SUPPLEMENTARY MATERIAL S11

Annotated list of taxa of Zov Tigra National Park

Diversity-Basel

A Model of Southern Sikhote-Alin Liverwort Flora and a New Approach to Analyze the Altitudinal Distribution Patterns in the Zov Tigra National Park (South of the Russian Far East, Temperate Pacific Asia)

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The names of taxa in the list are arranged alphabetically, nomenclature follows Söderström *et al.* (2016) [62], with the exceptions for: 1) Solenostomataceae, where narrow genus concept was adopted, 2) acceptance of *Pseudolophozia* Konstant. et Vilnet distinct from *Barbilophozia* Loeske, 3) new concept of *Schistochilopsis* (N. Kitag.) Konstant. according to Bakalin *et al.* (2020a), 4) new concept of taxa in *Calypogeia* Raddi according to Bakalin *et al.* (2022) and 5) the narrow species concept in *Blepharostoma* (Dumort.) Dumort. (following Bakalin *et al.*, 2020b). However, concerning the latter, it worth mentioning that the revision of *Blepharostoma* by Bakalin *et al.* (2020b) showed that the most reliable morphological features for distinguishing taxa within the genus are oil body characteristics – a trait we did not paid attention in *Blepharostoma* before the cited work (Bakalin *et al.*, 2020b) was completed. This resulted in impossibility of reliable identification of several specimens of this genus and we provide wide treatment of all not properly identified taxa under *Blepharostoma trichophyllum* s.l. or *Blepharostoma* sp. (especially in cases when *Blepharostoma* species was found as accompanying taxa). Field numbers of the specimens where identification of species was not made with a confidence (cf.) are marked with asterisk (*).

The following information is noted for each taxon: (1) altitudinal range, in meters above sea level in square brackets; (2) collection localities according to the list of collection localities and Figure 3, and letters are presented in a bold font; (3) reproduc-tive structures, if present (ant.—antheridia; arch.—archegonia; per.—perianths; spor.—sporophytes; gemm.—gemmae) divided into five frequency classes: very com-mon (cc)—more than 65%, common (c)—40–65%, frequent (f)—20–39.9%, sporadic (s)—5–19.9%, and rare (r)—0.1–4.9%; 4) literature reference, if there is a previous rec-ord concerning the study area; and 5) floristic elements and area types according to Bakalin (2009) [50], with some updates. New species are marked with exclamation marks before the species name: one (!)—new for the park flora, two (!!)—new for Pri-morye Territory, and three (!!!)—new for the Sikhote-Alin Mts.

List of taxa

!*Acrolejeunea sandvicensis* (Gottsche) Steph. – [356], **J** (58). Open cliffs in a broadleaved deciduous forest. With *Frullania taradakensis*. P-43-15-12. Tropical-subtropical Asian.

Anastrophyllum michauxii (F. Weber) H. Buch – (per., ant. – c, spor. – s) [600–1768], **F** (16), **G** (27), **H** (37, 41), **I** (46). Decaying logs in coniferous forests with deciduous trees admixture, decaying trunk of *Betula lanata* in the thickets of *Alnus fruticosa* with young trees of *Betula lanata*, crevice between rocky blocks in lichen-dwarf shrub tundra with gravelly barrens fields. With *Bazzania denudata, Blepharostoma trichophyllum* s.l*., Calypogeia muelleriana, Cephalozia otaruensis, Fuscocephaloziopsis leucantha, Lepidozia reptans, Mylia verrucosa, Ptilidium pulcherrimum, Scapania microdonta, Sphenolobus minutus, S. saxicola, Tritomaria exsecta*. P-70-6-07, P-73-7-07, Prim-48-19-17, Prim-64-20-17, Prim-68-3-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya Mt. (**H** collection area). Boreal Circumpolar.

!*Aneura pinguis* (L.) Dumort. – (arch. – cc, ant. – c) [536–950], **G** (25), **H** (43), **J** (60). Moist decaying logs in flood-plain forests, rotten logs in coniferous and mixed forest. In pure mats or with *Chiloscyphus polyanthos*, *Lophocolea* sp. P-45-1-12, Prim-57-1-17, Prim-71-7-17. Multizone Multi-area.

!*Asterella leptophylla* (Mont.) Grolle – (arch., spor. – c) [356–780], **A** (1), **I** (50), **J** (58). Humus covering rocks along stream in mixed forest, cliff in a broadleaved deciduous forest. In pure mats. P-43-21-12, P-77-14-07, Prim-33-2-17. Subtropical East Asian.

Barbilophozia barbata (Schreb.) Loeske – [1364–1839], **B** (6), **C** (8), **H** (31, 32, 33, 34, 35), **I** (45, 55). Plant debris over rocks and boulders in *Alnus fruticosa*, *Pinus pumila* thickets, in *Betula lanata* crooked forest, in tundra-like herb communities near mountain tops, on rock fields. In pure mats or with *Diplophyllum taxifolium*, *Douinia plicata*, *Herbertus buchii, Lophozia ventricosa, Lophoziopsis excisa,*

Ptilidium pulcherrimum, Scapania sphaerifera, Sphenolobus saxicola, Trilophozia quinquedentata, Tritomaria exsecta. P-72-5-07, Prim-38-1-17, Prim-40-1-17, Prim-59-1-17, Prim-60-11-17, Prim-61-6-17, Prim-62-2-17, Prim-119-7-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya Mt. (**H** collection area). Arctic-boreal Circumpolar.

Bazzania denudata (Torr. ex Gottsche, Lindenb. et Nees) Trevis. – [738–1839], **C** (8), **D** (10), **E** (12), **F** (14, 15, 16, 19, 21), **G** (27, 28, 29), **H** (32, 33, 34, 36, 37, 40, 42), **I** (44, 45, 46), **J** (60). Humus over rocks in *Alnus fruticosa*, *Pinus pumila* thickets, in coniferous forests with deciduous trees admixture, crevices on rock fields. In pure mats or with *Anastrophyllum michauxii, Bazzania tricrenata, B. trilobata, Blepharostoma trichophyllum* s.l., *Calypogeia integristipula, Calycularia laxa, Diplophyllum taxifolium, Douinia plicata, Fuscocephaloziopsis lunulifolia, Gymnomitrion parvitextum, Lepidozia reptans, Lophozia silvicola, L.* cf. *ventricosa, Lophoziopsis longidens, Marsupella emarginata, Metacalypogeia cordifolia, Mylia taylorii, M. verrucosa, Ptilidium pulcherrimum, Radula obtusiloba, Scapania microdonta, Schistochilopsis incisa, Sphenolobus saxicola, Sphenolobus minutus, Trilophozia quinquedentata, Tritomaria exsecta*. P-70-1-07, P-71-11-07, P-72-15a-07, P-73-5-07, P-79-5-07, P-45-14-12, Prim-40-9-17, Prim-42-2-17, Prim-44a-5-17, Prim-46-4-17, Prim-47-2-17, Prim-48-28-17, Prim-51-1-17, Prim-53-4-17, Prim-59-12-17, Prim-60-1-17, Prim-61-23-17, Prim-63-13-17, Prim-64-3-17, Prim-67-1-17, Prim-69-2-17, Prim-122-12-17. Previously recorded by Gambaryan (1984, 1992) [3,32] as *Bazzania ovifolia* (Steph.) S. Hatt. for Oblachnaya and Snezhnaya Mts., and Milogradovskie Waterfalls (**H**, **I**, **K** collection areas). Temperate East Asian-American.

!*Bazzania manczurica* Bakalin – [600–1839], **G** (27), **H** (34), **I** (53). Vertical surface of rocks in thickets of *Alnus fruticosa*, young trees of *Betula lanata* and *Pinus pumila*, bare humus on steep slope, rotten log in mixed forest, in pure mat or with *Diplophyllum taxifolium, Gymnomitrion parvitextum*. P-70-11-07, P-39-20-14, Prim-61-26-17. Boreal-temperate East Asian.

!*Bazzania parabidentula* Bakalin – [632–1839], **F** (17), **H** (30, 34, 40, 43), **J** (59) –. Rotten wood and over boulders in coniferous forest with deciduous trees admixture, humus in mixed forest. In pure mats or with *Fuscocephaloziopsis lunulifolia, Lepidozia reptans, Tritomaria exsecta*. P-44-1-12, Prim-49-8-17, Prim-61-8-17*, Prim-67-11-17, Prim-70-2-17, Prim-71-1-17*. Previously recorded by Gambaryan (1984, 1992) [3,32] as *Bazzania bidentula* (Steph.) Yasuda for Oblachnaya Mt. (**H** collection area). Boreal-temperate East Asian.

!*Bazzania tricrenata* (Wahlenb.) Trevis. – (ant. – s) [694–1839], **C** (8), **F** (14, 16, 17, 20, 22), **G** (29), **H** (34, 37, 40), **I** (53). Vertical surface of rocks and humus over rocks in mixed and coniferous forests, thickets of *Alnus fruticosa* with young trees of *Betula lanata*, once on *Picea* trunk in coniferous forest. In pure mats or with *Bazzania denudata*, *Blepharostoma minor*, *Diplophyllum taxifolium, Cephalozia otaruensis, Lophozia ventricosa, Scapania crassiretis, Schistochilopsis incisa, Solenostoma obscurum*, *Sphenolobus saxicola.* P-79-6-07, P-39-2-14, Prim-40-3-17, Prim-46-7-17, Prim-48-25-17, Prim-49-2-17, Prim-52-25-17, Prim-54-1-17, Prim-61-20-17, Prim-64-21-17, Prim-67-7-17. Arctic-boreal Circumpolar.

!*Bazzania trilobata* (L.) Gray – [600–1200], **G** (27, 28, 29), **I** (47). Humus covering N-facing rocks, forest litter in mixed forests, cliffs in mostly coniferous forests. In pure mats or with *Bazzania denudata*, *Blepharostoma trichophyllum* var. *trichophyllum*. P-70-8-07, P-74-1-07, P-79-5-07, P-39-14-14, Prim-122-15-17. Temperate Amphi-Oceanic.

!*Blepharostoma minor* Horik. – (per. – f) [1076–1404], **F** (14, 16), **H** (30). Boulder in coniferous forest with deciduous trees admixture. In pure mats or with *Diplophyllum taxifolium. Bazzania tricrenata*. Prim-46-11-17, Prim-48-25-17, Prim-70-1-17. Temperate East Asian.

!*Blepharostoma neglectum* Vilnet et Bakalin – (per. – c) [809], **I** (57). Humus and decaying wood in coniferous forest with broadleaved deciduous trees admixture. With *Lepidozia reptans, Lophocolea*

heterophylla, Conocephalum salebrosum, Plagiochila sp. Prim-121-8-17, Prim-121-12-17. Boreal-temperate East Asian.

