INTRODUCTION

The liverworts of the Urals are still a relatively poorly studied. Most of the studies covered mainly the Western slopes of the Northern and Middle Urals (Zinovjeva, 1973; Baisheva & Potemkin, 1998; Bakalin et al., 2001; Dulin, 2007; Konstantinova et al., 2010; Konstantinova & Bezgodov, 2005; Ignatova et al., 2019;). Information about the liverworts of the Polar and Subpolar Urals is extremely limited. There is only one publication on the Sob’ river valley in the Polar Urals (Konstantinova & Chernyadjeva, 1995). Data on liverworts of the Eastern slopes of the Urals are presented in two more or less comprehensive lists of species of the Subpolar Urals: the Ner-Oika Mountain and the basin of Puiva river (Konstantinova & Lapshina, 2014, 2017). This paper provides the results of identifications of specimens collected in the basin of the Khulga River, located in the North-Eastern part of the Subpolar Urals, about 120 km from the previously studied sites.

STUDY AREA

The study area is located in the Beresovskiy District in north-west part of the Khanty-Mansi Autonomous Area (Yugra). The sources of the Khulga River are located slightly south of the Arctic circle on the border of the Polar and Subpolar Urals. The river flows along the eastern slope of the Ural Mountains to the South to the Severnaya Sosva River which is a left tributary of the Ob River. In the middle and lower reaches, the river flows through a flat, sometimes gently undulating plain with absolute elevations of 40–90 m above sea level. The narrow regularly flooded part of river valley is occupied by well-drained forests and wet lowlands. Flat river valley terraces are poorly drained and covered with raised and transitional peat bogs and swampy open woodlands with *Pinus sibirica* Du Tour and *Picea obovata* Ledeb. Local permafrost is widespread in the peatlands and thermokarst landforms are widely represented.

On the right bank in the upper reaches of the river, up to a height of 350–400 m alt. mountain birch-spruce-larch forests and their derivatives predominate. In the subalpine zone, up to a height of 450–500 m, *Pinus sibirica-Betula pubescens* Ehrh. with an admixture of *Larix sibirica* Ledeb. open forests, alternating with thicketts of *Betula nana* L. and *Duschekia fruticosa* Opiz are widespread. The mountain tundra is represented on the highest peaks, reaching a height of 600–750 m.

Mountains are composed of metamorphic and intrusive rocks, with frequent outcrops of carbonates. This provides a diversity of rocks from pure carbonates to rocks of basic, neutral and acidic compositions. For a more detailed descrip-
tion of the vegetation and habitats see Lapshina et al. (2020).

MATERIAL AND METHODS

Liverworts were gathered in the basin of the Khulga River from 7 to 18 July 2018 by Elena Lapshina and Ilya Filippov. The routes were planned to cover all the diversity of the main vegetation types. Landsat 8 satellite images with a resolution of 15 m were used for this purpose. The valleys of small rivers and streams, rock outcrops, banks of rivers and lakes were studied most thoroughly. In total 300 specimens were collected from 190 sites at altitudes from 24 to 625 m. On the map all collecting sites are grouped into 24 locations within four key territories (Fig. 1). For all collecting sites the coordinates and elevations were measured using GPS. The collected specimens were studied in the laboratory of the Polar-Alpine Botanical Garden-Institute (Kirovsk, Murmansk Province). The specimens are deposited in the Biological collection of Yugra State University (YSU); some duplicates are deposited in the Herbarium of Polar-Alpine Botanical Garden-Institute of the Kola Scientific Center, Russian Academy of Sciences (KPABG). Label data of duplicates are incorporated in the CRIS – Cryptogamic Russian Information System (kpabg.ru›cris/?q=node/16).

Collecting localities (Fig.1.)

I. Upper Khulga River near the mouth of Tykotlova River (right tributary of Khulga River).

Valley of Khulga River: 1 – right bank, 2 km below mouth of Tykotlova River, 65.252°N, 62.170°–62.177°E, 61 m alt.; 2 – near the mouth of Tykotlova River, 65.253°–65.269°N, 62.177°–62.184°E, 61 m alt.; 3 – left bank, 2 km above mouth of Tykotlova River, 65.278°–65.286°N, 62.189°–62.207°E, 66 m alt.

Tykotlova peatland area between the valleys of the Khulga and Tykotlova Rivers: 4 – flat palsa bog, 65.275°–65.285°N, 62.132°–62.147°E, 66 m alt.; 5 – rich fen in area of carbonate groundwater discharge, 65.253°–65.269°N, 62.177°–62.184°E, 68 m alt.; 6 – sloping bog at base of carbonate rock outcrops, 65.297°N, 62.128°E, 72 m alt.

Mid-mountain belt eastern ridges of Subpolar Urals: 7 – shore of lake in intermontane basin, 65.302°N, 62.075°E, 75 m alt.; 8 – rich fen at base of carbonate rock by lake, 65.298°N, 62.095°E, 75 m alt.; 9 – carbonate rocks and carbonate outcrops in spruce-larch forest, 65.301°N, 62.119°E, 105 m alt.; 10 – dry carbonate rocks on steep slope of southern exposure, 65.298°N, 62.085°E, 81 m alt.; 11 – huge boulder on gentle north-eastern faced slope, 65.277°N, 62.111°E, 92 m alt.; 12 – valley in the middle reaches of Tykotlova River, 65.278°N, 62.101°E, 72 m alt.

II. Upper reaches of the Khulga River in the area of the Balbanty Lake. 13 – valley of Khulga River, 2 km east of the Balbanty Lake, 65.150°–65.154°N, 62.108°–62.126°E, 52 m alt. The eastern spurs of the Subpolar Urals: 14 – lower part of western slope and swampy valley of Balbanshor Brook on northern shores of lake in forest belt, 65.161°–65.176°N, 62.026°–62.048°E, 81 m alt.; 15 – deep intermontane brook valley near the timberline, 65.201°N, 61.996°E, 487 m alt.; 16 – gentle slopes and plateaus at the top of mountain tundra belt, 65.202°–65.210°N, 61.970°–61.986°E, 510 m alt.; 17 – upper Balbanshor Brook under snowfield, 65.216°–65.222°N, 61.922°–61.939°E, 608 m alt.; 18 – valley of the Khulga River, near the mouth of Balban’yu River, 65.104°N, 62.216°–62.218°E, 46 m alt.

III. Valley of the Khulga River in its middle course: 19 – high palsa-hollow complex on right bank of Khulga River, 64.936°–64.937°N, 61.993°–61.999°E, 45 m alt.; 20 – coastal silty-sand sediment outcrop along on left bank of river, 64.870°N, 62.034°E, 40 m alt.; 21 – meso-oligotrophic aapa mire complex with palsas on left-bank terrace of the Khulga River, 64.870°–64.871°N, 62.042°–62.046°E, 43 m alt.; 22 – left bank of the Khulga River opposite the mouth of Khalmer’yu River, 64.558°N, 61.642°E, 43 m alt.

