

LIVERWORTS OF THE ALGAMA RIVER BASIN (TOKINSKY STANOVIK RANGE,  
SOUTH-EASTERN YAKUTIA)

ПЕЧЕНОЧНИКИ БАССЕЙНА РЕКИ АЛГАМА (ХРЕБЕТ ТОКИНСКИЙ СТАНОВИК,  
ЮГО-ВОСТОЧНАЯ ЯКУТИЯ)

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Abstract

An annotated list of liverworts of the Algama River Basin is presented (the Tokinsky Stanovik Range). It includes 69 species, 45 of them are recorded for the Tokinsky Stanovik Range for the first time. *Cephalozia pachycaulis* and *Mylia taylorii* were found in Yakutia only in this area. Information on habitat, substrates, reproductive system and associated species is provided. The liverwort flora for the Tokinsky Stanovik Range currently totals 77 species.

Резюме

Приводится список печеночников бассейна р. Алгама (хребет Токинский Становик), включающий 69 видов, из них 45 видов приводятся впервые для флоры хребта. *Cephalozia pachycaulis* и *Mylia taylorii* выявлены в Якутии только в этом районе. В списке для каждого вида указаны местообитания, субстрат, наличие органов размножения и сопутствующие виды. В настоящее время флора печеночников хребта Токинский Становик насчитывает 77 видов.

KEYWORDS: Hepatics, flora, ecology, Algama River, Tokinsky Stanovik Range, Southeastern Yakutia.

INTRODUCTION

This paper considers liverworts of the upper reaches of the Algama River where the river crosses the Tokinsky Stanovik Range (55°–56°N and 129°10'–129°41'E). Landscapes of the study area are typical for mountain taiga territories of the Far East with the monsoon climate and also for continental taiga regions of permafrost region. Because of the remoteness of the settlements the Tokinsky Stanovik Range is still poorly studied. The Utuk River basin, for example, counts only fragmentary data on 32 species (Stepanova *et al.*, 1995). I had an opportunity to collect liverworts while rafting down the Algama River in July, 2000. Some results were published (Sofronova, 2001, 2010, 2012, 2013, Biodiversity..., 2010). About 140 samples were collected in the river basin at the following areas: 1. the mouth of the Kolbochi Creek; 2. the mouth of the Artyk-1 Creek; 3. the mouth of the Tarynnakh River; 4. the mouth of the Artyk-2 River; 5. the mouth of the Chaydakh River; 6. middle reach of the Tuksani River (the right tributary of the Algama River) 7. headwaters of the Karayalag River (right tributary of the Tuksani River) (Fig. 1 and Table 1).

STUDY AREA, GEOLOGY, CLIMATE, VEGETATION

The studied area is located in the extreme southeast of Yakutia. The Tokinsky Stanovik Range is the highest south-eastern part of the Stanovoy Range. The highest peak (mountain Skalistyj Golets) is 2412 m above sea level.

The Range has a horst and graben structure. The total cooling of the climate during the Pleistocene led to its glaciation and development by the mountain-valley type. As a result of glacial activity and erosion under tectonic activity the modern alpine terrain type of the Range has been developed. The range is composed mostly of Achaean felsic crystalline rocks: granitoids, gneisses, also there are calciphyre and marble lenses. Anorthosites appear in outcrops as well as basalts and tuffs related to Quaternary volcanism. The climate of the Tokinsky Stanovik Range can be characterized as moderate continental, very cold and super-humid. The average annual air temperature is -4.0°C, precipitation sum is about 800 mm per year, most of it in the summer. Snow depth is more than over 80 cm. The studied area belongs to the zone of discontinuous permafrost distribution. The permafrost is located on the most blown uplands of watersheds in the tundra belt and also on the windward slopes mainly on the northwestern side (Biodiversity..., 2010).

The bottom side of the slope is occupied by a belt of larch forests and open woodlands (*Larix cajanderi* Mayr) on podsolc and humus soils and taiga podburs. The ayan spruce forest (*Picea ajanensis* (Lindl. et Gord.) Fisch. ex Carr.) forms tree layer continuum on steep slopes (20-45°) of different exposures, though to a lesser degree on gentle slopes at the foot of mountains or in floodplains with abundant moisture and excellent drainage on brown

