

BRYOPHYTES OF ALTAI MOUNTAINS. V.
PRELIMINARY LIST OF THE ALTAIAN HEPATICS
МОХООБРАЗНЫЕ АЛТАЯ. V.
ПРЕДВАРИТЕЛЬНЫЙ СПИСОК ПЕЧЕНОЧНИКОВ АЛТАЯ

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Abstract

The list includes 143 species of hepatics, which were revealed in ca. 1500 specimens collected in Altai mostly by Ignatov and Zolotukhin and identified mostly by VanĀ. Each species is annotated with the habitat preferences and the data on spatial and altitudinal distribution within the Altaian territory. *Anastophyllum assimile* and *Lophozia* cf. *diversiloba* reported from Russia for the first time. *Lophozia murmanica* and *Scapania obcordata* reported for the first time outside the Arctic (*S. obcordata* is known also from Antarctic).

Резюме

Список включает 143 вида печеночников, которые были выявлены в результате изучения около 1500 образцов, собранных на Алтае главным образом Игнатовым и Золотухиным и определенных преимущественно Ваней. Для всех видов указаны особенности местообитаний, пространственное и высотное распределение на территории Алтая. *Anastophyllum assimile* и *Lophozia* cf. *diversiloba* приводятся для России впервые. *Lophozia murmanica* и *Scapania obcordata* впервые выявлены за пределами Арктики (*S. obcordata* известна также из Антарктики).

INTRODUCTION

This paper belongs to the series dealing with the bryophyte flora of Altai Mountains started in the third volume of *Arctoa*. For the information about natural conditions of Altai, history of its bryological exploration and for the explanation of specimen citation see the introductory paper of Ignatov (1994).

Unlike mosses, earlier collectors of Altaian bryophytes ignored hepatics nearly at all. Zass (1894) mentioned only *Marchantia polymorpha*, Keller (1914) cited also only one very common hepatic species, *Ptilidium ciliare*. Some geobotanical publications have added few other widespread species, but all these data did not make an important contribution to the hepatic flora of Altai.

The rich collections of hepatics were made in Altai in 1973-1993 by N.I.Zolotukhin (phanerogamist) and in 1989-1993 by Ignatov (mus-

cologist). Though both collectors were not professional hepaticologists, they tried to collect habitually unusual liverworts from contrasting habitats, avoiding overcollection of common species like *Ptilidium*, *Blepharostoma*, *Radula*, etc. The senior author has identified about 1500 specimens of these collectors. Some specimens were named by J.Duda (*Scapania* p. p.), Ignatov (some common and easy species), A.D.Potemkin, and N.A.Konstantinova.

The following list includes 143 species. This is more than in any other region of the South Siberia: in the Western Sayan Mountains Konstantinova & Vasiljev (1994) list 127 species; in Khamar-Daban Range (south from Baikal Lake) Kazanovsky (1993) lists 119 species. However, many species known in South Siberia (Konstantinova & al., 1992) are still unknown in Altai and are obviously expected there after more thorough collecting in the future.

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Among them are *Calypogeia muelleriana* (Schiffn.) K.Muell., *Cladopodiella fluitans* (Nees) Buch, *Diplophyllum taxifolium* (Wahlenb.) Dum., *Marsupella sphacelata* (Gieseke ex Lindenb.) Dum., *Obtusifolium obtusum* (Lindb.) S.Arnell, *Plectocolea obovata* (Nees) Lindb., *Scapania uliginosa* (Lindenb.) Dum., etc., so the hepatic flora of Altai could be expected to have about 160-170 species.

Despite of some incompleteness we decide to publish this preliminary list because of rather numerous phytogeographically interesting findings. The distribution of the most interesting species, *Iwatsukia jishibae*, *Gymnomitrium laceratum*, *Jungermannia pyriformis* and *Scapania sphaerifera* have been already discussed by V_{an}a (1993). Later in Altaian collections have been found *Anastrophyllum assimile* and *Lophozia cf. diversiloba*, previously not known from Russia, and also *Lophozia murmanica* and *Scapania obcordata*, which were known earlier only from the Arctic (and *Scapania* also from Antarctic).

THE LIST OF ALTAIAN HEPATICS

Anastrophyllum assimile (Mitt.) Steph. - on wet cliffs, especially on overhangs or otherwise sheltered surfaces, more rare on sides of tussocks at lake shore, in upper taiga to lower alpine zones.

Specimens examined: *Kayakkatuyarykskij Creek* 1760 m (8/266); 1850 m (3/196; 3/197); 1920 m (3/117; 3/24); 2150 m (4/1).

Anastrophyllum hellerianum (Nees ex Lindenb.) Schust. - on strongly decaying wood of big logs (usually already decorticated), especially in lower forest zone, in wet valleys and other humid areas. One collection is from subalpine zone.

Specimens examined: *Bayas Lake* 1750 m (0/1761a); *Bolshoi Shaltan Creek* 540 m (0/1935); *Bolshoye Istyube Creek* 470 m (18/95a); *Ok-Porok Creek*, 1.5 km upstream 470 m (2/36); *Ust-Sema* 680 m (24/78; 24/80); 700 m (24/148).

Anastrophyllum michauxii (F. Web.) Buch - on strongly rotten logs and stumps in wet *Pinus sibirica* or *Abies sibirica* forest, at lower elevations of in the Northern Altai.

Specimens examined: *Bolshoye Istyube Creek* 470 m (0/1985a; 18/62; 18/89); *Kairu Creek*, 8 km upstream 1000 m (15/149); *Kobukhta* 650 m (0/1934; 0/1949a); *Korbu* 440 m (Zolotukhin 20.X.1988).

Anastrophyllum minutum (Schreb.) Schust. - rather common species on wet rocks (in canyons, *Pinus sibirica* forests, subalpine and alpine wet areas) in all the altitudinal zones; sometimes grows also on stumps, at bases of fallen trunks, etc.

Specimens examined: *Ayulyuyuzyuk Creek* 2500 m (0/1870a; 0/1932); *Bayas Creek* 1800 m (0/1974a); *Bayas Lake* 1750 m (0/1775; 0/1866a; 0/1930; 0/1955a; 0/2013); *Bolshoye Istyube Creek* 470 m (0/1896a; 0/1933; 0/1993a); *Booshkon Pass* 2700 m (Zolotukhin 5.VII.1990); *Karakol Lakes* 1900 m (28/119); *Kayakkatuyarykskij Creek* 1650 m (8/121; 8/122); 1760 m (8/231); 1800 m (8/341); 1850 m (8/50); 1950 m (3/31); 2000 m (3/16a; 3/88a); 2050 m (7/23); *Kukol* 1850 m (0/1959a); *Maloye Istyube Creek*, 1 km upstream 600 m (Zolotukhin 19.V.1977); *Uedinennoye Lake* 880 m (0/1931).

Anastrophyllum saxicola (Schrad.) Schuster - all the collections were done on rocks of rock fields, in forest and subalpine zones.

Specimens examined: *Artyshu Creek* 1100 m (Zolotukhin 8.IX.1987); *Kairu Creek*, 16 km upstream 1400 m (14/55a); *Kamga Creek*, 10 km upstream 600 m (0/1929); *Kayakkatuyarykskij Creek* 1930 m (3/276); *Maloye Istyube Creek*, 1 km upstream 600 m (Zolotukhin 12.IV.1977); *Yakhansoru Lake* 1850 m (Zolotukhin 28.VI.1990).

Aneura pinguis (L.) Dum. - in two kinds of habitats: (1) on wet sandy banks and bars of creeks and rivers; (2) on rotten logs in forests of *Pinus sibirica*, *Picea obovata* or *Abies sibirica*. In forest zone and in the woody areas in valleys of forest-steppe zone.

Specimens examined: *Ayukol* 1000 m (0/1874); *Bayas Creek*, at mouth 450 m (Zolotukhin 21.VIII.1987); *Bolshoye Istyube Creek* 470 m (18/8); *Chemal* 400 m (29/45); *Kamga Creek*, 14 km upstream 600 m (0/1807a); *Malyi Yaloman* 1050 m (25/92); 1100 m (25/124); *Yailyu* 450 m (0/2012).

Anthelia juratzkana (Limpr.) Trev. - in subalpine and especially alpine zones on bare soil in open tundra, in boggy places, on rock outcrops and in rock fields (mostly on thin soil layer upon rocks), and on creek bars; one locality in taiga zone, on bar of the Itykul Lake.

Specimens examined: *Ayulyuyuzyuk Creek* 2500 m (0/143); *Bayas Creek* 1800 m (0/1974a); *Bogoyash Creek*, upper course 2200 m (36/26); *Bogoyash Lake* 2550 m (Zolotukhin & al. 15.VI.1986; Korolyeva 18.VI.1986); *Itykul Lake* 1665 m (Zolotukhin 22.VI.1990); *Karakol Lakes* 1950 m (28/83); *Kayakkatuyarykskij Creek* 2000 m (7/27a); 2050 m (5/12); 2150 m (4/24); 2200 m (6/29; 6/31; 6/33a); 2700 m (7/63); *Uzunkol Lake* 2600 m (Zolotukhin 1.VII.1990).

Apometzeria pubescens (Schrank) Kuwah. - very common on more or less shaded rock outcrops in lower forest zone, rarer in taiga and very rare in subalpine zone, where it is growing among rocks in rock-fields.

Specimens examined: *Artybash* 450 m (22/5); *Artyshu Creek* 1100 m (Zolotukhin 8.IX.1987); *Ayukol* 1350 m (0/1883); *Chiri Creek*, 0.5 km upstream 450 m (17/94); *Chodor Creek* 440 m (Marina & al. 13.V.1977); *Chulcha River*, in middle course 960 m (9/93); 1000 m (9/57); 1200 m (9/26); *Elekmonar Creek*, 5 km upstream 700 m (26/29); *Kairu Creek*, 16 km upstream 1400 m (14/34; 14/52); *Kairu Creek*, 8 km upstream 1000 m (15/40; 15/43); *Kamga Creek*, 10 km upstream 530 m (0/1884); *Kamga Creek*, 8 km upstream 560 m

(0/1878); *Karagai* 440 m (0/2009a); 500 m (Zolotukhin 10.VIII.1988); *Kayakkatuyarykskij Creek* 1600 m (8/70); 2000 m (3/288); *Kobukhta* 700 m (0/249); *Kobukhtushka* 440 m (0/1920a); *Korbu* 440 m (Zolotukhin 20.X.1988); *Kukol* 1800 m (0/1882; 0/1885); 1850 m (0/1880; 0/1881; 0/1946a); *Kyga River, 1 km upstream* 550 m (0/1879); *Ok-Porok Creek, 1.5 km upstream* 470 m (2/9); *Tura Creek, in middle course* 1300 m (28/33; 28/34a); *Yailyu* 450 m (1/14); 460 m (0/2015a); *Yakhansoru Lake* 1850 m (Zolotukhin 28.VI.1990); *Yurga* 450 m (21/8).

Asterella saccata (Wahlenb.) Nees - along trails on steppe slopes in steppe and forest zones.

Specimens examined: *Bele* 700 m (Zolotukhin 14.IV.1982); *Chulyshman against Kokpash* 600 m (Zolotukhin & al. 27.IV.1978).

Barbilophozia attenuata (Mart.) Loeske - on strongly rotten logs and stumps, occasionally on soil at trunk bases and on rocks. Scattered throughout forest and subalpine zones.