IV. Valley of the Khulga River at its lower reaches. Left-bank terrace near the mouth of Man’ya River (right tributary of the Khulga River): 23 – aapa mire complex, 64.348°–64.349°N, 61.107°–61.150°E, 25 m alt.; 24 – mesotrophic poor fen, 64.337°–64.339°N, 61.066°–61.067°E, 24 m alt.

ANNOTED LIST OF SPECIES

The annotated list of liverworts includes 84 species. The nomenclature of bryophytes generally follows Hodgetts et al. (2020). The species in the list are arranged in alphabetical order. Common synonyms are given in square brackets. After
Aneura pinguis (L.) Dumort. – 5, 17, 21: on bare peat in poor fens or scattered in mats of Sphagnum warnstorffii, Ptychothamnus pseudotriquetrum in rich fens and dwarf shrubs (Betula nana, Salix)-sedge (Carex arctisibirica)-Sphagnum warnstorffii mires in forest and tundra zone [YSU-MH-00521].

Anthelia juratzkana (Limpr.) Trevis. (per., spor.) – 16, 17: on clay spots in rocky dwarf shrub tundra on top of mountain, [YSU-MH-00503], on stream banks under snowfield, on moist organic-mineral substrate. Often mixed with other arctomontane liverworts (Marsupella sprucei, Prasanthus suecicus, Barbilophozia sudetica etc.) or liverworts widespread in the north of holarctic (Blepharostoma trichophillum, Fuscocephaloziopsis pleniceps, Mesoptychia heterocolpos, etc) [KPABG(H):22287].

** Arnellia fennica (Gottsche) Lindb. – 9: carbonate boulders in coniferous (Picea obovata, Larix sibirica, Pinus sibirica) dwarf shrub-green-moss forest, between rocks, mixed with Tritomaria scita, Mesoptychia heterocolpos [YSU-MH-00148]; 10: rock outcrop, in moist shaded niches, in pure mats and mixed with Myurella tenerima, Pophila cruda, Bryoerythrophyllum recurvirostrum, Scapania gymnostomophila, Cyrtonnium hymenophylloides, Platydictya jungermannioides [KPABG(H):122255]; 11: huge boulder, in shaded niches, single shoots in turf of Scapania gymnostomophila [YSU-MH-00344]. Previously the species was only known on the European slopes of the Urals. It is reported for the first time for the Asian part of the Urals.

Barbilophozia barbara (Schmidel ex Schreb.) Loeske –1, 3, 7, 9, 11, 15 (Fr.): in dark coniferous and mixed (Picea obovata, Pinus sibirica, Betula pubescens, Larix sibirica) shrub-herb and grass-green-moss short-flooded river valley forests, in the forest floor, in pure mats [KPABG(H):122250] or mixed with Sciuro-hypnum curtum, Eurynchiasastrum pulchellum, Plocodium schreberi, Abietinella abietina, Hypnum cupressiforme and Lophocolea minor.

Barbilophozia hatcheri (A. Evans) Loeske – 15: rock outcrops on steep slopes, on cliff ledges on forest litter [YSU-MH-00418], in pure mats or mixed with Lescurea saxicola [YSU-MH-00417].

Barbilophozia sudetica (Nees ex Huebener) L.Söderstr., De Roo & Hedd. [Lophozia sudetica (Nees ex Huebener) Grolle, Pseudolophozia su-
**Diplophyllum taxifolium** (Wahlenb.) Dumort. – 15, 16, 17 (Sp.): on cliffs in forest zone, between rocks, in rocky dwarf shrub tundra in pure mats [YSU-MH-00501] or mixed with *Barbilophozia sudetica*, *Lophozia murmanica*, Gymnomitrium concinnatum, Gymnocolea inflata and *Tetraplodon setiformis* [KPABG(H):122274].

This is a recently described species (Mamontov et al., 2020) previously referred to *F. bolanderi*.

**Fuscephaloziopsis albescens** (Hook.) Väna et L. Söderstr. *Pleurocladula albescens* (Hook.) Grolle – 17: bank of stream under snowfield, on fine earth, mixed with *Lophozia murmanica*, *Diplophyllum taxifolium*, *Pohlia drummondii*. [KPABG(H):122283]

**Fuscephaloziopsis connivens** (Dicks.) Väna et L. Söderstr. *Cephalozia connivens* (Dicks.) Lindb.] – 6: boggy *Betula nana-Rubus chamaemorus-Sphagnum fuscum* open spruce woodland at the base of carbonate outcrops [YSU-MH-00103], mixed with *Mylia anomala*.

**Fuscephaloziopsis leucantha** (Spruce) Väna et L. Söderstr. *Cephalozia leucantha* Spruce] – 6: boggy *Betula nana-Rubus chamaemorus-Sphagnum fuscum* open spruce woodland at the base of carbonate outcrops, on peat, mixed with *Prototrophozia elongata*, *Cephalozia ambiguа*, Calypogeia spp. and *Sphenolobus minutus*
[KPABG(H):122247]. It is the second record for Khanty-Mansi Autonomous Area, until now the species was only found in the Nature Park “Numto” [Lapshina et al., 2018].

Fuscocephaloziopsis lunulifolia (Dumort.) Väña et L. Söderstr. [Cephalozia lunulifolia (Dumort.) Dumort.] (per, spor.) – 3, 6, 14 (Sp.): in birch and moist mixed forests, boggy Betula nana-Rubus chamaemorus-Sphagnum fuscum open spruce woodland, on decayed wood in pure mats [KPABG(H):122262] or mixed with Lophocolea heterophylla, Lophozia guttulata, L. ascendants, Lophoziopsis longidens, Tritomaria exsectiformis, Riccardia latifrons and Scapania curta.

Fuscocephaloziopsis pliceps (Austin) Väña et L. Söderstr. [Cephalozia pliceps (Austin) Lindb.] (per., ant.) – 3, 6, 13, 14, 17 (Sp.): on soil in floodplain forests and boggy birch-peat-moss Pinus sibirica-spruce woodlands in mats with Schistochilopsis grandiretis, Rhizomnium pseudopunctatum [KPABG(H):122261], on banks of streams in the mountain-tundra, with Barbiophozia sudetica, Blepharostoma trichophyllum, Mesophtychia heterocopolis, M. collaris, Anthelia juratzkana and Schljakovianthus quadrilobus.

Gymnocoella inflata (Huds.) Dumort. – 16: dwarf shrub (Betula nana, Vaccinium uliginosum, Empetrum hermaphroditum) tundra, on fine earth mixed with Diplophyllum taxifolium, Lophozia murmanica and Gymnomitrion concinnatum [YSU-MH-00493].