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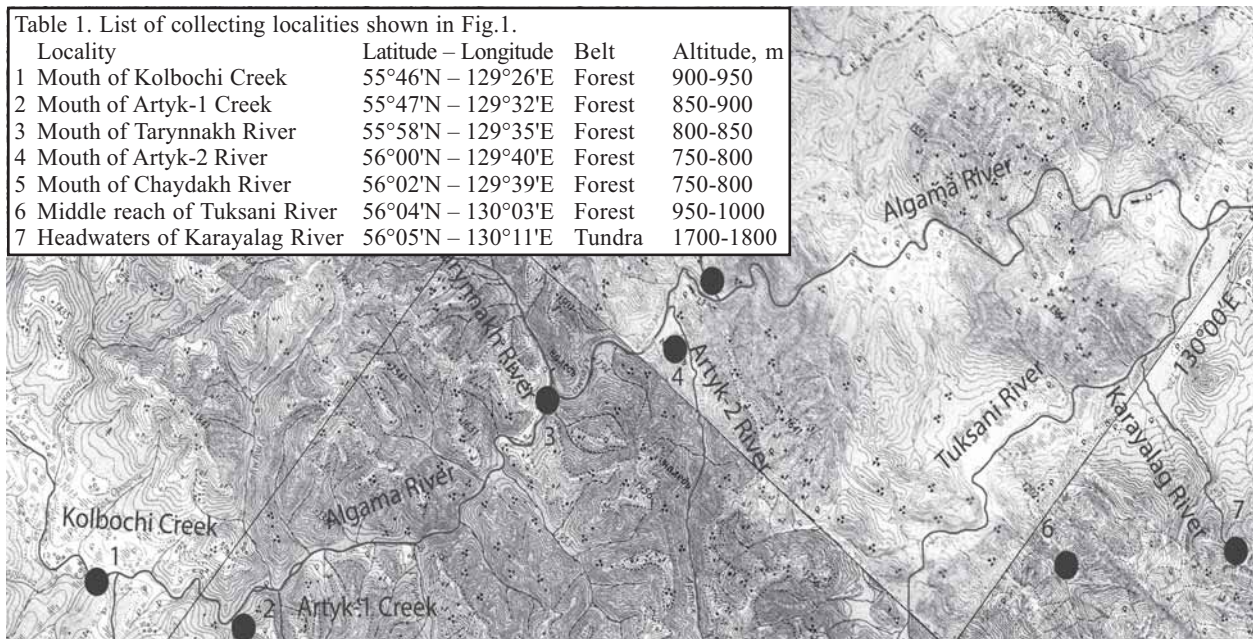


Fig. 1. The Algama River area, indicating collecting localities, cf. also Table 1.

soils. At the edge of the forest belt in ecotopes similar to ayan spruce forests, stone birch forest (*Betula lanata* (Regel) V. Vassil.) grows at snowy and humus-rich soils. Forest line is at an altitude 1300-1600 m above sea level. Bald-shrub (subalpine) belt is above the forest belt with dominating shrubs on podzolic humus soils and podburs. The baseline plant here is Siberian dwarf pine (*Pinus pumila* (Pall.) Regel). The tundra belt extends above from 1700 m with predominance of mountainous tundra on the tundra podburs, stone fields, rocks.

#### ANNOTATED LIST OF SPECIES

Nomenclature follows Potemkin & Sofronova (2009). Data include information on the presence of reproductive structures, using the following abbreviations: gyn. – gynoecia, andr. – androecia; per. – perianthia, spor. – sporophytes, gem. – gemmae. Collecting localities (1-7) are recorded, elevation range is given in parentheses and habitats are listed, including coordinates and elevation for each site and collection number. The samples collected by K.A. Volotovskiy are marked by letter "V". Habitats are characterized and associated hepatic species are cited. Specimens are deposited in SASY.

*Anastrophyllum michauxii* (F. Weber) H. Buch – 3: spruce forest, on rotting wood (TC-00-58), with *Myliia taylorii*, *Lophozia longiflora*, *Sphenolobus minutus*. 18.VII.2000.

*Aneura pinguis* (L.) Dumort. – 3: spruce forest, on soil in shallow temporary brook (TC-00-54,56), with *Scapania crassiretis*, *Blepharostoma trichophyllum*, *Plagiochila porelloides*. 18.VII.2000.

*Anthelia juratzkana* (Limpr.) Trevis. (gyn., andr.: parocious) – 5: willow on aufeis glade, on fine soil (TC-00-93,94), with *Cephaloziella elegans*, *Scapania hyperborea*. 23.VII.2000; 7: bank of the stream on plateau over the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-120,122-

124,126-128,130), with *Anthelia juratzkana*, *Marsupella boeckii*, *M. emarginata*, *Pleurocladula albescens*, *Lophozia sudetica*, *Nardia geoscyphus*, *Schistochilopsis opacifolia* and other. 31.VII.2000.