Specimens examined: *Ayukol* 1350 m (0/1928); 1450 m (0/1950a); *Bayas Lake* 1750 m (0/1761); *Bolshoi Shaltan Creek* 530 m (0/1925); *Bolshoye Istyube Creek* 470 m (18/62a; 18/63); *Kairu Creek, 16 km upstream* 1400 m (14/40); *Karakol Lakes* 1900 m (28/156); *Kukol* 1750 m (s-1); *Uedinennoye Lake* 880 m (0/1926; 0/1927); 900 m (0/1924).

Barbilophozia barbata (Schmid. ex Schreb.) Loeske - a common species in forest zone, rarer in subalpine and lower alpine zone; grows in wide range of habitats, including rocks, logs (both rotten and rather fresh), sometimes trunk bases, or among other mosses in litter of conifer forests, shrubs or tall-herb vegetation.

Specimens examined: *Bolshoi Mianok Creek, at mouth* 440 m (Zolotukhin 8.VIII.1988); *Booshkon Creek* 1900 m (Zolotukhin & al. 31.VII.1979); *Chelyush Cape* 450 m (Zolotukhin & al. 19.VII.1980); *Chemal* 400 m (29/55); *Chichelgan Cape* 440 m (Zolotukhina 30.III.1988); *Chulcha River, in middle course* 1000 m (9/56); *Elekmonar Creek, 5 km upstream* 700 m (26/10; 26/9); *Kairu Creek, 8 km upstream* 1000 m (15/89a); *Kairu-Bazhi Peak* 2050 m (13/7); *Kamga Bay* 450 m (Zolotukhin 20.X.1988); *Karagai* 440 m (0/1922); *Kayakkatuyarykskij Creek* 1920 m (3/136); 2050 m (3/36; 3/51); 2100 m (3/25); *Kobukhtushka* 440 m (0/1920); *Sostuoyuk Creek, in middle course* 2150 m (Zolotukhin 19.VI.1990); *Srednij Shaltan Creek* 670 m (0/1923); 1000 m (0/2003); *Tura Creek, in middle course* 1300 m (28/32; 28/40a; 28/41); 1650 m (28/4); *Ust-Sema* 400 m (24/109; 24/4); *Yailyu* 460 m (0/2015a); *Yakhansoru Lake* 1850 m (Zolotukhin 28.VI.1990).

Barbilophozia binsteadii (Kaal.) Loeske - two collections in boggy areas in lower alpine zone (in upper course of Chulyshman River).

Specimens examined: *Bogoyash Creek, upper course* 2350 m (36/5); *Kobiguayuk Creek* 2350 m (0/131).

Barbilophozia floerkei (Web. et Mohr) Loeske - relatively rare species of alpine zone, occurring on bare soil on alpine meadows, among rocks, near late snow beds, etc.

Specimens examined: *Karatumysh* 2110 m (Zolotukhin & al. 14.VIII.1978); *Kobiguayuk Creek* 2650 m (0/1780);

Kolyushta Peak 2100 m (0/1986a); *Tabozhok Peak* 2350 m (31/335).

Barbilophozia hatcheri (Evans) Loeske - in wide range of habitats (rocks, soil banks along stream beds, alpine meadows, etc.) in upper taiga to subalpine and alpine zones.

Specimens examined: *Bayas Lake* 2200 m (s-11); *Karakol Lakes* 1900 m (28/101); *Kayakkatuyarykskij Creek* 2350 m (7/3); *Kobiguayuk Creek* 2100 m (0/1917); 2280 m (0/1919); 2300 m (0/1921); 2600 m (0/1916); 2750 m (0/1791); 2800 m (0/1789); *Kolyushta Peak* 2150 m (0/1918); *Krasivoye Lake* 2530 m (36/13); *Lesnoi Creek* 2600 m (t-8); *Sostuoyuk Creek, in middle course* 2000 m (Zolotukhin 20.VI.1990); *Tamanel Peak* 2150 m (36/31); *Tokpak Creek, in middle course* 2600 m (36/27); *Trekhlavaya Peak* 2850 m (Zolotukhin 19.VII.1990); 3150 m (Zolotukhin 19.VII.1990); *Uzunkol Lake* 2050 m (Zolotukhin 23.VI.1990); 2600 m (Zolotukhin 1.VII.1990); *Yakhansoru Lake* 1850 m (Zolotukhin 28.VI.1990).

Barbilophozia kunzeana (Hueb.) K. Muell. - in taiga, subalpine to lower alpine zone on soil rich in humus, often on peat, on wet to moist places (bogs, hummocks, lake shores, etc.).

Specimens examined: *Itykul Lake* 1900 m (Makhatkov & al. 14.VIII.1978); *Kayakkatuyarykskij Creek* 1760 m (8/243; 8/245; 8/260); *Kobiguayuk Creek* 2250 m (0/1782a); 2350 m (0/132); 2400 m (0/1792); *Mushtuairy Creek, at mouth* 1700 m (36/9); *Sai-Khonash* 2400 m (Zolotukhin 8.VII.1990); *Stremechko Lake* 2180 m (Zolotukhin 20.VII.1990); *Uzunoyuk Creek, in middle course* 2150 m (Zolotukhin 10.VII.1990).

Barbilophozia lycopodioides (Wallr.) Loeske - not rare in subalpine and alpine zone in cliff crevices, among rocks in rock-fields, sometimes on litter in subalpine conifer forests. Once collected in lower forest zone in rock-field with developed fern vegetation.

Specimens examined: *Bayas Lake* 1850 m (0/1762); *Booshkon Pass* 2700 m (Zolotukhin 5.VII.1990); *Karakol Lakes* 1900 m (26/112; 28/134); *Kobiguayuk Creek* 2300 m (0/1915); *Sostuoyuk Creek, in middle course* 2150 m (Zolotukhin 19.VI.1990); *Uedinennoye Lake* 880 m (0/1773); *Yakhansoru Lake* 1850 m (Zolotukhin 28.VI.1990).

Barbilophozia quadriloba (Lindb.) Loeske - among mosses in springy bog in subalpine zone.

Specimens examined: *Kairu-Bazhi Peak* 2050 m (13/29; 13/8).

Bazzania bidentula (Steph.) Steph. - on rotten logs in *Pinus sibirica* and *Abies sibirica* forests; very common and abundant in some particularly humid areas of Northern Altai; grows at lower altitudes, in some places reaching 1200-1350 m.

Specimens examined: *Ayukol* 1000 m (0/1996); 1350 m (0/1777); *Bayas Creek, in middle course* 1200 m (16/43); *Bolshoye Istyube Creek* 470 m (0/1998; 0/2014; 18/62a; 18/63a; 18/64; 18/79; 18/80); *Kamga Creek, 5 km upstream* 480 m (0/2001); *Kamga Creek, 9 km upstream* 530 m (0/2004); *Kobukhta* 650 m (0/1901a; 0/1949a; 0/1999; 0/2000); *Kobukhtushka* 440 m (Zolotukhin 18.IV.1977; 0/1997); *Kyga River, at mouth* 450 m (0/1760a; 0/1995); *Ok-Porok Creek, 1.5 km upstream* 470 m (2/1); *Uedinennoye Lake* 880 m (0/2002); *Yailyu* 460 m (0/1902a).

Bazzania tricrenata (Wahlenb.) Lindb. - rare, on rocks in narrow canyons close to waterfalls and otherwise permanently humid habitats, in lower forest zone.

Specimens examined: *Bolshoye Istyube Creek* 470 m (0/1993); *Kishite* 440 m (Zolotukhin 11.VII.1988); *Uedinennoye Lake* 880 m (0/1994).

Blasia pusilla L. - on permanently fresh or wet clayish soil along trails and roads, ravine slopes, landslips, on logs covered by alluvium in flood valleys, on creek bars, etc. All collections are from lower altitudes.

Specimens examined: *Bayas Creek, in middle course* 850 m (16/41); 1000 m (16/22); *Bele* 500 m (0/50); *Kairu Creek, 8 km upstream* 1000 m (15/136); *Kyga River, 1 km upstream* 650 m (Zolotukhin 24.VIII.1987); *Yailyu* 480 m (0/1877).

Bllepharostoma trichophyllum (L.) Dum. - on rotten wood and also on soil rich in humus in forests, sometimes in rock crevices or among rocks. Very common in lower forest and taiga zones, several collections are from subalpine zone, where it grows at lake shores, just above water table and on rocks. Very rare in alpine zone (among rocks).

Specimens examined: *Bashkaus River, upper course* 2250 m (36/367); *Bayas Creek* 1850 m (0/1969); *Bayas Creek, in middle course* 850 m (16/38a); *Bayas Lake* 1750 m (0/1763a; 0/1909a); *Bogoyash Creek, upper course* 2550 m (36/18a); *Bolshoi Shaltan Creek* 540 m (0/1793a); *Bolshoye Istyube Creek* 470 m (18/117a; 18/82a; 18/85a; 18/86a; Zolotukhin 5.VI.1986); *Itykul Lake* 1665 m (Zolotukhin 22.VI.1990); *Kairu Creek, 16 km upstream* 1400 m (14/20a; 14/66a); *Kairu-Bazhi Peak* 1700 m (13/186; 13/187a); *Kamga Creek, 14 km upstream* 660 m (0/1809a); *Karakol Lakes* 1950 m (28/81a; 26/129a; 26/130a); *Kayakkatuyarykskij Creek* 1760 m (8/114a); 2050 m (7/148; 7/31); *Kobiguayuk Creek* 2100 m (0/1917a); 2240 m (0/1968); *Kokkul Lake* 2300 m (33/38a); *Kukul* 1750 m (0/1967); 1800 m (0/1799a; 0/1907a; 0/1964a; 0/1970); *Kyga River, at mouth* 450 m (0/1760a); *Ok-Porok Creek, 1.5 km upstream* 470 m (2/37a); *Sostuoyuk Creek, in middle course* 2000 m (Zolotukhin 20.VI.1990); *Srednij Shaltan Creek* 640 m (0/1977a); *Uedinennoye Lake* 880 m (0/1781); *Yakhansoru Lake* 1935 m (Zolotukhin 26.VI.1990).

Calypogeia integristipula Steph. - scattered in forest to subalpine zones, growing on soil rich in humus, in fresh and shaded places: under rock overhangs, under upturned roots of fallen trees, under dense ferns, at lake banks just above water, etc.

Specimens examined: *Ayukol* 1660 m (0/1992); *Bolshoye Istyube Creek* 470 m (0/1991; 18/102a; 18/7); *Kayakkatuyarykskij Creek* 2050 m (8/109).

Calypogeia neesiana (Mass. et Carest.) K. Muell. - one collection on hummock at low lake shore in upper taiga zone.

Specimens examined: *Kayakkatuyarykskij Creek* 1760 m (8/220).

Calypogeia suecica (H.Arn. et J. Perss.) K.Muell. - found in only one locality on big strongly rotten decorticated logs.

Specimens examined: *Ust-Sema* 680 m (24/12; 24/78a; 24/79; 24/80a).

Cephalozia ambigua Mass. - in subalpine and alpine zones, on bare soil in boggy habitats and in mossy shrubs of dwarf *Betula*.

Specimens examined: *Bogoyash Lake* 2550 m (Zolotukhin & al. 15.VI.1988); *Kayakkatuyarykskij Creek* 2000 m (7/27).

