

CONTRIBUTION TO THE LIVERWORT FLORA OF ALASKA

К ФЛОРЕ ПЕЧЕНОЧНИКОВ АЛЯСКИ

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Abstract

The annotated list of liverworts collected by the expedition to Southern Alaska in 1992 counts 113 species and one subspecies, including *Cephalozia hamatiloba* and *Nardia pacifica* new to Alaska. *Scapania obscura* is reported for Alaska with reference to the specimen for the first time. The data on the flora of the three studied boroughs were significantly expanded to include 59 species new to Matanuska-Susitna, 51 species new to Anchorage and 20 species new to Kenai. New localities for numerous phylogeographic interesting and/or poorly known species are reported. The distribution of species recently described from Alaska, as well as some poorly studied, mainly amphipacific species, is characterized.

Резюме

Приводится аннотированный список печеночников, собранных на Аляске в ходе экспедиции в 1992 году. Список включает 113 видов и один подвид, в том числе новые для Аляски *Cephalozia hamatiloba* и *Nardia pacifica*. *Scapania obscura* впервые указывается для Аляски со ссылкой на образец. Значительно дополнены списки известных печеночников для трех административных районов Аляски. Список района Матануска-Суситна увеличился на 59 видов, Анкориджа – на 51 видов и Кенаи – на 20 вида. Выявлены новые местонахождения для многочисленных фитогеографически интересных, редких и малоизученных таксонов. Характеризуется распространение недавно описанных с Аляски видов, а также мало изученных, преимущественно амфипацифических видов.

KEYWORDS: liverworts, Alaska, distribution, phytoecography, amphipacific species

INTRODUCTION

In 1992, Diana G. Horton organized a small expedition to Alaska. Initially, three persons were planned to participate: Diana G. Horton, her student Terry O'Brien and I. However, after learning about the planned expedition, Rudolf M. Schuster wanted to take part in it. Collecting liverworts in North America mainly in their eastern part, Schuster was very interested in the liverworts of the west coast of the continent and joined our small group in Chicago, from where we flew to Anchorage. The route and the gathering places were planned by D. Horton in advance and only slightly adjusted in the course of the trip when discussing with Schuster. The work was carried out from June 29 to July 8 1992 in southern Alaska in Matanuska-Susitna (MS), Anchorage (AN) and Kenai (KE) boroughs (Fig. 1). Some of the most interesting discoveries including newly described species were published soon after the field trip. In total, as a result of studying the collected specimens, three new species were described, namely *Cephalozia pachycaulis* R.M.Schust. (Schuster, 1993), *Apotreubia hortoniae* Konstant. (*Apotreubia hortoniae* R.M.Schust. & Konstant. nom. inval., Schuster & Konstantinova, 1995, Konstantinova *et al.*, 2013), *Gymnomitrium mucrophorum* R.M. Schust.

(Schuster, 1995). However, the identification of the entire collection has not yet been completed. This year, I have finally completed the identification of all specimens collected by me. As a result, the lists of species of the three boroughs in Alaska were significantly expanded.

The results of previous bryological research have been summarized in a recently published checklist of liverworts of Alaska (Söderström *et al.*, 2015). Of the investigated by us areas Matanuska-Susitna Borough and Anchorage Borough were shown in this paper among the least explored regions of Alaska with 22 and 35 species respectively. The list of species from the Kenai Borough included 82 species (Söderström *et al.*, 2015). Data below significantly supplement the lists of liverworts known for three studied boroughs and gives us a better idea of the distribution of liverworts in Alaska including some worldwide rare and amphipacific species.

MATERIAL AND METHODS

In total, about 200 specimens were collected by myself. The collecting localities are grouped and are shown on the map as eleven groups, I–XI (Fig.1).

The coordinates of the gathering places were determined by D. Horton based on maps and sent to the participants of the expedition immediately after returning.