*Arnellia fennica* (Gottsche) Lindb. – 6: spruce forest, on soil (TC-00-102), with *Preissia quadrata*, *Blepharostoma trichophyllum*; (TC-00-105), with *Leiocolea heterocolpos*, *Sphenolobus minutus*, *Tritomaria exsecta*. 29.VII.2000.

*Barbilophozia barbata* (Schmidel ex Schreb.) Loeske (per.) – 2: spruce forest, on rotting wood (TC-00-35), with *Lophozia longidens*, *Tritomaria exsectiformis*; on stone (TC-00-38), with *Tritomaria quinquedentata*, *Sphenolobus saxicola*. 15.VII.2000; 4: *Chosenia* forest, on the bark of poplar (TC-00-79), with *Plagiochila porelloides*, *Blepharostoma trichophyllum*. 21.VII.2000.

*Blasia pusilla* L. – 1: shingle, on sand between rocks (TC-00-14), with *Solenostoma confertissimum*, *Scapania irrigua*. 11.VII.2000.

*Blepharostoma trichophyllum* (L.) Dumort. – 1-4,6,7: larch forest, spruce forest, *Chosenia* forest, rock outcrops in forest belt, bank of the stream in glacial cirque in the tundra belt; on soil, rotting wood, on the bark of poplar, stones covered with humus (TC-00-16,17,19,20,27,42-44,46,56,57,63-66,68-71,79,80,102-104,106,116,120,130), usually with *Anthelia juratzkana*, *Calypogeia integristipula*, *Cephalozia bicuspidata*, *Plagiochila porelloides*, *Sphenolobus minutus*, *Tritomaria exsecta* and other.

*Calypogeia integristipula* Steph. (spor.) – 2,3: larch forest, spruce forest, rock outcrops in forest belt; on stones covered with humus, soil, rotting wood (TC-00-34,36,42-44,46-50,60,62-64,71), with *Blepharostoma trichophyllum*, *Cephalozia* ssp., *Diplophyllum* ssp., *Lepidozia reptans*, *Lophozia* ssp., *Sphenolobus minutus*, *Tritomaria* ssp. and other.

*C. muelleriana* (Schiffn.) Müll. Frib. – 1: larch forest, on *Sphagnum* (TC-00-05), rotting wood (TC-00-07). 9.VII.2000;