Cephalozia bicuspadata (L.) Dum. - common species, occurring in nearly all the altitudes in wide range of habitats: on rocks, both shaded and rather exposed (on creek and river banks), rotten logs, rich soil under ferns or tall herbs, on wet peaty soil along trails and on banks of water-bodies and in boggy tundra.

Specimens examined: *Atkichu Creek, at mouth* 440 m (Zolotukhin 21.X.1989); *Ayukol* 1450 m (0/1990); *Ayulyuyuzuk Creek* 2300 m (0/160); 2500 m (0/1988); *Bayas Creek, in middle course* 850 m (16/34; 16/35; 16/36a); 1000 m (16/37a); *Bayas Lake* 1600 m (0/1887a); 1750 m (s-5a); *Bolshoye Istyube Creek* 470 m (18/102; 18/116; 18/7a); *Bolshoi Shaltan Creek* 540 m (0/2117c); *Chemal* 400 m (29/72); *Karakol Lakes* 1800 m (26/110); 1900 m (28/69); *Kayakkatuyarykskij Creek* 1650 m (8/145); 1920 m (3/245a; 3/266; 3/267); 1930 m (7/155); 2000 m (3/88a; 3/89; 3/90; 3/91); 2050 m (8/109a; 8/110); *Kukul* 1990 m (0/1989).

Cephalozia lunulifolia (Dum.) Dum. - rare in upper taiga and subalpine zones, on sides of hummocks, banks of lakes just above water, on bare peat in bogs.

Specimens examined: *Ayulyuyuzuk Creek* 2250 m (0/1776a); *Karakem River* 2070 m (Zolotukhin 17.VI.1989); *Kayakkatuyarykskij Creek* 1760 m (8/17; 8/261; 8/262; 8/266a).

Cephalozia pleneiceps (Aust.) Lindb. - in taiga, subalpine and alpine zones, on different kinds of bare soil and peat - along trails, banks of temporary streams, lake shores, among rocks in rock-fields, sides of tussocks.

Specimens examined: *Berekhuyaryk* 1600 m (0/1987); *Bogoyash Creek, upper course* 2550 m (36/18a); *Bogoyash Lake* 2550 m (Zolotukhin & al. 15.VI.1988); *Kairu-Bazhi Peak* 2050 m (13/25); *Kayakkatuyarykskij Creek* 1650 m (8/145a); 1700 m (8/136); 1760 m (8/17a); 1920 m (3/245a); 1930 m (3/167); *Kukul* 1800 m (0/1778); *Stremekhko Lake* 2180 m (Zolotukhin 20.VII.1990).

Cephalozia arctica Bryhn et Douin - found twice: (1) on bare peat in bog in subalpine zone; (2) in springy bog in Kobresian tundra in alpine zone.

Specimens examined: *Bogoyash Creek, upper course* 2350 m (36/2); *Kayakkatuyarykskij Creek* 2000 m (7/149).

Cephalozia divaricata (Sm.) Schiffn. - in rocky habitats, both on upper sufaces and in sheltered places in caves, crevices, overhangs, in wet to rather dry habitats; in forest zone, forest-steppe, and rarer relatively xeric areas of of subalpine and alpine zones.

Specimens examined: *Aedigan* 550 m (a17a); 650 m

(a12); *Bogoyash Creek, upper course* 2300 m (36/14a); *Chemal, 4 km upstream along Katun* 450 m (a6); *Kairu-Bazhi Peak* 2100 m (13/70); *Kayakkatuyarykskij Creek* 2150 m (3/293); *Malyi Yaloman* 900 m (25/147; 25/109; 25/99); *Tamanel Peak* 1940 m (a15); *Ust-Sema* 450 m (24/16).

Several sterile specimens probably also belong to this species: *Bele* 500 m (0/1779); *Yailyu* 450 m (1/36).

Cephloziella hampeana (Nees) Schiffn. - on hummock in boggy shrubs of dwarf *Betula* in upper taiga zone.

Specimen examined: *Tokpak Creek, in middle course* 1950 m (36/30).

Cephaloziella rubella (Nees) Warnst. - two collections: on soil under shrubs on shrubby south-facing slope in forest zone and on hummock in bog in subalpine zone.

Specimens examined: *Ayulyuyuzuk Creek* 2250 m (0/1776); *Chulcha River, in middle course* 1100 m (9/27).

Chiloscyphus polyanthos (L.) Corda - rare in Altai, found only three times on rocks close to springs, waterfall and just above water on river bank, in forest zone.

Specimens examined: *Karagai* 500 m (Zolotukhin 10.VIII.1988); *Kobukhtushka* 440 m (Zolotukhin 28.III.1988); *Kukul* 1750 m (s-2).

Chiloscyphus rivularis (Schrad.) Hazsl. - single collection in running water of a creek in forest zone.

Specimens examined: *Maloye Istyube Creek, 1 km upstream* 650 m (Zolotukhin 19.V.1977).

Conocephalum conicum (L.) Underw. - not rare in lower forest zone, on clay or rocks along creeks, waterfalls, on soil in willow thickets in flood valleys, on permanently fresh and shaded rich soil under ferns.

Specimens examined: *Bolshoi Shaltan Creek* 540 m (Zolotukhin); 700 m (Zolotukhin 19.V.1977); *Bolshoye Istyube Creek* 470 m (Zolotukhin 5.VII.1988); 600 m (Zolotukhin 19.V.1977); *Chemal Creek, 3 km upstream* 450 m (34/223); *Chulcha River, in middle course* 850 m (Zolotukhin 18.IX.1989); 1000 m (9/60); *Kairu Creek, 8 km upstream* 1000 m (15/11); *Kolbala* 1450 m (Zolotukhin 16.VI.1987); *Kyga River, 2 km upstream* 550 m (0/1863); *Maima* 280 m (35/55); *Samysh* 440 m (Zolotukhin 26.IV.1977); *Srednij Shaltan Creek* 620 m (0/1862); *Ust-Sema* 580 m (24/144).

Diplophyllum obtusifolium (Hook.) Dum. - single collection in narrow valley, close to waterfall, on soil bank.

Specimens examined: *Bolshoye Istyube Creek* 470 m (0/1947).

Frullania davurica Hampe - rather common on mesic to rather xeric rocks at lower altitudes in forest and forest-steppe zones. Only one collection is from upper taiga zone. Typically grows on nearly vertical moderately shaded surfaces.

Specimens examined: *Chemal* 450 m (29/2; 29/3); *Chemal Creek, 3 km upstream* 450 m (34/5); *Chemal, 10 km upstream along Katun* 450 m (34/4; a2); *Chiri Creek, 0.5 km upstream* 450 m (17/4); *Elekmonar Creek,*

5 km upstream 700 m (26/47); *Kairu Creek, at mouth* 500 m (Zolotukhin 11.IX.1987); 550 m (Zolotukhin 12.IX.1987); *Kishte* 440 m (Zolotukhin 11.VII.1988); *Kukul* 1850 m (0/2118); *Malyi Yaloman Creek, 4 km upstream* 900 m (25/68); *Ust-Sema* 380 m (24/73); 400 m (24/109a; 24/63); 450 m (24/16a); 580 m (24/30); *Yailyu* 440 m (0/1810); 450 m (0/1811; 0/2007; 1/21); 460 m (0/2015).

Frullania muscicola Steph. - on rock outcrops on open and shrubby (with *Rhododendron*) slopes and in open xeric *Pinus sylvestris* stands in lower forest and forest-steppe zones.

Specimens examined: *Chemal* 450 m (29/11); *Chiri* 450 m (17/53); *Malyi Yaloman* 900 m (25/141a; 25/142); *Ust-Sema* 580 m (24/48).

Frullania parvistipula Steph. - the commonest species of the genus in Altai. It grows on rocks, both wet and xeric, shaded and open, and trunks (*Populus, Abies, Padus, Betula, Sorbus, Salix* - on trunks up to 1350 m). Widespread at lower altitudes, but sometimes reaches the lower alpine zone, growing there among moss tufts.

Specimens examined: *Aedigan* 550 m (a17); 650 m (a14); *Artyshu Creek* 600 m (Zolotukhin 20.IX.1989); 650 m (Zolotukhin 20.VI.1989; 24.IX.1989); *Ayukol* 1000 m (0/1802); 1350 m (0/1820); *Bele* 440 m (0/1787); 500 m (0/56); *Berekhtuyaryk* 1640 m (0/1788); *Bolshoi Mianok Creek, at mouth* 450 m (Zolotukhin 8.VIII.1988); *Chemal, 10 km upstream along Katun* 450 m (a3); *Chemal, 4 km upstream along Katun* 450 m (a4); *Chiri* 450 m (17/59; 17/98); *Chodro* 800 m (0/1816); *Chulcha River, in middle course* 960 m (9/133); 1100 m (9/78); *Elekmonar Creek, 5 km upstream* 700 m (26/55); *Kamga Creek, 10 km upstream* 500 m (0/93); *Karagai* 440 m (0/261); *Kayakkatuyarykskij Creek* 1950 m (8/155); 2200 m (7/98); *Kobiguayuk Creek* 2150 m (0/1817); 2200 m (0/141); *Kobukhta* 750 m (0/2011); *Kukul* 1750 m (0/1813; 0/1815; 0/1845); 2000 m (0/1812); *Kyga River, 1 km upstream* 450 m (0/1822); *Malyi Shaltan Creek, at mouth* 450 m (Zolotukhin 20.X.1988); *Tura Creek, in middle course* 1300 m (28/42); *Ust-Sema* 380 m (24/7); 580 m (24/103; 24/48); *Yailyu* 400 m (0/1824); 440 m (Zolotukhin 6.VIII.1988/ 14.VII.1988; 0/1818); 450 m (0/1821; 0/1823); 460 m (Zolotukhin 14.VII.1988; 0/1814; 0/1819).

Frullania tamarisci (L.) Dum. - few collections on wet rocks in forest, subalpine and alpine zones.

Specimens examined: *Bogoyash Creek, upper course* 2400 m (36/10; 36/12a; 36/20; 36/23); *Kairu Creek, 8 km upstream* 1000 m (15/17); *Kayakkatuyarykskij Creek* 2050 m (3/58).

Geocalyx graveolens (Schrad.) Nees - the only collection on sandy bar (temporary overflowed) of Kamga Creek, where it runs in narrow canyon (lower forest zone).

Specimens examined: *Kamga Creek, 14 km upstream* 600 m (0/1807).

Gymnocolea inflata (Huds.) Dum. - in upper taiga and subalpine zones, on wet cliffs, hollows of bog, lake shores just above water.

Specimens examined: *Bardaky Lake* 1950 m (12/29; 12/31; 12/37); *Kayakkatuyarykskij Creek* 1760 m (8/25); 2050 m (3/300; 3/301).

Gymnomitrium apiculatum (Schiffn.) K. Muell. - the single collection in lower alpine zone, on soil bank just above the bog table.

Specimens examined: *Kayakkatuyarykskij Creek* 2200 m (6/33).

Gymnomitrium concinnatum (Lightf.) Corda - common in subalpine and sporadic in alpine zone (up to 2600 m), on rock outcrops, soil banks on slopes, rare in flattened areas in tundra.