Blepharostoma trichophyllum (L.) Dumort. var. ***trichophyllum*** – (per. – f, spor. – s) [600–1649], **E** (11), **F** (14), **G** (27), **H** (38, 41, 42), **I** (44, 47, 49). Humus and decaying wood in coniferous and mixed forests, boulders in mixed forests. In pure mats or with *Anastrophyllum michauxii, Bazzania denudata, B. trilobata, Calypogeia muelleriana, Cephalozia bicuspidata, C. otaruensis, Conocephalum salebrosum, Fuscocephaloziopsis leucantha, F. lunulifolia, Geocalyx graveolens, Mesoptychia heterocolpos, Lepidozia reptans, Lophocolea heterophylla, Lophozia longiflora, L. silvicoloides, L. lantratoviae, Metacalypogeia cordifolia, Metzgeria lindbergii, Mylia taylorii, M. verrucosa, Pellia neesiana, Plagiochila ovalifolia, Ptilidium pulcherrimum, Riccardia palmata, Schistochilopsis incisa, Solenostoma obscurum, Trilophozia quinquedentata, Tritomaria exsecta*. P-70-3-07, P-71-3-07, P-74-2-07, P-76-20-07, Prim-43-5-17, Prim-46-4-17, Prim-65-1a-17, Prim-68-1-17, Prim-69-5-17. Due to the fact that we did not paid attention to the oil bodies characteristic during the identification process of the aforementioned specimens, these data characterize the species complex, but not single, species. See the explanation for this genus in the sec-tion preceding the list. Arctic-boreal Circumpolar.

!*Calycularia laxa* Lindb. et Arnell – (ant. – c, per., arch., spor. – s) [600–1768], **F** (18), **G** (27, 29), **H** (37), **I** (44, 48, 49, 53). Humus over rocks, sometimes with plant debris, in thickets of *Alnus fruticosa* with young trees of *Betula lanata*, over rocks in mixed, coniferous, *Betula-Picea* forests, humus on slope to stream in *Betula* forest. In pure mats or with *Blepharostoma trichophyllum* s.l.*, Diplophyllum taxifolium, Cephalozia* sp.*, Conocephalum salebrosum, Fuscocephaloziopsis lunulifolia, Lophozia silvicola, Marsupella tubulosa, Metacalypogeia cordifolia, Mylia taylorii, Scapania crassiretis, Solenostoma pseudopyriflorum, Trilophozia quinquedentata, Tritomaria exsecta*. P-70-23-07, P-71-15-07, P-75-4-07, P-76-5-07, P-39-12-14, Prim-50-3-17, Prim-64-1-17, Prim-122-8-17. Arctic-boreal Asian-American.

!*Calypogeia integristipula* Steph. – (gemm. – s), [632–1707]. **B** (5), **D** (10), **F** (14, 18), **H** (32, 33, 40, 42), **I** (47, 48, 53), **J** (59). Humus, rotten wood and humus over rocks in coniferous and mixed forests, humus on slope under *Betula* roots in *Betula-Alnus* crooked forest, in *Pinus pumila* thickets in subapical part of the mountain. In pure mats or with *Bazzania denudata, Diplophyllum taxifolium, Fuscocephaloziopsis lunulifolia, Lepidozia reptans, Lophozia silvicola, Schistochilopsis cornuta*. P-74-15-07, P-75-38-07, P-39-11-14, P-44-2-12, Prim-37-1-17, Prim-42-3-17, Prim-46-2-17, Prim-50-4-17, Prim-59-20-17, Prim-60-2-17, Prim-67-1-17, Prim-69-1-17. Arctic-boreal Circumpolar.

!*Calypogeia muelleriana* (Schiffn.) Müll. Frib. – (gemm. – f), [600–1076], **F** (16), **G** (27), **I** (48). Decaying log along streambed in coniferous forest with deciduous trees admixture, bare humus on steep slope and wet cliffs along stream in mixed forest. In pure mats or with *Anastrophyllum michauxii, Blepharostoma trichophyllum* s.l.*, Cephalozia otaruensis, Fuscocephaloziopsis leucantha, F. lunulifolia Lophozia silvicoloides*, *Mylia verrucosa, Solenostoma pseudopyriflorum*. P-70-13-07, P-75-20-07, Prim-48-19-17. Arctic-boreal Circumpolar.

Calypogeia neesiana (C. Massal. et Carestia) Müll. Frib. – **K**. The left bank of the Milogradovka River (Gambaryan, 1992) [3]. The recent research on *Calypogeia* (Bakalin *et al.*, 2022b) has shown *Calypogeia subalpina* described from Japan is a species distinct from European accession of *C. neesiana*. Which species occurs in Southern Sikhote-Alin is still unclear, because no specimens were sequenced from here. Not included in the analysis.

!*Calypogeia orientalis* Buczk. et Bakalin – [975], **F** (19). Humus with plant debris over rocks along the stream in mixed forest. In pure mat. Prim-51-3-17. Temperate East Asian.

!*Calypogeia suecica* (Arnell et J. Perss.) Müll. Frib. – [1076–1199], **F** (15, 16). Rotten wood in coniferous and mixed forests. With *Fuscocephaloziopsis leucantha, F. lunulifolia, Mylia verrucosa,*

Nowellia curvifolia, Tritomaria exsecta. Prim-47-9-17, Prim-48-21-17. Boreal Amphi-Oceanic.

Cephalozia bicuspidata (L.) Dumort. – (per., ant. – c, arch. – s), [1000–1768], **C** (7), **F** (15), **H** (36, 37), **I** (48). Humus over rocks and boulders in coniferous forests and swampy *Pinus pumila* thickets on N-facing slope, rotten wood in thickets of *Alnus fruticosa* with young trees of *Betula lanata*, once on *Sphagnum* debris in swampy *Pinus pumila* thickets on N-facing slope, decaying wood in *Betula-Picea* forest. In pure mats or with *Blepharostoma trichophyllum* s.l., *Diplophyllum albicans, Fuscocephaloziopsis lunulifolia*, *Lophocolea heterophylla*, *Scapania crassiretis, Schistochilopsis incisa*. P-75-6-07, Prim-39-2-17, Prim-47-4-17, Prim-63-7-17, Prim-64-10-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Snezhnaya Mt. (**I** collection area). Arctic-boreal Multizone.

!*Cephalozia otaruensis* Steph. – (per. – c, ant. – f) [600–1728], **C** (9), **E** (13), **F** (16, 21, 22), **G** (27), **H** (32, 37), **I** (46, 47, 48). Decaying wood in coniferous forests and *Alnus fruticosa* thickets with young trees of *Betula lanata* on N-facing slope, humus over rocks and in crevices in mixed forests, humus over boulders in animal holes, crevices between rocky blocks in subapical part of the mountains. With *Anastrophyllum michauxii, Bazzania tricrenata, Blepharostoma trichophyllum* s.l.*, Calypogeia muelleriana, Diplophyllum taxifolium, Geocalyx graveolens, Fuscocephaloziopsis leucantha, Lepidozia reptans, Lophocolea heterophylla, Lophozia silvicoloides, L. lantratoviae, Metacalypogeia cordifolia, Mylia verrucosa, Schistochilopsis incisa, Trilophozia quinquedentata, Tritomaria exsecta*. P-70-6-07, P-73-13-07, P-74-9-07, P-75-8-07, Prim-41-1-17, Prim-45-4-17, Prim-48-19-17, Prim-53-2-17, Prim-54-4-17, Prim-59-18-17, Prim-64-11-17. Despite Potemkin and Sofronova (2013) [72] accepted the synonymy of *C. otaruensis* with *C. hamatiloba* described from southern Japan we still maintain the species level for *C. otaruensis* that is somewhat different in morphology and distribution (*C. hamatiloba* is mostly East Asian subtropic taxon). Boreal Amphi-Pacific.

!*Cephaloziella divaricata* (Sm.) Schiffn. – [1728], **H** (32). Soil wall around small pond at the bottom of rock field hill in environs of mountain top. With *Diplophyllum taxifolium, Scapania mucronata, Schistochilopsis incisa*. Prim-59-4-17. Arctic-montane Circumpolar.

!!*Cephaloziella rubella* (Nees) Schiffn. – (per., spor. – cc, ant., arch., gemm. – f) [1657–1728], **E** (13), **H** (32). Humus among grasses shaded by *Pinus pumila*, humus in niche between boulders in subapical part of the mountains. With *Isopaches bicrenatus, Lophoziopsis excisa, Tritomaria exsecta*. Prim-45-1-17, Prim-45-2-17, Prim-59-31-17. Boreal Circumpolar.

!*Cephaloziella spinicaulis* Douin – [356], **J** (58). Cliff crevice in a broadleaved deciduous forest. With *Porella gracillima*. P-43-10-12. Temperate Asian-American.

!*Chiloscyphus fragilis* (A. Roth) Schiffn. – (ant. – c) [861–1100], **I** (44, 49). Bark of leaved tree submerged in water in dominantly coniferous forest, boulder in streambed splashed by water during floods in *Betula* forest with conifers admixture. In pure mats. P-71-1-07, P-76-19-07. Taxonomic status of the species needs verification. Boreal Circumpolar.

Chiloscyphus pallescens (Ehrh. ex Hoffm.) Dumort. – [1000], **H**. *Picea-Abies* forest, boulders on a stream bank (Gambaryan, 1984, 1992) [3,34]. This taxon is questionable. The taxonomic status of this record is questionable and needs verification. We did not examin the specimen. The best way to distinguish *C. pallescens* from morphologically polymorphous *C. fragilis* is the study of oil bodies: 2–4 in *C. fragilis* versus 8–10 in *C. pallescens*. The sizes of midleaf cells strongly overlap in both specimens. In the course of our studies, when the material was studied alive, we never observe in Sikhote-Alin plants with more than four oil bodies per cell, and, therefore, it is highly probable that all previous reports of *C. pallescens* in South Primorye actually belong to *C. fragilis*. Not included in the analysis.

Chiloscyphus polyanthos (L.) Corda – (ant. – cc, per., arch. – f) [536–741], **F** (22, 24), **G** (25). Sandy soil over rocks in niche near small waterfall in mixed forest, bark of decaying wood partially in ditch water in mixed forest. In pure mats or with *Aneura pinguis*. Prim-54-9-17, Prim-56-3-17, Prim-57-

2-17. Previously recorded by Gambaryan (1992) [3] for Oblachnaya Mt. (**H** collection area). Boreal Circumpolar.

!*Clevea nana* (Shimizu et S. Hatt.) Borovich. et Bakalin – (spor. – cc) [356], **J** (58). Cliff crevice in broadleaved deciduous forest. In pure mats. P-43-9-12, P-43-11-12, P-43-12-12. Temperate East Asian.

Cololejeunea ornata A.W. Evans – [600], **G** (27). Shaded wet cliff in mixed forest on rocky slope to valley. With *Radula obtusiloba*. P-70-14-07. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya Mt. (**H** collection area). Temperate-subtropical East Asian.

!*Conocephalum salebrosum* Szweyk., Buczk. et Odrzyk. – [356–1649], **F** (20), **G** (25, 27, 29), **H** (38), **I** (50, 53, 57), **J** (58). Humus over rocks and humus along stream in mixed forest, boulders in temporary streambed in *Betula* forest, clayish soil and humus over bark of living *Populus* trunk in flood-plain forest. In pure mats or with *Blepharostoma trichophyllum* s.l., *B. neglectum, Calycularia laxa, Mesoptychia heterocolpos, Lepidozia reptans, Plagiochila* sp., *Scapania crassiretis, Solenostoma obscurum, S. pseudopyriflorum, Trilophozia quinquedentata*. P-70-23-07, P-77-4-07, P-39-8-14, P-43-17-12, Prim-52-23-17, Prim-57-8-17, Prim-65-3-17, Prim-121-8-17, Prim-122-8-17. Boreal-temperate Circumpolar.