- on *Sphagnum* (TC-00-12), with *Lophozia* cf. *ventricosa* var. *uliginosa*, *Cephaloziella rubella*. 11.VII.2000; 7: bank of the stream on plateau over the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-119), with *Cephalozia bicuspidata*, *Scapania scandica*. 31.VII.2000.
- Cephalozia bicuspidata* (L.) Dumort. (spor.) – 1-7: larch forest, spruce forest, *Sphagnum* bog, banks of rivers and streams in forest belt, bank of the stream on plateau over the tarn and flowing out of the tarn in the tundra belt, rock outcrops in forest belt; on soil, rotting wood, stones covered with humus (TC-00-19,30,31,39,40,46,61,63,64,67,68,71,74,75,83,85,96,97,99,116-119,120,126-129), with *Anthelia juratzkana*, *Blepharostoma trichophyllum*, *Lepidozia reptans*, *Pleurocladula albescens*, *Scapania* ssp., *Schistochilopsis* ssp., *Sphenolobus minutus*, *Tritomaria exsecta* and others.
- C. pachycaulis* R.M. Schust. (gem.) – 7: bank of the stream flowing out of the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-117), with *Cephalozia bicuspidata*. 31.VII.2000.
- C. pleniceps* (Austin) Lindb. – 2: spruce forest, on rotting wood (TC-00-37), with *Lepidozia reptans*, *Ptilidium pulcherrimum*; larch forest, on soil (TC-00-47), with *Calypogeia integristipula*, *Lophozia* cf. *ventricosa* var. *uliginosa*, *Sphenolobus minutus*. 15.VII.2000; 7: bank of the stream on plateau over the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-129-131), with *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Pleurocladula albescens*, *Schistochilopsis opacifolia* and other. 31.VII.2000.
- Cephaloziella arctogena* (R.M. Schust.) Konstant. (spor.: paroicous) – 1: larch forest, on rotting wood (TC-00-13). 11.VII.2000.
- C. elegans* (Heeg) Schiffn. (gem., gyn., andr., spor.: paroicous) – 4: bank of the river, on soil (TC-00-84). 21.VII.2000; 5: willow on aufeis glade, on fine soil (TC-00-93), with *Anthelia juratzkana*, *Scapania hyperborea*. 23.VII.2000.
- C. rubella* (Nees) Warnst. (per.) – 1: larch forest, on *Sphagnum* (TC-00-11,12), with *Lophozia* cf. *ventricosa* var. *uliginosa*, *Calypogeia muelleriana*. 11.VII.2000.
- C. spinigera* (Lindb.) Warnst. (per., andr.: autoecious) – 6: *Sphagnum* bog, on soil in shallow temporary brook (TC-00-100), with *Orthocaulis kunzeanus*, *Mylia anomala*. 29.VII.2000.
- Diplophyllum obtusifolium* (Hook.) Dumort. (per.: paroicous) – 3: spruce forest, on rotting wood (TC-00-68), with *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Lepidozia reptans*, *Sphenolobus minutus*, *Tritomaria exsecta*; on stones covered with humus (TC-00-71), with *Blepharostoma trichophyllum*, *Calypogeia integristipula*, *Cephalozia bicuspidata*, *Lepidozia reptans*, *Tritomaria exsecta*. 18.VII.2000.
- D. taxifolium* (Wahlenb.) Dumort. (gem.) – 2,3: spruce forest, rock outcrops in forest belt; on stones covered with humus, rotting wood, fine soil (TC-00-42,43,52,53,61,63,64,69), usually with *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Calypogeia integristipula*, *Tritomaria* ssp. and others.
- Frullania bolanderi* Austin (gem.) – 2: spruce forest, on the bark of stone birch (TC-00-135), with *Frullania koponenii*. 15.VII.2000.
- F. davurica* Hampe – 1: rock outcrops, on stone (V: TC-00-26), with *Metzgeria pubescens*. 12.VII.2000.
- F. koponenii* S. Hatt. (gyn.) – 2: spruce forest, on the bark of stone birch (TC-00-136), with *Frullania bolanderi*. 15.VII.2000.
- Gymnocolea inflata* (Huds.) Dumort. (per., andr., spor.) – 4: bank of the river, on rotting wood (TC-00-81), with *Scapania irrigua*, *S. paludicola*. 21.VII.2000; 5: bank of the stream, on soil (TC-00-96,97), with *Cephalozia bicuspidata*, *Nardia geoscyphus*, *Scapania* ssp.; in water of creek near the icefield, on stone (TC-00-88,89), with *Scapania crassiretis*. 23.VII.2000.
- Gymnomitron concinnatum* (Lightf.) Corda – 7: rock outcrops in glacial cirque in the tundra belt, on stones covered with humus (TC-00-107), with *Marsupella emarginata*. 31.VII.2000.
- Jungermannia exsertifolia* Steph. subsp. *cordifolia* (Dumort.) Váňa – 7: bank of the stream flowing out of the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-115), with *Scapania crassiretis*. 31.VII.2000.
- Leiocolea heterocolpos* (Thed. ex C. Hartm.) H. Buch (gem., andr.) – 1,6: spruce forest, rock outcrops; on soil, stones covered with humus, rotting wood (TC-00-27,29,103-106), usually with *Blepharostoma trichophyllum*, *Odontoschisma macounii*, *Sphenolobus minutus*, *Tritomaria* ssp. and others.
- Lepidozia reptans* (L.) Dumort. – 2,3: spruce forest; on rotting wood, soil under stone, stones covered with humus (TC-00-36,37,57,63-65,67,68,71), usually with *Blepharostoma trichophyllum*, *Calypogeia integristipula*, *Cephalozia* ssp., *Diplophyllum* ssp. and others.
- Lophozia longidens* (Lindb.) Macoun (gem.) – 2: spruce forest, on rotting wood (TC-00-35), with *Barbilophozia barbata*, *Tritomaria exsectiformis*. 15.VII.2000; 3: larch forest, on rotting wood (V-TC-00-51). 18.VII.2000.
- L. longiflora* (Nees) Schiffn. (= *L. guttulata* (Lindb. et Arnell) A. Evans) (gem.) – 3: spruce forest, on rotting wood (TC-00-58,60,64), with *Anastrophyllum michauxii*, *Calypogeia integristipula*, *Mylia taylorii*, *Schistochilopsis incisa*, *Sphenolobus minutus* and other. 18.VII.2000.
- L. sudetica* (Nees ex Huebener) Grolle (gem.) – 7: bank of the stream on plateau over the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-130), with *Anthelia juratzkana*, *Blepharostoma trichophyllum*, *Cephalozia pleniceps*, *Pleurocladula albescens*, *Schistochilopsis opacifolia*. 31.VII.2000.
- L. cf. ventricosa* (Dicks.) Dumort. var. *ventricosa* (per., andr., gem.) – 2: spruce forest, on soil (TC-00-36,39), with *Lepidozia reptans*, *Calypogeia integristipula* or *Cephalozia bicuspidata*. 15.VII.2000; 4: bank of the river, on soil (TC-00-87), with *Scapania mucronata*, *Tritomaria exsectiformis*. 21.VII.2000.
- L. cf. ventricosa* var. *uliginosa* Breidl. ex Schiffn. (gem., per., spor.) – 1,2: larch forest, rock outcrops in the forest belt; on soil, stones covered with humus, *Sphagnum* (TC-00-06,12,16,18,20,21,47,49), usually with *Blepharostoma trichophyllum*, *Calypogeia* ssp., *Sphenolobus* ssp. and others.
- Mannia pilosa* (Hornem.) Frye et L. Clark (spor.) – 6: rock outcrops in the forest belt, on fine soil (V-TC-00-136).