Gymnomitrion concinnatum (Lightf.) Corda – 16: rocky dwarf shrub tundra, between stones on fine earth, in pure mats [KPABG(H):122272] and mixed with Lophozia wenzelii, L. murmanica, Diplophyllum taxifolium and Sphenolobus minutus; and dwarf birch tundra on clay spots, mixed with Gymnomitrion corallioides, etc. (see below). [YSU-MH-00504].

Gymnomitrion corallioides Nees – 16: dwarf birch tundra, on clay spots, some shoots mixed with Gymnomitrion concinnatum, Prasanthus suecicus, Solenostoma sp., Sphenolobus minutus, Barbiophozia sudetica, Isopaches bicrenatus and Scapania parvifolia [YSU-MH-00504].

Heterogemma laxa (Lindb.) Konstant. et Vilnet – 6, 14, 21 (Sp.): sides of Sphagnum hummocks, often on dried Sphagnum in boggy Betula nana-Sphagnum fuscum open Pinus sibirica-Picea obovata woodlands, on side of hummock in aapa mire, sedge-Menyanthes hollow. Always scattered in mats or turfs of bryophytes, more often among Sphagnum fuscum, Tomentypnum nitens and Rhizomnium pseudopunctatum [YSU-MH-0048];

Isopaches bicrenatus (Schmidel ex Hoffm.) H. Buch – 16: dwarf birch tundra on bare clay spots, single shoots among Gymnomitrion corallioides, G. concinnatum, Prasanthus suecicus, Solenostoma sp., Sphenolobus minutus, Barbiophozia sudetica and Scapania parvifolia [YSU-MH-00504].

Jungermannia pumila With. (per., ant., spor) – 17 in pure mat on rocks in stream bed under snowfield [KPABG(H):122277] and on fine earth on stream bank mixed with Marchantia quadrata, Solenostoma confertissimum, Trilophozia quinquetentata, Mesophtychia heterocopolos, Philonotis tomentella and Bartramia ittyphylla.

Lepidozia reptans (L.) Dumort. – 1: larch-birch-spruce shrub-green moss old-growth forest in river valley, on decayed wood in pure mats [KPABG(H):122251]; 23: aapa mire, dwarf shrub-Sphagnum divinum ridge with stunted Pinus silvestris, at the base of pine trunk, mixed with Pohlia nutans and Schljakovia kunzeana [YSU-MH-00798].

Lophocolea heterophylla (Schrad.) Dumort. (per.) – 3, 14 (Sp.): birch and birch-spruce with herb-shrub layer floodplain forests, on decayed wood, in pure mats and mixed with Fuscocephaloziopsis lunulifolia, Lophozia ascendants, L. guttulata and Lophocolea minor [KPABG(H):122243].

Lophocolea minor Nees (gem.) – 1, 3, 7 (Sp.): on soil in birch-spruce and mixed (Picea obovata, Betula pubescens, Pinus sibirica, Larix sibirica) shrub-herb-green moss forests in river valley, on dry peat ledge along lake shore [KPABG(H):122294].

Lophozia ascendants (Warnst.) R. M. Schust. (gem.) – 1: birch-spruce river valley forest, on decaying wood numerous in mats with dominance of Lophozia guttulata; [KPABG(H):122244]; 3: birch-spruce river valley forest, on decayed wood in mats with dominance of Lophocolea heterophylla [KPABG(H):122294].

Lophozia guttulata (Lindb. et Arnell) A. Evans (gem., ant., per.) – 1: birch-spruce river valley...
Lophozia, Preissia quadrata

[YSU-]

Lophozia wenzelii (Nees) Steph. var. -

murmanica cranum fragilifolium (per., gem.) – 16: dwarf shrub tundra, in lophoziopsis excisa of carbonate rocks in forest belt. open woodlands and on organic litter on ledges

Diplophyllum taxifolium juratzkana

snowfield, on fine earth mixed with [KPABG(H):122285], on bank of stream under

bilophozia sudetica, Diplophyllum taxifolium mixed with [YSU-] shrub tundra, between rock, in pure mats or

16, 17 (Sp.): in dwarf shrub and rocky dwarf-

var. [YSU-MH-00519]; 17: bank of stream

under snowfield, single shoots among mosses [YSU-MH-00540].

Lophozia silvicola H. Buch (gem., ant., per.) – 1, 3, 13, 14, 18, 19 (Fr.): on soil, litter and decayed wood in river valley coniferous forests [KPABG(H):122269], in secondary mountain birch-green moss forests, in boggy peat-moss spruce open woodlands in pure mats [YSU-MH-00207] but more often mixed with other bryophytes of such habitats: Lophozia longiflora, Fuscocephaloziopsis lunulifolia, Tritoma excisA with [YSU-MH-00607].

Lophozia silvicola (Nees) Schiiffn. [Lophozia ventricosa var. longiflora (Nees) Macoun] – 6: boggy Betula nana-Rubus chamaemorus-Sphagnum fuscum open spruce woodland at the base of mountain slope, mixed with Cephalozia leucantha, Calypogeia sphagnicola, Calypogeia neesiana and Sphenolobus minutus [YSU-MH-00096]; 16: dwarf birch tundra, on clay spots, mixed with Anthelia juratzkana and Cephalozia bicuspidata [YSU-MH-00607].

Lophozia wenzelii (Nees) Steph. var. wenzelii (gem.) – 16: rocky dwarf shrub (Betula nana, Vaccinium uliginosum, V. vitis-idaea, Empetrum hermaphroditum, Diapensia lapponica) tundra between rocks, mixed with Gymnomitrium concinnatum and Sphagnum minutus [YSU-MH-00492].

Lophozia wenzelii (Nees) Steph. var. wenzelii var. groenlandica (Nees) Bakalin (gem.) – 1, 9, 16, 17 (Sp.): in dwarf shrub and rocky dwarf-shrub tundra, between rock, in pure mats or mixed with Trilophozia quinquadentata, Barbilophozia sudetica, Diplrophyllum taxifolium [KPABG(H):122285], on bank of stream under snowfield, on fine earth mixed with Anthelia juratzkana, Fuscocephaloziopsis albecens and Diplrophyllum taxifolium [KPABG(H):122287] in open woodlands and on organic litter on ledges of carbonate rocks in forest belt.

Lophozia excisa (Dicks.) Konstant. et Vilnet (per., gem.) – 16: dwarf shrub tundra, in Dicranum fragilifolium turf mixed with Lophozia murmanica [YSU-MH-00519]; 17: bank of stream under snowfield, single shoots among mosses [YSU-MH-00540].

Lophozia longiflora (Nees) Steph. var. longiflora (Nees) Macoun – 1, 2, 13, 15, 17 (Sp.): in mixed birch-spruce forests in river valley and on slopes of mountains, at base of trunks and on decaying wood [KPABG(H):122242], mixed with other liverworts characteristic for decaying wood (Lophozia guttulata, L. ascends Tritoma exsectiformis, etc.). It was once collected in dwarf-shrub-green moss tundra in turf dominated by Dicranum fragilifolium.