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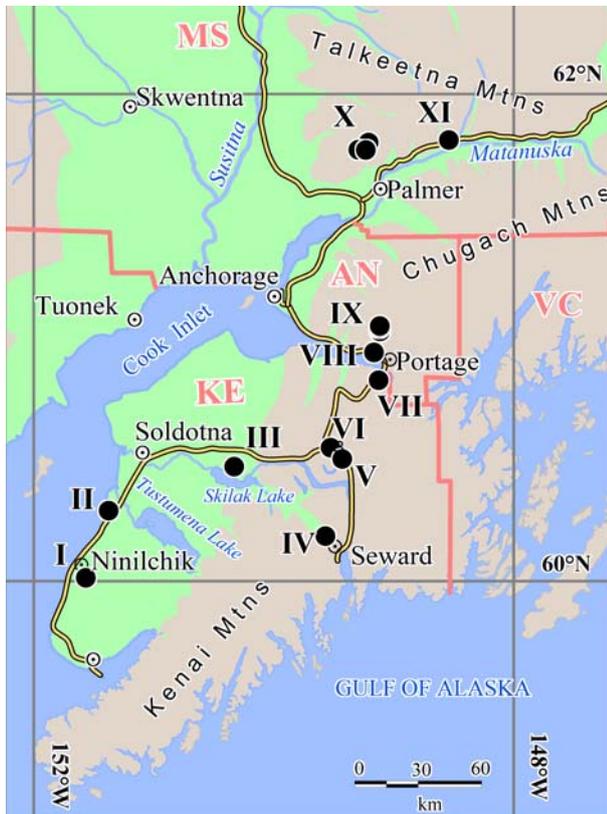


Fig. 1 Collecting localities shown as eleven groups, I-XI in Table 1.

A small part of the specimens were studied by myself just on return to Iowa City at the herbarium of University of Iowa City. In particular, I have studied oil-bodies in some specimens. However, most of the specimens were later identified in the laboratory of the Polar-Alpine Botanical Garden-Institute (Kirovsk, Murmansk Province) in 1993-1994, but the results were not published. In the course of recent work, I have identified the rest of the collected specimens and restudied some questionable specimens, as well as specimens from genera and species whose taxonomy has been revised after 1995. However, some of the specimens have not yet been accurately identified due to the absence of the necessary structures: oil-bodies, gametangia, gemmae, etc. In some cases, such species are given in the list with the "cf." sign, or not listed at all. These are mainly *Cephaloziella*, *Solenostoma*, *Nardia*, and *Lophozia* species.

The specimens are deposited in the Herbarium of Polar-Alpine Botanical Garden-Institute of the Kola Scientific Center, Russian Academy of Sciences (KPABG) and its unformation system, available at <https://isling.org/hepatics>.

STUDY AREA

We gathered bryophytes in nine main sites in the Kenai-Chugach mountain system (sites III – IX), two sites (X – XI) in Talkeetna Mountains (Alaska Range) and two sites (I – II) on the coastal plain of Cook Inlet (Fig. 1, 2). All sites are situated within the Southern Alaska Sector of Alaska-Yukon Province (Jorgensen &

Table 1. List of collecting localities shown also in Fig. 1.

- I. 4.4 mi E of Hwy 1 in Ninilchik on Oilwell Road, 60°02'N, 150°35'W, 125 m a.s.l., open intermediate fen with islands of *Picea mariana* (Mill.) Britton, Sterns & Poggenburg.
- II. Coast of Cook Inlet Area between Ninilchik and Soldotna, 59°27'N, 151°42'W, 60–120 m a.s.l., different types of *Sphagnum* bogs.
- III. South end of Engineer Lake, 8.3 mi SE on Skilak Lake road from Hwy 1, E of Soldotna, 60°27'N, 150°20'W, 130 m a.s.l., fen developing via terrestrialization along lake margin, rich fen with *Myrica* sp., *Betula nana* L., *Menyanthes* sp., *Carex livida* Willd., *C. chordorrhiza* Ehrh., *Scorpidium* sp., etc.
- IV. Resurrection River crossing 7.4 mi W of Hwy. 9 on road to Exit Glacier, 60°11'N, 149°35'W, 120 m a.s.l., steep slope with N&W aspect, siliceous outcrops with *Picea sitchensis* (Bong.) Carrière, *Oplopanax horridus* (Sm.) Miq.
- V. Trail to N end of Carter Lake, Hwy. 9 between Hwy. 1 and town of Moose Pass, 60°30'N, 149°30'W, 150–490 m a.s.l., steep slope with N aspect, streams, siliceous outcrops with *Tsuga mertensiana* (Bong.) Carrière, *Picea sitchensis*, *Duschekia sinuata* (Regel) Pouzar, alpine meadow with grasses, *Anemone narcissiflora* L., *Lupinus* sp.
- VI. Steep slope near the turn to Seward. Dry steep cliffs overgrown with *Tsuga mertensiana*, *Picea sitchensis*, *Populus balsamifera* Mill. and *Oplopanax horridus*, *Alnus crispa* Pursh with plots of *Sphagnum*, rocks, seepages, 60°33'N, 149°32'W. On peat soil in shade under bushes, in crevices and on dry rocks.
- VII. Chugach Mts, 4.5 km South of Ingram Creek crossing on Hwy. 1 south of Portage, along Ingram Creek, 60°50'N, 149°05'W, intermediate and poor fens bordered above and below by *Picea sitchensis* forest.
- VIII. Chugach Mts., west of Portage, 60°50'N, 149°05'W, 60 m a.s.l., on slope, *Picea sitchensis* forest bordering intermediate fen.
- IX. Chugach Mts, Chugach State Park, Crow Pass Trail, Eagle River: 1 – 61°01'32"N, 149°6'52"W; 2 – 61°2'23"N, 149°7'17"W, 800–900 m a.s.l.; 3 – 61°2'51"N, 149°6'57"W, stream bank, late snow bed, 950–1075 m a.s.l.
- X. Talkeetna Mts: 1 – Archangel Creek valley, slopes SE of Sidney Creek, NNW of Palmer (61°48'N, 149°13'W), ca. 1000 m a.s.l.; 2 – Hatcher Pass, SW of Independence Mine State Historical Park, NNW of Palmer (61°46'N, 149°18'W), ca. 1100–1200 m a.s.l., siliceous outcrops on tundra slopes with E aspect, frost boils, seepages and streams, late snow bed; 3 – near Archer Pass, NW of Palmer (61°48'N, 149°13'W), ca. 1000 m a.s.l.
- XI. Talkeetna Mts: S face of Castle Mtn., NW of Chikaloon, 61°50'N, 148°33'W, along small stream with seasonal fluctuation in water level: dense *Salix* shrubs.