- 4.VIII.2000.
- Marchantia latifolia* Gray (andr., gyn.) – 3: burnt-out larch forest with willow herb, on soil (TC-00-137). 19. VII.2000.
- Marsupella boeckii* (Austin) Kaal. – 7: bank of the stream on plateau over the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-120,122,123), with *Anthelia juratzkana*, *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Marsupella emarginata*, *Pleurocladula albescens*.
- M. emarginata* (Ehrh.) Dumort. (andr.) – 3,7: rock outcrops in the forest belt, rock outcrops in glacial cirque in the tundra belt, bank of the stream flowing out of the tarn in the tundra belt, bank of the stream on plateau over the tarn in the tundra belt; on stones covered with humus, soil in shallow temporary brook, rotting wood in stream (TC-00-73,107,109,110,112,118,120), usually with *Cephalozia bicuspidata*, *Marsupella boeckii*, *Pleurocladula albescens*, *Tritomaria quinquedentata* and others.
- Metzgeria pubescens* (Schrank) Raddi – 1: rock outcrops in the forest belt, on stone (V: TC-00-25,26), with *Frullania davurica*; on stones covered with humus (TC-00-27,28), with *Blepharostoma trichophyllum*, *Leiocolea heterocolpos*, *Plagiochila porelloides*, *Sphenolobus minutus*, *Tritomaria* ssp. 12.VII.2000.
- Mylia anomala* (Hook.) Gray – 6: *Sphagnum* bog, on soil in shallow temporary brook (TC-00-100), with *Cephaloziella spinigera*, *Orthocaulis kunzeanus*. 29.VII.2000.
- M. taylorii* (Hook.) Gray (per., andr., gem.) – 3: spruce forest, on rotting wood (TC-00-58), with *Anastrophyllum michauxii*, *Lophozia longiflora*, *Sphenolobus minutus*. 18.VII.2000.
- Nardia geoscyphus* (De Not.) Lindb. – 5: bank of the stream, on soil (TC-00-97,98), with *Gymnocolea inflata*, *Cephalozia bicuspidata*, *Scapania* ssp. 23.VII.2000; 7: bank of the stream on plateau over the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-126-128), with *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Pleurocladula albescens*, *Scapania mucronata*, *Schistochilopsis opacifolia*. 31.VII.2000.
- Odontoschisma macounii* (Austin) Austin – 6: spruce forest, on soil (TC-00-103,104), with *Blepharostoma trichophyllum*, *Leiocolea heterocolpos*, *Sphenolobus minutus*, *Tritomaria exsecta*; on rotting wood (TC-00-106), with *Blepharostoma trichophyllum*, *Leiocolea heterocolpos*, *Sphenolobus minutus*, *Tritomaria exsecta*, *T. quinquedentata*. 29.VII.2000.
- Orthocaulis kunzeanus* (Huebener) H. Buch – 6: *Sphagnum* bog, on soil in shallow temporary brook (TC-00-100), with *Cephaloziella spinigera*, *Mylia anomala*. 29.VII.2000.
- Pellia* cf. *endiviifolia* (Dicks.) Dumort. – 6: Rock outcrops in the forest belt, on fine soil (V-TC-00-133). 4.VIII.2000.
- Plagiochila porelloides* (Torrey ex Nees) Lindenb. – 1: rock outcrops in the forest belt, on stones covered with humus (TC-00-23,24,27,29), with *Blepharostoma trichophyllum*, *Leiocolea heterocolpos*, *Metzgeria pubescens*, *Scapania scandica*, *Sphenolobus minutus*, *Tritomaria* ssp. 12.VII.2000; 3: spruce forest, on soil in shallow temporary brook (TC-00-56), with *Aneura pinguis*, *Blepharostoma trichophyllum*, *Scapania crassiretis*. 18.VII.2000; 4: chosenia forest, on the bark of poplar (TC-00-79,80), with *Barbilophozia barbata*, *Blepharostoma trichophyllum*, *Ptilidium ciliare*, *Tritomaria quinquedentata*. 21.VII.2000.