Specimens examined: *Ayulyuyuzuyuk Creek* 2500 m (0/151; 0/1870); *Bayas Lake* 1750 m (0/1866a; 0/1869a; 0/1871); *Kayakkatuyarykskij Creek* 1930 m (3/173); 1950 m (3/203; 3/207a; 3/208a); 2050 m (5/11; 5/23a; 7/25); 2150 m (4/24a); 2200 m (6/31a; 6/32; 6/33a); *Kolyushta Peak* 2200 m (0/1872a); *Tamanel Peak* 2150 m (a16a; a9); 2250 m (a5); *Uzunkol Lake* 2600 m (Zolotukhin 1.VII.1990).

Gymnomitrium corallioides Nees - rare in subalpine (on rocks) and more often in alpine zones (up to nearly highest places studied). In the latter - in wide range of types of tundra, on soil and rocks.

Specimens examined: *Ayulyuyuzuyuk Creek* 2500 m (0/1870a); *Kayakkatuyarykskij Creek* 1950 m (3/203a); 2750 m (7/62); *Kobiguayuk Creek* 2725 m (Zolotukhin 28.VI.1989); 2850 m (0/191); 2908 m (0/158a; 0/1784); *Uzunkol Lake* 2050 m (Zolotukhin 23.VI.1990).

Gymnomitrium laceratum (Steph.) Horik. - the single collection in alpine zone (one of the wettest area of Altai), on soil under rock overhang.

Specimens examined: *Kolyushta Peak* 2200 m (0/1872).

Harpanthus scutatus (Web. et Mohr) Spruce - on strongly rotten decorticated logs in wet valleys (close to waterfalls) of northern shore of Teletzkoje Lake, the area of outstanding wet and mild climate.

Specimens examined: *Bolshoye Istyube Creek* 470 m (18/100a; 18/117; 18/83); *Ok-Porok Creek, 1.5 km upstream* 470 m (2/36a).

Iwatsukia jishibae (Steph.) Kitag. - on strongly rotten decorticated logs in wet valley, close to waterfalls, in lower forest zone, at the northern shore of Teletzkoje Lake.

Specimens examined: *Bolshoye Istyube Creek* 470 m (0/1985; 18/95; 8/140).

Jamesoniella autumnalis (DC.) Steph. - scattered in lower forest zone, typically on rotten logs, sometimes on fern tussocks. One collection is from the area of Flakiyash Lake, at 2280 m, in moss mat in dwarf *Betula* shrubs in alpine zone.

Specimens examined: *Bolshoye Istyube Creek* 470 m (0/1972); *Flakiyash Lake* 2280 m (Zolotukhin 29.VI.1986); *Kamga Creek, 2 km upstream* 450 m (0/1973); *Ok-Porok Creek, 1.5 km upstream* 470 m (2/37); *Ok-Porok Creek, at mouth* 460 m (Zolotukhin 14.X.1988); *Ust-Sema* 580 m (24/11); 680 m (24/13); *Yailyu* 450 m (0/1971).

Jungermannia atrovirens Dum. - in lower forest zone on wet rocks and on wet loamy banks of creeks. All collections were made in proximity to the northern shore of Teletzkoje Lake.

Specimens examined: *Bolshoi Shaltan Creek* 530 m (0/1805; 0/1983); *Bolshoye Istyube Creek* 470 m (0/1984; 18/45a); *Ok-Porok Creek, 1.5 km upstream* 470 m (2/33); *Yailyu* 450 m (1/58).

Jungermannia borealis Damsh. et V_{an}a - once collected on the bank of a lake in open tundra in South-East Altai.

Specimens examined: *Kokkul Lake* 2300 m (33/38).

Jungermannia confertissima Nees - few findings on rotten logs and on wet cliffs in narrow canyons.

Specimens examined: *Bayas Creek, in middle course* 850 m (16/32); *Bolshoye Istyube Creek* 470 m (18/101a; 18/103); *Kairu-Bazhi Peak* 1700 m (13/187); *Tura Creek, in middle course* 1300 m (28/47).

Jungermannia exsertifolia Steph. subsp. **cordifolia** (Dum.) V_{an}a - on wet cliffs in narrow canyon just below waterfall.

Specimens examined: *Bolshoye Istyube Creek* 470 m (18/50).

Jungermannia hyalina Lyell - the single collection on wet but well-exposed cliffs in narrow canyon just below waterfall.

Specimens examined: *Bolshoye Istyube Creek* 470 m (18/45).

Jungermannia pumila With. - few collections in lower forest zone (close to northern shore of Teletzkoje Lake): on wet cliffs and rotten logs in narrow canyon just below waterfall and on rocks beside a small stream.

Specimens examined: *Bolshoye Istyube Creek* 470 m (Zolotukhin 5.VII.1988; 18/101); *Udinennoye Lake* 800 m (0/1981).

Jungermannia pyriflora Steph. - single collection on north-facing rock outcrops in fir forest, at a small lake shore, in lower forest zone.

Specimens examined: *Udinennoye Lake* 880 m (0/1982).

Jungermannia sphaerocarpa Hook. - in upper taiga, subalpine and alpine zones, on soil among dwarf *Betula* shrubs, along wet trails, in moist depressions.

Specimens examined: *Ayulyuyuzuyuk Creek* 2300 m (0/1980); *Bayas Lake* 1600 m (0/1887a); *Bogoyash Lake* 2550 m (Zolotukhin & al. 15.VI.1986).

Jungermannia subulata Evans - in forest zone, on wet and moist substrates, both wood and rocks.

Specimens examined: *Bolshoye Istyube Creek* 470 m (18/100a; 18/115; 18/81; 18/82a; 18/83a; 18/85a; 18/98); *Kamga Creek, 12 km upstream* 600 m (0/1976); *Kamga Creek, 14 km upstream* 660 m (0/1978); *Karagai* 440 m (0/283); 500 m (Zolotukhin 10.VIII.1988); *Kobukhtushka* 440 m (Zolotukhin 28.III.1988); 460 m (Zolotukhin 28.III.1988); *Ok-Porok Creek, 1.5 km upstream* 470 m (2/35; 2/36a); *Srednij Shaltan Creek* 640 m (0/1977); *Tura Creek, in middle course* 1300 m (28/46; 28/47a); *Udinennoye Lake* 800 m (0/1975); *Yailyu* 450 m (0/1979; 1/56).

Lejeunea cavifolia (Ehrh.) Lindb. - not rare on wet rocks in forest zone of Northern Altai, once found on pine logs.

Specimens examined: *Bolshoi Shaltan Creek* 560 m (Zolotukhin 7.VI.1989); *Bolshoye Istyube Creek* 470 m (18/126; 18/61a); *Chulcha River, in middle course* 850 m (Zolotukhin 18.IX.1989); *Kairu Creek, 8 km upstream* 1000 m (15/21; 15/29a); *Kamga Creek, 14 km upstream* 660 m (0/1808; 0/1809; 0/1912a); *Karagai* 500 m (Zolotukhin 10.VIII.1988); *Kishte* 440 m (Zolotukhin 11.VII.1988); *Korbu* 440 m (Zolotukhin 20.X.1988); *Ok-Porok Creek, 1.5 km upstream* 470 m (2/20; 2/43).

Lepidozia reptans (L.) Dum. - very common on rotten logs in forest zone, occurring also in subalpine more or less dense stands, sometimes also on wet rocks, on soil rich in humus under upturned roots of fallen trees, etc.

Specimens examined: *Adylda Creek* 1100 m (34/220); *Ayukol* 1000 m (0/1966a; 0/2005); *Bayas Creek, in middle course* 850 m (16/35a; 16/36); *Bayas Lake* 1600 m (0/1892a); *Bolshoye Istyube Creek* 470 m (18/94; 18/97a); *Kairu Creek, 8 km upstream* 1000 m (15/49a); *Kukul* 1750 m (0/1904a); *Oimok* 1100 m (Zolotukhin 3.IX.1987); *Seminskij Pass* 1800 m (25a/13; 25a/5); *Tura Creek, in middle course* 1300 m (28/32a); *Yailyu* 450 m (0/1979a; 0/2006).

Lophocolea heterophylla (Schrad.) Dum. - only in lower forest zone on rotten logs, rarer on soil at trunk bases.

Specimens examined: *Ayukol* 1000 m (0/1874a; 0/1938); *Chemal Creek, 3 km upstream* 450 m (34/224); *Kairu Creek, 8 km upstream* 1000 m (15/146; 15/147); *Oimok* 1100 m (Zolotukhin 3.IX.1987); *Ok-Porok Creek, 1.5 km upstream* 470 m (2/36a); *Ok-Porok Creek, at mouth* 450 m (Zolotukhin 14.X.1988); *Yailyu* 450 m (0/1939); 480 m (0/1940).

Lophocolea minor Nees - scattered in forest zone on soil banks (in ravines, along roads, on steep slopes), rare on rotten logs.

Specimens examined: *Bele* 530 m (0/1936; 0/2010); *Itykul Lake* 1665 m (Zolotukhin 21.VI.1990); *Kukul* 1800 m (0/1937); *Ust-Sema* 580 m (24/143); *Yazula* 1700 m (0/1797).

Lophozia ascendens (Warnst.) Schust. - only three collections: on rocks in fir forest (lower forest zone) and on rocks and rotten logs in taiga zone.

Specimens examined: *Artybash* 450 m (22/11); *Kairu Creek, 16 km upstream* 1400 m (14/20; 14/66a).

Lophozia badensis (Gott.) Schiffn. - on soil banks along lake shore and along dry creek bed and in spotty tundra in subalpine zone.

Specimens examined: *Bashkaus River, upper course* 2250 m (36/4); *Kayakkatuyarykskij Creek* m (3/26); *Kokkul Lake* 2300 m (33/38a); *Tabozhok Peak* 2350 m (31/341).

Lophozia bantriensis (Hook.) Steph. - cliffs at creek banks in forest zone and on soil sheltered by a boulder at lake shore in subalpine zone.

Specimens examined: *Bayas Creek, in middle course* 850 m (16/38a); *Bolshoi Shaltan Creek* 530 m (0/1805a); 540 m (0/1795); *Bolshoye Istyube Creek* 470 m (18/71); *Kobiguayuk Creek* 2250 m (0/1766).

Lophozia bicrenata (Schmid. ex Hoffm.) Dum. - on rocks in wet alpine area.

Specimens examined: *Kolyushta Peak* 2200 m (0/1872a).

Lophozia cf. diversiloba Hatt. - one locality in middle course of Kairu Creek, on mesic N-facing landslip, in forest zone.

Specimens examined: *Kairu Creek, 8 km upstream* 1000 m (15/50; 15/96).

Lophozia excisa (Dicks.) Dum. - on xeric slope in forest-steppe zone, in taiga and alpine zones on soil on open places (creek bars, on rock outcrops, in open tundras, etc.).

Specimens examined: *Ayulyuyuzuk Creek* 2500 m (0/1914; 0/1988a); *Karakem River, 6 km upstream* 1600 m (0/1913); *Kokkul Lake* 2300 m (33/35; 33/36a; 33/37); *Malyi Yaloman* 1100 m (25/147a); *Tabozhok Peak* 2350 m (31/338); 2450 m (31/340a); *Tura Creek, in middle course* 1300 m (28/25). Probably to this species also belong collection: *Bashkaus River, upper course* 2250 m (36/4a).

Lophozia heterocolpos (Thed ex Hartm.) Howe - typically grows on wet rocks from lower forest to subalpine zones, also on sandy bars of creeks and lakes, sometimes of soil in taiga, or under upturned roots of fallen trees, on bare soil in tundra, soil banks on wet meadows, etc.

