. – on fine soil in cracks and crevices of limestone outcrops, alt. 600 m. [2]. S-.

Drepanocladus aduncus (Hedw.) Warnst. – Spar. – on mires on bottoms of hillsides and on mires of tall-herb belt, in habitats with periodical moistening (Muldiyarov & Lapshina, 1996). Occasionally in other wet eutrophic habitats – on swampy stream banks and in sites of temporary water flows on slopes. S-.

Encalypta procera Bruch – Rar. – on fine soil in cracks and crevices of limestone outcrops [2; 5]; in both points in abundance. S-.

E. rhaptocarpa Schwaegr. – Un. – on fine soil in cracks of limestone outcrops, alt. 750 m [5]. S+. (Sporophyte of the sample have well-developed peristom.)

Entodon concinnus (De Not.) Par. – Un. – on fine soil on ledges of dry rock outcrops on steep bushy slope, alt. 900 m. [12]. S-.

Eurhynchium hians (Hedw.) Sande Lac. – Rar. – on soil under canopy of tall-herb communities and in cracks of rock outcrops, all collections are from narrow altitudinal interval, 1000-1100 m. S-.

E. pulchellum (Hedw.) Jenn. – Rar. – on soil in *Abies* forests. S+.

Fissidens adianthoides Hedw. – Spar. – on moist rocks near streams and waterfalls; the highest collecting point is at 1100 m. S+.

F. bryoides Hedw. – Com. – in forest- and subalpine- belts; common on soil under canopy of tall-herb communities; occurs in crevices of rock outcrops and in recesses on taluses, on bare soil along stream banks. S+.

F. osmundoides Hedw. – Rar. – in forest and tall-herb belts in wet habitats on fine soil and rock surfaces near streams and waterfalls; occasionally on partly flooded logs. S-.

F. taxifolius Hedw. – Rar. – mainly in forest-belt; on soil under canopy of tall-herb meadows. S-.

Fontinalis antipyretica Hedw. – Spar. – common on rocks, occasionally on flooded wood in water of streams and rivers; never collected above timberline. S+.

Grimmia alpestris (Web.et Mohr.) Schleich.ex Nees – Rar. – on ledges of rock outcrops and on surface of boulderes; from upper part of forest-belt to tundra-belt. S-.

G. anomala Hampe ex Schimp. – Rar. – on rocks in tall-herb meadow and in cracks of rock outcrops; all collections are from 800-1050 m alt. S-.

G. caespiticia (Brid.) Jur. – Rar. – some samples from the same point: on surface of boulders not far from snow patch in small circus in the upper course of Chernij Ijus River [15]. S-.

G. elatior Bruch ex Bals. et De Not. – Rar. – in cracks of rock outcrops near timberline, in partly shaded habitats [1; 10]. S+.

G. incurva Schwaegr. – Spar. – on rock fields and rock outcrops above timberline; abundant both in more or less protected habitats (in this case the plants have typical for the species appearance), and in exposed sunny sites (in this case the plants are in suppressed form, as it is described by Ignatov & Cao Tong (1994): with straight short leaves without hair-point). S+.

G. londirostris Hook. (=*G. affinis* Hoppe et Hornsch.) – Spar. – all over profile on rock fields, rock outcrops and separate boulders; mainly in exposed sunny habitats. S+.

G. muehlenbeckii Schimp. – Rar. – on rock fields, rock outcrops and separate boulders, from 800 to 1300 m alt. S-.

G. reflexidens Muell. (=*G. sessitana* De Not.) – Spar. – on wet rock fields and rock outcrops above timberline, in exposed sunny habitats. S+.

Gymnostomum aeruginosum Sm. – Rar. – on fine soil in shaded crevices of limestone outcrops [2; 5]. S-.

Hamatocaulis vernicosus (Mitt.) Hedenaes – reported by Volkova & Muldiyarov (2000): one record in mires of intermountain depressions, in swamps with periodical moistening.

Haplocladium angustifolium (Hampe et C.Muell.) Broth. – Un. – in herbaceous *Abies* forest, on *Sorbus sibirica* trunk, in small abundance, alt. 900 m. [1]. S-.

Hedwigia ciliata (Hedw.) Beauv. – Rar. – only 2 collections from dry rock outcrops in forest-belt, in exposed sunny habitats [1; 12]. S+.

Herzogiella striatella (Brid.) Z. Iwats. – Un. – one collection is preliminary attributed to the species. It has clear decurrently leaves and serrulate leaf margins; stem in low part with bunches of papillose rhizoids; median lamina cells 40-50 x 7-8 *м;* basal cells porose, in leaf corners small group of inflated cells; capsule inclinated, furrowed when dry. On fine soil on ledges of dry rock outcrops, in partly shaded habitats, alt 940 m. [8]. S+.

Hygrohypnum duriusculum (De Not.) Jamieson – Spar. – on rocks in water of streams and small rivers. S+.

H. luridum (Hedw.) Jenn. – Rar. – on rocks in water of streams and small rivers. S+.

H. ochraceum (Turn. ex Wils.) Loeske – Spar. – on rocks in water of streams and small rivers. S-.

Hylocomiastrum pyrenaicum (Spruce) Fleisch. – Wid. – all over profile. Common in forests and open tree stands on forest litter and on logs; grows on fine soil in cracks of rock outcrops and in recesses on rock fields, on separate more or less shaded boulders; occasionally also on ridges of ridge-hollow mires of intermountain depressions and in mires of gullies of mountain slopes (Muldiyarov & Lapshina, 1996). S-.

H. umbratum (Hedw.) Fleisch. – Com. – on litter in grassy *Abies* forests; in upper part of forest-belt often codominate in ground cover of *Abies* forests with *Athyrium distentifolium* in herb layer. Recorded on fine soil on wet shady rock outcrops. In small abundance occurs on forested sites of bog massifs in the bases of hillsides – on litter and base of tree trunks (Volkova, Muldiyarov, 2000). Always below 1100 m alt. S-.

Hylocomium splendens (Hedw.) B.S.G. – Com. – common, but not abundant on rotten wood in forests (where it is absent on litter); occasionally grows on fine soil on upper surfaces of dry rock outcrops and boulders all over profile; abundant in tundra communities. Reported also for drainage habitats in bogs of tundra-belt (Muldiyarov & Lapshina, 1996). S-.

Hypnum cupressiforme Hedw. – Spar. – mainly in forest and tall-herb belts. On fine soil on ledges and cracks of rock outcrops; occasionally on logs and bases of tree trunks in forests. S-.