Meidinger, 2015). The Kenai-Chugach mountain system borders the Gulf of Alaska in a peculiar arc, separated from the Talkeetna Mountains in the north by the valley of the Matanuska River. The average elevation of the Kenai Mountains is 900 to 1,500 meters, whereas the Chugach group is higher, averaging 2,100 to 2,400 meters. The mountains are extremely rugged and heavily glaciated. The underlying rocks of the Kenai-Chugach



Fig. 2. Members of the expedition. R. Schuster (the first on the left), T. O'Brien (third from the left), two local botanists, and D. Horton (the first on the right), the organizer and sponsor of this field trip to Alaska, the enthusiastic bryologist and wonderful persons, to whom author dedicated this paper.

Mountain system being primarily marine sediments and of volcanic origin, have been intensely metamorphosed, folded, and faulted and have been intruded by small to moderate-size igneous bodies. The Talkeetna Mountains consist of a compact group of radial ridges averaging from 1,800 to 2,700 meters in elevation. Small glaciers are still present at the heads of many valleys in the Talkeetna. The bedrock consists of granite batholith that intruded during the Mesozoic. Paleozoic and Mesozoic sediments and volcanics are exposed on the flanks of the highlands (Nowacki *et al.*, 2001). The climate in south central Alaska can be characterized as continental subarctic – *Dfc* according to the Köppen–Geiger climate classification system (https://en.wikipedia.org/wiki/Köppen_climate_classification) due to its short, cool summers. According to Bioclimatic zonation based on continentality and growing degree days it is referred to subcontinental-Cool Boreal. This is in large part due to its proximity to the coast. The majority of the studied sites are situated in the Maritime ecoregion (coastal Rainforests subdivision particularly) and four sites are located in the boreal region with two sites (I and II) located in the Cook Inlet Basin area and two (X and XI) in the Alaska Range Transition (Nowacki *et al.*, 2001).

ANNOTATED LIST OF SPECIES

The annotated list of liverworts includes 113 species and one subspecies. The species in the list are arranged in alphabetical order. The nomenclature of liverworts generally follows Söderström *et al.* (2016) except for *Apopellia endiviifolia*, *Marchantia quadrata* subsp. *hyperborea*, *Protochilopsis grandiretis* and *Pseudomoerckia blyttii* which have been published recently. After the species name the presence of reproductive structures is given in parentheses (andr. – androecia; gyn. – gynoecia; per. – perianths or pseudoperianths; spor. – sporophytes; gem. – gemmae). The collecting sites are listed

in Tabl. 1. Habitat characteristics are given for sporadic and widespread species, and at least one reference to a herbarium number in the Cryptogamic Russian Information System – L. / CRIS (<https://isling.org/hepatics>) is cited. For species collected from 1–2 (3) localities, labels are given in full and the herbarium numbers of specimens in the Herbarium of Polar-Alpine Botanical Garden-Institute (KPABG) are specified.