- Pleurocladula albescens* (Hook.) Grolle – 7: bank of the stream on plateau over the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-120-124,126,129,130), with *Anthelia juratzkana*, *Blepharostoma trichophyllum*, *Cephalozia* ssp., *Marsupella* ssp., *Nardia geoscyphus*, *Schistochilopsis opacifolia* and other. 31.VII.2000.
- Preissia quadrata* (Scop.) Nees (andr., spor.) – 6: spruce forest, on soil (TC-00-102), with *Arnellia fennica*, *Blepharostoma trichophyllum*. 29.VII.2000; rock outcrops in forest belt, on fine soil (V-TC-00-132). 4.VIII.2000.
- Ptilidium ciliare* (L.) Hampe – 1: larch forest, on soil (TC-00-04). 9.VII.2000; larch forest, on soil (TC-00-15). 11.VII.2000; 2: aufeis glade, shrubby cinquefoil community, on soil (TC-00-32); on the rocks beneath boulders (TC-00-33). 14.VII.2000; 4: *Chosenia* forest, on the bark of poplar (TC-00-80), with *Blepharostoma trichophyllum*, *Plagiochila porelloides*, *Tritomaria quinquedentata*. 21.VII.2000.
- P. pulcherrimum* (Weber) Vain. (per., spor.) – 1: larch forest, on soil (TC-00-08). 9.VII.2000; rock outcrops in the forest belt, on rotting wood (TC-00-22). 12.VII.2000; 2: spruce forest, on rotting wood (TC-00-37), with *Lepidozia reptans*, *Cephalozia pleniceps*; larch forest, on soil (TC-00-46), with *Blepharostoma trichophyllum*, *Calypogeia integristipula*, *Cephalozia bicuspidata*, *Sphenolobus minutus*. 15.VII.2000; 3: spruce forest, on rotting wood (TC-00-59). 18.VII.2000; spruce forest, on the bark of spruce (TC-00-72). 19.VII.2000.
- Scapania crassiretis* Bryhn (gem., andr.) – 1,3,5,7: larch forest, spruce forest, rock outcrops in glacial cirque in the tundra belt, bank of the stream, in the water creek near the icefield, bank of the stream flowing out of the tarn in the tundra belt; on stone and stones covered with humus, on soil in shallow temporary brook, on soil, on rotting wood (TC-00-19,30,55,56,89,96,98,109-111,113,115), usually with *Blepharostoma trichophyllum*, *Cephalozia bicuspidata*, *Gymnocolea inflata*, *Marsupella emarginata*, *Scapania* ssp. and other.
- S. curta* (Mart.) Dumort. (gem., per.) – 5: bank of the stream, on soil (TC-00-97), with *Gymnocolea inflata*, *Nardia geoscyphus*, *Cephalozia bicuspidata*, *Scapania paludicola*. 23.VII.2000; 7: bank of the stream flowing out of the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-113), with *Scapania crassiretis*. 31.VII.2000.
- S. hyperborea* Jørg. (gem.) – 5: willow on aufeis glade, on fine soil (TC-00-91-93), with *Anthelia juratzkana*, *Cephaloziella elegans*. 23.VII.2000.
- S. irrigua* (Nees) Nees (per., andr.) – 1: shingle, on sand between the rocks (TC-00-14), with *Blasia pusilla*, *Solenostoma confertissimum*. 11.VII.2000; 4: bank of the river, on rotting wood (TC-00-81), with *Gymnocolea inflata*, *Scapania paludicola*. 21.VII.2000.
- S. kaurinii* Ryan – 7: bank of the stream on plateau over the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-125). 31.VII.2000.
- S. microdonta* (Mitt.) Müll. Frib. – 2: rock outcrops in forest belt, on stones covered with humus (TC-00-41,45), with