H. fauriei Card. – Rar. – in lower part of forest belt only, in valley grassy conifers forests (with dominance of *Abies sibirica*, *Pinus sibirica* or *Picea obovata* in tree layer), on rotten wood. S+.

H. lindbergii Mitt. (= *Calliergonella lindbergii* (Mitt.) Hedenaes) – Spar. – on soil and alluvium along of streams and rivers banks; occurs on soil in wet valley forests. S-.

H. pallescens (Hedw.) P.Beauv. – Rar. – in forests on logs and on *Sorbus* and *Betula* trunks; in the same habitats recorded in mire systems in valleys and in the basis of hillsides in forest belt (Volkova & Muldiyarov, 2000). S+.

H. plicatulum (Lindb.) Jaeg. – Rar. – all over profile on fine soil in cracks of rock outcrops; also on logs in *Abies* forests. S-.

H. recurvatum (Lindb. et H.Arnell) Kindb. – Rar. – two collections on fine soil in cracks of limestone outcrops [2; 5]. S+.

Isopterygiopsis pulchella (Hedw.) Iwats. – Spar. – on rotten wood in forests; on fine soil in cracks of rock outcrops and in recesses on taluses; all over profile. S+.

Iwatsukiella leucotricha (Mitt.) Buck et Crum – Rar. – some collections in different habitats: in *Dicranum*-tufts in tundra, on *Sorbus* trunk near timberline, on fine soil in cracks of rock outcrops; in small abundance [9; 13]. S-.

Kiaeria blyttii (Schimp.) Broth. – Rar. – on fine soil between rocks and in recesses on taluses above timberline. S+.

K. falcata (Hedw.) Hag. – Rar. – only threes specimens were attribute to the species with confidence: the plants have regularly falcate-secund leaves and median lamina cells are clearly papillose; on fine soil between rocks above timberline; two from the samples were collected not far from snow patches which are existing all year around [10; 14]. S+.

K. starkei (Web.et Mohr) Hag. – Spar. – common and abundant above timberline near snow patches and in places with long-staying snow. In the habitats it forms spacious turfs to several dozens sq.m. In tall-herb belt also occurs on mires with distinctly periodical moistening (Muldiyarov & Lapshina, 1996). S+.

Leptodictyum humile (P.Beauv.) Ochyra – reported by Volkova & Muldiyarov (2000): one record in forest belt, on bog massif «Startovij» in a valley of tributary stream of river Kija, in willow stand with dominance of *Carex spp.*

Lescuraea mutabilis – reported Volkova & Muldiyarov, 2000): one record in forest belt, on bog massif «Domashnee», on bases of tree trunks. The report seems to be doubtful, basing on old broad concept of *L.mutabilis*: in narrow sense *L.mutabilis* is epiphyte species with more southern distribution.

L. saxicola (B.S.G.) Milde – Wid. – one of the most common and abundant epiliths; common on rocky substrates in different conditions: on rock outcrops, in recesses on rock fields, on boulders in forests and on tall-herb meadows, in nival communities; in forest belt sometimes occurs on logs and on *Sorbus sibirica* trunks. S+.

Leskea polycarpa Hedw. – Rar. – in valley forests on *Salix* and *Sorbus* trunks, occasionally on logs. S+.

Leskeella nervosa (Brid.) Loeske – Spar. – in forest- and subalpine- belts rather common on rock outcrops and on rocks under canopy of tall-herb communities; rarely occurs in forests on logs and on *Sorbus* and *Abie*s trunks. S-.

Limprichtia cossonii (Schimp.) Anderson et al. – Rar. – reported by Muldiyarov & Lapshina (1996): one record in mire at the base of hillsides.

L. revolvens (Sw.) Loeske – reported by Volkova & Muldiyarov (2000): in moss cover on mires in river valleys and in the basis of hillsides; in communities with dominance of *Carex altaica*, *Schultzia crinita*, *Baeotryon cespitosum* and *Sphagnum* and *Hypnum*-mosses, "not rare".

Meesia triquetra (Richter.) Aongstr. – reported by Volkova & Muldiyarov (2000): one record on mire-system «Krestovskije», in open tree stand with dominance of *Betula alba var. tortuosa* and *Abies sibirica*; on decayed wood. S-.

Mnium lycopodioides Schwaegr. – Rar. – two collections from forest-belt: on fine soil in shaded crevices of rock outcrops, alt. 1155 m.; on rotten wood in valley *Abies* and *Picea* herbaceous forest, alt. 650 m. [4; 8]. S-.

M. spinosum (Voit) Schwaegr. – Wid. – the most common and abundant species of *Mniaceae*. Widespread in forest and tall-herb belts: in forests on litter and logs; on soil and in the bases of rocks under canopy of tall-herb communities; occurs in crevices of rock outcrops. The highest collecting point is 1150 m. S+.

M. spinulosum B.S.G. – Un. – on rotten wood in *Abies* forest, alt. 650 m [4]. S+.

M. stellare Hedw. – Rar. – in shaded habitats on soil in forests and on fine soil in crevices of rock outcrops and taluses; in altitude interval 600-1250 m. S-.

M. thomsonii Schimp. – Rar. – on fine soil in shaded crevices of limestone outcrops, alt. 600 and 750 m. [2, 5]. S-.

Myurella julacea (Schwaegr.) B.S.G. – Un. – on fine soil in wet shaded crevices and recesses of limestone outcrops, alt. 750 m. [5]. S-.

M. sibirica (C.Muell.) Reim. – Rar. – on fine soil in wet shaded crevices and recesses of limestone outcrops, alt. 600 and 750 m. [2, 5]. S-.

M. tenerima (Brid.) Lindb. – Un. – on fine soil in wet shaded crevices and recesses of limestone outcrops, alt. 750 m. [5]. S-.

Oligotrichum hercynicum (Hedw.) DC. – Rar. – only above timberline: in nival communities; in recesses on taluses and on fine soil between rocks in places with long-staying snow. One specimen was checked by Ignatov. S-.

Oncophorus virens (Hedw.) Brid. – Un. – on alluvium on river bank close to water, alt. 550 m. [4]. S+.

O. wahlenbergii Brid. – Rar. – in *Abies* forests on rotten wood. S+.

Orthodicranum flagellare (Hedw.) Loeske – reported by Volkova & Muldiyarov (2000): one record on mire-system «Krestovskije», in open tree stand with dominance of *Betula alba var. tortuosa* and *Abies sibirica*; on decayed wood.

O. montanum (Hedw.) Loeske – Com. – common in forests on logs and bases of tree trunks. In the same habitats common in mire-complexes in river valleys and in the basis of hillsides (Volkova, Muldiyarov, 2000). Was not collected above timberline. S+.