Anastrophyllum assimile (Mitt.) Steph. (per.) – X(1), 1000 m a.s.l.: rock outcrops in dwarf shrub tundra, several specimens [123828]; 2, 1200 m a.s.l.: siliceous outcrops on tundra slopes with E aspect, deep cleft, several specimens [123855]. **New to MS.**

Aneura pinguis (L.) Dumort. – II, 125 m a.s.l., dwarf shrub – *Equisetum*-moss mire with hummocks, between hummocks [123913]; IX, 1070 m a.s.l.: rich vegetation below snow field along the stream, on bank of stream. **New to AN, KE.**

Anthelia juratzkana (Limpr.) Trevis. – IX(1,2), 950 m a.s.l.: rock outcrop, wet crevices among small rocks, dry cliffs near the trail, in crevices [123751]; X(1), 1000 m a.s.l.: rock outcrops in dwarf shrub tundra, several specimens [123829]; X(2), 1200 m a.s.l.: siliceous outcrops on tundra slopes with E aspect, deep cleft, several specimens [123885]. **New to AN, MS.**

Apopellia endiviifolia (Dicks.) Nebel & D.Quandt [*Pellia endiviifolia* (Dicks.) Dumort.] – V, 490 m a.s.l.: in alpine meadow with grasses, *Anemone narcissiflora*, *Lupinus* sp. [124324].

Apotreubia nana (S.Hatt. et Inoue) S.Hatt. & Mizut. (*Apotreubia hortoniae* R.M.Schust. & Konstant.) – X(1), 1000 m a.s.l.: rock outcrops in dwarf shrub tundra, in tundra, several specimens including the type of *Apotreubia hortoniae* [115280]. As was recently shown by Bakalin & Vilnet (2017) *A. hortoniae*, *A. nana* and *A. yunnanensis* do not differ genetically, which allowed the authors (l.c.) to synonymize these species.

Asterella lindenberiana (Corda ex Nees) Lindb. – IX (2), 950 m a.s.l.: on slope to the stream, associated with *Diplophyllum taxifolium*, *Cephalozia bicuspidata*, *Fuscocephalozia albescens*, *Calycularia laxa* [123762]; X(2): late snow bed