- Sphenolobus saxicola*, *Tritomaria quinquedentata*. 15.VII.2000; 3: rock outcrops in forest belt, on rotting wood (TC-00-75), with *Cephalozia bicuspidata*; on fine soil (TC-00-77,78), with *Sphenolobus saxicola*. 19.VII.2000.
- S. mucronata* H. Buch (gem.) – 3: spruce forest, on rotting wood (TC-00-69), with *Blepharostoma trichophyllum*, *Diplophyllum taxifolium*, *Schistochilopsis incisa*, *Sphenolobus minutus*, *Tritomaria exsecta*. 18.VII.2000; 4: bank of the river, on soil (TC-00-85-87), with *Cephalozia bicuspidata*, *Tritomaria exsectiformis*. 21.VII.2000; 7: bank of the stream on plateau over the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-128), with *Anthelia juratzkana*, *Cephalozia bicuspidata*, *Nardia geoscyphus*. 31.VII.2000.
- S. paludicola* Loeske et Müll. Frib. – 4: bank of the river, on rotting wood (TC-00-81,83), with *Cephalozia bicuspidata*, *Gymnocolea inflata*, *Scapania irrigua*. 21.VII.2000; 5: willow on aufeis glade, on fine soil (TC-00-90,95); bank of the stream, on soil (TC-00-97), with *Cephalozia bicuspidata*, *Gymnocolea inflata*, *Nardia geoscyphus*, *Scapania curta*. 23.VII.2000.
- S. rufidula* Warnst. – 7: bank of the stream flowing out of the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-114), with *Scapania cf. subalpina*, *Tritomaria quinquedentata*. 31.VII.2000.
- S. scandica* (Arnell et H. Buch) Macvicar (gem., per., andr., spor.) – 1: rock outcrops in forest belt, on stones covered with humus (TC-00-21,23), with *Lophozia cf. ventricosa* var. *uliginosa*, *Plagiochila porelloides*, *Sphenolobus minutus*, *Tritomaria quinquedentata*. 12.VII.2000; 2: spruce forest, on soil (TC-00-40), with *Cephalozia bicuspidata*. 15.VII.2000; 7: bank of the stream on plateau over the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-119), with *Calypogeia muelleriana*, *Cephalozia bicuspidata*. 31.VII.2000.
- S. sphaerifera* H. Buch et Tuom. (gem.) – 1: rock outcrops, on fine soil among the rocks (TC-00-01), with *Sphenolobus minutus*, *S. saxicola*. 9.VII.2000.
- S. cf. subalpina* (Nees ex Lindenb.) Dumort. – 7: bank of the stream flowing out of the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-110,114), with *Marsupella emarginata*, *Scapania* ssp., *Solenostoma hyalinum*, *Tritomaria quinquedentata*. 31.VII.2000.
- Schistochilopsis incisa* (Schrad.) Konstant. – 3: spruce forest, on rotting wood (TC-00-57,60,64,69), with *Blepharostoma trichophyllum*, *Calypogeia integristipula*, *Lepidozia reptans*, *Lophozia longiflora*, *Sphenolobus minutus*, *Tritomaria exsecta* and others; on stones covered with humus (TC-00-61), with *Cephalozia bicuspidata*, *Diplophyllum taxifolium*, *Sphenolobus minutus*. 18.VII.2000.
- S. obtusa* (Lindb.) Potemkin – 6: outputs rocks in the forest belt, on soil (V-TC-00-134). 4.VIII.2000.
- S. opacifolia* (Culm. ex Meyl.) Konstant. – 7: bank of the stream on plateau over the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-127,130,131), with *Anthelia juratzkana*, *Blepharostoma trichophyllum*, *Cephalozia* ssp., *Nardia geoscyphus*, *Pleurocladula albescens* and other. 31.VII.2000.
- Solenostoma confertissimum* (Nees) Schljakov – 1: shingle, on sand between rocks (TC-00-14), with *Blasia pusilla*, *Scapania irrigua*. 11.VII.2000.
- S. hyalinum* (Lyell) Mitt. (per.) – 7: bank of the stream flowing out of the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-110,112), with *Marsupella emarginata*, *Scapania crassiretis*, *S. cf. subalpina*; bank of the stream on plateau over the tarn in the tundra belt, on soil in shallow temporary brook (TC-00-131), with *Cephalozia pleniceps*, *Schistochilopsis opacifolia*. 31.VII.2000.
- Sphenolobus minutus* (Schreb.) Berggr. (per., andr., spor.) – 1-3,6: larch forest, spruce forest, *Sphagnum* bog, rock outcrops in forest belt; on soil, fine soil, stones covered with humus, rotting wood (TC-00-01-03,06,09,10,17,20,23,24,27-29,46,47,49,53,57,58,61,63,65,66,69,70,74,101,104-106), usually with *Blepharostoma trichophyllum*, *Cephalozia* ssp., *Leiocolea heterocolpos*, *Lophozia* ssp., *Metzgeria pubescens*, *Plagiochila porelloides*, *Scapania* ssp., *Sphenolobus saxicola*, *Tritomaria* ssp. and others.
- S. saxicola* (Schrad.) Steph. – 1-3: larch forest, spruce forest, rock outcrops in forest belt; on soil, stone, stones covered with humus, fine soil among rocks (TC-00-01-03,06,09,38,45,76,78), usually with *Scapania microdonata*, *Sphenolobus minutus*, *Tritomaria quinquedentata* and others.
- Tetralophozia setiformis* (Ehrh.) Schljakov – 7: rock outcrops in glacial cirque in the tundra belt, on stones covered with humus (TC-00-108). 31.VII.2000.
- Tritomaria exsecta* (Schmidel ex Schrad.) Schiffn. ex Loeske (gem., andr.) – 1,3,6: spruce forest, rock outcrops in forest belt, bank of the stream; on rotting wood, stones covered with humus, soil (TC-00-27,30,57,63,64,67-69,103-106), usually with *Blepharostoma trichophyllum*, *Calypogeia integristipula*, *Cephalozia bicuspidata*, *Lepidozia reptans*, *Sphenolobus minutus*, and others.
- T. exsectiformis* (Breidl.) Loeske (gem.) – 2: spruce forest, on rotting wood (TC-00-35), with *Barbilophozia barbata*, *Lophozia longidens*. 15.VII.2000; 4: bank of the river, on soil (TC-00-86,87), with *Scapania mucronata*. 21.VII.2000.
- T. quinquedentata* (Huds.) H. Buch (per., andr., spor.) – 1-4,6,7: larch forest, spruce forest, chosenia forest, rock outcrops in forest belt, rock outcrops in glacial cirque in the tundra belt, bank of the stream flowing out of the tarn in the tundra belt; on soil, stones covered with humus, fine soil, rotting wood, bark of poplar (TC-00-23,24,27-29,38,42,45,49,76,80,106,109,114,116,118), with *Barbilophozia barbata*, *Blepharostoma trichophyllum*, *Calypogeia integristipula*, *Cephalozia bicuspidata*, *Leiocolea heterocolpos*, *Plagiochila porelloides*, *Scapania* ssp., *Sphenolobus* ssp., *Tritomaria exsecta* and others.