Specimens examined: *Bayas Lake* 1750 m (0/1909); 1850 m (0/1908); *Bolshoye Istyube Creek* 470 m (18/45a); *Bolshoi Shaltan Creek* 540 m (0/2117b); *Itykul Lake* 1665 m (Zolotukhin 22.VI.1990); *Kairu-Bazhi Peak* 2150 m (13/145a); *Kamga Creek, 14 km upstream* 660 m (0/1910; 0/1912); *Karakol Lakes* 1900 m (28/116; 28/135); 1950 m (28/81); *Kayakkatuyarykskij Creek* mca. 2000 (3/35); *Kolyushta Peak* 2050 m (0/1854a); *Kukul* 1750 m (0/1911); 1800 m (0/1801; 0/1907); 1850 m (0/1798; 0/1946a).

Lophozia incisa (Schrad.) Dum. - one of the commonest epixylic species, abundant on big logs throughout forest zone; in upper taiga, subalpine and lower alpine zones also grows on rocks, soil and peat (highest findings are from bogs and hummocks).

Specimens examined: *Ayukol* 1000 m (0/1903); *Bayas Creek* 1800 m (0/1974a); *Bogoyash Creek, upper course* 2350 m (36/8); *Bolshoye Istyube Creek* 470 m (18/3a); *Kairu Creek, 8 km upstream* 1000 m (15/88); *Kairu-Bazhi Peak* 2050 m (13/31); *Karakem River* 2070 m (Zolotukhin 17.VI.1989); *Kayakkatuyarykskij Creek* 1760 m (8/9); 1850 m (3/198; 8/50a); 1920 m (3/155); 1950 m (3/11; 3/205a; 3/21); *Kobiguayuk Creek* 2400 m (0/1803); *Kobukhta* 650 m (0/1901); *Korbu* 440 m (Zolotukhin 20.X.1988); *Kukul* 1750 m (0/1783; 0/1904); 1800 m (0/1799); *Kyga River, 2 km upstream* 600 m (0/1905); *Seminskij Pass* 1800 m (25a/13a); *Uedinennoye Lake* 880 m (0/1781a); *Yailyu* 450 m (0/1804); 460 m (0/1902; 0/1906).

Lophozia longidens (Lindb.) Macoun - scattered throughout forest zone, on rotten logs, sometimes at bases of living trunks (in fir or spruce forests), rare on rocks. One collection is from alpine zone (in crevice of wet cliffs).

Specimens examined: *Bogoyash Creek, upper course* 2550 m (36/18); *Bolshoye Istyube Creek* 470 m (18/84; 18/85a); *Kobiguayuk Creek* 2030 m (0/1900); *Oimok* 1100 m (Zolotukhin VIII.1989); *Srednij Shaltan Creek* 640 m (0/1977a); *Uedinennoye Lake* 1030 m (0/1899).

Lophozia longiflora (Nees) Schiffl. - rather common on rocks, soil and rotten wood in forest and subalpine zones, rarer in alpine zone on bare peat in bogs.

Specimens examined: *Ayukol* 1660 m (0/1992a); *Ayulyuyuzuk Creek* 2100 m (0/172; 0/1891); 2500 m (0/1895); *Bayas Lake* 1600 m (0/1892); 1950 m (0/1898); *Bolshoi Shaltan Creek* 540 m (0/1793); *Bolshoye Istyube Creek* 470 m (0/1896; 0/1947a; 18/117a); *Kairu Creek, 16 km upstream* 1400 m (14/39); *Karakem River* 2070 m (Zolotukhin 17.VI.1989); *Karakol Lakes* 1800 m (28/77); 1900 m (26/116; 28/135a; 28/145; 28/153; 28/60; 28/70); *Kayak Lake* 2280 m (7/193); *Kayakkatuyarykskij Creek* 1760 m (8/220a; 8/236; 8/261a); *Kobiguayuk Creek* 2030 m (0/1900a); 2100 m (0/1917a); 2220 m (0/1894); 2250 m (0/1782); *Kukol* 1750 m (0/1893; 0/1904a; s-3a); 1800 m (0/1897); *Lesnoi Creek* 1860 m (Zolotukhin 2.VII.1990); *Sai-Khonash* 2400 m (Zolotukhin 8.VII.1990); *Seminskij Pass* 1800 m (25a/13a); *Sostuoyuk Creek, in middle course* 2000 m (Zolotukhin 20.VI.1990); *Tamanel Peak* 2150 m (a13); *Uedinennoye Lake* 880 m (0/1769); *Ust-Sema* 700 m (24/147a); *Uzunoyuk Creek, in middle course* 2150 m (Zolotukhin 10.VII.1990).

Lophozia murmanica Kaal. - once collected among rocks on the top of peak in upper alpine zone.

Specimens examined: *Kobiguayuk Creek* 2908 m (0/158).

Lophozia opacifolia Culm. ex Meylan - on rocky slope in subalpine zone in South-East Altai (Kuraiskij Mt. Range).

Specimens examined: *Tabozhok Peak* 2350 m (31/337).

Lophozia perssonii Buch et S. Arn. - on moraine deposits at cliff base on steep rocky slope in subalpine zone in South-East Altai (Kuraiskij Mt. Range).

Specimens examined: *Tabozhok Peak* 2400 m (31/332; 31/333).

Lophozia sudetica (Nees ex Hueb.) Grolle - very common above tree line on soil and rocks in wide range of habitats, from well shaltered caves and niches among rocks to open tundra; the lowest collection is in upper taiga zone, along a trail.

Specimens examined: *Ayulyuyuzuk Creek* 2550 m (0/1889); *Bayas Lake* 2000 m (s-10; s-9); *Kairu-Bazhi Peak* 2050 m (13/116); 2150 m (13/95); 2200 m (13/178); *Karakol Lakes* 1900 m (26/129a; 28/110; 28/146a; 28/147a; 28/159); *Kayakkatuyarykskij Creek* 1650 m (8/145a); 1760 m (8/22; 8/31); 1900 m (8/77); 1920 m (3/220); 1930 m (3/138; 3/172; 3/235a; 3/236a; 3/237; 3/255a; 7/153a; 7/154); 1950 m (3/202; 3/204a; 3/207a); 2050 m (5/21a; 5/22; 5/23; 7/174a; 7/177); 2150 m (4/21); 2200 m (6/33a); 2250 m (6/34; 6/35); 2280 m (7/19a); *Kobiguayuk Creek* 2600 m (0/1785); *Kolyushta Peak* 2350 m (0/1890); *Krasivoye Lake* 2530 m (36/25); *Sostuoyuk Creek, in middle course* 2000 m (Zolotukhin 20.VI.1990); *Tamanel Peak* 2150 m (a16; a9); *Trekhlavaya Peak* 2850 m (Zolotukhin 19.VII.1990).

Lophozia ventricosa (Dicks.) Dum. - typically grows on rotten logs in taiga zone; occurs sporadically on rocks and soil banks in lower forest and subalpine zones.

Specimens examined: *Ayukol* 1450 m (0/1990a); *Bayas Lake* 1850 m (0/1762a); *Kairu Creek, 8 km upstream* 1000 m (15/89); *Kairu-Bazhi Peak* 2050 m (13/161); *Karakem*

River, 6 km upstream 1660 m (0/1962a); *Karakol Lakes* 1800 m (26/110a); 1900 m (28/154); *Kayakkatuyarykskij Creek* 1600 m (8/134); 1650 m (8/121a); 1760 m (8/180); 1920 m (3/164); 1950 m (3/22; 3/30); 2000 m (3/16; 3/79; 3/88); 2050 m (7/172; 7/175a); *Lesnoi Creek* 1865 m (Zolotukhin 2.VII.1990); *Malaya Kokorya Creek* 2300 m (36/7); *Tura Creek, in middle course* 1300 m (28/20; 28/31a); *Yailyu* 450 m (0/1888); 460 m (0/1806); *Yakhansoru Lake* 2030 m (Zolotukhin 26.VI.1990).

Lophozia wenzelii (Nees) Steph. - among rocks in rock-fields, in alpine meadows, boggy banks of creeks, alpine bogs and hummocks; in subalpine and alpine zones, and once collected along a trail in taiga zone on burnt area shrubbed by dwarf *Betula*.

Specimens examined: *Bayas Lake* 1600 m (0/1887); *Itykulbazhi Creek* 2110 m (Zolotukhin & al. 14.VIII.1978); *Kayakkatuyarykskij Creek* 2200 m (6/30; 6/31a; 6/5); *Kobiguayuk Creek* 2250 m (0/1768); *Sai-Khonash* 2400 m (Zolotukhin 8.VII.1990).

Mannia fragrans (Balbis) Frye et Clark - xeric rock outcrops in forest, forest-steppe and steppe zones. One collection - from alpine zone of SE Altai, where the species grows on S-facing slope.

Specimens examined: *Aedigan* 550 m (a17a); *Bele* 700 m (Zolotukhin 14.IV.1982); *Bijka Creek, 2 km upstream along Katun* 450 m (a11); *Bogoyash Creek, in middle course* 2400 m (34/6); *Chemal, 4 km upstream along Katun* 450 m (a4a); *Chiri* 450 m (17/49; 17/64); *Chulcha River, in middle course* 750 m (Koroleva & al. 20.IV.1987); *Elekmonar Creek, 15 km upstream* 900 m (26/71); *Malyi Yaloman* 900 m (25/141); *Ulushtu* 600 m (Zolotukhin & al. 27.IV.1978); *Ust-Sema* 380 m (24/162); 580 m (24/27).

Mannia pilosa (Hornem.) Frye et Clark - on rather wet rock outcrops in lower forest zone in Northern and Central Altai.

Specimens examined: *Derbogach* 440 m (0/1855a); 450 m (0/16); *Elekmonar Creek, 5 km upstream* 700 m (26/45); *Kamga Creek, 10 km upstream* 500 m (0/108).

Marchantia alpestris (Nees) Burgeff - rare, found in springy mires in forest zone and on silty banks in alpine zone.

Specimens examined: *Bogoyash Lake* 2550 m (Koroleva 15.VI.1988); *Kobukhtushka* 440 m (0/1861); *Krasivoye Lake* 2530 m (36/1); *Kurkure Mt. Range* 2300 m (Galanin 12.VIII.1976); *Oier Creek* 670 m (Zolotukhin 26.V.1978); *Teletzkoye Lake* ca. 450 m (Korotkov 1958).

Marchantia paleacea Bertol. - on rocks close to Teletzkoye Lake shore, and adjacent regions in lower forest zone.

Specimens examined: *Chulcha River, middle course* 800 m (Zolotukhin 11.V.1987); *Saratki Cape* 450 m (Zolotukhin 14.X.1987); *Teletzkoye Lake* 550 m (Zolotukhin 23.VIII.1987).

Marchantia polymorpha L. - on rocks and bare soil, both mineral and peaty, on disturbed or naturally denudated places, in forest, forest-steppe and subalpine zones.