Marchantia polymorpha ssp. montivagans Bischl. et Boissel.-Dub. – 12: floodplain forest, on bare soil; 22: dwarf willow-herb-green moss community on silty-gravel river bank [YSU-MH-00792].

Marchantia quadrata Scop. [Preissia quadrata (Scop.) Nees] (per., spor.) – 17: on fine earth on bank of stream under snowfield, mixed with bryophytes [KPABG(H):122286].

Marsupella sprucei (Limpr.) Berner (per., spor.) – 16 rocky dwarf shrub tundra on top of mountain, on clay spots, mixed with Solenostoma confertissimum, S. sphaerocarpum, Anthelia juratzkana and Prasanthus suecicus [YSU-MH-00503].

Mesoptychia collaris (Nees) L. Söderstr. et Våňa [Leiocolea collaris (Nees) Schlijakov] – 7, 9, 15, 17 (Sp.): on fine earth between rocks on rock outcrops on mountain slopes in forest belt, [YSU-MH-00150], on peat on bank of lake, on banks of streams under snowfields in pure mats or mixed with other bryophytes, mostly calciphytes (Scapania gymnostomophila, Tritomaria scitula, Marchantia quadrata, etc.)

Mesoptychia heterocolpos (Thed. ex Hartm.) L. Söderstr. et Våňa [Leiocolea heterocolpos (Thed. ex C. Hartm.) H. Buch] (gem., per.) – 5, 9, 17 (Sp.): on peat-moss hummocks and decayed stumps in moist Picea obovata-Equisetum-Sphagnum open woodlands [KPABG(H):122245] , on mountain slope between carbonate rocks in coniferous dwarf shrub-green moss forest, on fine earth on bank of stream under snowfield [YSU-MH-00584], usually mixed with other bryophytes.

**Mesoptychia ruthetana** (Limpr.) L. Söderstr. et Våňa [Leiocolea ruthetana (Limpr.) Müll. Frib.] – 8: dwarf birch-sedge-moss rich fen at the base of carbonate rock [KPABG(H):122253], mixed with Scorpidium revolvens, S. scorpioides, Meesia
Isopterygiopsis. The species was previously recorded in the Northern Urals (Zheleznova & Shubina, 1998; Konstantinova & Bezgodov, 2005). This is the first record of the species for Subpolar Urals.

**Metzgeria furcata** (L.) Corda – 17: rock outcrops in dwarf birch tundra, in shaded niches between rocks, mixed with *Isopertygiopsis pulchella*, *Cynodontium strumariferum*, *Trilophozia quinquedentata*, *Tritomaria scitula* and *Distichium capillaceum* [KPABG(H):122291]. This is the northernmost locality in the Urals and the first record of the species in the Asian part of the Urals.

*Mylia anomala* (Hook.) Gray (gem.) – 4, 6, 14, 21 (Sp.): in boggy dwarf birch-peat-moss (*Sphagnum fuscum*) open spruce woodlands, in flat palsa mires usually mixed with *Sphagnum* [KPABG(H):122293].

*Nardia geoscyphus* (De Not.) Lindb. – 17: bank of stream under snowfield, on fine earth, mixed with *Plectocolea subelliptica* [YSU-MH-00539].

*Odontoschisma elongatum* (Lindb.) A. Evans – 3: palsa mire complex, waterlogged hollow in thermokarst depression [YSU-MH-00795, YSU-MH-00796], in mossy Equisetum-Carex rostrata community, single shoots among *Sphagnum centrale* and *Scorpidium revolvens*.

*Odontoschisma fluitans* (Nees) L. Söderstr. & Váha [Cladopodiella fluitans (Nees) Jorg.] – 24: aapa mire, in *Menyanthes trifoliata*-sedge-moss hollows, some shoots mixed with *Sphagnum centrale* and *S. platyphyllum* [YSU-MH-00639], in waterlogged hollow with *Trichophorum cespitosum* and *Drosera anglica*, and on peat with *Sphagnum subsecundum*, *Scapania paludicola* and *Straminergon streminum*.

*PELLA NEESIANA* (Gottsche) Limpr. (ant., per.) – 12: floodplain forest, on soil; 22: dwarf willow-herb-green moss community on silty-gravel on bank of river, mixed with *Ptychostomum pallens*, *Calliergon cordifolium* and *Calliergonella lindbergii* [KPABG(H):122236].

*Plectocolea hyalina* (Lyell) Mitt. [Solenostoma hyalinum] (Lyell) Mitt.] – 18: gravelly flooded river bank, in pure mats [KPABG(H):122240]; 22: dwarf willow-herb-green moss community on silty-gravel bank, mixed with *Scapania irigua*, *Calliergonella lindbergii* and *Pohlia filum* [KPABG(H):122238].

*Porella platyphylla* (L.) Pfeiff. – 9, 10, 17 (Sp.): on shaded carbonate rocks in forest belt [KPABG(H):122256] or in niches on cliffs in dwarf birch tundra [YSU-MH-00138, 00591] usually in pure mats. The species is recorded for the first time for the Asian part of Subpolar Urals.

*Prasanthus suecicus* (Gottsche) Lindb. – 16: dwarf shrub tundra, on clay spots, two specimens with single shoots in mats with other arctic-montane liverworts: *Marsupella sprucei*, *Anthelia juratzkana*, *Gymnomitrium* spp., etc. [YSU-MH-00503, 504].

*Protolophozia elongata* (Steph.) Schljakov – (per.) 6: boggy Betula nana-Rubus chamaemorus-Sphagnum fuscum open spruce woodland at the base of slope, on peat, in mixed with *Fuscocephaloziopsis leucantha*, *Cephalozia ambiguca*, *Calypogeia sphagnicola*, *C. neesiana*, *Sphenolobus minutus* [KPABG(H):122247] and in almost pure mat with some shoots of *Cephalozia ambiguca* [YSU-MH-00097]. Red-listed in Russia (as *Lophozia elongata* Steph., Bardunov, 1998). This species was known previously in Urals from two findings in Vishera State Nature Reserve (Konstantinova & Bezgodov, 2005) and one collection in the Upper Puiva River area (Konstantinova & Lapshina, 2017).

*Ptildium ciliare* (L.) Hampe – 3, 11, 14, 17, 19 (Sp.): in birch and birch-spruce mountain and river valley forests, on rock outcrops, and on litter and soil in forest floor; in swampy willow thickets [KPABG(H):122266], in low shrub (*Salix* spp., *Betula nana*-sedge (*Carex arctisibirica*)-peat moss mire in tundra belt.