## DISCUSSION

The basin of the Algama River at the Tokinsky Stanovik Range is an extremely hard-to-reach area of Yakutia. As rafting on a mountain river took a long time, the material was collected mainly in the forest belt. Only in the sampling area № 7 (headwaters of the Karayalag River) samples were collected in the tundra belt in the glacial cirque at an altitude of about 1700 m above sea level. 69 species were found in total, including 45 new to the Tok-

insky Stanovik Range. Those are mainly common, widespread species: *Aneura pinguis*, *Blasia pusilla*, *Cephalozia bicuspidata*, *C. pleniceps*, *Plagiochila porelloides*, *Scapania irrigua*, *S. mucronata*, *Tritomaria exsectiformis* and others. However, two species (*Cephalozia pachycaulis*, *Mylia taylorii*) were found in Yakutia only in this area. *Cephalozia pachycaulis* is mainly distributed in Siberia, the Far East of Russia and the Khamar-Daban Range (Konstantinova *et al.*, 2004). *Mylia taylorii* is sporadically distributed through Russian Far East but in southern Siberia occurs only in rather humid mountain areas (Potemkin & Sofronova, 2009). A number of species were formerly revealed in Yakutia only in the tundra and southern Yakutia: *Marsupella boeckii*, *Nardia geoscyphus*, *Pleurocladula albescens*, *Scapania curta*. These species are absent not only in the lowland central areas but also in the Verkhoyansk Mountain Range in the northeast of the country. They probably avoid areas with extreme continental and dry climate. Such species as *Anastrophyllum michauxii*, *Frullania bolanderi*, *F. davurica*, *F. koponenii*, *Lepidozia reptans*, *Mylia taylorii* are found mainly in dark coniferous forests in South Yakutia. Revealed species of *Scapania* (*Scapania hyperborea*, *S. kaurinii*, *S. rufidula*, *S. sphaerifera*) disjunctively are found in Yakutia disjunctively in all mountain areas. *Scapania sphaerifera* is included in the Red Data Book of the Russian Federation (2008).

At present the liverwort flora of the Tokinsky Stanovik Range numbers 77 species. This area provides a link between the alpine flora of the Far East and South Siberia. Therefore, the actual number of species will undoubtedly exceed this level.

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