- community, some thalli in mats dominated by *Scapania curta* with admixture of *Pellia neesiana*, *Schistochilopsis opacifolia*, *Barbilophozia hatcheri* [123873]. **New to AN.**
- Barbilophozia hatcheri* (A.Evans) Loeske (gem.) – V, IX(3), X(1,2): on peat soil in shade under bushes, in crevices and on dry rocks on soil and rocks in *Salix* thickets along streams. In alpine tundra meadow, late snow bed [123943]. **New to AN, MS.**
- B. lycopodioides* (Wallr.) Loeske – VI: seepages, on peat soil in shade under bushes [123943].
- B. sudetica* (Nees ex Huebener) L.Söderstr., De Roo & Hedd. (per., andr., gem.) – VI, VIII, IX(1,3), X(1,2), 60–1200 m. a.s.l.: on rocks, fine earth, soil at base of slope, on cliffs, on rock outcrops, on sandy soil on edge of tundra communities, on and between boulders, in crevices on boulders in fields of large boulders, on soil and rocks in *Salix* thickets along streams, mostly in tundra zone [123751]. **New to MS.**
- Blepharostoma trichophyllum* (L.) Dumort. s.l. (per., andr., spor.) – II, V, VII, VIII, IX (2,3), X (1,2), 60–1200 m a.s.l.: on soil and soil covered cliff, in clefts in a field of large boulders, on peat soil on banks of streams, in rich vegetation below snowfields, on sides of hummocks in intermediate and poor fens, on cliffs near waterfalls, in small caves near the water on banks, on rotting wood in moist forests [123932]. One of the most common species. **New to AN, MS.** *B. trichophyllum* was recently split into several sibling species (Bakalin & al., 2020) whose separation based on morphology is extremely difficult and we did not revise the collected specimens of this species.
- Calycularia laxa* Lindb. & Arnell (andr., arch) – IV, VI, X(1,2), 120–1200 m a.s.l.: between boulders on steep slopes, on peat soil in shade under bushes, in alpine tundra meadow on slope to the stream, late snow bed, under *Sphagnum* turf on boulder, in deep caves, shade, on soil-covered rocks. Not rare but always mixed with other liverworts [123796].
- Calypogeia azurea* Stotler & Crotz – VIII, 60 m a.s.l.: on rotting wood in thickets, mixed with *Lophozia guttulata*, *Riccardia palmata*, *Fuscocephaloziopsis lunulifolia* [124319]. **New to AN.**
- C. integristipula* Steph. – II, V, VII, VIII, X(2), 60–1200 m a.s.l.: on peat soil in small depressions, on paths in intermediate and poor fens, on roots of *Picea sitchensis* in moist forests bordered fens, on rotting wood, peat, under hummock in dwarf shrub – *Sphagnum* bogs, on soil in alpine meadow, along seepages on slopes near late snow melt [123960]. **New to AN, KE, MS.**
- C. neesiana* (C.Massal. & Carestia) Müll.Frib. – II, 125 m a.s.l.: *Sphagnum* bog, on hummock in *Dicranum* turf mixed with *Fuscocephaloziopsis lunulifolia* and *Mylia anomala* [123897].
- C. sphagnicola* (Arnell & J.Perss.) Warnst. & Loeske – II, III: dwarf shrub – *Equisetum*-moss with hummocks mire, on side of hummock, three specimens, mixed with *Aneura pinguis*, *Cephaloziella* sp. [123905, 123906], *Cephalozia bicuspidata* [123913]; III: between *Sphagnum*, on hummock [76-4-92]. **New to KE.**
- Cephalozia ambigua* C.Massal. – IX(3), X(1,2), 950–1200 m a.s.l.: on soil on banks of stream, in late snow beds, on peat soil covered rocks on tundra slopes, in dwarf shrub tundra [123776]. **New to AN, MS.**
- C. bicuspidata* (L.) Dumort. (per., andr., spor.) – II, III, V, VI, VII, VIII, IX, X(1,2), 60–1200 m a.s.l.: on peat soil and among mosses on side or between hummocks in microdepressions in intermediate and poor fens, on rotting wood and on roots of *Picea sitchensis* in moist forests, on soil covered cliff, in crevices of rocks on slopes, on cliffs near waterfalls, on peat, under hummock in late snow bed, on soil and rocks in *Salix* thickets along streams, in wet crevices among small rocks, on slope to the streams, on banks of streams, on and between boulders in alpine tundra meadows, often along trails and paths. One of the commonest species [123900]. **New to AN, MS.**
- C. hamatiloba* Steph. [*Cephalozia otaruensis* Steph.] – V: on side of trail in moist spruce-moss forest with *Lophozia wenzelii* [124290]. **New to Alaska.**
- Cephaloziella hampeana* (Nees) Schiffn. ex Loeske – III: between hummocks [124293] among mosses (*Calliergon*).
- C. spinigera* (Lindb.) Warnst. – III: between hummocks, in water mixed with *Cephalozia bicuspidata*, *Mylia anomala*, *Gymnocolea inflata*, *Fuscocephaloziopsis lunulifolia* [124295]. **New to KE.**
- Chiloscyphus pallescens* (Ehrh. ex Hoffm.) Dumort. var. *fragilis* (Roth) Müll.Frib. – IX: bank of river, in *Salix* thickets along creek, mixed with *Scapania subalpina*, *Pellia neesiana* [123918].
- Clevea hyalina* (Sommerf.) Lindb. (spor.) – VIII, 60 m a.s.l.: cliffs near waterfall, on soil covered cliff, single thalli among mosses and single shoots *Solenostoma obovatum* [123930]; IX (900 m a.s.l.): irrigated bed of stream below snowfield, on moist soil (mixed with *Blepharostoma trichophyllum*, *Solenostoma obovatum*, *Mesoptychia gillmanii* [123770]). **New to AN.**
- Conocephalum salebrosum* Szweyk., Buczk. & Odrzyk. – IX: along rivulet on peat soil, in pure mats [123754]; X:1(1000 m a.s.l.): on soil in grasses on bank of rivulet, in pure mats [123830]. **New to AN, MS.**
- Diplophyllum albicans* (L.) Dumort. (per.) – IV, V, X, 120–1200 m a.s.l.: on soil between boulders on steep slopes with siliceous outcrops, in crevice on rock, in clefts in a field of large boulders, on rock outcrops in dwarf shrub tundra, on and under rocks in alpine tundra meadows, along rivulets on peat soil, most collections from Talkeetna mountains [123827]. **New to KE, MS.**
- D. taxifolium* (Wahlenb.) Dumort. – II, IV, VI, VII, IX, X(2), 60–1200 m a.s.l.: on and under rocks on steep slopes, at base of dry steep cliffs, on cliffs in thickets of *Alnus*, ferns, on rock outcrops in dwarf shrub tundra, on soil in crevices and ledges of cliffs, in clefts in a field of large boulders, in alpine tundra meadow, *Harimonella*-lichen tundra, small caves near the water, in intermediate and poor fens, on peat in dwarf shrub-*Sphagnum* bog. **New to MS.**
- Douinia imbricata* (M.Howe) Konstant. & Vilnet – VI, IX, X(1,2,3), 1000–1200 m a.s.l.: on rocks in deep moist clefts, crevices, ledges in rock outcrops in tundras, a fields of large boulders, in alpine tundra meadow, late snow bed, under *Sphagnum* turf on boulders [123846]. **New to AN, MS.**
- Fuscocephaloziopsis albescens* (Hook.) Váňa & L.Söderstr. [*Pleurocladula albescens* (Hook.) Grolle] – IX(2,3), X(2), 800–1200 m a.s.l.: on soil on frost boils on siliceous outcrops in tundra zone, late snow bed, at base of slope, crevice on rocks, banks of streams, soil covered rocks on edge of streams, between boulders in rock fields, rich vegetation below snow field [123861] **New to AN.**
- F. leucantha* (Spruce) Váňa & L.Söderstr. (per., andr.) – VII, VIII, X(1), 60–1000 m a.s.l.: covered by mosses logs, rotting woods in intermediate and poor fens, in moist forests, the dying turfs of mosses in fields of large boulders, in alpine tundra meadow [123969]. **New to AN, MS.**