*Ptildium pulcherrimum* (Weber) Vain. (per., spor.) – 1, 2, 3, 13 (Sp.): in birch-spruce and mixed (*Pinus sibirica*, *Picea obovata*, *Betula pubescens*) dwarf shrub-herb river valley forests at base of trees and on decayed wood, in pure mats and mixed with *Sanionia uncinata*, *Lophoziospis longidens*, *Lophocolea heterophylla* and *Dicranum fragilifolium* [KPABG(H):122241]

*Radula complanata* (L.) Dumort. (per., spor.) – 11: huge boulder on gentle mountain slope, on rock [YSU-MH-00337], mixed with *Neckera oligocarpa*; 15: rock outcrops on mountainside in young birch forest, on shaded rocks, in pure mats or with mixed with *Neckera oligocarpa*, *Pseudoleskeella rupestris*, *Zygodon sibiricus*, *Chionoloma tenuirostre* and *Frullania austini* [YSU-MH-00454].
**Riccardia** cf. *Chamedryfolia* (With.) Grolle – 21 central part of aapa mire, *Menyanthes*-sedge waterlogged hollow, single shoots on peat with *Sarmentypnum exannulatum* [YSU-MH-000647].

**Riccardia latifrons** (Lindb.) Lindb. – 3: birch-spruce river valley forest, on decayed wood, mixed with *Lophozia pseudolongidens* and *Fuscocephaloziopsis lunulifolia* [YSU-MH-00084].

**Saccobasis polita** (Nees) H. Buch – 17: on bank of stream under snowfield on fine earth mixed with *Lescuraea saxicola* and *Bartramia ithyphylla* [KPABG(H):122280].

**Scapania curta** (Mart.) Dumort. (per.) – 3: birch-spruce river valley forest, on decayed wood, single shoots with *Lophozia guttulata*, *Lophozia pseudolongidens*, *Tritomaria exsectiformis*, *Lophozia ascendens* and *Fuscocephaloziopsis lunulifolia* [KPABG(H):122244].

**Scapania cuspiduligera** (Nees) Müll. Frib. (gem.) – 15: rock outcrops on steep mountain slope in young birch forest, on organic litter covered rocks, single shoots among *Blepharostoma trichophyllum* and *Pohlia cruda* [YSU-MH-00420].

**Scapania gymnostomophila** KaaL. (gem.) – 9, 10, 11 (Sp.): carbonate rocks in forest belt, in shaded niches between rocks, often in pure mats [KPABG(H):122248, KPABG(H):122254] or mixed with other calciphiles.

**Scapania irrigua** (Nees) Nees Müll. Frib. (gem.) – 1, 17, 21, 22 (Sp.): birch-willow-sedge-peat-moss mires, [YSU-MH-000228], in sedge (*Carex lasiocarpa*)-peat-moss ridge in aapa mire, on silty-gravel soil in willow-grass-green moss community on river banks [KPABG(H):122237], on slope along stream bank under snowfield.

**Scapania mucronata** H. Buch – 1, 3, 11 (Sp.): on decayed wood in birch-spruce river valley forest [YSU-MH-00089], in mixed *Pinus sibirica*-birch-spruce river valley forest, [YSU-MH-00068], on fine earth covered ledge on boulder on gentle slope. Usually mixed with other bryophytes (*Sanionia uncinata*, *Lophozia pseudolongidens*, *Pohlia nutans*, *Fuscocephaloziopsis lunulifolia* etc.).

**Scapania obcordata** (Berggr.) S. W. Arnell – 18: gravelly flooded river bank [KPABG(H):122239].

**Scapania paludicola** Loeske et Müll. Frib. – 1, 17, 21, 24 (Sp.): in hollows and on hummocks in transitional fens, aapa mires, on stream banks under snowfield, in pure mats [KPABG(H):122297] or mixed with *Psychostomum pseudotriquetrum*, *Polytrichum juniperinum*, *Sanionia uncinata* and *Schljakovia kunzeana* [KPABG(H):122252].

**Scapania parvifolia** Warnst. – 16: dwarf birch tundra, on clay spots, single shoots mixed with *Prasanthus suecicus*, *Gymnomintrion corallioides*, *G. concinnatum*, *Solenostoma sp.*, *Sphenolobus minutus*, *Barbilophozia sudetica* and *Isopaches biceraturnus* [YSU-MH-00504].

**(*) Scapania spharifera** H. Buch et Tuom. – 11: large boulder on gentle mountain slope, on ledge of rock, on fine earth [KPABG(H):122121]. The species is extremely rare in Europe where it is recorded in the type locality in Murmansk Province and recently in Ural in Vishera State Nature Reserve (Konstantinova et al. 2019). However the species is not rare in Siberia including the mountains of South Siberia (l. c.) so its finding in the Asian part of the Urals is more or less predictable.

**Scapania subalpina** (Nees ex Lindenb.) Dumort. – 1: bank of small stream, on silted fine earth [YSU-MH-00243]; 17: bank of stream under snowfield, on fine earth [KPABG(H):122281].

**Scapania uliginosa** (Sw. ex Lindenb.) Dumort. – 21: central part of aapa mire complex, *Carex lasiocarpa*-peat-moss hummock in small hollow [KPABG(H):122296].

**Scapania undulata** (L.) Dumort. – 2: river bank, on flooded rocks, pure mats [YSU-MH-000646].

*** Schistochilopsis grandiretis** (Lindb. ex Kaal.) Konstant. – 14: *Betula nana-Rubus chamaemorus*-peat-moss open spruce woodland, mixed with *Fuscocephaloziopsis pleniceps* and *Rhizomnium pseudopunctatum* [KPABG(H):122261]; 15: rock outcrops on slope in young birch forest, on fine earth between rocks, single shoots mixed with *Blepharostoma trichophyllum*, *Mesopychia collaris* and *Pohlia cruda* [YSU-MH-00419]; 17: on bank of stream under snowfield, single shoots among *Blepharostoma trichophyllum* *Plectoceola cf. subelliptica*, *Trilophozia quinuendentata f. gracilis* and *Fuscocephaloziopsis pleniceps* [YSU-MH-00587].

This arctomontane species is widespread in the north of the Holarctic but usually occurs in small populations and is probably overlooked.

**Schljakovia kunzeana** (Huebener) Konstant. et Vilnet (gem., per., spor.) – 1, 11, 14, 17, 23 (Fr.):
in boggy dwarf birch-Rubus chamaemorus-peat moss open spruce woodlands, in swampy forests and willow thickets, on hummocks in transitional fens, in dwarf shrub-sedge- Sphagnum warnstorfii dominated bogs, sporadic in moist niches on carbonate rock outcrops, in pure mats [KPABG(H):122265 or mixed with other bryophytes.

Schlakjovianthus quadrilobus (Lindb.) Konstant. et Vilnet – 17: low dwarf shrub (Salix, Betula nana-Carex arctisibirica-peat-moss) mire in Sphagnum warnstorfii turf [KPABG(H):122275] and on bank of stream under snowfield, on fine earth, mixed with Scapania subalpina and S. paludicola [KPABG(H):122288].