!!*Diplophyllum albicans* (L.) Dumort. – (per., gemm. – s) [1724–1768], **H** (36, 37). Vertical surface of rocks in swampy *Pinus pumila* thickets along rocks on N-facing slope and *Alnus fruticosa* thickets with young trees of *Betula lanata*. In pure mats or with *Diplophyllum taxifolium, Cephalozia bicuspidata, Gymnomitrion parvitextum*, *Scapania mucronata, Schistochilopsis incisa*. Prim-63-11-17, Prim-64-24-17, Prim-64-28-17. Arctic-montane Amphi-Oceanic.

!*Diplophyllum sibiricum* Bakalin et Vilnet – (per., ant. – cc, spor. – f) [1000–1839], **F** (16), **H** (33, 34), **I** (48). Vertical surface of rocks and humus over it in mixed forest in stream valley and *Pinus pumila* thickets in subapical part of the mountains. In pure mats or with *Diplophyllum taxifolium, Douinia plicata, Gymnomitrion parvitextum, Lophoziopsis* cf. *longidens, Marsupella emarginata, Schistochilopsis incisa, Solenostoma pseudopyriflorum*. P-75-22-07, Prim-48-27-17, Prim-60-5-17, Prim-61-29-17. Arctic-boreal Asian.

Diplophyllum taxifolium (Wahlenb.) Dumort. – (per., gemm. – s, ant. – r) [600–1798], **C** (7, 8), **D** (10), **E** (13), **F** (16, 19), **G** (27, 29), **H** (30, 31, 32, 33, 34, 35, 36, 37, 40), **I** (45, 47, 53, 55), **J** (60). Humus over rocks and boulders in niches, crevices and animal holes in environs near mountain tops, humus over rocks and boulders in coniferous and mixed forests. In pure mats or *Barbilophozia barbata, Bazzania denudata, B. manczurica, B. tricrenata, Blepharostoma minor, B. trichophyllum* s.l., *Calycularia laxa, Calypogeia integristipula, Cephalozia otaruensis, Cephaloziella divaricata, Diplophyllum albicans, D. sibiricum, D. taxifolium, Douinia plicata, Fuscocephaloziopsis lunulifolia, Gymnomitrion parvitextum, Herbertus aduncus, Lophozia silvicola, L. ventricosa, Lophoziopsis longidens, Marsupella emarginata, M. tubulosa, Metacalypogeia cordifolia, Metzgeria lindbergii, Mylia verrucosa, M. taylorii, Pseudolophozia debiliformis, P. sudetica, Radula* sp., *Scapania mucronata, S. parvifolia, S. sphaerifera, Schistochilopsis incisa, Solenostoma pseudopyriflorum, Sphenolobus saxicola, S. minutus, Trilophozia quinquedentata, Tritomaria exsecta*. P-70-16-07, P-72-6-07, P-74-14-07, P-39-15-14, P-45-12-12, Prim-39-1-17, Prim-40-10-17, Prim-42-1-17, Prim-45-4-17, Prim-48-25-17, Prim-51-1-17, Prim-59-4-17, Prim-60-8-17, Prim-61-2-17, Prim-62-6-17, Prim-62-13-17, Prim-63-8-17, Prim-64-2-17, Prim-67-2-17, Prim-70-5-17, Prim-119-3-17, Prim-122-11-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya and Snezhnaya Mts. (**H**, **I** collection areas). Arctic-boreal Circumpolar.

Douinia plicata (Lindb.) Konstant. et Vilnet – (gemm. – f) [600–1798], **E** (12, 13), **F** (15), **G** (28), **H** (33, 35, 36, 40, 42), **I** (45, 46, 48, 55). Plant debris with humus over boulders and rocks in niches and crevices in subapical part of the mountains, over boulders and rocks, over decaying *Betula lanata* bark,

Picea trunk base in coniferous forests. In pure mats or with *Barbilophozia barbata, Bazzania denudata*, *Diplophyllum sibiricum, D. taxifolium, Gymnomitrion parvitextum, Lophozia silvicola, Lophoziopsis excisa, L. longidens, Marsupella emarginata, Metzgeria furcata, Pseudolophozia debiliformis, Ptilidium pulcherrimum, Scapania sphaerifera, Schistochilopsis incisa, Sphenolobus saxicola, S. minutus, Trilophozia quinquedentata, Tritomaria exsecta*. P-79-8-07, P-72-15-07, P-73-3-07, P-73-5-07, P-75-12-07, Prim-44a-4-17, Prim-45-5-17, Prim-47-5-17, Prim-59-8-17, Prim-60-14-17, Prim-59-6-17, Prim-60-5-17, Prim-62-9-17, Prim-63-1-17, Prim-67-10-17, Prim-69-7-17, Prim-119-8-17. Previously recorded by Gambaryan (1992) [3] for Oblachnaya and Snezhnaya Mts. (**H**, **I** collection areas) as *Macrodiplophyllum plicatum* (Lindb.) Perss. Arctic-boreal Amphi-Pacific.

Frullania appendiculata Steph. – [800–1500], **I** (45), **J** (60). Crevice between rocky blocks on rock field, cliff crevice and on bolder side in mixed forest. In pure mats or with *Tritomaria exsecta*. P-72-7-07, P-45-10-12. Previously recorded by Gambaryan (1992) [3] for Oblachnaya Mt. and Milogradovskie Waterfalls (**H**, **K** collection areas). Temperate East Asian.

!*Frullania austinii* J.J. Atwood, Vilnet, Mamontov et Konstant. – (per.– f) [536–539], **G** (25, 26). Bark of decaying and living *Betula* trunks in mixed forests. In pure mats. Prim-57-10-17, Prim-58-4-17, Prim-58-6-17. Reports are based on a transfer of all Asiatic specimens before named as *F. bolanderi* to *F. austinii* (cf. Mamontov *et al.*, 2020) [73]. Boreal-temperate Asian-American.

!*Frullania davurica* Hampe – (per. – s) [356–1407], **C** (8), **F** (20), **H** (30, 43), **J** (58). Vertical surface of rocks, *Picea* and *Abies* trunks, *Betula* trunk bases in mixed forests, cliffs in a broadleaved deciduous forest. In pure mats or with *Frullania sinensis, F. taradakensis, Metzgeria pubescens, Porella vernicosa*. P-43-14-12, Prim-40-4-17, Prim-52-4-17, Prim-59a-1-17, Prim-70-7-17, Prim-71-5-17. Boreal-temperate Asian.

!*Frullania koponenii* S. Hatt. – (per., arch. – cc) [1000], **I** (51). Tree trunk in coniferous forest, in pure mat. P-78-1-07. Temperate Asian.

Frullania muscicola Steph. – (per., arch. – c) [356–820], **A** (2), **G** (27), **I** (44, 53), **J** (58). Shaded wet cliff, bark of decaying stamp, *Abies* and *Tilia* trunks in mixed fores, shaded cliffs in dominanty coniferous forest, cliffs in broadleaved deciduous forest. In pure mats. P-70-17-07, P-71-12-07, P-39-6-14, P-43-2-12, P-44-4-12, Prim-34-2-17. Previously recorded by Gambaryan (1984) [32] for Oblachnaya Mt. (**H** collection area). Temperate-subtropical East Asian.

!*Frullania sinensis* Steph. – (per. – c) [747–950], **A** (2), **H** (43). *Picea* trunk in coniferous forest with deciduous trees admixture, *Populus tremula* trunk in mixed forest. In pure mats or with *Frullania davurica*. Prim-34-1-17, Prim-71-5-17. Temperate East Asian.

!*Frullania takayuensis* Steph. – (per. – cc) [600–1798], **G** (27), **H** (30, 43). Bark of died and living *Abies* trunks in coniferous forest with deciduous trees admixture. In pure mats or with *Radula complanata*. P-70-9-07, Prim-70-8-17, Prim-71-4-17. Boreal-temperate East Asian.

!*Frullania taradakensis* Steph. – [356], **J** (58). Cliffs and its crevices in a broadleaved deciduous forest. In pure mats or with *Frullania davurica*, *Porella vernicosa, Trocholejeunea sandvicensis*. P-43-1-12, P-43-7-12. Temperate-subtropical East Asian.

!*Fuscocephaloziopsis catenulata* (Huebener) Váňa et L. Söderstr. subsp. ***nipponica*** (S.Hatt.) Váňa et L. Söderstr. – (per. – c) [800], **J** (60). Rotten log in mixed forest. In pure mats. P-45-4-12, P-45-5-12. Temperate-subtropical Amphi-Oceanic.

Fuscocephaloziopsis leucantha (Spruce) Váňa et L. Söderstr. – (per. – f, ant., spor. – s) [809–1543], **C** (9), **F** (15, 16), **H** (40, 41), **I** (47, 48, 57). Rotten or decaying wood in coniferous, mixed forests, humus in *Betula-Alnus* crooked forest, cliffs in *Betula-Picea* forest. In pure mats or with *Anastrophyllum michauxii, Blepharostoma trichophyllum* s.l., *Calypogeia muelleriana, C. suecica, Cephalozia otaruensis, Fuscocephaloziopsis lunulifolia*, *Lepidozia reptans, Lophozia silvicoloides, Mylia verrucosa*,

Neoorthocaulis attenuates, Nowellia curvifolia, *Ptilidium pulcherrimum, Schistochilopsis incisa, S. cornuta, Solenostoma pseudopyriflorum, Tritomaria exsecta.* P-74-16-07, P-75-20-07, P-77-12-07, Prim-41-1-17, Prim-47-7-17, Prim-48-19-17, Prim-67-13-17, Prim-68-8-17, Prim-121-5-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya and Snezhnaya Mts. (**H**, **I** collection areas). Arctic-boreal Circumpolar.

Fuscocephaloziopsis lunulifolia (Dumort.) Váňa et L. Söderstr. – (per. – f, ant., spor. – s, arch. – r) [694–1768], **E** (11), **F** (14, 15, 17, 18, 19), **G** (29), **H** (37, 40, 41, 42), **I** (47, 48). Rotten wood, humus and humus over boulders and rocks in mixed, coniferous forests and *Betula-Alnus* crooked forest, in thickets of *Alnus fruticosa* with young trees of *Betula lanata*, rotten wood in mixed forest. In pure mats or with *Bazzania denudata, B. parabidentula, Blepharostoma trichophyllum* s.l., *Calycularia laxa, Calypogeia integristipula, C. muelleriana, C. suecica, Cephalozia bicuspidata, Diplophyllum taxifolium, Fuscocephaloziopsis leucantha, Gymnomitrion parvitextum, Lepidozia reptans, Lophocolea heterophylla, Lophozia silvicoloides, Metacalypogeia cordifolia, Mylia verrucosa, Schistochilopsis cornuta, S. incisa, Solenostoma pseudopyriflorum, Trilophozia quinquedentata, Tritomaria exsecta*. P-74-15-07, P-75-20-07, Prim-43-4-17, Prim-46-1-17, Prim-47-4-17, Prim-49-8-17, Prim-50-4-17, Prim-51-1-17, Prim-64-3-17, Prim-67-2-17, Prim-68-7-17, Prim-69-9-17, Prim-122-4-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya and Snezhnaya Mts. (**H**, **I** collection areas). Arctic-boreal Circumpolar.