Specimens examined: *Bayas Lake* 1800 m (s-4); *Bele* 640 m (Zolotukhin 22.VIII.1981); *Bolshoye Istyube Creek* 470 m (18/61a; 18/66a; 18/67); *Booshkon Creek* 1300 m (Zolotukhin & al. 1.VIII.1979); *Chodor Creek* 440 m (Zolotukhin

et al. 13.V.1977); *Chulcha River*, in middle course 1000 m (9/71); *Chulyshman River*, 2 km below Dzhulukol 2190 m (Zolotukhin 1.VIII.1987); *Kamga Creek*, 4 km upstream 460 m (0/1859); *Karagai* 450 m (Zolotukhin & al. 31.VII.1986); *Kayakkatuyarykskij Creek* 1600 m (8/146); 1760 m (8/33); 2000 m (7/150); *Kolbala* 1450 m (Zolotukhin et al. 16.VI.1987); *Kukol* 1750 m (0/1860); *Kyigak Creek* 750 m (Zolotukhin 24.VIII.1987); *Malyi Shaltan Creek*, at mouth 450 m (Zolotukhin 20.X.1988); 650 m (Zolotukhina 5.VI.1986); *Trekhglavaya Peak* 2250 m (Zolotukhin 18.VII.1990); *Yailyu* 450 m (Zolotukhin 29.IX.1990).

Marsupella boeckii (Aust.) Lindb. ex Kaal. - wet rock outcrops in subalpine zone (both localities have very humid climate).

Specimens examined: *Bayas Lake* 1750 m (s-5); *Karakol Lakes* 1900 m (28/146; 28/147).

Marsupella emarginata (Lindenb.) Dum. - common on wet rocks from lower forest zone (here - mainly in deep canyons and near waterfall) to alpine zone (here - among rocks in rock fields); especially abundant in subalps, where it often covers wet cliffs by extensive pure mats.

Specimens examined: *Bayas Creek* 1800 m (0/1974a); *Bayas Lake* 1750 m (0/1864; 0/1866; 0/1869; 0/1871a; s-5a); *Bolshoye Istyube Creek* 470 m (0/1867; 0/1868; 0/1941a; 0/1993a); *Kairu Creek*, 8 km upstream 1000 m (15/29); *Kayak Lake* 2280 m (7/190); *Kayakkatuyarykskij Creek* 1760 m (8/24; 8/26); 1800 m (8/233; 8/234); 1920 m (3/252a); 1950 m (3/106; 3/206; 3/207a; 3/208); 2000 m (3/78; 3/99); 2050 m (3/110; 5/12a; 7/173; 7/174; 7/175; 7/20; 7/22; 7/24; 7/25a); 2150 m (4/2); 2280 m (7/19); *Kishte* 440 m (Zolotukhin 11.VII.1988); *Sostuoyuk Creek*, in middle course 2000 m (Zolotukhin 20.VI.1990); *Srednij Shaltan Creek* 640 m (0/1865); *Uzunkul Lake* 2050 m (t-18; Zolotukhin 23.VI.1990).

Marsupella sprucei (Limpr.) H. Bernet - the only collection have been made on bare wet loamy spot in swampy tundra in subalpine zone.

Specimens examined: *Kayakkatuyarykskij Creek* 2000 m (7/26).

Mesoptychia sahlbergii (Lindb.) Evans - on wet cliffs in canyon below waterfall.

Specimens examined: *Bolshoye Istyube Creek* 470 m (18/103a; 18/23).

Metzgeria conjugata Lindb. - relatively rare on wet and shaded cliffs in forest zone of Northern Altai, and also among rocks in rock-field in subalpine zone on Shapshal Mt. Range.

Specimens examined: *Bolshoye Istyube Creek* 470 m (18/61); *Derbogach* 450 m (0/10); *Kamga Bay* 450 m (Zolotukhin 20.X.1988); *Yakhansoru Lake* 1850 m (Zolotukhin 28.VI.1990).

Metzgeria furcata (L.) Dum. - collected twice, on rock outcrops in wet conifer forest in Northern Altai.

Specimens examined: *Tura Creek*, in middle course 1300 m (28/14); *Yailyu* 450 m (0/1886).

Mylia anomala (Hook.) S.Gray - rare, in subalpine zone on hummocks in bogs, and also on rock outcrops.

Specimens examined: *Bardaky Lake* 1950 m (12/45); *Karakol Lakes* 1900 m (28/119a); *Kayakkatuyarykskij*

Creek 1760 m (8/220a; 8/266a); *Mushtuairy Creek*, at mouth 1700 m (36/369).

Mylia taylorii (Hook.) S. Gray - on rotten logs and wet rock outcrops; very common and abundant in some areas in forest zone (especially in wet narrow canyons, or in *Pinus sibirica* + *Abies sibirica* forests) and in subalpine zone.

Specimens examined: *Ayukol* 1450 m (0/1950); *Bayas Creek*, in middle course 1200 m (16/42); *Bolshoye Istyube Creek* 470 m (0/1948; 0/1985a; 18/144; 18/62a; 18/75; 18/77; 18/93; 18/95a); *Kamga Creek*, 10 km upstream 550 m (0/120); *Karakol Lakes* 1900 m (28/120; 28/152); *Kayakkatuyarykskij Creek* 1950 m (4/6); 2000 m (3/87); *Klyk Pass* 700 m (0/1951); *Kobukhta* 650 m (0/1949); *Maloye Istyube Creek*, 1 km upstream 600 m (Zolotukhin 19.V.1977).

Nardia breidlereri (Limpr.) Lindb. - single finding on bare wet loamy spot in boggy tundra in subalpine zone (with *Marsupella sprucei*).

Specimens examined: *Kayakkatuyarykskij Creek* 2000 m (7/26a).

Nardia geoscyphus (De Not.) Lindb. - in subalpine zone on rock outcrops and on sides of sedge tussocks at lake shore; in lower alpine zone - on bare soil on landslip (just above a bog table) and on gravelly creek bar.

Specimens examined: *Bayas Creek* 1800 m (0/1974); *Bogoyash Creek*, upper course 2200 m (36/26a); *Kayakkatuyarykskij Creek* 1920 m (3/119); 2200 m (6/33a).

Odontoschisma denudatum (Nees.) Dum. - single collection on rotten wood in deep canyon.

Specimens examined: *Bolshoye Istyube Creek* 470 m (0/1985a).

Odontoschisma elongatum (Lindb.) Evans - one collection in upper taiga zone, in mire along lake shore.

Specimens examined: *Kayakkatuyarykskij Creek* 1760 m (8/219a).

Pellia endiviifolia (Dicks.) Dum. - springy mire at the shore of Teletzkoye Lake.

Specimens examined: *Kobukhtushka* 440 m (0/2008).

Pellia epiphylla (L.) Corda - wet cliffs and rotten logs in canyons, in lower forest to taiga zones.

Specimens examined: *Bolshoye Istyube Creek* 470 m (18/112; 18/66); *Elekmonar Creek*, 5 km upstream 700 m (26/11); *Sadeurtem Creek* 1700 m (36/32).

Pellia neesiana (Gott.) Limpr. - wet rocks, in forest to subalpine zones. Probably not rare, but fertile plants are not often and many specimens could be identified only as *Pellia sp.*

Specimens examined: *Bolshoye Istyube Creek* 600 m (Zolotukhin 19.V.1977); *Kamga Creek*, 10 km upstream 560 m (0/88); *Kayakkatuyarykskij Creek* 1950 m (3/205a).

Peltolipsis quadrata (Saut.) K. Muell. - only one collection on rocks in upper taiga zone in South-Eastern Altai.

Specimens examined: *Tokpak Creek* 1950 m (36/29).

Plagiochila porelloides (Torrey ex Nees) Lindenb. - very common in forest zone on litter, soil, fallen logs, rocks, also very characteristic under tall-herb vegetation, above tree line infrequent, occurring among rocks in rock-fields and on lake shores.

Specimens examined: *Adylda Creek* 1100 m (34/221); *Artyshu Creek* 1100 m (Zolotukhin 8.IX.1987); *Ayukol* 1000 m (s-12); *Bayas Creek* 1850 m (0/1969a); *Bayas Creek, in middle course* 850 m (16/4); *Bayas Lake* 1750 m (0/1763); *Bele* 500 m (0/53); 530 m (0/2010a); *Bogoyash Creek, upper course* 2400 m (36/24); 2450 m (36/19); *Bolshoye Istyube Creek* 470 m (Zolotukhin 5.VI.1986; 18/10; 18/68); *Chainary Creek, upper course* 1800 m (34/222); *Chemal* 400 m (29/60); 450 m (29/1a); *Chulcha River, in middle course* 1000 m (9/95); *Elekmonar Creek, 5 km upstream* 500 m (26/3); 700 m (26/23; 26/53); *Itykul Lake* 1665 m (Zolotukhin 22.VI.1990); *Kairu Creek, 8 km upstream* 1000 m (15/156); *Kamga Bay* 460 m (Zolotukhin 20.X.1988); *Kamga Creek, 14 km upstream* 600 m (0/1807a); *Kayakkatuyarykskij Creek* 1900 m (8/165; 8/304); *Kishie* 440 m (Zolotukhin 11.VII.1988); *Kobiguayuk Creek* 2200 m (0/1790); 2350 m (0/1851); *Kobukhta* 700 m (0/251); *Kobukhtushka* 460 m (0/1852); *Kokkul Lake* 2300 m (33/36; 33/38a); *Korbu* 440 m (Zolotukhin 20.X.1988); *Kukol* 1750 m (0/1770); 1820 m (0/1796); 1850 m (0/1798a); *Kyga River, at mouth* 450 m (0/1760); *Malaya Kokorya Creek* 2300 m (36/28); *Maloye Istyube Creek* 700 m (Zolotukhin 22.VII.1991); *Ok-Porok Creek, 1.5 km upstream* 470 m (2/18); *Ok-Porok Creek, at mouth* 460 m (Zolotukhin 14.X.1988); *Teletzkoye Lake* ca. 450 m (Korotkov 1958); *Tura Creek, in middle course* 1300 m (28/39; 28/40); *Uedinnoye Lake* 880 m (0/1848); *Ust-Sema* 700 m (24/114); *Yailyu* 400 m (0/1849; 0/1850); 450 m (0/1794); 470 m (0/1847); *Yakhansoru Lake* 1850 m (Zolotukhin 28.VI.1990); 1935 m (Zolotukhin 26.VI.1990); *Yazula* 1750 m (Zolotukhin 28.VI.1989).

Pleurocladula albescens (Hook.) Grolle - in subalpine and lower alpine zones occurs sporadically in tundra and on rock outcrops.

Specimens examined: *Kayakkatuyarykskij Creek* 2200 m (6/29a); *Kolyushta Peak* 2100 m (0/1986); *Sostuoyuk Creek, in middle course* 2000 m (Zolotukhin 20.VI.1990).

Porella gracillima Mitt. - rather widespread at lower elevations on relatively dry rock outcrops. Especially common in lower forest zone, once collected in subalpine zone - under cliff overhang.

Specimens examined: *Azhi Cape* 440 m (21/40); *Bogoyash Creek, upper course* 2300 m (36/368); *Bolshoi Shaltan Creek* 530 m (0/1834); *Bolshoye Istyube Creek* 470 m (Zolotukhin 5.VII.1988; 18/20); *Chemal* 450 m (29/47; 29/76); *Chemal Creek, 3 km upstream* 450 m (34/2); *Chichelgan Range* 800 m (Zolotukhin 21.X.1989); *Chiri* 450 m (0/2022; 17/99); *Derbogach* 450 m (0/29); *Kairu Creek, 8 km upstream* 1000 m (15/8); *Kairu-Bazhi Peak* 2150 m (13/167); *Kamga Creek, 14 km upstream* 640 m (0/1835); *Karagai* 450 m (Zolotukhin 11.VIII.1988); 500 m (Zolotukhin 10.VIII.1988); *Kobukhtushka* 440 m (0/1920a); *Ust-Sema* 400 m (24/137; 24/3; 24/38); 450 m (24/16a); *Yailyu* 440 m (0/1833); 450 m (0/1832); *Yurga* 450 m (21/3).