Orthothecium intricatum (C.Hartm.) B.S.G. – Un. – on fine soil in cracks and small crevices of

limestone outcrops, alt. 750 m. [5]. S-.

Orthotrichum anomalum Hedw. – Un. – on dry sunny surfaces of limestone outcrops, alt. 750 m. [5]. S+.

O. cupulatum Brid. – Un. – on dry sunny surfaces of limestone outcrops, alt. 750 m. [5]. S+.

O. obtusifolium Brid. – Rar. – in forest-belt only; on *Sorbus* and *Betula* trunks. S+.

O. speciosum Nees in Sturm – Spar. – in forest-belt only; on *Sorbus* and *Betula* trunks. S+.

Oxystegus tenuirostris (Hook. et Tayl.) A.J.E.Smith – Com. – in forest and tall-herb belts: on fine soil in crevices of rock outcrops, on rocks under canopy of tall-herb communities; occasionally in forests on logs; all collections in altitude interval 600-1200 m. S+.

Paludella squarrosa (Hedw.) Brid. – Rar. – in tall-herb belt, in mires in saddles and on gentle slopes, in conditions of permanent flow moistening (Muldiyarov, Lapshina, 1996). S-.

Palustriella commutata (Hedw.) Ochyra (=*Cratoneuron commutatum* (Hedw.) G.Roth) – Rar. – in water-supplied hollow on stream terrace and near water on river bank; both collections are from forest-belt [8; 12]. S-.

P. decipiens (DeNot.) Ochyra (=*Cratoneuron decipiens* (De Not.) Loeske) – Rar. – in forest-belt, between rocks along stream banks. S-.

Paraleucobryum enerve (Thed.in Hornem.) Loeske – Un. – on fine soil in recesses on talus above timberline, alt. 1600 m. [16]. S-.

P. longifolium (Hedw.) Loeske – Wid. – all over profile on rock outcrops, separate boulders and taluses; occasionally on logs in forests. S-.

Philonotis fontana (Hedw.) Brid. s.l. – Most samples of *Philonotis* are sterile, and determination them with confidence is problematical. All samples with gametangia belong to *P. fontana* s. str.. The sterile material is not homogenous, and, according to descriptions of Ignatov & Ignatova (2003) the specimens can be attributed to two another species: *P. caespitosa* Jur. (*P. fontana var. caespitosa*): plants light-green, laminal cells short, with papilla in distal ends; and *P. seriata* Mitt. (*P. fontana var. seriata*): plants with more or less 5-ranked falcate-secund leaves with short laminal cells. – Spar. – all over profile in moist eutrophic habitats on banks of streams and small rivers; in mires of gullies of mountain slopes and in mires of tall-herb belt (Muldiyarov & Lapshina, 1996). *Philonotis seriata* was also reported for bog communities (Volkova & Muldiyarov, 2000): forest island in big bog system «Krestovskije», on peat outcrop near flowing water.

Plagiomnium confertidens (Lindb. et H.Arnell) T.Kop. – Rar. – some collections in wet valley coniferous forests in Kija valley, at altitude about 650 m, on litter and rotten wood. S-.

P. cuspidatum (Hedw.) T.Kop. – Spar. – most common in lower part of forest belt, on rotten logs and bases of tree trunks, occasionally on forest litter; uppermost records are at 1000 m on soil and rotten logs under canopy of tall-herb meadows. S+.

P. drummondi (Bruch et Schimp.) T.Kop. – Rar. – in herbaceous *Abies* forests on rotten wood and bases of tree trunks; was not found above 1000 m. S+.

P. ellipticum (Brid.) T.Kop. – Com. – in wet habitats of forest-belt and lower part of tall-herb belt: in moss cover in wet and swampy valley forests with participation of *Picea obovata* in tree layer; on wet meadows; on flat stream and river banks. Occurs on mires of gullies of mountain slopes (Muldiyarov, Lapshina, 1996). S-.

P. medium (B.S.G.) T.Kop. – Spar. – in forest- and tall-herb belts. The most common in *Abies* and *Abies* + *Picea* forests on litter and rotten wood; occasionally grows on fine soil in crevices of shaded rock outcrops. S-.

Plagiopus oederiana (Sw.) Crum et Anderson – Un. – on fine soil in wet partly shaded crevices of limestone outcrops, 750 m. [5]. S+.

Plagiothecium cavifolium (Brid.) Iwats. – Spar. – in forest- and tall-herb belts; on bare soil in wet coniferous forests in valleys, and in shaded crevices of rock outcrops. S-.

P. curvifolium Schlieph. ex Limpr. – reported by literature data only (Volkova & Muldiyarov, 2000): forest belt, mires on the basis of hillsides and mires of intermountain depressions, in forest islands on decayed wood and bases of tree trunks, "not rare in small abundance".

P. denticulatum (Hedw.) B.S.G. – Wid. – Widespread up to 1400 m alt.; common in all types of forest communities (including open tree stands near timberline) on logs and bases of tree trunks; occurs on soil under canopy of tall-herb meadows, on stream and river banks, in recesses on rock fields and in and crevices of rock outcrops. Reported also for ridges of complex ridge-hollow mires of intermountain depressions and for mires of gullies of mountain slopes (Muldiyarov & Lapshina, 1996). S+.

P. laetum B.S.G. – Com. – all over profile; common in forests on logs and on base of tree trunks; occurs in open tree stands and, occasionally – on fine soil in cracks of rocks and rock outcrops. Reported also for mires on the basis of hillsides and for complex mires of intermountain depressions (Volkova, Muldiyarov, 2000): in forest islands on decayed wood and bases of tree trunks; once – on peat outcrop. S+.

Platydictya confervoides (Brid.) Crum (= *Serpoleskea confervoides* (Brid.) Loeske) – Spar. – in forest- and tall-herb belts on surface of small rocks under canopy of tall-herb meadows. S+.

P. jungermannioides (Brid.) Crum – Un. – on fine soil in partly shaded cracks of limestone outcrops, alt. 750 m [5]. S-.

Pleurozium schreberi (Brid.) Mitt. – Wid. – all over profilee; in small abundance common on logs in forests (where it is rare on litter); on fine soil on upper surfaces of rock outcrops and boulders; on on ridges of ridge-hollow mires of intermountain depressions (Muldiyarov & Lapshina, 1996). The most constant and abundant in tundra communities. S-.

Pogonatum dentatum (Brid.) Brid. – Com. – all over profile. Common on disturbed places – on bare soil in forests, along of path, along stream and river banks, on fine soil in cracks of rock outcrops and on rock fields. S+.