!*Geocalyx graveolens* (Schrad.) Nees – (arch. – s) [600–980], **F** (18, 21, 24), **G** (27, 29), **I** (53), **J** (60). Humus over rocks, vertical surface of rocks, bark of decaying wood partially in ditch water, and rotten or decaying wood in mixed forest. In pure mats or with *Blepharostoma trichophyllum* s.l., *Cephalozia otaruensis, Harpanthus scutatus, Liochlaena subulata, Metacalypogeia cordifolia, Mylia verrucosa*. P-70-3-07, P-70-4-07, P-39-17-14, P-45-3-12, Prim-50-1-17, Prim-53-2-17, Prim-53-3-17, Prim-56-4-17, Prim-122-2-17. Boreal Circumpolar.

Gymnocolea inflata (Huds.) Dumort. – [800], **I**. Boulders in a streambed, coll. L.V. Bardunov (Gambaryan, 1984, 1992) [3,32]. We refer to this taxon as questionable due to phytogeographic and ecological issues: most common habitats for this species in Sikhote-Alin – mossy swamps, overwetted banks of small ponds, and wet hollows not lower than 1450 m a.s.l. in the alpine belt. The nearest confirmed locality of the species is more than 400 km to the north (Klimova, unpublished). We were not able to find the specimen on which the record in Gambaryan (1984, 1992) [3,32] was based. Not included in the analysis.

!*Gymnomitrion parvitextum* (Steph.) Mamontov, Konstant. et Potemkin – (per., ant., arch.– s) [1543–1839], **H** (33, 34, 35, 36, 37, 40). Humus over rocks in crevices and niches, vertical surface of rocks in environs of mountain top. In pure mats or with *Bazzania denudata, B. manczurica, Diplophyllum albicans, D. sibiricum, D. taxifolium, Douinia plicata, Herbertus aduncus, Fuscocephaloziopsis lunulifolia, Lophoziopsis* cf. *longidens, Scapania sphaerifera, S. praetervisa, Schistochilopsis incisa, Sphenolobus minutus*. Prim-60-5-17, Prim-60-8-17, Prim-60-9-17, Prim-61-13-17, Prim-62-7-17, Prim-63-17-17, Prim-64-28-17, Prim-67-3-17. Boreal East Asian.

!*Harpanthus flotovianus* (Nees) Nees – [752], **F** (23). Humus over bark of decaying *Betula* trunk near small waterfall in mixed forest, in pure mat. Prim-55-1-17. Arctic-boreal Amphi-Oceanic.

!*Harpanthus scutatus* (F. Weber et D. Mohr) Spruce – (per., gemm. – f) [600–1100], **G** (27, 29), **I** (49). Rotten wood, bare humus on steep slope in mixed forest, once on stone in streambed splashed by water during floods in *Betula* forest. In pure mats or with *Bazzania denudata, Blepharostoma trichophyllum* s.l., *Geocalyx graveolens, Liochlaena subulata, Mylia verrucosa, Plagiochila* sp. P-70-12-07, P-76-17-07, Prim-122-2-17. Temperate Circumpolar.

Herbertus aduncus (Dicks.) Gray – [1798], **H** (35). Humus over rocks in crevice near mountain

top, with *Diplophyllum taxifolium, Gymnomitrion parvitextum, Scapania praetervisa*. Prim-62-7-17, Prim-62-8-17, Prim-62-14-17. The relationships between *H. dicranus* and *H. aduncus* need clarification. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya and Snezhnaya Mts. (**H**, **I** collection areas). Arctic-boreal Asian-American.

!*Herbertus buchii* Juslen – [1407–1500], **C** (8), **I** (45). Vertical surface of rocks in crooked *Betula-Picea* forest on a ridge, crevice between rocky blocks on a rock field, with *Barbilophozia barbata, Sphenolobus minutus, Tritomaria exsecta, Sphenolobus saxicola*. P-72-13-07, Prim-40-8-17. Taxonomic status of the species needs verification. Arctic-boreal Asian.

!*Herbertus dicranus* (Taylor ex Gottsche, Lindenb. et Nees) Trevis. – [1600–1832], **H** (32, 34), **I** (52). Vertical surface of rocks in *Alnus fruticosa*, young trees of *Betula lanata* and *Pinus pumila* thickets, crevices between stones on rock field. In pure mats or with *Scapania sphaerifera, Sphenolobus saxicola*. P-38-1-14, Prim-59-15-17, Prim-61-25-17. Temperate-subtropical mainly Asian.

!*Isopaches bicrenatus* (Schmidel) H. Buch – (per., ant., gemm. – cc, arch., spor. – f) [1000–1728], **H** (32), **I** (51, 52, 55). Humus among grasses shaded by *Pinus pumila*, clayish soil on the edge of *Cassiope redowskii* spots, crevice between boulders on a rock field in subapical part of the mountain, fine-grained soil along roadside in coniferous forest. In pure mats or with *Cephaloziella rubella*. P-78-9-07, P-38-3-14, Prim-59-31-17, Prim-119-9-17. Arctic-boreal Circumpolar.

!*Jungermannia pumila* With. – (per., ant. – cc) [1100], **I** (49). Boulder in temporary streambed in *Betula* forest, in pure mat. P-76-18-07. Arctic-montane Circumpolar.

Lejeunea japonica Mitt. – [800], **J** (60). Boulder side in mixed forest. In pure mat. P-45-16-12. Previously recorded by Gambaryan (1992) [3] for Oblachnaya Mt. (**H** collection area). Temperate East Asian.

Lepidozia reptans (L.) Dumort. – (per. – f, spor. – s) [600–1768], **C** (7, 8, 9), **E** (11), **F** (14, 15, 17), **G** (27), **H** (33, 37, 41, 42), **I** (46, 49, 53, 57). Humus, decaying or rotten wood in coniferous and mixed forests, once in a crevice between rocky blocks in lichen-dwarf shrub tundra. In pure mats or with *Anastrophyllum michauxii, Bazzania denudata, B. parabidentula, Blepharostoma trichophyllum* s.l.*, B. neglectum, Calypogeia integristipula, Cephalozia otaruensis, Conocephalum salebrosum, Fuscocephaloziopsis leucantha, F. lunulifolia, Lophocolea heterophylla, Lophozia silvicola, Mylia verrucosa, Plagiochila* sp.*, Ptilidium pulcherrimum, Schistochilopsis incisa, Sphenolobus minutus, Tritomaria exsecta.* P-70-2-07, P-73-12-07, P-76-8-07, P-39-7-14, Prim-40-12-17, Prim-41-1-17, Prim-43-5-17, Prim-46-2-17, Prim-47-8-17, Prim-49-7-17, Prim-60-2-17, Prim-64-15-17, Prim-68-3-17, Prim-69-3-17, Prim-121-8-17. Previously recorded by Gambaryan (1984) [32] for Oblachnaya and Snezhnaya Mts., Milogradovskie Waterfalls (**H**, **I**, **K** collection areas). Boreal Circumpolar.

!*Liochlaena subulata* (A. Evans) Schljakov – (per. – c, gemm. – f, ant. – s) [356–800], **F** (24), **G** (27, 29), **I** (44, 50, 53), **J** (58, 60). Bark of decaying wood partially in ditch water, decaying or rotten wood in mixed forests, vertical cliff wall in broadleaved deciduous forest, with *Bazzania denudata, Blepharostoma trichophyllum* s.l.*, Geocalyx graveolens, Harpanthus scutatus, Lophozia lantratoviae, Metzgeria pubescens, Mylia verrucosa, Plagiochila* sp. P-70-10-07, P-71-5-07, P-77-3-07, P-43-20-12, P-45-2-12, P-39-19-14, Prim-56-4-17, Prim-122-1-17. Boreal-temperate Circumpolar.

!*Lophocolea cuspidata* (Nees) Limpr. – **I** (49) – 1100. Humus on slope to stream in *Betula* forest. In pure mat. P-76-7-07. Temperate Amphi-Oceanic.

Lophocolea heterophylla (Schrad.) Dumort. – (per., ant.– cc, spor. – f, arch. – s) [536–1768], **F** (14, 15, 19, 20), **C** (25, 26), **H** (30, 37, 39, 41, 43), **I** (44, 56, 57). Wood of varying degrees of decay in mixed, coniferous and flood-plain forests. In pure mats or with *Blepharostoma trichophyllum* s.l.*, B. neglectum, Cephalozia bicuspidata, C. otaruensis, Fuscocephaloziopsis lunulifolia, Lepidozia reptans, Lophozia longiflora, Mylia verrucosa, Riccardia palmata, Scapania apiculata, S. carinthiaca, Trilophozia*

quinquedentata, Tritomaria exsecta. P-71-7-07, Prim-46-13-17, Prim-47-6-17, Prim-51-5-17, Prim-52-10-17, Prim-57-7-17, Prim-58-2-17, Prim-64-10-17, Prim-66-1-17, Prim-68-6-17, Prim-70-3-17, Prim-71-6-17, Prim-120-1-17, Prim-121-12-17. Previously recorded by Gambaryan (1984) [32] for Oblachnaya Mt. (**H** collection area). Boreal Circumpolar.

!*Lophocolea minor* Nees – (gemm. – cc, ant.– f) [536–713], **F** (20), **G** (25). Moist decaying logs in flood-plain forest, once vertical surface of rocks in mixed forest in stream valley. In pure mats. Prim-52-12-17, Prim-57-3-17, Prim-57-4-17. Arctic-boreal Circumpolar.

!*Lophozia guttulata* (Lindb. et Arnell) A. Evans – (gemm. – cc, ant.– f) [1707–1768], **H** (33, 37). Humus covering rocks in *Pinus pumila* thickets with big rocky blocks in environs of mountain top. In pure mats or with *Schistochilopsis incisa, Tritomaria exsecta*. Prim-60-4-17, Prim-60-3-17*, Prim-64-17-17. Arctic-boreal Circumpolar.

!*Lophozia lantratoviae* Bakalin – (gemm. – cc, per.– f) [1000–1430], **F** (16), **H** (41), **I** (47, 48, 49). Sandy soil covering boulder in a streambed in mixed and *Betula* forests, decaying wood in coniferous forests, cliff crevice in *Betula-Alnus* crooked forest. In pure mats or with *Blepharostoma trichophyllum* var. *trichophyllum, Cephalozia otaruensis, Liochlaena subulata, Mylia verrucosa, Plagiochila ovalifolia, Solenostoma obscurum, S. pseudopyriflorum, Trilophozia quinquedentata*. P-74-5-07, P-75-7-07, P-76-20-07, P-77-3-07, Prim-48-6-17, Prim-68-4-17. Boreal Asian.

Lophozia longiflora (Nees) Schiffn. – [1430], **H** (41). Decaying decorticated *Acer* trunk in coniferous forest with deciduous trees admixture, with *Blepharostoma trichophyllum* s.l.*, Lophocolea heterophylla, Mylia verrucosa, Riccardia palmata, Tritomaria exsecta*. Prim-68-6-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Snezhnaya Mt. (**I** collection area). Arctic-boreal Circumpolar.