Porella platyphylla (L.) Pfeiff. - on wet to dry rocks in forest, forest-steppe and steppe zones, and rarely in subalpine zone.

Specimens examined: *Artyshu Creek* 620 m (Zolotukhin 21.X.1989); 650 m (Zolotukhin 24.VI.1989); *Azhi Cape*

440 m (21/41); *Bolshoi Mianok Creek, at mouth* 450 m (Zolotukhin 8.VIII.1988); *Chainary Creek, upper course* 1800 m (34/1); *Chemal* 450 m (29/1); *Chiri* 450 m (17/36); *Chulcha River, in middle course* 1100 m (9/138); *Kairu Creek, 8 km upstream* 1000 m (15/41); *Kobukhta* 580 m (0/232); 600 m (0/242); *Kukol* 1750 m (0/1829); 1800 m (0/1964a); 1850 m (0/1830); 1900 m (0/1826; 0/1827); *Malyi Yaloman* 1100 m (25/5); *Malyi Yaloman Creek, 7 km upstream* 1000 m (25/35); *Ok-Porok Creek, at mouth* 450 m (Zolotukhina 30.III.1988; 0/1828); *Tabozhok Peak* 2100 m (31/339); *Tamanel Peak* 1950 m (34/3); *Tura Creek, in middle course* 1300 m (28/16); *Tushken Creek, 1 km upstream* 560 m (Zolotukhin & al. 15.VII.1982); *Yailyu* 450 m (1/64); 460 m (0/1831); 550 m (0/2017).

Preissia quadrata (Scop.) Nees - on wet rocks and loamy banks on creeks, rivers and lakes in forest and forest-steppe zones, rarer in subalpine and lower alpine zones - on rock outcrops and wet bare soil in tundra.

Specimens examined: *Bayas Creek, in middle course* 850 m (16/33); *Bolshoi Shaltan Creek* 530 m (0/1853; 0/1983a); 560 m (Zolotukhin 7.VI.1989); *Bolshoye Istyube Creek* 470 m (0/1857; 18/35); *Chemal* 400 m (29/61); *Chulcha River, in middle course* 870 m (Zolotukhin 18.IX.1989); *Derbogach* 440 m (0/1855); 450 m (0/3); *Kairu Creek, 8 km upstream* 1000 m (15/1); *Kamga Creek, 12 km upstream* 600 m (0/1858); *Kamga Creek, 14 km upstream* 660 m (0/1809a); *Kamga Creek, upper course* 830 m (Zolotukhin 7.VI.1991); *Karagai* 440 m (0/279); *Karakol Lakes* 1950 m (28/104); *Kolyushta Peak* 2050 m (0/1854); *Malyi Yaloman Creek, 7 km upstream* m; *Tuldaidyuly Creek* 800 m (0/1856; Zolotukhin 22.VI.1988).

Ptilidium ciliare (L.) Hampe - from upper taiga (on rotten log) to subalpine and alpine zones, where it is very common on rocks and soil, both in sheltered and exposed habitats (rocky and lichen tundras), in upper elevations also common in boggy vegetation, growing among mosses.

Specimens examined: *Itykul Lake* 1665 m (Zolotukhin 21.VI.1990); *Kairu Creek, 8 km upstream* 1000 m (15/123); *Kayakkatuyarykskij Creek* 1850 m (3/195a); 2650 m (7/45); *Kobiguayuk Creek* 2300 m (0/1915a; 0/302); 2908 m (0/1786; 0/424); *Kukol* 1750 m (0/1839); *Malaya Kokorya Creek* 2300 m (36/366); *Yakhansoru Lake* 1850 m (t-16; Zolotukhin 28.VI.1990).

Ptilidium pulcherrimum (G. Web.) Vain. - exclusively common in forest zone on living and fallen trunks, as well as on decaying wood; in taiga and subalpine zones also grows on rocks.

Specimens examined: *Kobiguayuk Creek* 2000 m (0/177); *Korbu* 460 m (Zolotukhin 20.X.1988); *Kukol* 1750 m (s-1a); *Nizhnij Kulash* 1550 m (Zolotukhin 2.VII.1989); *Ok-Porok Creek, 1.5 km upstream* 460 m (Zolotukhin 14.X.1988); *Saraiti Cape* 460 m (Zolotukhin 13.X.1987); *Uedinnoye Lake* 1030 m (0/1899a); *Yailyu* 445 m (Zolotukhin 18.IV.1977); 460 m (0/1838); 470 m (0/1837); 480 m (0/1836); *Yakhansoru Lake* 2030 m (Zolotukhin 26.VI.1990).

Radula complanata (L.) Dum. - in forest zone common on rocks and also on trunks of *Salix*, *Populus*, *Sorbus*, *Padus*, also on thin twigs of *Abies* (on trunks - up to 1000 m); in taiga and subalpine (and lower alpine) zones - only on rock outcrops or among rocks in rock-fields.

Specimens examined: *Baigazan* 450 m (19/4); *Be-rekhtuyaryk* 1600 m (0/1841); *Bogoyash Creek, upper course* 2400 m (36/22); *Bolshoi Shaltan Creek* 560 m (Zolotukhin 7.VI.1989); *Chemal Creek, 3 km upstream* 450 m (34/225; 34/226); *Chiri Creek, 0.5 km upstream* 450 m (17/85); *Kairu Creek, 8 km upstream* 1000 m (15/105; 15/57); *Kairu-Bazhi Peak* 2100 m (13/36); 2150 m (13/158); *Karagai* 500 m (Zolotukhin 10.VIII.1988); *Karakem River, 6 km upstream* 1600 m (0/1844); *Karakol Lakes* 1900 m (28/137); *Kishte* 440 m (Zolotukhin 11.VII.1988); *Kobiguayuk Creek* 2300 m (0/1840; 0/1842); *Kobukhta* 750 m (0/1846); *Kukol* 1800 m (0/1843; 0/1964a); *Tura Creek, in middle course* 1300 m (28/34); *Ust-Sema* 400 m (24/109a); 580 m (24/98); *Yailyu* 400 m (0/1824a); 480 m (0/1845); *Yakhansoru Lake* 1850 m (Zolotukhin 28.VI.1990); 1940 m (Zolotukhin 26.VI.1990).

***Reboulia hemisphaerica* (L.) Raddi** - on soil among rocks in forest and forest-steppe zones and two collections are from subalpine zone.

Specimens examined: *Arzhan (Chulyshman lower course)* 520 m (Zolotukhin 26.VIII.1987); *Atushinskij Ortozha* 520 m (Zolotukhin 26.VIII.1987); *Kayakkatuyarykskij Creek* 1900 m (8/309); 1970 m (7/127); *Kurkure Creek* m (Zolotukhin & al. 23.V.1982); *Saratki Cape* 450 m (Zolotukhin 14.X.1987); *Ust-Sema* 400 m (24/2).

***Riccardia incurvata* Lindb.** - one collection in springy area along a small stream in subalpine zone.

Specimens examined: *Kairu-Bazhi Peak* 2050 m (13/181).

***Riccardia latifrons* (Lindb.) Lindb.** - in forest zone at middle elevations, on rotten stumps and on fallen logs in conifer forests.

Specimens examined: *Ayukol* 1000 m (0/1876); *Kairu Creek, 16 km upstream* 1400 m (14/66a).

***Riccardia multifida* (L.) S. Gray** - on rotten log in deep canyon.

Specimens examined: *Bolshoye Istyube Creek* 470 m (18/100a).

***Riccardia palmata* (Hedw.) Carruth.** - on rotten logs and stumps in humid areas of lower forest zone, and one collection from subalpine *Larix* forest on South-East Altai (Kuraiskij Mt. Range).

Specimens examined: *Atkichu Creek, at mouth* 440 m (Zolotukhin 21.X.1989); *Bolshoye Istyube Creek* 470 m (18/116a; 18/3; 18/99); *Chemal Creek, 3 km upstream* 450 m (a10); *Kamga Creek, 4 km upstream* 460 m (0/1765); *Tabozhok Peak* 2300 m (31/336); *Ust-Sema* 680 m (24/12a); 700 m (24/147; 24/148a); *Yailyu* 460 m (0/1875).

***Riccia fluitans* L.** - in stagnant water of an ancient river bed in middle course of Chulyshman River.

Specimen examined: *Akkurum* (Zolotukhin 10.VIII.1993).

***Riccia cavernosa* Hoffm. emend. Raddi** - open disturbed place along a small channel in xeric valley in Central Altai and in Katun flood valley near Gorno-Altai; in both these places grows in abundance.

Specimens examined: *Maima* 280 m (35/1); *Malyi Yaloman Creek, 4 km upstream* 900 m (25/106).

***Riccia sorocarpa* Bisch.** - on clayish soil bank among rock-fields of steep and rather xeric S-facing slope in subalpine zone.

Specimens examined: *Kayakkatuyarykskij Creek* 1950 m (8/164).

***Sauteria alpina* (Nees) Nees** - on soil bank on steep steppe (semi-desert) slope on Kuraiskij Mt. Range in South-East Altai.

Specimens examined: *Tabozhok Creek, 12 km upstream* 2200 m (30/155).

***Scapania apiculata* Spruce** - on rotten logs in several localities: in deep canyons in lower forest zone and in conifer forests in taiga zone.

Specimens examined: *Bayas Creek, in middle course* 850 m (16/34a); 1000 m (16/37); *Bolshoye Istyube Creek* 470 m (18/100a; 18/85); *Kairu Creek, 16 km upstream* 1400 m (14/66); *Kairu Creek, 8 km upstream* 1000 m (15/145; 15/49).

***Scapania carinthiaca* Jack ex Lindb.** - on rotten logs beside the waterfall of Bolshoye Istyube Creek.

Specimens examined: *Bolshoye Istyube Creek* 470 m (18/100; 18/85a).

***Scapania* cf. *scandica* (H. Arnell et Buch) Macv.** - few collections from forest, subalpine and alpine zones, on rocks.

Specimens examined: *Bogoyash Creek, upper course* 2300 m (36/14); 2400 m (36/17); 2450 m (36/11); *Ust-Sema* 400 m (24/107; 24/108; 24/109a); *Yakhansoru Lake* 1850 m (Zolotukhin 28.VI.1990).

***Scapania crassiretis* Bryhn** - on rotten logs beside the waterfall of Bolshoye Istyube Creek in forest zone and in subalpine zone on rock outcrops and among rocks in rock-fields.

Specimens examined: *Bolshoye Istyube Creek* 470 m (18/86); *Kayakkatuyarykskij Creek* 1920 m (3/252); 1950 m (3/207; 3/208a); 2150 m (4/3; 4/4).

***Scapania curta* (Mart.) Dum.** - in narrow valley of Bolshoye Istyube Creek, on soil bank.

Specimens examined: *Bolshoye Istyube Creek* 470 m (0/1947a).

***Scapania cuspiduligera* (Nees) K. Muell.** - rather common in upper taiga and subalpine zones on rotten logs, on soil along trails, on rock outcrops, on boulders among dwarf *Betula* shrubs, on mossy places along creeks, one locality is in the forest zone, two - in alpine zone on soil banks of temporary stream in tundra and on rock outcrops.