P. urnigerum (Hedw.) P.Beauv. – Spar. – all over profile, in recesses on rock fields and in crevices of rock outcrops, along paths, and in nival communities. S+.

Pohlia cruda (Hedw.) Lindb. – Com. – all over profile in recesses on rock fields and in crevices of rock outcrops; occasionally on rotten wood in forests. S+.

P. drummondii (C.Muell.) Andrews – Spar. – common and abundant in nival communities and along of cold steams; occurs in wet habitats in recesses on rock fields and in crevices of rock outcrops; mostly above timberline. Samples without propagulae were attributed to the species only preliminary. S-.

P. nutans (Hedw.) Lindb. – Com. – all over profile. In small abundance common on logs in forests; occurs on bare ground on slopes to rivers and in crevices of rock outcrops. Reported for ridges of complex ridge-hollow mires intermountain depressions and for mires of gullies of mountain slopes (Muldiyarov, Lapshina, 1996). S+.

P. obtusifolia (Brid.) L.Koch – Un. – on fine soil between rocks on a place of snow patch, which melted in the end of summer, alt. 1100 m. [10]. The sample was checked by Ignatov. S+.

P. sphagnicola (Bruch et Schimp.) Lindb. et H.Arnell – reported by literature data only (Muldiyarov & Lapshina, 1996): some records in moss cover on mires of intermountain depressions and in swampy tundras.

P. wahlenbergii (Web. et Mohr) Andrews – Spar. – all over profile in wet habitats on stream banks, in nival communities. Reported also for mires of gullies of mountain slopes (Muldiyarov & Lapshina, 1996). S-.

Polytrichastrum alpinum (Hedw.) G.L.Sm. – Spar. – mainly above timberline (1300-1800 m): in moss cover of tundra communities, in mossy *Betula rotundifolia* shrublets, on fine soil in recesses on rock fields; once collected in forest belt – on log in herbaceous *Abies* forest (alt.900 m). S+.

P. formosum (Hedw.) G.L.Sm. – Spar. – on logs and litter in *Abies* forests with dominance of *Calamagrostis obtusata* or *Athyrium distentifolium* in herb layer; occasionally on fine soil in crevices of rock outcrops; was not recorded above timberline; there are a lot of sterile specimens that are intermediate with *P.longisetum* features (in proportion of sheathing lamina cells, number of cell rows in one-layer part of lamina) . So, in many cases their separation was almost impossible. S+.

P. longisetum (Sw. ex Brid.) G.L.Smith *var. anomalum* (Milde) Ignatov et G.L.Smith – Wid. – all over profile; common in forests on rotten wood and litter; occurs in nival communities, on fine soil in shaded crevices of rock outcrops, on bare ground on precipices to rivers; in small abundance common in different types of mires (Muldiyarov & Lapshina, 1996). S+.

P. pallidisetum (Funck) G.L.Sm. – Un. – on bare soil in herbaceous *Abies* forest, 550 m. [3]. S+.

P. sexangulare (Brid.) G.L.Sm. – Spar. – common and abundant above timberline near permanent and temporary snow beds, where it cover sometimes up to tens of square meter; also grows on wet rock fields. Muldiyarov & Lapshina (1996) reported it on mires of tall-herb belt with distinctly periodical moistening. S+.

Polytrichum commune Hedw. – Cm. – all over profile: on litter and rotten wood in forests, on swampy meadows, in wet recesses on rock fields, in *Betula rotundifolia* shrublets, in thickets of dwarf *Abies* "trees-in-skirts", in high-mountains thickets with dominance of *Bergenia crassifolia* and *Vaccinium myrtillus*. Occurs on ridges of ridge-hollow complexes in forest belt mires and in boggy tundras (Muldiyarov & Lapshina, 1996). S+.

P. juniperinum Hedw. – Wid. – all over profile; common between rocks, on rock outcrops, on soil covered boulders on taluses,in forests and open tree stands on logs, in moss cover in tundras, along trails and paths. Occasionally in rather wet habitats – in nival communities, in communities with dominance of *Schultzia crinita*. Occurs on ridges of complex ridge-hollow mires of intermountain depressions (Muldiyarov & Lapshina, 1996). S+.

P. piliferum Hedw. – Com. – all over profile in dry sunny habitats: on fine soil in cracks and on a surface of rocks, on rock fields and rock outcrops; along of path; occasionally on logs in forests and open tree stands. S+.

P. strictum Brid. – Spar. – in small abundance regularly occurs on ridges of complex ridge-hollow mires of intermountain depressions, in boggy tundras (Muldiyarov & Lapshina, 1996). S+.

Pseudobryum cinclidioides (Hueb.) T.Kop. – Com. – in wet eutrophic habitats, along streams and in near springs; mostly in forest-belt. Muldiyarov & Lapshina (1996) reported this species in mires of gullies of mountain slopes, in mires on the basis of hillsides, in complex mires of intermountain depressions. S-.

Pseudocalliergon trifarium (Web. et Mohr) Loeske – reported by Volkova & Muldiyarov (2000): one record on mire in the bases of hillside in a valley of river Krestovaja, in forested grassy bog community.

Pseudoephemerum nitidum (Hedw.) Loeske – Un. – in site with disturbed soil cover along a road, in abundance. Alt. 950 m. [9]. S+.

Pseudoleskea incurvata (Hedw.) Loeske – Wid. – all over profile on rock surfaces in moderately wet and shaded habitats: on rocks under canopy of tall-herb meadows or bushy slopes, in recesses on rock fields and in shade on rock outcrops. S+.

P. patens (Lindb.) Kindb. – Spar. – on rock surfaces in moderately wet and shaded habitats: on rocks under canopy of tall-herb meadows or bushy slopes, in recesses on rock fields; all collections were made near and above timberline. S+.

Pseudoleskeella papillosa (Lindb.) Kindb. – Rar. – on surfaces of rocks under canopy of tall-herb meadows and bushy slopes, on rock fields and rock outcrops; in moderately shaded habitats. All specimens were collected at altitudes 1000-1150 m. S+.

P. tectorum (Funck ex Brid.) Kindb. in Broth. – Rar. – on fine soil in cracks on rock outcrops, 750 and 1100 m. [1; 5]. S-.

Pterigynandrum filiforme Hedw. – Spar. – on surfaces rock outcrops and separate rocks; once recorded in herbaceous *Abies* forest on a trunk of *Sorbus;* all specimens were collected at altitudes 900-1150 m. S-.