Solenostoma confertissimum (Nees) Schljakov (per., spor.) – 16: dwarf shrub tundra on top of mountain, on bare spots, mixed with Marsupella sprucei, Anthelia juratzkana, Prasanthus suecicus and Solenostoma sphaerocarpum [YSU-MH-00503]; 17: stream bank under snowfield [KPABG(H):122282].

Solenostoma sphaerocarpum (Hook.) Steph. – 16: dwarf birch tundra, on clay spots, mixed with Solenostoma confertissimum [YSU-MH-00608]; and single shoots mixed with Solenostoma confertissimum, Marsupella sprucei, Anthelia juratzkana and Prasanthus suecicus [YSU-MH-00503]. Very small plants that fits well in description Solenostoma pusillum (C. E. O. Jensen) Steph. or Solenostoma sphaerocarpum var. nanum (Nees ex Flot.) R. M. Schust., both were recently synonymized with S. sphaerocarpum (Hodgetts et al., 2020).

Solenostoma subellipticum (Lindb. ex Heeg) R.M.Schust. [Plectoecola subelliptica (Lindb. ex Heeg) A. Evans] – 17: stream bank under snowfield, on fine earth, mixed with Nardia geoscyphus [YSU-MH-00539].

Sphenolobus minutus (Schreb.) Berggr. – 6, 9, 11, 16, 19 (Sp.): dwarf shrubs, dwarf birch rocky tundra, on clay spots and between rocks; in boggy dwarf shrub-peat moss open spruce woodlands; on carbonate rock outcrops in forests. Usually mixed with other bryophytes [KPABG(H):122247].

Sphenolobus saxicola (Schrad.) Steph. – 11: huge boulder on gentle mountain slope, on ledge of rock, in pure mats [KPABG(H):122257] and mixed with Tetralophozia setiformis [KPABG(H):122258].

Tetralophozia setiformis (Ehrh.) Schljakov – 11: Huge rock block on gentle mountain slope, on ledge of rock with Sphenolobus saxicola [KPABG(H):122258]; 16: rocky dwarf shrub tundra, on rocks [KPABG(H):122270].

Trilophozia quinquedentata (Huds.) Bakalin [Tritomaria quinquedentata (Huds.) H.Buch] – 6, 9, 11, 17 (Fr.): in moist dwarf shrubs gravelly tundras, on litter on cliff ledges both in forests and mountain-tundra, in Betula nana-Carex arctisibirica-peat-moss mires, in boggy Betula nana-peat-moss open spruce forests, in pure mats or mixed with other bryophytes [KPABG(H):122271]. Once on bank of stream under snowfield the arctic form Trilophozia quinquedentata f. gracilis was collected mixed with Anthelia juratzkana, Cephalozia bicuspidata and Fuscocephaloziopsis pleniceps [YSU-MH-00586].

Tritomaria exsectiformis (Breidl.) Loeske (gem., ant.) – 3, 19: on decayed wood in birch-spruce and Pinus sibirica-birch-spruce river valley forests, usually mixed with other species of decaying wood (Lophozia ascendens, L. guttulata, Lophoziopsis longidens, etc. [YSU-MH-00074; YSU-MH-00068]; 19: birch-larch-Pinus sibirica dwarf shrub-peat moss community in high palsa complex, on decayed wood mixed with Lophozia silvicola and Sphenolobus minutus [YSU-MH-00207].

Tritomaria scitula (Taylor) Jørg. – 9: on organic litter on ledges of carbonate rocks, mixed with Trilophozia quinquedentata and Barbilophozia barbata [YSU-MH-00141] and on slope between carbonate rocks in Pinus sibirica-larch-spruce shrub-green-moss forest mixed with Mesopychia heterocolpos, Scapania gymnostomophila and Arnellia fennica [KPABG(H):122249]; 17: rock outcrops in dwarf birch tundra, in shaded niches between rocks, single shoots among Metzgeria furcata, Isopterygiopsis pulchella, Distichium capillaceum and Trilophozia quinquedentata [YSU-MH-00606].

DISCUSSION

The liverwort flora of the Khulga River basin counts 84 species including seven (Arnellia fennica, Frullania austinnii, Mesopychia rutheana, Metzgeria furcata, Porella platyphylla, Scapania sphaerifera and Schistochilopsis grandiretis) new for the Khanty-Mansi Autonomous Area. Of these, Scapania sphaerifera was not previ-
ously known for the Urals and was only recently discovered almost simultaneously on both the European and Asian parts of these mountains (Konstantinova et al., 2019). Locations in the Urals are almost 1,500 kilometers away from the only known location of the species in Europe and 1,800 kilometers and more from the Asian locations of the species. (l.c.) *Frullania austinii* is a recently described species which is not rare in Eurasia but found generally in more southern areas (Mamontov et al., 2020). The record from the Khulga River Basin is one of the northernmost known at present. The rest of the liverworts firstly recorded for the Autonomous Area are mainly mountain species more or less widespread in the North of Holarctic. Since most of the studied region’s territory is swampy lowlands, there are very few suitable habitats for these species here.

A total of 144 species incl. 2 subspecies and one variety have been recorded in three territories studied on the Asian slopes of the Urals within the Khanty-Mansi Autonomous Area. Of these 55 species or ca. 37% are represented in all three studied areas. All liverworts common for three studied areas are widespread in the north of Holarctic and they are mostly the most common species in the studied areas (Appendix). The diversity of liverworts in the Khulga River basin is slightly less than in the previously studied flora of Ner-Oika mountain (97 species) or the Upper Puiva River basin (104 species), located 120 km further south (Konstantinova & Lapshina, 2014, 2017). This is mainly due to the fact that the Khulga river flows through low mountains and plains: most collecting sites were located here at altitudes not exceeding 100 meters and only three were located at altitudes of ca. 500–600 m. The studied areas of the Ner-Oika Mt. (325–960 m alt.) and Puiva River basin (680–1030 m alt.) are located significantly higher. Of 17 liverworts specific to the Khulga River basin eleven are primarily or exclusively peat mires and swampy area species (*Aneura pinguis, Riccardia chamedryfolia, Fuscocephaloziopsis convivens, F. leucantha, Odontoschisma fluitans, Cephalozia hampeana, Mesoptychia rutheana, Heterogemma laxa, Scapania uliginosa and Schistochilopsis grandiretis*). This is due to the much wider distribution and diversity of mires ecosystems in the Khulga River basin compared to other studied areas on the Eastern slopes of the Urals. Three species (*Metzgeria furcata, Radula complanata* and *Porella platyphylla*) are not rare in the Eurasia mainly mountain species, but more common in southern areas. For these species there are rather few appropriate habitats at high altitudes explored in Ner-Oika Mt. and Puiva River basin. *Lophozia guttulata* is a not rare species of coniferous forests that were not quite carefully studied in mentioned above areas because collecting there was mostly done in the upper belts. *Arnellia fennica* is a rather rare and scattered occurring species everywhere and *Scapania sphaerifera* is a rare species just recently found in Urals.