!*Lophozia silvicola* H. Buch – (gemm. – cc, per.– s) [1406–1768], **D** (10), **E** (13), **H** (32, 33, 34, 37), **I** (55). Humus covering rocks, sometimes in niches and crevices, in *Pinus pumila* thickets in environs of mountain top, thickets of *Alnus fruticosa* with young trees of *Betula lanata*, in open *Betula* forest with tundra-like vegetation spots on a ridge. In pure mats or with *Bazzania denudata, Calycularia laxa, Calypogeia integristipula, Diplophyllum taxifolium, Douinia plicata, Lepidozia reptans, Lophoziopsis excisa, L. longidens, Tritomaria exsecta, Schistochilopsis incisa, Sphenolobus saxicola, S. minutus.* Prim-42-5-17, Prim-45-6-17, Prim-59-36-17*, Prim-60-2-17, Prim-61-11-17, Prim-64-26-17, Prim-119-5-17. Arctic-boreal Circumpolar.

!*Lophozia silvicoloides* Kitag. – (per. – cc, ant. – c, gemm. – f) [1000–1500], **I** (46, 47, 48). Crevice between rocky blocks in lichen-dwarf shrub tundra with rock fields, humus on slope under *Betula* roots in *Betula-Alnus* crooked forest, wet cliffs in *Betula-Picea* forest. In pure mats or with *Calypogeia muelleriana, Cephalozia otaruensis, Fuscocephaloziopsis lunulifolia, F. leucantha, Schistochilopsis incisa, Solenostoma pseudopyriflorum*. P-73-11-07, P-74-17-07, P-75-20-07. Arctic-boreal Circumpolar.

!*Lophozia ventricosa* (Dicks.) Dumort. – (gemm. – cc, ant. – s) [1076–1839], **F** (16), **H** (32, 34, 37). Humus covering rocks in *Alnus fruticosa*, young trees of *Betula lanata* and *Pinus pumila* thickets in environs of mountain top, once over *Sphagnum* debris in thickets of *Alnus fruticosa* with young trees of *Betula lanata*. In pure mats or with *Barbilophozia barbata, Bazzania tricrenata, B. denudata, Diplophyllum taxifolium, Lophoziopsis excisa, Marsupella emarginata, Scapania parvifolia, S. parvitexta, Schistochilopsis incisa, Sphenolobus saxicola, Trilophozia quinquedentata, Tritomaria exsecta.* Prim-48-15-17*, Prim-59-34-17, Prim-61-19-17, Prim-64-8-17. Arctic-boreal Circumpolar.

!*Lophoziopsis excisa* (Dicks.) Konstant. et Vilnet – (per., ant. – cc, arch., spor., gemm. – f) [1657–1839], **E** (12, 13), **H** (32, 33, 34, 35), **I** (46). Humus covering rocks and boulders in a belt of rocks and rock fields with tundra-like vegetation and thickets of *Alnus fruticosa* and *Pinus pumila* in subapical part of the mountains, crevice between rocky blocks in lichen-dwarf shrub tundra with rock fields. In pure

mats or with *Barbilophozia barbata, Cephaloziella rubella, Douinia plicata, Metzgeria furcata, Lophozia silvicola, L. ventricosa, Sphenolobus saxicola, Tritomaria exsecta*. P-73-2-07, Prim-44a-6-17, Prim-45-1-17, Prim-59-14-17, Prim-60-11-17, Prim-60-13-17, Prim-61-17-17, Prim-62-2-17. Arctic-boreal Circumpolar.

!!*Lophoziopsis longidens* (Lindb.) Konstant. et Vilnet – (gemm. – cc) [1600–1839], **E** (12), **H** (32, 34), **I** (52, 55). Humus covering boulders in niches in a belt of rocks and rock fields with tundra-like vegetation and thickets of *Alnus fruticosa* and *Pinus pumila* in subapical part of the mountains. In pure mats or with *Bazzania denudata, Diplophyllum taxifolium, D. sibiricum, Douinia plicata, Gymnomitrion parvitextum, Lophozia silvicola, Ptilidium pulcherrimum, Schistochilopsis incisa, Sphenolobus saxicola*. P-38-5-14, Prim-44a-5a-17, Prim-59-36-17, Prim-61-23-17, Prim-119-4-17. Arctic-boreal Circumpolar.

!*Marchantia alpestris* (Nees) Burgeff – [539], **G** (26). Humus under hut in mixed forest at ranger station. In pure mats. Prim-58-1-17. Arctic-boreal Circumpolar.

!*Marsupella emarginata* (Ehrh.) Dumort. – (ant. – c, per. – s, arch., spor. – r) [741–1839], **F** (16, 17, 22), **H** (31, 32, 33, 34, 35, 36, 37). Humus covering boulders and vertical surface of rocks in a belt of rocks and rock fields with tundra-like vegetation and thickets of *Alnus fruticosa* and *Pinus pumila* in subapical part of the mountains, sandy and fine soil over boulders and rocks near stream in mixed forest. In pure mats or with *Bazzania denudata, Diplophyllum sibiricum, D. taxifolium, Douinia plicata, Lophozia* cf. *ventricosa, Metacalypogeia cordifolia, Pseudolophozia sudetica, Pseudolophozia debiliformis, Scapania parvitexta, S. sphaerifera, S. subalpina, Schistochilopsis incisa, Sphenolobus saxicola, S. minutus, Solenostoma obscurum, S. pseudopyriflorum, Trilophozia quinquedentata*. Prim-48-12-17, Prim-49-4-17, Prim-54-5-17, Prim-59-9-17, Prim-60-10-17, Prim-61-5-17, Prim-62-4-17, Prim-63-6-17, Prim-64-25-17. Arctic-boreal Circumpolar.

Marsupella tubulosa Steph. – (ant. – c, per. – f) [1000–1500], **I** (46, 47, 48). Crevice between rocky blocks in lichen-dwarf shrub tundra with rock fields, cliff crevice, humus on slope under *Betula* roots in *Betula-Alnus* crooked forest, cliffs along stream in *Betula-Picea* forest. In pure mats or with *Diplophyllum taxifolium, Mylia taylorii*, *Sphenolobus saxicola, Scapania microdonta, S. sphaerifera, Trilophozia quinquedentata*. P-73-10-07, P-74-4-07, P-75-14-07. Previously recorded by Gambaryan (1984, 1992) [3,32] Snezhnaya Mt. and Milogradovskie Waterfalls (**I**, **K** collection areas). Arctic-boreal Circumpolar.

!*Mesoptychia heterocolpos* (Thed. ex Hartm.) L. Söderstr. et Váňa – [1649], **H** (38). Humus covering boulder in a temporary streambed in *Betula lanata* forest. With *Blepharostoma trichophyllum* s.l.*, Conocephalum salebrosum, Solenostoma obscurum, Trilophozia quinquedentata*. Prim-65-3-17. Arctic-montane Circumpolar.

!*Mesoptychia ussuriensis* (Bakalin) L. Söderstr. et Váňa – [980], **F** (18). Vertical surface of rocks in mixed forest in a stream valley. In pure mats. Prim-50-2-17. Temperate-subtropical East Asian.

Metacalypogeia cordifolia (Stephani) Inoue – [694–1500], **F** (17, 21, 22), **G** (29), **H** (42), **I** (44, 49, 53). Humus covering rocks in mixed and coniferous forests, moist trunk base in mixed forest, rotten wood in coniferous forest, wet cliffs in *Betula-Picea* forest, humus on slope to stream in *Betula* forest. In pure mats or with *Bazzania denudata, Blepharostoma trichophyllum* s.l.*, Calycularia laxa, Cephalozia otaruensis, Diplophyllum taxifolium, Fuscocephaloziopsis lunulifolia, Geocalyx graveolens, Marsupella emarginata, Solenostoma pseudopyriflorum*. P-71-9-07, P-76-5-07, P-39-4-14, Prim-49-4-17, Prim-53-2-17, Prim-54-6-17, Prim-69-9-17, Prim-122-11-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya Mt. (**H** collection area). Temperate East Asian.

!*Metzgeria furcata* (L.) Corda – (ant. – c) [1657–1839], **E** (13), **H** (34). Niches in rocks and between boulders in a belt of rock fields and *Pinus pumila* thickets in environs of mountain tops. With *Douinia plicata, Lophoziopsis excisa, Metzgeria pubescens, Scapania microdonta*. Prim-45-9-17, Prim-

61-28-17*. Boreal-temperate Circumpolar.

Metzgeria furcata var. ***ulvula*** (Nees) Gottsche, Lindenb. et Nees – (ant., gemm. – c) [1483], **E** (12). Niches between boulders in a belt of rock fields and *Pinus pumila* thickets in environs of mountain top, with *Douinia plicata, Lophoziopsis excisa*. Prim-44a-4-17, Prim-44a-6-17. Previously recorded by Gambaryan (1992) [3] for Oblachnaya Mt. (**H** collection area). Boreal-temperate Circumpolar.

Metzgeria lindbergii Schiffn. – (ant., arch. – cc) [1000–1543], **H** (40, 41), **I** (49, 51). Vertical surface of rocks, humus over rocks, fine-grained soil along roadside in coniferous forests, vertical surface of boulder in *Betula* forest, with *Diplophyllum taxifolium, Blepharostoma trichophyllum* s.l.*, Radula* sp.*, Tritomaria exsecta*. P-76-1-07, P-78-10-07, Prim-67-6-17, Prim-68-1-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya Mt. (**H** collection area) as *Metzgeria conjugata* Lindb. Temperate-subtropical East Asian.

Metzgeria pubescens (Schrank) Raddi – (arch. – s) [975–1839], **C** (8), **F** (19), **G** (27), **H** (30, 34, 42, 43), **I** (49, 53). Vertical surface of rocks, over boulders, bare soil and tree trunk bases in mixed and coniferous forests, over rocks in thickets of *Alnus fruticosa*, young trees of *Betula lanata* and *Pinus pumila* in environs of mountain top. In pure mats or with *Frullania davurica, Liochlaena subulata, Metzgeria* cf. *furcata, Porella vernicosa, Radula obtusiloba*. P-70-10-07, P-76-3-07, P-39-5-14, Prim-40-5-17, Prim-51-2-17, Prim-61-28-17, Prim-69-6-17, Prim-70-6-17, Prim-71-2-17. Previously recorded by Gambaryan (1984) [32] for Oblachnaya Mt. (**H** collection area) as *Apometzgeria pubescens* (Schrank) Kuwah. Boreal-temperate Circumpolar.

!*Metzgeria temperata* Kuwah. – [1728], **H** (32). Covering rocks in a deep hole between boulders in a belt of rock fields and *Pinus pumila* thickets in environs of mountain top. In pure mats. Prim-59-33-17. Boreal-temperate Amphi-Oceanic.

!*Mylia taylorii* (Hook.) Gray – (ant. – c, gemm. – f, per. – s) [1000–1768], **H** (37, 40), **I** (47, 48). Humus with plant debris over rocks, decaying trunk of *Betula lanata* in thickets of *Alnus fruticosa* with young trees of *Betula lanata*, cliff crevice, humus on slope under *Betula* roots in *Betula-Alnus* crooked forest, cliffs along stream in *Betula-Picea* forest, rotten wood in coniferous forest, with *Bazzania denudata, Blepharostoma trichophyllum* s.l.*, Diplophyllum taxifolium, Fuscocephaloziopsis leucantha, Marsupella tubulosa, Mylia verrucosa, Neoorthocaulis attenuates, Ptilidium pulcherrimum, Schistochilopsis incisa, Sphenolobus minutus, Tritomaria exsecta*. P-74-10-07, P-75-29-07, Prim-64-14-17, Prim-67-13-17. Arctic-boreal Circumpolar.