Ptilium crista-castrensis (Hedw.) De Not. – Spar. – in small abundance on logs in forests, on soil covered boulders and rock outcrops, in moss cover of open tree stands. Also reported for mire community with dominance of *Abies sibirica*, *Pinus sibirica* and *Betula tortousa* in tree layer and *Vaccinium myrtillus* and *Sphagnum* spp. in ground cover (Volkova & Muldiyarov, 2000). Never found above timberline. S-.

Pylaisia polyantha (Hedw.) Schimp. – Spar. – in forest belt, mostly in the lower part; on logs and trunks of *Sorbus* and *Betula*. S+.

Racomitrium canescens (Hedw.) Brid. – Com. – all over profile on upper surfaces of rock outcrops and boulders, mostly in sunny, moderately wet habitats; above timberline also on lithosoil in open tree stands and in tundras. Often the species is represented by forms with leaves without hair-point. S+.

R. heterostichium (Hedw.) Brid. – reported by Volkova & Muldiyarov (2000): rare on mires on the basis of hillsides; on roots and trunk bases of trees and on rotten wood.

R. microcarpon (Hedw.) Brid. – Com. – mostly above timberline, on upper surfaces of rock outcrops and boulders, in recesses on rock fields. S+.

R. sudeticum (Funck) B.S.G. – Wid. – one of the most common epilithic mosses, the most common and abundant species of *Grimmiaceae;* common on rocky substrates on rock fields, both in recesses and in exposed habitats, rock outcrops, separate boulders in forests and under canopy of tall-herbs in moeadows, in nival communities. S+.

Rhabdoweisia crispata (Dicks.) Lindb. – Rar. – in shade on vertical walls and overhangs of rocky outcrops; in forest-belt. [6; 8]. S+.

Rhizomnium magnifolium (Horik.) T.Kop. – Spar. – on litter in herbaceous *Abies*-forests; also in wet shaded habitats along river and stream banks; up to 1000 m alt. S-.

Rhizomnium pseudopunctatum (Bruch et Schimp.) T.Kop. – Rar. – all over profile in wet shaded habitats: on soil and litter in *Abies* forests and under canopy of tall-herb meadows, in recesses on wet rock fields. Occurs in mires of gullies of mountain slopes (Muldiyarov & Lapshina, 1996).

R. punctatum (Hedw.) T.Kop. – Spar. – in forest- and tall-herb-belts on soil, litter and rotten wood in wet forests; in crevices of wet rock outcrops; in wet shaded habitats along stream banks and near waterfalls. S+.

Rhodobryum roseum (Hedw.) Limpr. – Com. – on soil under canopy of tall-herb meadows, on litter and rotten wood in *Abies* forests; occurs on fine soil in wet crevices of rock outcrops; was not collected above 1000 m. Some samples have features of *R.ontariense*: the plants have 25-30 leaves in rosette and leaf margins are strongly recurved. However dorsal epidermis of the costa of the leaves is 2-3-stratose (in *R.ontariense* it is 1-stratose). The latter species was not collected so far in the investigated territory. S-.

Rhytidiadelphus subpinnatus (Lindb.) T.Kop. – Wid. – common and often abundant in forest- and tall-herb belts: in moss cover and on logs in *Abies* forests, on soil under canopy of tall-herb meadows; also on fine soil in wet crevices of rock outcrops and on upper surface of moderately shaded boulders. Muldiyarov & Lapshina, (1996) reported this species on ridges of complex ridge-hollow mires of intermountain depressions, in mires of gullies of mountain slopes and in mires on the basis of hillsides. S-.

R. triquetrus (Hedw.) Warnst. – Spar. – in forest belt only: in small abundance occurs in rotten wood in forests and on fine soil on upper surface of moderately shaded boulders. Once recorded on small bog in forest belt (Volkova, Muldiyarov, 2000). S-.

Rhytidium rugosum (Hedw.) Kindb. – Cm. – the most common in tundra communities, including boggy tundras (Muldiyarov & Lapshina, 1996); in moss cover in open tree stands near timberline; in forest belt in dry sunny habitats on fine soil on upper-turned rock surfaces. S-.

Saelania glaucescens (Hedw.) Broth. – Rar. – in shaded habitats in crevices of rock outcrops and on bare ground of cliff banks of rivers; all collections are from forest-belt. S-.

Sanionia uncinata (Hedw.) Loeske – Wid. – all over profile: common on logs and bases of tree trunks in all forest communities; occurs on fine soil in recesses on rock fields and on boulders, on soil along of stream and river banks, occasionally on rocks under canopy of tall-herb meadows. Reported also for mires of intermountain depressions and for mires of tall-herb belt (Muldiyarov & Lapshina, 1996). S+.

Schistidium apocarpum s. l. – in attemps to follow concept of Blom (1996, 1998) and Ignatov & Ignatova (2003) the material is possible to attribute to four species: S. *apocarpum* (Hedw.) B.S.G. – 1 specimen (from forest-belt); *S. dupretii* (Ther.) W.A.Weber. – 4 specimens (from forest- and tall-herb belts); *S. boreale* Poelt – 4 specimens (from forest-belt); *S. submuticum* Broth.et Blom – 3 specimens (from forest-belt). Referring of the specimens to the last two species seems to be clear, whereas *S. apocarpum* and *S. dupretii* did not fit their diagnoses in all features. All collections were done on more or less shaded rocks; all have sporophytes. S+.

S. rivulare (Brid.) Podp. – Spar. – all collections are from upper part of forest-belt; rather common on rocks near water of streams, rivers and lakes, mostly in periodically flooded sites. S+.

Schistostega pennata Hedw. – Rar. – in forest belt only, on soil walls at upturned roots of fallen trees, in shade. S+.

Seligeria pusilla (Hedw.) B.S.G. – Un. – on shaded vertical walls and overhangs on limestone outcrops, in abundance. [5]. The specimen was checked by Ignatov. S+.

S. tristichoides Kindb. – Un. – on shaded vertical walls and overhangs on limestone outcrops, in abundance, at 750 m alt. [5]. The specimen was checked by Ignatov. S+.

Sphagnum angustifolium (Russ.) C.Jens. – Spar. – often dominate and codominate in moss cover in swamps and hollows in complex mires of intermountain depressions with permanent moistening; in small abundance occurs on ridges of ridge-hollow mires, occasionally – in mires of gullies of mountain slopes and in boggy tundras (Muldiyarov & Lapshina, 1996).

S. aongstroemii C.Hartm. – Rar. – in small abundance in boggy tundras (Muldiyarov & Lapshina, 1996).

S. balticum (Russ.) Russ. ex C.Jens. – Rar. – in swamps in complex mires of intermountain depressions with permanent moistening (Muldiyarov & Lapshina, 1996).