Specimens examined: *Bayas Creek* 1800 m (0/1944); *Bayas Creek, in middle course* 850 m (16/32a; 16/38); *Bayas Lake* 1850 m (0/1942); *Bogoyash Creek, upper course* 2450 m (36/3); *Kairu-Bazhi Peak* 2100 m (13/83); *Kokkul Lake* 2300 m (33/36a); *Kukol* 1800 m (0/1943; 0/1952a); 1850 m (0/1945; 0/1946); *Tabozhok Peak* 2350 m (31/342); 2400 m (31/343); 2450 m (31/340).

***Scapania degenii* Schiffn. ex K. Muell.** - on wet rock outcrops in forest and subalpine zones.

Specimens examined: *Bayas Creek, at mouth* 460 m (0/1764); *Bolshoye Istyube Creek* 470 m (18/103a); *Bolshoi*

Shaltan Creek 540 m (0/2117); *Kayakkatuyarykskij Creek* 1800 m (4/15); 1920 m (3/268); 1930 m (3/236; 7/153).

Scapania gymnostomophila Kaal. - wet cliffs in subalpine and alpine zones.

Specimens examined: *Kairu-Bazhi Peak* 2100 m (13/147); *Tabozhok Peak* 2750 m (31/334).

Scapania hyperborea Joerg. - wet cliffs in forest and subalpine zones.

Specimens examined: *Kairu Creek, 8 km upstream* 1000 m (15/16); *Kayakkatuyarykskij Creek* 1760 m (8/219); 1850 m (3/195); 1920 m (3/269).

Scapania irrigua (Nees) Nees - on open and shrubby banks of creeks in upper taiga; in subalpine zone - on rocks in streams, among rocks in rock-fields; in alpine zone - in cliff crevices and in springy bogs.

Specimens examined: *Bogoyash Creek, upper course* 2350 m (36/21); 2400 m (36/12); *Booshkon Pass* 2700 m (Zolotukhin 5.VII.1990); *Kayakkatuyarykskij Creek* 1650 m (8/132); 1750 m (8/119); 1760 m (8/244); 1930 m (3/255); *Lesnoi Creek* 1860 m (Zolotukhin 2.VII.1990); *Tamanel Peak* 1800 m (a7).

Scapania mucronata Buch - in taiga zone on S-facing rocks; in subalpine *Pinus sibirica* forest on rocks with dense moss mat.

Specimens examined: *Kairu Creek, 8 km upstream* 1000 m (15/87); *Kayakkatuyarykskij Creek* 1930 m (3/126). Probably to this species belong also specimen from *Bolshoye Istyube Creek* 470 m (18/82).

Scapania nemorea (L.) Grolle - on wet cliffs beside waterfall and in other wet places, rarer on decaying wood.

Specimens examined: *Bolshoye Istyube Creek* 470 m (Zolotukhin 5.VI.1986; 18/85a); *Kamga Bay* 450 m (Zolotukhin 20.X.1988); *Karagai* 500 m (Zolotukhin 10.VIII.1988); *Kishte* 440 m (Zolotukhin 11.VII.1988).

Scapania obcordata (Berggr.) S. Arnell - one collection in tundra of South-Eastern Altai, with *Anthelia juratzkana*, *Nardia geoscyphus*.

Specimens examined: *Bogoyash Creek, upper course* 2200 m (36/26b).

Scapania paludicola Loeske et K. Muell. - on side of sedge tussocks at low lake shore, in pools of wet places of extensive bogs and bogging lakes in subalpine zone; in crevices of wet cliffs in alpine zone.

Specimens examined: *Bardaky Lake* 1950 m (12/14; 12/21); *Kayakkatuyarykskij Creek* 1760 m (8/265); 1920 m (3/118); *Stremechno Lake* 2180 m (Zolotukhin 20.VII.1990); *Tutuoyuk Creek* 2500 m (Zolotukhin 17.VII.1990); *Uzunoyuk Creek, in middle course* 2150 m (Zolotukhin 10.VII.1990).

Scapania parvifolia Warnst. - on rock outcrops in upper taiga and subalpine zones, and on lake shore, among lichens.

Specimens examined: *Kayakkatuyarykskij Creek* 1760 m (8/23); 1920 m (3/245); 2000 m (3/73).

Scapania spitsbergensis (Lindb.) K. Muell - on wet rocks in forest and subalpine zones.

Specimens examined: *Kayakkatuyarykskij Creek* 1930 m (3/235); 2050 m (7/21); *Ok-Porok Creek, 1.5 km upstream* 470 m (2/8).

Scapania subalpina (Nees ex Lindenb.) Dum. - in hanging bog beside a stream and on rocks in dry stream bed in alpine zone.

Specimens examined: *Kayakkatuyarykskij Creek* 2350 m (7/89); 2650 m (7/73).

Scapania undulata (L.) Dum. - in forest zone in canyon of Bolshoye Istyube Creek; in alpine zone - on rocks at lake shore just above water table and in crevices of cliffs.

Specimens examined: *Bolshoye Istyube Creek* 470 m (0/1941); *Booshkon Pass* 2700 m (Zolotukhin 5.VII.1990); *Kayak Lake* 2280 m (7/12; 7/191).

Targionia hypophylla L. - xeric S-facing rock outcrops in forest, forest-steppe and subalpine zones.

Specimens examined: *Chulcha River, in middle course* 1000 m (9/10; 9/125); *Kairu Creek, lower course* 500 m (Zolotukhin 12.IX.1987); *Kayakkatuyarykskij Creek* 1900 m (8/162); *Yailyu* 450 m (0/1873).

Tetralophozia setiformis (Ehrh.) Schljak. - rather common in subalpine and alpine zones on rocky places (usually rather open). One finding is in taiga zone, on rocks of big rock-field on slope to Kairu Creek valley.

Specimens examined: *Booshkon Pass* 2700 m (Zolotukhin 5.VII.1990); *Kairu Creek, 16 km upstream* 1400 m (14/5; 14/55); *Kayakkatuyarykskij Creek* 1760 m (8/27); 1920 m (3/264; 3/265); 2000 m (3/55); *Kobiguayuk Creek* 2700 m (0/119); 2850 m (0/1767); *Uzunkul Lake* 2050 m (Zolotukhin 23.VI.1990).

Trichocolea tomentella (Ehrh.) Dum. - once collected on fallen log, in moss mat, in springy bog with *Alnus*, at Teletzkoye Lake shore.

Specimens examined: *Kobukhtushka* 450 m (Zolotukhin 28.III.1988).

Tritomaria exsecta (Schmid.) Loeske - in forest and subalpine zones; equally common on rocks and on rotten logs.

Specimens examined: *Atkichu Creek, at mouth* 440 m (Zolotukhin 21.X.1989); *Ayukol* 1000 m (0/1966); 1350 m (0/1771); *Bolshoye Istyube Creek* 470 m (18/117a; 18/118; 18/81a; 18/85a; 18/97); *Kairu Creek, 16 km upstream* 1400 m (14/20a); *Kairu Creek, 8 km upstream* 1000 m (15/117); *Karagai* 440 m (0/2009); *Karakol Lakes* 1900 m (28/154a); *Kishte* 440 m (Zolotukhin 11.VII.1988); *Kobiguayuk Creek* 2250 m (0/2016); *Korbu* 440 m (Zolotukhin 20.X.1988); 450 m (0/1965); *Kukol* 1800 m (0/1907a; 0/1964); *Nizhnij Kulash* 1550 m (Zolotukhin 2.VII.1989); *Tura Creek, in middle course* 1300 m (28/31); *Yailyu* 450 m (0/1888a); 460 m (0/1806a).

Tritomaria exsectiformis (Breidl.) Loeske - similar with *T. exsecta* in altitudinal range and habitats, but prefers rotten logs, with rare occurrence on rocks; more characteristic for taiga zone, with only few localities in both lower forest zone and above tree-line in high mountains.

Specimens examined: *Bolshoye Istyube Creek* 470 m (0/1896a; 18/87); *Kairu Creek, 8 km upstream* 1000 m

(15/49a); *Karakem River, 6 km upstream* 1660 m (0/1962); *Kayakkatuyarykskij Creek* 1950 m (3/229; 3/22a); *Kobukhta* 650 m (0/1901a); *Kukol* 1750 m (0/1963; s-3); 1800 m (0/1897a); *Lesnoi Creek* 1865 m (Zolotukhin 2.VII.1990); *Seminskij Pass* 1800 m (25a/13a).

Tritomaria polita (Nees) Joerg. - springy meadow along a stream in subalpine zone.

Specimens examined: *Kairu-Bazhi Peak* 2050 m (13/29a; 13/78); 2150 m (13/145).

Tritomaria quinquentata (Huds.) Buch - very widespread species, covering all the altitudinal zones. Occurs in wide range of habitats, but more common in rocky places, especially among rocks in rock-fields. On rotten logs found only two times in lower forest zone. In alpine zone not rare in open tundras.

Specimens examined: *Ayulyuyuzuk Creek* 2250 m (0/1960); 2450 m (0/166); 2500 m (0/1956); *Bayas Creek* 1800 m (0/1974a); *Bayas Lake* 1700 m (0/1772); 1750 m (0/1763a; 0/1909a; 0/1955; s-6); 2000 m (0/1961; s-10a); *Bogoyash Creek, upper course* 2350 m (36/15; 36/16); *Bolshoye Istyube Creek* 470 m (Zolotukhin 5.VII.1988); *Bolshoi Shaltan Creek* 540 m (0/2117a); *Kairu Creek, 16 km upstream* 1400 m (14/19); *Kamga Creek, 10 km upstream* 500 m (0/91); *Kamga Creek, 9 km upstream* 540 m (0/1957); *Karagai* 447 m (Zolotukhin 11.VIII.1988); *Kayak Lake* 2280 m (7/192);

Kayakkatuyarykskij Creek 1760 m (8/19); 1800 m (8/234a); 1920 m (3/264a); 1930 m (3/255; 3/277); 1950 m (3/204a; 3/205a; 3/209); 2050 m (5/1; 5/21; 7/176); 2200 m (6/13); 2650 m (7/75); 2700 m (7/64); *Kobiguayuk Creek* 2250 m (0/1782a); 2800 m (0/1774); *Kukol* 1850 m (0/1958; 0/1959); *Maloye Istyube Creek* 700 m (Zolotukhin 22.VII.1991); *Maloye Istyube Creek, 1 km upstream* 600 m (Zolotukhin 19.V.1977); *Seminskij Pass* 1800 m (25a/12); *Sostuoyuk Creek, in middle course* 2000 m (Zolotukhin 20.VI.1990); *Tamanel Peak* 2150 m (a8); *Uzunkul Lake* 2050 m (Zolotukhin 23.VI.1990); *Yailyu* 460 m (0/1902a); *Yakhansoru Lake* 1850 m (Zolotukhin 28.VI.1990); 1935 m (Zolotukhin 26.VI.1990).

Tritomaria scitula (Tayl.) Joerg. - on rotten wood in taiga zone and on rocks in subalpine zone.

Specimens examined: *Ayulyuyuzuk Creek* 2300 m (0/1953); *Bayas Creek* 1740 m (0/1954); *Karakol Lakes* 1900 m (26/129; 26/130); *Kukol* 1800 m (0/1952).

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