Mylia verrucosa Lindb. – (per., ant. – f, spor., gemm. – r) [600–1543], **B** (4), **C** (9), **E** (11), **F** (14, 15, 16, 17, 19), **G** (27, 29), **H** (40, 41), **I** (48, 50, 51, 53, 57). Rotten or decaying wood in coniferous and mixed forests, once humus over vertical surface of boulder in coniferous forest. In pure mats or with *Anastrophyllum michauxii, Bazzania denudata, Blepharostoma trichophyllum* s.l.*, Calypogeia suecica, C. muelleriana, Cephalozia otaruensis, Diplophyllum taxifolium, Fuscocephaloziopsis leucantha, F. lunulifolia, Geocalyx graveolens, Harpanthus scutatus, Lepidozia reptans, Liochlaena subulata, Lophocolea heterophylla, Lophozia lantratoviae, L. longiflora, Mylia taylorii, Nowellia curvifolia, Ptilidium pulcherrimum, Riccardia palmata, Scapania apiculata, S. carinthiaca, Schistochilopsis incisa, S. cornuta, Trilophozia quinquedentata, Tritomaria exsecta*. P-70-3-07, P-75-11-07, P-77-12-07, P-78-8-07, P-39-19-14, Prim-36-2-17, Prim-41-1-17, Prim-43-6-17, Prim-46-13-17, Prim-47-6-17, Prim-48-19-17, Prim-49-7-17, Prim-51-1-17, Prim-67-12-17, Prim-68-3-17, Prim-121-4-17, Prim-122-5-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya and Snezhnaya Mts. (**H**, **I** collection areas). Temperate East Asian.

!*Neoorthocaulis attenuatus* (Mart.) L. Söderstr., De Roo et Hedd. – (gemm. – c) [1200], **I** (47). Humus on slope under *Betula* roots in *Betula-Alnus* crooked forest, with *Fuscocephaloziopsis leucantha, Mylia taylorii*. P-74-19-07, P-74-20-07. Boreal Circumpolar.

Nowellia curvifolia (Dicks.) Mitt. – (per. – cc) [1076], **F** (16). Partly rotten log near streambed in mixed forest. In pure mats or with *Blepharostoma* sp.*, Calypogeia suecica, Fuscocephaloziopsis leucantha, Mylia verrucosa*. Prim-48-21-17, Prim-48-22-17, Prim-48-24-17. Previously recorded by Gambaryan (1992) [3] for Snezhnaya Mt. (**I** collection area). Temperate Amphi-Oceanic.

!*Pedinophyllum truncatum* (Steph.) Inoue – (per. – cc) [356–713], **F** (20), **G** (25), **J** (58). Humus and mosses over rocks in mixed forest in stream valley, moist barked decaying stick in flood-plain forest, cliffs in a broadleaved deciduous forest. In pure mats. P-43-13-12, Prim-52-1-17, Prim-57-6-17. Temperate East Asian.

Pellia endiviifolia (Dicks.) Dumort. – [800], **I**. Young *Picea* forest with *Betula* admixture, coll. Nazarova M.M. (Gambaryan, 1984) [32]. Boreal Circumpolar.

!*Pellia neesiana* (Gottsche) Limpr. – (per. – cc) [1649], **H** (38). Humus covering boulder in temporary streambed in *Betula lanata* forest, with *Blepharostoma trichophyllum* s.l.*, Lophocolea* sp.*, Scapania irrigua, Solenostoma obscurum*. Prim-65-1-17. Arctic-boreal Circumpolar.

!*Plagiochila ovalifolia* Mitt. – (per. – f) [600–1430], **F** (20), **G** (27), **H** (41), **I** (49, 53, 57), **J** (60). *Abies* root, wet cliff, wet hollow in mixed forests in stream valley, bottom of dried up pond in coniferous forest with broadleaved deciduous trees admixture, boulder in a streambed in *Betula* forest. In pure mats or with *Blepharostoma trichophyllum* (L.) Dumort. var. *trichophyllum*, *Lophozia lantratoviae, Solenostoma pseudopyriflorum, Porella faurieri*. P-70-18-07, P-76-20-07, P-45-18-12, P-39-1-14, Prim-52-6-17, Prim-121-11-17. Temperate-subtropical East Asian.

Plagiochila porelloides (Torr. ex Nees) Lindenb. – [604–1839], **B** (4), **F** (20, 24), **G** (29), **H** (34, 38), **I** (57). Humus with plant debris in mixed forests, over boulder in streambed in *Betula lanata* forest, humus covering rocks in *Pinus pumila* thickets at the mountain top. In pure mats or with *Scapania mucronata, Trilophozia quinquedentata.* Prim-36-1-17, Prim-52-7-17, Prim-56-2-17, Prim-61-3-17, Prim-65-2-17, Prim-121-7-17, Prim-122-16-17*. Previously recorded by Gambaryan (1992) [3] for Milogradovskie Waterfalls (**K** collection area). Arctic-boreal Circumpolar.

Plagiochila satoi S. Hatt. – [1500], **H**. *Picea ajanensis* trunk base in subalpine *Picea* forest with green moss cover, det. H. Inoue (Gambaryan, 1984, 1992) [3,32]. Boreal East Asian.

!*Plectocolea infusca* Mitt. var. ***infusca*** – (per., ant. – cc) [800], **J** (60). Cliff crevice in a broadleaved deciduous forest. In pure mat. P-45-11-12. Temperate-subtropical East Asian.

Plectocolea ovalifolia (Amakawa) Bakalin et Vilnet – Recorded by Gambaryan (1992) [3] for Milogradovskie Waterfalls as *Plectocolea infusca var. ovalifolia* Amakawa (**K** collection area). Boreal-temperate East Asian.

!*Porella fauriei* (Steph.) S. Hatt. – [800], **J** (60). Boulder side in mixed forest, in pure mat or with *Plagiochila ovalifolia*. P-45-17-12, P-45-18-12, P-45-18a-12. Boreal-temperate Amphi-Oceanic.

!*Porella gracillima* Mitt. – [356], **J** (58). Cliff crevice in a broadleaved deciduous forest. With *Cephaloziella spinicaulis*. P-43-10-12. Boreal-temperate Asian.

!*Porella grandiloba* Lindb. – [356–800], **J** (58, 60). Cliffs in a broadleaved deciduous forest, boulder side in mixed forest. In pure mats. P-43-18-12, P-45-15-12. Temperate-subtropical East Asian.

Porella platyphylla (L.) Pfeiff – **K**. The middle course of Miligradovka River, “waterfall” (Gambaryan, 1992) [3]. Boreal-temperate Circumpolar.

!*Porella vernicosa* Lindb. – (per., spor. – s) [356–1274], **F** (20, 21), **G** (27, 28, 29), **H** (30), **I** (44, 50, 57), **J** (58). Cliffs in mixed forests, cliff ledge, *Populus maximowiczii* trunk, over mosses on *Betula* trunk, *Abies* trunk base in coniferous forests, cliffs in broadleaved deciduous forest. In pure mats or with *Frullania taradakensis*, *F. davurica*, *Metzgeria pubescens, Radula obtusiloba, Syzygiella autumnalis*. P-70-19-07, P-79-1-07, P-71-8-07, P-77-9-07, P-43-7-12, P-43-14-12, Prim-52-3-17, Prim-53-1-17, Prim-70-12-17, Prim-121-1-17, Prim-122-10-17. Temperate-subtropical East Asian.

!!!*Pseudolophozia debiliformis* (R.M. Schust. et Damsh.) Konstant. et Vilnet – (gemm. – c) [1706], **H** (31). Humus in crevice between boulders in tundra-like herb community with *Pinus pumila* thickets in environs of mountain top, with *Diplophyllum taxifolium, Douinia plicata, Marsupella emarginata, Sphenolobus saxicola, Trilophozia quinquedentata*. Prim-59-9-17. Arctic-montane Amphi-Oceanic.

Pseudolophozia sudetica (Nees ex Huebener) Konstant. et Vilnet – (gemm. – c, ant. – f) [1076–1768], **F** (16), **H** (32, 37). Humus covering boulders in niches in a belt of tundra-like vegetation and *Pinus pumila* thickets in environs of mountain top, humus covering vertical surface of rocks in thickets of *Alnus fruticosa* with young trees of *Betula lanata*, sandy soil covering boulders near streambed in mixed forest in. In pure mats or with *Diplophyllum taxifolium, Marsupella emarginata, Scapania subalpina, Sphenolobus saxicola, S. minutus*. Prim-48-8-17, Prim-59-25-17, Prim-64-25-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Snezhnaya Mt. as *Lophozia sudetica* (Nees ex Huebener) Grolle (**I** collection area). Arctic-montane Circumpolar.

Ptilidium ciliare (L.) Hampe – [539–1707], **G** (26), **H** (33). Humus with plant debris covering rocks in *Pinus pumila* thickets in environs of mountain top, rotten wood in mixed forest. In pure mats. Prim-58-3-17, Prim-60-7-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya Mt. (**H** collection area). Arctic-boreal Circumpolar.

Ptilidium pulcherrimum (Weber) Vain. – (per., spor. – f, ant. – s) [539–1839], **B** (3), **C** (8), **E** (11), **F** (16), **G** (26), **H** (34, 36, 37, 41, 42), **I** (44, 45, 48, 55). Living and decaying trunks of *Betula lanata* in thickets of *Alnus fruticosa* with young trees of *Betula lanata*, coniferous forests and mixed forests, *Pinus pumila* trunks in *Pinus pumila* thickets and coniferous forests, decaying wood in coniferous and mixed forests, rock fields with rocky outcrops in alpine belt, humus covering boulder in *Betula* forest, *Alnus fruticosa* branch and decaying wood in *Betula-Picea* forest, crevice between rocky blocks on rock field. In pure mats or with *Anastrophyllum michauxii, Barbilophozia barbata, Bazzania denudata, Blepharostoma trichophyllum* var. *trichophyllum, Douinia plicata, Fuscocephaloziopsis leucantha, Lepidozia reptans, Lophoziopsis longidens, Mylia taylorii, M. verrucosa, Sphenolobus saxicola, S. minutus, Trilophozia quinquedentata, Tritomaria exsecta*. P-71-3-07, P-72-4-07, P-75-1-07, Prim-35-1-17, Prim-40-2-17, Prim-43-1-17, Prim-48-23-17, Prim-58-5-17, Prim-61-27-17, Prim-63-10-17, Prim-64-13-17, Prim-68-5-17, Prim-69-10-17, Prim-119-4-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya and Snezhnaya Mts. (**H**, **I** collection areas). Boreal Circumpolar.

!*Radula auriculata* Steph. – [713], **F** (20). Vertical surface of rocks in mixed forest in stream valley. In pure mats. Prim-52-13-17, Prim-52-22-17. Boreal-temperate Amphi-Pacific.

Radula complanata (L.) Dumort. – (per., ant. – cc, arch., spor. – s) [539–950], **F** (20), **G** (26), **H** (43), **I** (50), **J** (60). *Abies* and *Betula* trunk bases in mixed and coniferous forests, fine-grained soil in cliff crevice in mixed forest. In pure mats, once with *Frullania takayuensis*. P-77-5-07, P-45-6-12, Prim-52-5-17, Prim-58-7-17, Prim-71-4-17. Previously recorded by Gambaryan (1992) [3] for Oblachnaya Mt. (**H** collection area). Boreal Circumpolar.