S. capillifolium (Ehrh.) Hedw. – Com. – dominate and codominate in moss cover on ridges of complex ridge-hollow mires of intermountain depressions; also in boggy tundras (Muldiyarov & Lapshina, 1996).

S. centrale C.Jens. – reported by Muldiyarov & Lapshina (1996) in small abundance on ridges of complex ridge-hollow mires of intermountain depressions.

S. compactum DC. – Com. – common and often dominate in moss cover in swamps and hollows in complex mires of intermountain depressions with distinct periodic moistening (Muldiyarov & Lapshina, 1996).

S. contortum K.F. Schultz – reported by literature data only (Muldiyarov & Lapshina, 1996): in swamps in complex mire of intermountain depressions with periodic moistening.

S. fallax (Klinggr.) Klinggr. – Spar. – often dominate and codominate in moss cover in swamps and hollows in complex mires of intermountain depressions (mostly with permanent moistening), occurs on mires at base of hillsides (Muldiyarov & Lapshina, 1996).

S. flexuosum Dozy et Molk. – Com. – often dominate and codominate in moss cover in swamps and hollows in complex mires of intermountain depressions with permanent moistening (occasionally grows on ridges of ridge-hollow mires); sometimes abundant on mires at base of hillsides; occurs in mires of gullies of mountain slopes (Muldiyarov & Lapshina, 1996).

S. fuscum (Schimp.) Klinggr. – Com. – often dominate and codominate in moss cover on ridges of complex ridge-hollow mires of intermountain depressions; also in boggy tundras (Muldiyarov & Lapshina, 1996).

S. girgensohnii Russ. – reported by Muldiyarov & Lapshina (1996): in small abundance on ridges of complex ridge-hollow mires of intermountain depressions; occasionally on mires in bottoms of hillsides.

S. jensenii H.Lindb. – Com. – often dominate and codominate in moss cover in swamps and hollows

in complex mires of intermountain depressions, occasionally grows on ridges of ridge-hollow mires; sometimes occurs on mires of tall-herb belt (Muldiyarov & Lapshina, 1996).

S. magellanicum Brid. – Com. – in small abundance common on ridges of complex ridge-hollow mires intermountain depressions; occasionally in boggy tundras (Muldiyarov & Lapshina, 1996).

S. majus (Russ.) C.Jens. – Rar. – in swamps in complex mires of intermountain depressions with permanent moistening (Muldiyarov & Lapshina, 1996).

S. obtusum Warnst. – reported by Muldiyarov & Lapshina (1996): in swamps in complex mire of intermountain depressions with permanent moistening.

S. palustre L. – reported by Muldiyarov & Lapshina (1996): in swamps in complex mire of intermountain depressions with permanent moistening.

S. papillosum Lindb. – Com. – often dominate and codominate in moss cover in swamps in complex mires of intermountain depressions with permanent moistening; occasionally in small abundance on ridges of ridge-hollow mires (Muldiyarov & Lapshina, 1996).

S. pulchrum (Lindb. ex Braithw.) Warnst. – reported by Muldiyarov & Lapshina (1996): some records in swamps in complex mires of intermountain depressions with permanent moistening.

S. riparium Aongst.– Rar.– in swamps in complex mires of intermountain depressions with permanent moistening (Muldiyarov & Lapshina, 1996).

S. rubellum Wils. – Rar. – in boggy tundras (Muldiyarov & Lapshina, 1996).

S. russowii Warnst. – Com. – often dominate and codominate in moss cover on ridges of complex ridge-hollow mires of intermountain depressions, occurs in swamps; occasionally grows on mires in bottoms of hillsides and in boggy tundras (Muldiyarov & Lapshina, 1996).

S. squarrosum Crome – Spar. – on mires at bases of hillsides and in mires of gullies of mountain slopes (Muldiyarov & Lapshina, 1996).

S. subnitens Warnst. – reported by Muldiyarov & Lapshina (1996): in swamps in complex mire of intermountain depressions with permanent moistening.

S. subsecundum Nees ex Sturm – Com. – often dominate and codominate in moss cover on mires in the bases of hillsides; common in swamps in complex mires of intermountain depressions with distinctly periodical moistening, occasionally grows in swamps in complex mires of intermountain depressions with permanent moistening; occurs on mires of gullies of mountain slopes and in mires of tall-herb belt (Muldiyarov & Lapshina, 1996).

S. tenellum (Brid.) Brid. – reported by Muldiyarov & Lapshina (1996): some records in swamps in complex mires of intermountain depressions, mostly in conditions of permanent moistening.

S. teres (Schimp.) Aongstr. ex Hartm. – Spar. – in small abundance occurs on mires in the bases of hillsides and on mires of gullies of mountain slopes, in swamps in complex mires of intermountain depressions, in subalpine mires (Muldiyarov & Lapshina, 1996).

S. warnstorfii Russ. – Spar. – in small abundance in complex mires of intermountain depressions – on ridges of and hollows in ridge-hollow mires; occasionally on mires of gullies of mountain slopes (Muldiyarov & Lapshina, 1996).

Tayloria lingulata (Dicks.) Lindb. – Un. – on fine soil on rocks near small waterfall; alt. 950 m. [11]. S-.

Tetraphis pellucida Hedw. – Spar. – in forest belt only; on rotten wood. Volkova & Muldiyarov (2000) reported it in the same habitat in complex mire «Krestovskije». S+.

Tetraplodon mnioides (Hedw.) B.S.G. – Rar. – on soil in *Dryas* tundra; three collections from different years from the same point, alt. 1300 m. [10]. S+.

Thamnobryum neckeroides (Hook.) Lawt. – Wid. – on rocks in wet shaded habitats: in recesses and on down turned or overhanging rock surfaces; in small abundance this species can be found almost on any rock outcrops or large rock fields in forest and tall-herb belts. S-.

Timmia comata Lindb.et H.Arnell – Un. – in cracks and crevices of limestone outcrops, alt. 750 m. [5]. S-.

Tomentypnum nitens (Hedw.) Loeske – reported by Volkova & Muldiyarov (2000): mire «Berezovoje» in Kija valley below mouth of stream Startovij; in boggy community of *Betula alba* var. *tortuosa*, near trunk bases. S-.

Tortella tortuosa (Hedw.) Limpr. – Spar. – all over profile in wet recesses on rock fields and on fine soil in cracks and crevices of rock outcrops. S+.

Tortula norvegica (Web.f) Wahlenb. ex Lindb. (= *Syntrichia norvegica* Web.f.) – Spar. – on fine soil at upturned rock surfaces in wet moderately shaded habitats – under canopy of tall-herb meadows, on shaded rock outcrops and in recesses on rock fields; mostly in upper part of forest-belt and in tall-herb belt. S-.