Twenty species known from both high mountain areas (Ner-Oika Mt. and Upper Puiva River Basin) have not been found in the Khulga River basin. These are mostly not rare arctomontane species of rocky areas in subalpine and tundra zones (*Diplophyllum albicans, D. obtusifolium, Neoorthiscalis floerkei, N. binsteadii* and *Sacrobasis polymorpha*) or mountain species characteristic of rocky banks and beds of mountain cricks (*Scapania paludosa* and *Plectocolea obovata*) or species of bare soil (*Cephalozia varians, Nardia japonica* and *Solenostoma caespiticium*).

Significant differences in the composition of the floras of the compared areas can be explained by differences not only in geology and geomorphology described above but as well by relatively the small size of territories and representation by a small numbers of collections in each type of habitat.

Among the species of phytogeographic interest in addition to *Scapania sphaerifera* discussed above should be noted *Protolophozia elongata*. It is a rather rare worldwide species red-listed in Russia (Bardunov, 2008). In the Urals the species is recorded in the western slope of the Northern Urals in the Vishera State Nature reserve (Konstantinova, Bezgodov, 2005; Ignatova et al., 2019) and in one locality in Asian slopes of Urals (Konstantinova, Lapshina, 2017).

In general the liverwort flora of the Khulga river Basin is not very diverse and original. But the data obtained significantly expand our understanding of both the flora of the Subpolar Urals and the distribution and ecology of species in the Urals.
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## Appendix. List of liverworts of the Asian part of the Subpolar Urals

| Taxon                                         | Number of collected specimens in studied areas |
|-----------------------------------------------|-----------------------------------------------|
|                                               | Surroundings of the Ner-Oika Mt. | Upper Puiva River Basin | Khulga River Basin |
| Aneura pinguis (L.) Dumort.                  | 2                                             |
| Anthelia juratzkana (Limpri) Trevis.         | 16 12                                        |
| Arnellia fennica (Gottsche) Lindb.           | 2                                             |
| Asterella lindenbergiana (Corda ex Nees) Lindb. ex Arnell | 9 5 2                                    |
| Barbilophozia barbata (Schmidel ex Schreb.) Loeske | 2 5 5                                   |
| Barbilophozia hatcheri (A Evans) Loeske       | 2 24                                          |
| Barbilophozia lycopodioides (Wallr.) Loeske   | 2 17                                          |
| Barbilophozia sudetica (Nees ex Huebener) L.Söderstr., De Roo & Hedd. | 33 14 2                                   |
| Pseudolophozia sudetica (Nees ex Huebener) Konstant. & Vilnet | 33 14 2                                   |
| Biantheridion undulifolium (Nees) Konstant. & Vilnet | 2 1                                         |
| Blasia pusilla L.                            | 7 3 1                                         |
| Blepharostoma trichophyllum (L.) Dumort. subsp. brevirete (Bryhn & Kaal.) R.M.Schust | 10 6 5                                  |
| Calycularia laxa Lindb. & Arnell             | 3                                             |
| Calypogeia integristipula Steph.              | 2                                             |
| Calypogeia muelleriana (Schiffn.) Müll.Frib. | 2 4 2                                         |
| Calypogeia neoiana (C.Massal. & Carestia) Müll.Frib. | 2 3 2                                   |
| Cephalozia ambigua C.Massal.                 | 7 3 1                                         |
| Cephalozia bicuspidata (L.) Dumort.           | 38 14 2                                       |
| Cephalozia grimsulana (J.B.Jack ex Gottsche & Rabenh.) Lacout. | 3 3 3                                     |
| Cephalozia hamppeana (Nees) Schiffn. ex Loeske | 3 1                                         |
| Cephalozia rubella (Nees) Warnst.             | 1                                             |
| Cephalozia spinigera (Lindb.) Jörg.           | 2 3 1                                         |
| Cephalozia varians (Gottsche) Steph.          | 4 1                                            |
| Chiloscyphus pallescens (Ehrh.) Dumort.       | 3                                             |
| Chiloscyphus polyanthus (L.) Corda             | 2 3 2                                         |
| Clevea hyalina (Sommerf.) Lindb. [Athalamia hyalina (Sommerf.) S.Hatt. | 3 3 3                                     |
| Conocephalum conicum (L.) Dumort.             | 2 1                                            |
| Diplophyllum albicans (L.) Dumort.            | 2 9                                             |
| Diplophyllum obtusifolium (Hook.) Dumort.     | 2 6                                            |
| Diplophyllum taxifolium (Wahlenb.) Dumort.    | 17 6 3                                         |
| Endogemma caespitica (Lindenh.) Konstant., Vilnet & A.V.Troitsky | 2 1                                         |
| Frullania austenii J. J. Atwood, Vilnet, Mamontov et Konstant. | 2 2                                         |
| Fuscocephaloziopsis (Hook.) Váňa & L.Söderstr. | 10 7 1                                       |
| Fuscocephaloziopsis connivens (Dicks.) Váňa & L.Söderstr. | 10 7 1                                       |
| Fuscocephaloziopsis lunulifolia (Spruce) Váňa & L.Söderstr. | 10 8 3                                       |
| Gymnocolea inflata (Huds.) Dumort.            | 9 4 1                                         |
| Gymnomitrion brevissimum (Dumort.) Warnst.    | 6                                             |
| Gymnomitrion concinatum (Lightf.) Corda       | 6 9 2                                         |
| Gymnomitrion coralloides Nees                 | 4 1                                             |
| Harpanthus flotianus (Nees) Nees              | 10 4 2                                         |
| Heterogemma laxa (Lindb.) Konstant. & Vilnet  | 5 2                                             |
| Hygrobiella laxifolia (Hook.) Spruce          | 5 2                                             |