Radula constricta Steph. – **K**. Milogradovskie Waterfalls, left bank of the river (Gambaryan, 1992) [3]. Boreal-temperate East Asian.

!*Radula japonica* Gottsche ex Steph. – (arch. – cc, per. – f) [713–721], **F** (20), **G** (28). Covering wet rocks in mixed forest in stream valley. In pure mats. P-79-2-07, Prim-52-21-17. Temperate-subtropical East Asian.

Radula obtusiloba Steph. – (arch., ant. – s) [600–975], **F** (19, 20)**, G** (27), **I** (44). Vertical surface of rocks in mixed forest in stream valley. In pure mats, once with *Bazzania denudata, Cololejeunea ornata, Diplophyllum taxifolium, Metzgeria pubescens, Porella vernicosa*. P-70-14-07, P-71-14-07, Prim-51-2-17, Prim-52-15-17. Previously recorded by Gambaryan (1992) [3] for Milogradovskie Waterfalls (**K** collection area). Temperate East Asian.

!*Reboulia hemisphaerica* (L.) Raddi subsp. ***hemisphaerica*** – (arch., ant. – cc) [356–800], **J** (58, 60). Cliff crevice in a broadleaved deciduous and mixed forests. In pure mats. P-43-8-12, P-45-9-12. Multizone Multi-area.

!*Reboulia hemisphaerica* subsp. ***orientalis*** R.M. Schust. – (arch., ant. – cc, spor. – c) [356], **J** (58). Soil in the cliff cave in a broadleaved deciduous forest. In pure mat. P-43-4-12. Temperate East Asian.

!*Riccardia palmata* (Hedw.) Carruth. – [1430], **H** (41). Decaying decorticated *Acer* trunk in coniferous forest with deciduous trees admixture, with *Blepharostoma trichophyllum* s.l., *Lophocolea heterophylla, Lophozia longiflora, Mylia verrucosa, Tritomaria exsecta*. Prim-68-6-17. Boreal Circumpolar.

!*Scapania apiculata* Spruce – (gemm. – cc) [1199], **F** (15). Rotten wood in coniferous forest deciduous trees admixture, with *Lophocolea heterophylla, Mylia verrucosa, Scapania carinthiaca, Tritomaria exsecta*. Prim-47-6-17. Boreal Circumpolar.

!*Scapania carinthiaca* J.B. Jack ex Lindb. – (per., gemm. – c, ant., spor. – f) [721–1199], **F** (15), **G** (28), **I** (44). Rotten or decaying wood in coniferous forest deciduous trees admixture, with *Lophocolea heterophylla, Mylia verrucosa, Scapania apiculata, Tritomaria exsecta*. P-79-9-07, P-71-6-07, Prim-47-6-17. Boreal Circumpolar.

!*Scapania crassiretis* Bryhn – (gemm. – cc) [600–1765], **F** (22, 23), **G** (27, 29), **H** (36), **I** (48, 53). Humus covering rocks in a belt of rock fields with dwarf-shrub-lichen tundra spots and *Pinus pumila* thickets in environs of mountain top and in mixed forest in stream valley. In pure mats or with *Bazzania tricrenata, Calycularia laxa, Cephalozia bicuspidata, Conocephalum salebrosum, Solenostoma obscurum, S. pseudopyriflorum*. P-70-24-07, P-75-17-07, P-39-9-14, Prim-51-4-17, Prim-54-1-17, Prim-55-2-17, Prim-63-7-17, Prim-122-7-17. Arctic-montane Circumpolar.

!*Scapania diplophylloides* Amakawa et S. Hatt. – (per., ant. – cc) [1199], **F** (15). Humus covering vertical surface of rock in coniferous forest with deciduous trees admixture. With *Tritomaria exsecta*. Prim-47-3-17. Arctic-boreal East Asian.

!*Scapania irrigua* (Nees) Nees – (gemm. – f) [1649–1839], **H** (31, 34, 38). Humus covering boulder in temporary streambed in *Betula lanata* forest, soil wall around small pond at the bottom of a rock field hill, humus covering rocks in niche in environs of mountain top. In pure mats or with *Pellia neesiana, Schistochilopsis incisa, Solenostoma obscurum*. P-45-11-12*, Prim-61-12-17*, Prim-65-1-17. Arctic-boreal Circumpolar.

Scapania microdonta (Mitt.) Müll.Frib – (gemm. – f) [1483–1657], **E** (12, 13), **I** (44, 46, 52). Niche between boulders on a rock field with *Pinus pumila* clumps in environs of the mountain top. In pure mats or with *Anastrophyllum michauxii, Bazzania denudata, Marsupella tubulosa, Metzgeria furcata, Scapania sphaerifera, Sphenolobus saxicola, S. minutus*. P-72-12-07, P-73-7-07, P-38-2-14, Prim-44a-3-17, Prim-45-9-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya and Snezhnaya Mts. (**H**, **I** collection areas) as *Macrodiplophyllum microdontum* (Mitt.) Perss. Arctic-montane Eurasian.

!*Scapania mucronata* H. Buch – [1706–1839], **H** (31, 34, 36). Covering rocks in a small niche in swampy *Pinus pumila* thickets on N-facing slope, soil wall around small pond at the bottom of rock field hill in subapical part of the mountains, humus covering rocks in *Pinus pumila* thickets on mountain top. With *Diplophyllum albicans, D. taxifolium, Cephaloziella divaricata, Plagiochila porelloides, Schistochilopsis incisa, Trilophozia quinquedentata*. Prim-59-4-17, Prim-61-3-17, Prim-63-12-17. Arctic-boreal Circumpolar.

!*Scapania parvifolia* Warnst. – (per. – cc) [1768], **H** (37). *Sphagnum* debris in thickets of *Alnus fruticosa* with young trees of *Betula lanata*. As small admixture to *Schistochilopsis* aff. *incisa* with *Diplophyllum taxifolium, Lophozia ventricosa, Trilophozia quinquedentata, Tritomaria exsecta*. Prim-64-

8-17. Arctic-boreal Circumpolar.

!*Scapania parvitexta* Steph. – [1076], **F** (16). Humus covering boulder near streambed in mixed forest, with *Lophozia* cf. *ventricosa, Marsupella emarginata*. Prim-48-15-17. Boreal-temperate East Asian.

!!!*Scapania praetervisa* Meyl. – (gemm. – cc, arch. – f) [1706–1839], **H** (31, 34, 35). Humus covering rocks and once on soil in animal hole in a belt of rock fields with dwarf-shrub-lichen tundra spots and thickets of *Pinus pumila* and *Alnus fruticosa* on mountain top and its environs. In pure mats or with *Gymnomitrion parvitextum, Herbertus aduncus*. Prim-59-2-17, Prim-61-4-17, Prim-62-7-17. Arctic-montane Circumpolar.

!*Scapania sphaerifera* H. Buch et Tuom. – (gemm. – cc, per. – s) [975–1798], **E** (13), **H** (32, 33, 34, 35, 36), **I** (46, 52). Humus covering boulders and rocks in niches and crevices in a belt of rock fields with dwarf-shrub-lichen tundra spots and thickets of *Pinus pumila* on mountain tops and its environs. In pure mats or with *Barbilophozia barbata, Bazzania* cf. *parabidentula, Diplophyllum taxifolium, Douinia plicata, Gymnomitrion parvitextum, Herbertus dicranus, Marsupella emarginata, M. tubulosa, Scapania microdonta, Sphenolobus saxicola, S. minutus, Trilophozia quinquedentata*. P-73-6-07, P-38-7-14, Prim-45-10-17, Prim-59-11-17, Prim-60-9-17, Prim-61-8-17, Prim-62-9-17, Prim-63-9-17. Arctic-montane Eurasian.

Scapania subalpina (Nees ex Lindenb.) Dumort. – (gemm. – c, ant. – f) [604–1100], **F** (16, 24), **I** (49). Humus, sandy soil and plant debris covering boulders near stream in mixed forests, boulder in temporary streambed in *Betula* forest, once on decaying log in a streambed. In pure mats or with *Marsupella emarginata, Scapania* cf. *ligulata, Pseudolophozia sudetica*. P-76-16-07, Prim-48-2-17, Prim-56-1-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya Mt. (**H** collection area). Arctic-boreal Circumpolar.

!*Scapania undulata* (L.) Dumort. – (gemm. – f, ant., per. – s) [780–1076], **F** (16), **I** (44, 48, 50, 53). Sandy soil covering boulder in a streambed, boulder near stream in mixed forest, over boulders in coniferous forest, in *Betula-Picea* forest. In pure mats. P-71-2-07, P-75-2-07, P-77-1-07, P-39-3-14, Prim-48-5-17. Arctic-boreal Circumpolar.

!*Schistochilopsis cornuta* (Steph.) Konstant. – (per. – c, gemm. – f) [809–1199], **F** (15, 18), **I** (53, 57). Humus covering vertical surface of rock and rotten wood in coniferous forest with deciduous trees admixture, rotten wood in mixed forest. In pure mats or with *Blepharostoma trichophyllum* s.l., *Calypogeia integristipula, Fuscocephaloziopsis lunulifolia, F. leucantha, Mylia verrucosa, Tritomaria exsecta*. P-39-22-14, Prim-47-1-17, Prim-50-4-17, Prim-121-4-17. Temperate East Asian.

!*Schistochilopsis incisa* (Schrad.) Konstant. – (per., gemm. – f, ant., arch., spor. – s) [741–1839], **F** (14, 17, 22), **H** (31, 33, 34, 35, 36, 37, 40), **I** (47, 48). Humus covering rocks in a belt of rock fields with thickets of *Pinus pumila* and *Alnus fruticosa* on mountain top and its environs, in *Betula-Alnus* crooked forest, rotten wood in coniferous forest with deciduous trees admixture, cliffs in *Betula-Picea* forest. In pure mats or with *Bazzania denudata, B. tricrenata, Blepharostoma trichophyllum* s.l.*, Cephalozia bicuspidata, C. otaruensis, Cephaloziella divaricata, Diplophyllum albicans, D. sibiricum, D. taxifolium, Douinia plicata, Fuscocephaloziopsis leucantha, F. lunulifolia, Gymnomitrion parvitextum, Lepidozia reptans, Lophozia guttulata, L. silvicola, L. silvicoloides, L. ventricosa, Lophoziopsis* cf. *longidens, Marsupella emarginata, Mylia taylorii, M. verrucosa, Scapania* cf. *irrigua, S. mucronata, Sphenolobus saxicola, Tritomaria exsecta*. P-74-17-07, P-75-21-07, Prim-46-8-17, Prim-49-1-17, Prim-54-4-17, Prim-59-3-17, Prim-60-5-17, Prim-61-30-17, Prim-62-6-17, Prim-63-15-17, Prim-64-17-17, Prim-67-3-17. Arctic-boreal Circumpolar.