T. ruralis (Hedw.) Gaertn. et al. (=*Syntrichia ruralis* (Hedw.) Web. et Mohr.) – Un. – on limestone outcrops, alt. 750 m. [5]. S-.

Ulota rehmannii Jur. – Rar. – in forest-belt only, in *Abies* herbaceous forests on *Sorbus* and *Betula* trunks. S+.

Warnstorfia exannulata (B.S.G.) Loeske – Com. – common and sometime dominate in moss cover in swamps in complex mires of intermountain depressions with distinctly periodical moistening, in mires of tall-herb belt; occurs on mires on bottoms of hillsides and on mires of gullies of mountain slopes

(Muldiyarov & Lapshina, 1996). S+.

W. fluitans (Hedw.) Loeske – Spar. – in swamps in complex mires of intermountain depressions; on mires on bottoms of hillsides and in mires of tall-herb belt (Muldiyarov & Lapshina, 1996). S+.

Weissia brachycarpa (Nees et Hornsch.) Jur – Rar. – two specimens with well-developed sporophytes were found on fine soil in cracks and crevices of rock outcrops, alt. 900 and 1150 m. Many collections of *Weissia* have no sporophyte, making identification almost impossible. S+.

W. controversa Hedw. – Rar. – three specimens with well-developed sporophyte; on fine soil in cracks and crevices of rock outcrops, on ground walls of stream bands; alt 900-1000 m. S+.

DISCUSSION

The studied bryoflora is not very specific in the species composition. From the biogeographic point of view some records however are interesting.

Pseudoephemerum nitidum – first time collected in mountains of South Siberia. The species has scattered distribution in the Holarctic. In Siberia it was known only from the West Siberian Plane (surroundings of Surgut (Czernyadjeva, Kuzmina, 2002)). The specimen was collected in a habitat typical for this species – on a damp loamy substrate along the old tankette track, in shade. I don't think that the species is adventitious here: the territory is almost intact; few people visited the territory; most of them spend the whole life in this part of Siberia. I think that [guess - ОЛЬГА, guess в научной литературе имеет, как правило, смысл ругательства или претензии!] the species belongs to the native flora of the territory, spreading along a tracks as a new suitable habitat.

Pohlia obtusifolia – the species has scattered distribution in the Holarctic in arctic- and highmountain regions; reported from India (Shaw, 1982). For mountains of South Siberia the species was known only by data of Krylov (1924) and Bachurina (1939). Krylov reported the species for Altai Mountains, for Terekhtinskii Range, but no herbarium specimens were found; Bachurina collected the species in Western Sayan Mountains, on Aradansky Range (Bardunov, 1974). Afonina & Czernydjeva (1995) reported this *P. obtusiflia* for Siberian Arctic as a rare species. In the investigated area, *P. obtusiflia* was collected in its typical habitat – near late snow bed in the alpine belt.

Grimmia anomala – the species has scattered distribution in the Holarctic, extending southwards to Kashmir (India); everywhere it is a rare species. In Russia is known from several points in Caucasus, Urals and Altai. In the investigated area, the species was collected four times (Barhatniy Ridge, the valley of Krasnaja River and two points in surroundings of Chemodan Mountain) in similar habitats – on rocks on a tall-herb meadow and in cracks of rock outcrops in the upper part of forest belt and in tall-herb belt; all the samples have well-developed propagulas.

Below are discussed few more species, that a re relatively common in the studied area, but rather rare in South Siberia, have scattered distributions in the Holarctic; in the investigated area all of than found in their typical habitats:

Orthothecium intricatum – occurs mainly in mountains of boreal and temperate zones, on rocks (mostly limestones). In South Siberia it was known from only several points: Altai (surroundings of Telezkoje Lake; Chojsky Range (Ignatov, Ando, Ignatova, 1996)); Western Sayan Mountains (Borus Range, Ojsky Range (Bardunov, 1974)).

Anomodon rugelii – occurring mainly in mountains of boreal and temperate zones on rocks and trees, the most common in Eastern Asia. In Siberia it occurs only in the southern part; it is known from Khamar-Daban Range (Kazanovsky, 1993) and from only point on Kuznetskiy Alatau (Amzas river – Vasiliev, 1995). In the investigated area, *A. rugelii* is not rare, occurring on rocks in moist shaded sites.

Seligeria pusilla – widespread species with extensive disjunction, occuring mainly in boreal and temperate zones, on limestones. In Siberia it was known only from Altai Mountains (Ignatov, 1996).

Seligeria tristichoides – similar to previous species. In Siberia it was known from Yakutia (Ignatov & al., 2001) and from Altai Mountains (Ignatov, 1996).

Pseudoleskea patens – spreaded mainly in temperate regions. In Siberia it is known only in southern part, from Khamar-Daban Range (Kazanovsky, 1993) and from the single locality from Kuznetskiy Alatau (Sarala river – Vasiliev, 1995). In the investigated area, this species is not rare, growing on rock surfaces in moderately wet and shaded habitats.

Polytrichastrum pallidisetum – in Siberia it is spread only on the southern part of the territory; up to now it was known only from Altai Mountains, near Telezkoje Lake (Ignatov, Smith Merrill, 1995); Western Sayan Mountains, several places (Vasiliev, 1995) and Khamar-Daban Range (Kazanovsky, 1993).

Haplocladium angustifolium – occuring mainly in temperate and tropical zones. In Siberia it was known from only few places in Altai (Ignatov, 1996) and Western Sayan Mountains (Vasiliev, 1995).

Oligotrichum hercynicum – the species has arctic and alpine distribution. In Siberia it is a rare species: reported for few points in arctic zone (Afonina & Czernydjeva, 1995), Putorana Plateau (Andreeva & al., 1986), and Yakutia (Ignatov & al., 2001). In South Siberia it was reported from the single point in Kuznetskiy Alatau, Sarala River (Vasiliev, 1995). In the investigated area, the species was collected four times: near Ribnoje Lake, Krestovaja Mountain, two places near Kanim Mountain.

Tayloria lingulata – species with the scattered distribution in the Holarctic mountaines and in the Arctic, including Siberian Arctic (Afonina & Czernydjeva, 1995). In South Siberia it was reported only from few places in Altai and Sayan Mountains (Northern Chuja Range, Kantegirskiy and Bolshoj Sayan Ranges – Bardunov, 1974).