| Common Name                  | Scientific Name                                      | Author       | Page | Column 1 | Column 2 | Column 3 |
|------------------------------|------------------------------------------------------|--------------|------|----------|----------|----------|
| Isopaches bicrenatus         | Jungermannia atrovirens Schm.                      | H.Buch       | 7    | 4        | 1        |
|                              | Jungermannia borealis Schm. & Váňa                  |             | 4    |          |          |          |
|                              | Jungermannia eucordifolia Schljakov Schm.           |             | 1    |          |          |          |
|                              | Jungermannia polaris Lindb                          |             | 1    |          |          |          |
|                              | Jungermannia pumila With.                           |             | 2    | 3        | 1        |
|                              | Leidiozia reptsans Lindb                            |             | 2    | 3        | 1        |
|                              | Lophocolea heterophylla Schm.                       |             | 2    | 3        | 2        |
|                              | Lophocolea minor Nees                               |             | 2    | 6        | 3        |
|                              | Lophozia ascendens Warnst Schm.                     |             | 12   | 7        | 1        |
|                              | Lophozia guttulata Lindb & Arnell Schm.             |             | 13   | 19       | 2        |
|                              | Lophozia longiflora Lindb                           |             | 21   | 12       | 3        |
|                              | Lophozia murmanica Kaal Schm.                       |             | 6    | 7        | 4        |
|                              | Lophozia sylvicola Lindb                            |             | 3    | 5        |          |
|                              | Lophozia wenzeli Nees Schm.                         |             | 13   | 13       | 1        |
|                              | Lophozia wenzeli Nees var. massularioides Bakalin   |             |      |          |          |          |
|                              | Lophozia propaggera Lindb                           |             | 3    |          |          |          |
|                              | Lophoziopsis excisa Lindb                           |             | 12   | 7        | 1        |
|                              | Lophoziopsis jurensis Meyl Müll.                   |             | 7    | 6        | 3        |
|                              | Lophoziopsis longidens Lindb                        |             | 2    | 3        | 1        |
|                              | Lophoziopsis pellucida R.M.Schust.                  |             | 2    | 3        | 1        |
|                              | Marchantia polymorpha Lindb.                        |             | 9    | 12       | 1        |
|                              | Marchantia quadrata Lindb                           |             | 2    | 7        | 1        |
|                              | Marsupella apiculata Schm.                          |             | 13   | 13       | 1        |
|                              | Marsupella boeckii Lindb ex Kaal.                   |             | 6    |          |          |
|                              | Marsupella condensata Ängstr. Lindb. ex Kaal       |             |      |          |          |          |
|                              | Marsupella emarginata (Ehrh.) Lindb.                |             | 5    |          |          |          |
|                              | Marsupella sprucei Limpr. Bernet                    |             | 9    | 5        | 1        |
|                              | Mesiptychia galmanii (Austin) Söderstr. & Váňa      |             | 2    | 8        |          |
|                              | Mesiptychia badensis (Gottsch Raben) Söderstr. & Váňa|             | 1    |          |          |          |
|                              | Mesiptychia bantriensis (Hook) Söderstr. & Váňa     |             | 1    |          |          |          |
|                              | Mesiptychia collari (Nees) Söderstr. & Váňa         |             | 2    | 7        | 2        |
|                              | Mesiptychia heterocolpos (Theod. Hartm.) Söderstr. & Váňa|             | 12   | 2        |          |
|                              | Mesiptychia rusticana (Limpr.) Söderstr. & Váňa     |             | 1    |          |          |          |
|                              | Metzgeria furcata (L.) Corda                        |             | 1    |          |          |          |
|                              | Mylia anomala (Hook) Gray                           |             | 3    | 1        | 3        |
|                              | Nardia breidleri (Limpr.) Lindb                     |             | 6    |          |          |          |
|                              | Nardia geoscyphus (De Not.) Lindb                   |             | 14   | 6        | 1        |
|                              | Nardia japonica Schm.                               |             | 3    |          |          |          |
|                              | Neoortocaulis bineadellii (Kaal.) Söderstr., De Roo & Hedd. | H.Buch       | 2    | 3        |          |          |
|                              | Neoortocaulis flori (F.Weber & D.Mohr) Loeske       |             | 10   | 5        |          |
|                              | Odontoschisma elongatum (Lindb.) A.Evans            |             | 3    | 1        | 1        |
|                              | Odontoschisma fluitans (Nees) Söderstr. & Váňa      |             | 2    |          |          |          |
|                              | Odontoschisma macounii (Austin) Underw.             |             | 1    |          |          |          |
|                              | Odontoschisma francisci (Hook.) Söderstr. & Váňa    |             | 2    |          |          |          |
|                              | Pellia neesiata (Gottsch) Limpr.                    |             | 19   | 11       | 2        |
|                              | Plectocolea obovata (Nees) Lindb.                   |             | 9    | 3        |          |
Porella platyphylla (L.) Pfeiff.
Prasanthus suecicus (Gottsche) Lindb.
Protolophozia elongata (Steph.) Schljakov
Ptilidium ciliare (L.) Hampe
Ptilidium pulcherrimum (Weber) Vain.
Radula complanata (L.) Dumort.
Riccardia chamedryfolia (With.) Grolle
Riccardia latifrons (Lindb.) Lindb.
Ptilidium ciliare (L.) Hampe
Ptilidium pulcherrimum (Weber) Vain.
Sauteria alpina (Nees) Nees
Scapania crassiretis Bryhn
Scapania curta (Mart.) Dumort.
Scapania cuspiduligera (Nees) Müll.Frib.
Scapania degenii Schiffn. ex Müll.Frib.
Scapania gymnostomophila Kaal.
Scapania hyperborea Jørg.
Scapania irrigua Nees
Scapania irrigua Nees subsp. rufescens (Loeske) R.M.Schust. (as var. rufescens)
Scapania kaurinii Ryan
Scapania mucronata H.Buch
Scapania obcordata (Berggr.) S.W.Arnell
Scapania paludicola Loeske & Müll.Frib.
Scapania paludosa (Müll.Frib.) Müll.Frib.
Scapania parvifolia Warnst.
Scapania praetervisa Meyl.
Scapania scandica (Arnell & H.Buch) Macvicar
Scapania sphaerifera H.Buch & Tuom.
Scapania spitsbergenensis (Lindb.) Müll.Frib.
Scapania subalpina (Nees ex Lindenb.) Dumort.
Scapania tundracea (Arnell) H.Buch
Scapania uliginosa (Lindenb.) Dumort.
Scapania undulata (L.) Dumort.
Schistochilopsis grandiretis (Lindb. ex Kaal.) Konstant.
Schistochilopsis incisa (Schrad.) Konstant.
Schistochilopsis opacifolia (Culm. ex Meyl.) Konstant.
Schljakovia kunzeana (Huebener) Konstant. & Vilnet
Schljakovianthus quadrilobus (Lindb.) Konstant. & Vilnet
Solenostoma conferitissimum (Nees) Schljakov
Solenostoma hyalinum (Lyell) Mitt. [Plectocolea hyalina (Lyell) Mitt.]
Solenostoma sphaerocarpum (Hook.) Steph. [Solenostoma pusillum (C.E.O.Jens.) Steph., Solenostoma sphaerocarpum var. nanum (Nees ex Flot.) R.M.Schust.]
Solenostoma subellipticum (Lindb. ex Heeg) R.M.Schust. [Plectocolea subelliptica (Lindb. ex Kaal.) A.Evans]
Sphenolobus minutus (Schreb. ex D.Crantz) Berggr.
Sphenolobus saxicola (Schrad.) Steph.
Tetralophozia setiformis (Ehrh.) Schljakov
Trilophozia quinquedentata (Huds.) Bakalin
Tritomaria excisiformis (Breidl.) Schiffn. ex Loeske
Tritomaria scitula (Taylor) Iarp.