!*Solenostoma obscurum* (A. Evans) R.M. Schust. – (per. – cc, ant. – f) [741–1649], **F** (16, 22), **H** (38). Humus covering vertical surface of rocks and boulders in *Betula lanata* and mixed forests, with

Bazzania tricrenata, Blepharostoma trichophyllum s.l.*, Conocephalum salebrosum, Mesoptychia heterocolpos, Lophocolea sp., Lophozia lantratoviae, Marsupella emarginata, Pellia neesiana, Scapania crassiretis, S. irrigua, Solenostoma pseudopyriflorum, Trilophozia quinquedentata*. Prim-48-6-17, Prim-54-1-17, Prim-65-1-17, Prim-65-1a-17, Prim-65-3-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya Mt. and Milogradovskie Waterfalls (**H**, **K** collection areas) as *Plectocolea obovata* (Nees) Mitt. Arctic-boreal Amphi-Oceanic.

!*Solenostoma pseudopyriflorum* Bakalin et Vilnet – (per. – cc, ant. – c, spor. – s, gemm. – r) [694–1768], **E** (11), **F** (16, 17, 22), **G** (28, 29), **H** (37), **I** (44, 47, 48, 49, 53), **J** (60). Humus covering rocks in mixed forests and in thickets of *Alnus fruticosa* with young trees of *Betula lanata*, cliffs, over boulder in coniferous forest. In pure mats or with *Calycularia laxa, Calypogeia muelleriana, Cephalozia* sp.*, Conocephalum salebrosum, Diplophyllum sibiricum, D. taxifolium, Fuscocephaloziopsis lunulifolia, F. leucantha, Lophozia lantratoviae, L. silvicoloides, Marsupella emarginata, Metacalypogeia cordifolia, Plagiochila ovalifolia, Scapania crassiretis, Solenostoma obscurum, Trilophozia quinquedentata*. P-79-4-07, P-71-10-07, P-74-7-07, P-74-8-07, P-75-20-07, P-76-22-07, P-39-13-14, Prim-43-3-17, P-45-13-12, Prim-48-6-17, Prim-49-3-17, Prim-54-2-17, Prim-64-2-17, Prim-122-8-17. The report of *Solenostoma rishiriense* Amakawa by Gambaryan (1984, 1992) [3,32] for Snezhnaya Mt. (**I** collection area) presumably belongs to this species (cf. Bakalin, Vilnet, 2009) [4]. Boreal-temperate East Asian.

Sphenolobus minutus (Schreb.) Berggr. – (per. – f, spor. – s, gemm. – r) [1404–1839], **C** (8), **E** (12), **F** (14), **H** (32, 33, 34, 35, 36, 37). Humus covering rocks and boulders in a belt of rock fields with dwarf-shrub-lichen tundra spots and *Pinus pumila* thickets on mountain tops and its environs, *Betula lanata* trunk base in thickets of *Alnus fruticosa* with young trees of *Betula lanata*. In pure mats or with *Anastrophyllum michauxii, Barbilophozia barbata, Bazzania denudata, Diplophyllum taxifolium, Douinia plicata, Gymnomitrion parvitextum, Herbertus buchii, Lepidozia reptans, Lophozia silvicola, Lophoziopsis longidens, Marsupella emarginata, Mylia taylorii, Pseudolophozia sudetica, Ptilidium pulcherrimum, Scapania microdonta, S. sphaerifera, Sphenolobus saxicola, Trilophozia quinquedentata, Tritomaria exsecta*. Prim-40-7-17, Prim-44a-3-17, Prim-46-5-17, Prim-59-22-17, Prim-60-9-17, Prim-61-5-17, Prim-62-10-17, Prim-63-4-17, Prim-64-14-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Snezhnaya Mt. (**I** collection area) as *Sphenolobus minutus* var. *grandis* (Gottsche ex Lindb.) Jørg., but we do not accept the taxonomic status of this variety and treat it within *S. minutus* s.l. Arctic-boreal Circumpolar.

Sphenolobus saxicola (Schrad.) Steph. – [1500–1839], **E** (12, 13), **H** (31, 32, 33, 34, 35, 36), **I** (45, 46, 52, 55). Humus covering rocks and boulders in niches in a belt of rock fields with dwarf-shrub-lichen tundra spots and *Pinus pumila* thickets on mountain tops and its environs. In pure mats or with *Barbilophozia barbata, Bazzania denudata, B.* cf. *parabidentula, B. tricrenata, Diplophyllum taxifolium, Douinia plicata, Herbertus dicranus, Lophozia silvicola, L. ventricosa, Lophoziopsis excisa, Marsupella emarginata, Pseudolophozia debiliformis, P. sudetica, Ptilidium pulcherrimum, Scapania microdonta, S. sphaerifera, Schistochilopsis incisa, Sphenolobus minutus, Trilophozia quinquedentata, Tritomaria exsecta*. P-72-13-07, P-73-1-07, P-38-2-14, Prim-44a-2-17, Prim-45-3-17, Prim-59-6-17, Prim-60-11-17, Prim-61-2-17, Prim-62-5-17, Prim-63-1-17, Prim-119-2-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya and Snezhnaya Mts. (**H**, **I** collection areas). Arctic-boreal Circumpolar.

Syzygiella autumnalis (DC.) K.Feldberg, Váňa, Hentschel et J. Heinrichs – (per. – cc, ant. – f) [356–1000], **F** (20), **I** (50, 51), **J** (58). Humus covering rocks, fine-grained soil in cliff crevice in mixed forest, decaying wood in coniferous forest, cliff in broadleaved deciduous forest. In pure mats or with *Porella vernicosa*. P-77-8-07, P-78-7-07, P-43-19-12, Prim-52-3-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya Mt. and Milogradovskie Waterfalls (**H**, **K** collection areas) as *Crossogyna autumnalis* (DC.) Schljakov. Temperate Circumpolar.

!*Targionia hypophylla* L. – (spor. – c) [356–513], **A** (1), **J** (58). Humus covering rocks near stream in mixed forest, cliff cave in a broadleaved deciduous forest. In pure mats. P-43-6-12, Prim-33-1-17. Multizone Multi-area.

!*Trilophozia quinquedentata* (Huds.) Bakalin – (ant. – s) [1430–1839], **H** (31, 34, 37, 38, 40, 41). Humus with plant debris covering rocks in thickets of *Alnus fruticosa* with young trees of *Betula lanata*, in belt of rock fields with dwarf-shrub-lichen tundra spots and *Pinus pumila* thickets on mountain tops and its environs, in coniferous and *Betula lanata* forests. In pure mats or with *Barbilophozia barbata, Blepharostoma trichophyllum* s.l.*, Bazzania denudata, Calycularia laxa, Cephalozia otaruensis, Conocephalum salebrosum, Diplophyllum taxifolium, Douinia plicata, Fuscocephaloziopsis lunulifolia, Mesoptychia heterocolpos, Lophocolea heterophylla, Lophozia lantratoviae, L. ventricosa, Mylia verrucosa, Marsupella emarginata, Pseudolophozia debiliformis, Ptilidium pulcherrimum, Scapania mucronata, S. parvifolia, S. sphaerifera, Sphenolobus saxicola, S. minutus, Solenostoma obscurum, S. pseudopyriflorum, Plagiochila porelloides, Tritomaria exsecta*. Prim-59-9-17, Prim-61-3-17, Prim-64-3-17, Prim-65-3-17, Prim-67-4-17, Prim-68-4-17. Arctic-boreal Circumpolar.

Tritomaria exsecta (Schmidel ex Schrad.) Schiffn. ex Loeske – (gemm. – cc, ant. – r) [721–1839], **C** (8), **E** (13), **F** (14, 15, 19), **G** (28), **H** (33, 34, 40, 41, 42), **I** (45, 48, 49, 57), **J** (60). Rotten wood in different types of coniferous forests, in thickets of *Alnus fruticosa* with young trees of *Betula lanata*, once on *Picea* trunk base in coniferous forest, decaying wood, boulder in temporary streambed in *Betula* forest, cliff in mixed forest. In pure mats or with *Anastrophyllum michauxii, Barbilophozia barbata, Bazzania denudata, B. parabidentula, Blepharostoma trichophyllum* s.l.*, Calycularia laxa, Calypogeia suecica, Cephalozia otaruensis, Cephaloziella rubella, Diplophyllum taxifolium, Douinia plicata, Frullania appendiculata, Fuscocephaloziopsis leucantha, F. lunulifolia, Herbertus buchii, Lepidozia reptans, Lophocolea heterophylla, Lophozia guttulata, L. longiflora, L. silvicola, L. ventricosa, Lophoziopsis excisa, Marsupella tubulosa, Metzgeria lindbergii, Mylia taylorii, M. verrucosa, Ptilidium pulcherrimum, Radula* sp.*, Riccardia palmata, Scapania apiculata, S. carinthiaca, S. diplophylloides, S. parvifolia, Schistochilopsis incisa, S. cornuta, Sphenolobus saxicola, S. minutus, Trilophozia quinquedentata*. P-72-7-07, P-75-16-07, P-76-14-07, P-79-10-07, P-45-7-12, Prim-40-2-17, Prim-45-1-17, Prim-46-13-17, Prim-47-3-17, Prim-51-1-17, Prim-60-11-17, Prim-64-8-17, Prim-67-2-17, Prim-68-1-17, Prim-69-7-17, Prim-121-4-17. Previously recorded by Gambaryan (1984, 1992) [3,32] for Oblachnaya Mt. (**H** collection area). Boreal Circumpolar.

Excluded taxa

Anomylia cuneifolia (Hook.) R.M. Schust. – reported by Gambaryan (1992) [3] for Milogradovskie Waterfalls, excluded from Russian flora (Konstantinova, Bakalin *et al.*, 2009).

Bazzania bidentula (Steph.) Steph. – excluded from Russian flora, all records provided by Gambaryan (1984, 1992) [3,32] were transferred to *B. parabidentula* (cf. Bakalin, 2016) [7].

Frullania bolanderi Austin – excluded, all previous reports from Russian Asia including the Primorye Territory (Gambaryan, 1984, 1992; Bakalin, 2008b) [3,14,32] presumably belong to the recently described *F. austinii* (cf. Mamontov *et al.*, 2020) [73].

Lophoziopsis jurensis (Meyl. ex Müll. Frib.) Mamontov et Vilnet – as *Lophozia jurensis* Meyl. ex Müll. Frib was reported by Gambaryan (1984, 1992) [3,32] for Oblachnaya Mt., excluded from the flora of the southern part of the Russian Far East. The report is a misidentification of *Lophoziopsis excisa* (Rev. V.A. Bakalin, 2022).

Plectocolea obovata (Nees) Mitt. (=*Solenostoma obovatum* (Nees) C. Massal.) – reported by Gambaryan (1984, 1992) [3,32] for Oblachnaya Mt. and Milogradovskie Waterfalls, however, we excluded this species (vouchers not seen) for the geographical reasons. “True” *Solenostoma obovatum*

occurs in Europe and possibly North America, but has been totally replaced in Pacific Asia by *S. subellipticum*. Moreover, even *S. subellipticum* does not grow southward of the 50th latitude in Pacific Asia (Bakalin, 2010). The provided records (Gambaryan, 1984, 1992) [3,32] may belong to *S. obscurum* or other species.

Solenostoma rishiriense Amakawa – excluded from Russian flora, all records made by Gambaryan (1984, 1992) [3,32] for the park territory presumably belong to *S. pseudopyriflorum* Bakalin et Vilnet (cf. Bakalin, Vilnet, 2009) [4].