Habitat distribution of species

Indices of occurrence of moss species on the territory and their coenotic distribution are presented in Table 1. Species that prefer mire habitats are not considered here; their distribution was discussed by Lapshina & Muldiyarov (1995, 2000), Muldiyarov & lapshina (1996), and Volkova & Muldiyarov (2000).

Among common species (found 25 times or more) in the study area there are not only common in Siberia species with wide ecological amplitude (such as *Plagiothecium denticulatum, Brachythecium reflexum, B. salebrosum, Pleurozium schreberi, Polytrichum juniperinum, Sanionia uncinata),* but also *Brachythecium erythrorrhison, Hylocomiastrum pyrenaicum, Rhytidiadelphus subpinnatus, Lescuraea saxicola, Racomitrium sudeticum, Pseudoleskea incurvata, Thamnobryum neckeroides* – species, which in Altai-Sayan mountain system occur only in the most humid districts.

The most common species of boreal taiga, *Pleurozium schreberi* and *Hylocomium splendens* are not abundant in the forest belt on the investigated area. They prevail in tundras, together with *Rhytidium rugosum* and *Aulacomnium turgidum,* i. e. in more dry communities in comparison with forests. In forest communities one of the most abundant species is *Rhytidiadelphus subpinnatus.*

There are some species, which although not common in the territory in general, but quite constant in certain habitats: *Kiaeria starkei* and *Polytrichastrum sexangulare* are constant and abundant in nival communities; *Hylocomiastrum umbratum* and *Brachythecium ornellanum* – in forests, *Platydictya confervoides* – on small rocks under a canopy of tall-herb communities. All these species are rather rare in Altai-Sayan mountain system.

Xerophytic and mesoxerophytic species are rare or absent on the investigated area: for example, *Hedwigia ciliata* and *Tortula ruralis* are very rare on the territory; *Abietinella abietina* is also relatively rare , though in Altai and Sayan as a whole ther are very common.

Limestone outcrops are rare in the study area – only two of them were studied: in the valleys of rivers Kija and N.Ters (points №2 and №5 in Fig.1); therefore 26 species are recorded only from these two localities.

In general, the species composition and occurrence reflect quite humid climatic conditions of the territory.

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Species	Types of plant communities:				Rocks	Σ
	N	T	F	TH		
Kiaeria starkei	III[ab]	.	.	.	k	15
Polytrichastrum sexangulare	III[ab]	.	.	.	+	15
Pohlia wahlenbergii	II	.	.	.	k	13
Pohlia drummondii	II	.	.	.	+	11
Racomitrium sudeticum	II	+	.	.	K[ab]	40
Dicranum spadiceum	I	II	+	.	k	20
Polytrichum juniperinum	+	II	II	.	k	35
Pleurozium schreberi	.	III[ab]	III	.	+	54
Hylocomium splendens	.	III[ab]	II	.	+	28
Rhytidium rugosum	.	III[ab]	.	.	+	21
Aulacomnium turgidum	.	III[ab]	.	.	.	19
Polytrichum commune	.	II	+	.	+	25
Pohlia nutans	.	I	II	.	+	24
Dicranum scoparium	.	I	III[ab]	.	k[ab]	42
Brachythecium erythrorrhison	.	+	III[ab]	I	k[ab]	27
Brachythecium reflexum	.	+	III[ab]	III[ab]	k	57
Rhytidiadelphus subpinnatus	.	.	III[ab]	I	+	35
Hylocomiastrum umbratum	.	.	III[ab]	.	+	14
Plagiothecium laetum	.	+	III	.	+	20
Sanionia uncinata	.	+	III	+	k	42
Plagiothecium denticulatum	.	.	III	I	k[ab]	62
Brachythecium salebrosum	.	.	III	I	+	26
Dicranum fuscescens	.	.	III	.	+	16
Orthodicranum montanum	.	.	III	.	.	19
Rhodobryum roseum	.	.	II	I	+	26
Brachythecium ornellatum	.	.	II	I	.	16
Ptilium crista-castrensis	.	.	II	.	+	13
Tetraphis pellucida	.	.	II	.	.	12
Atrichum flavisetum	.	.	II	.	+	13
Hylocomiastrum pyrenaicum	.	+	II	.	k	26
Polytrichastrum longisetum	+	.	II	.	+	19
Brachythecium oedipodium	.	.	II	.	.	10
Brachythecium starkei	.	.	II	I	.	14
Mnium spinosum	.	.	II	I	k	33
Brachythecium velutinum	.	.	I	III[ab]	+	23
Fissidens bryoides	.	.	I	II	+	19
Pogonatum dentatum	.	+	I	.	+	16
Hypnum cupressiforme	.	I	I	.	k	13
Ceratodon purpureus	.	I	I	+	+	16
Plagiomnium ellipticum	.	.	I	+	+	16
Bryum pseudotriquetrum	.	.	+	+	+	18
Calliergon stramineum	I	.	.	+	+	26
Polytrichum piliferum	.	I	.	+	k	17
Aulacomnium palustre	.	+	.	+	.	19
Rhizomnium punctatum	.	.	I	.	+	11
Pohlia cruda	.	.	I	.	K	23
Leskeella nervosa	.	.	I	.	K	12
Isopterygiopsis pulchella	.	.	I	.	k	11
Oxystegus tenuirostris	.	.	+	.	K	16
Platydictya confervoides	.	.	+	.	K	15
Racomitrium microcarpon	.	I	.	.	K	17
Lescuraea saxicola	.	.	I	.	K[ab]	48
Pseudoleskea incurvata	+	.	.	.	K[ab]	30
Paraleucobryum longifolium	.	+	+	.	K[ab]	27
Andreaea rupestris	+	I	.	.	K[ab]	19
Racomitrium canescens	+	.	.	.	K[ab]	18
Dicranoweisia crispula	.	.	.	.	K[ab]	22
Tortella tortuosa	.	.	.	.	K[ab]	12
Thamnobryum neckeroides	.	.	.	.	K	27
Tortula norvegica	.	.	.	.	K	10
Brachythecium rivulare	.	.	.	.	w/K[ab]	17
Schistidium rivulare	.	.	.	.	w/K[ab]	10
Fontinalis antipyretica					w/K[ab]	10

Table 1. Coenotic disrtibution of moss species in Kuznetzkiy Alatau, and their occurrence on rocky substrates (only species, which were recorder 10 and more times). Types of plant communities: N – nival, T – tundra, F – forest, TH - tall-herb communities. Constancy: + <10% of relevees, I – 10-30%, II – 30-70%, III >70%. "ab" – species often abundant (cover in releves >1%). In "Rocks" column: K – only or mostly on rocks; k – regular on rocks; w – near and in the water; Σ – total number of a species records.

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