- F. lunulifolia* (Dumort.) Váňa & L.Söderstr. (per., andr., spor.) – II, III, VI, VII, VIII, X(1), 60–1000 m a.s.l.: on rotting wood, among mosses on hummocks, on peat, on the dying turf of mosses in intermediate and poor fens and in moist forests, on thin peaty soil in a fields of large boulders on mountain slopes, on soil in moist alpine tundra meadow and in *Salix* thickets along stream [123947]. **New to MS.**
- F. monticola* (J.D.Godfrey) Váňa & L.Söderstr. (per.) – VII, IX, X(2), 60–1200 m a.s.l.: on humus soil, on slopes to the road or streams [123764]; on siliceous outcrops on tundra slopes, *Salix* thickets along stream, in late snow bed communities. **New to MS.**
- F. pachycaulis* (R.M.Schust.) Váňa & L.Söderstr. (per., andr.) – X(1,3), 1200 m. a.s.l.: peaty soil in clefts in a field of large boulders, in alpine tundra meadow [123817].
- F. plenicaps* (Austin) Váňa & L.Söderstr. (per., andr., spor.) – III, VI, IX, X(2), 900 m a.s.l.: soil in *Salix* thickets along stream, late snow melt, between boulders, at the base of *Sphagnum* hummock on slopes, irrigated bed of stream below snow field, soil in moist tundra [123936]. **New to AN, KE, MS.**
- Gymnocolea inflata* (Huds.) Dumort. (per., andr., spor.) – II, III, VII, X (1), 60–1000 m a.s.l.: intermediate and poor fens in the depression between hummocks, in depressions on rock outcrops in fen [123963]. **New to KE, MS.**
- Gymnomitrium commutatum* (Limpr.) Schiffn. (per.) – IX, X(1,2), 1000–1200 m a.s.l.: dry cliffs, sides and crevices of rocks in fields of large boulders, in alpine tundra meadow, banks of streams [123750]. **New AN, MS.**
- G. concinnatum* (Lightf.) Corda (per., andr., spor.) – VI, IX, X(1,2), 950–1200 m. a.s.l.: on rocks and fine earth on dry cliffs, on sides of huge rocks in fields of large boulders, in alpine tundra meadow, on rocks (boulder) in rock fields, on banks of streams, in dwarf shrub – lichen tundras [123842]. **New to MS.**
- G. corallioides* Nees – IX, 1070 m a.s.l.: rich vegetation below snow field along the stream, on bank of stream [123778].
- G. mucrophorum* R.M.Schust. (spor.) – X(1): in crevice on boulder, just on rock some stems in mats dominated by *Marsupella boeckii* [123810] and dominated in mats with admixture of *Barbilophozia sudetica*, *Douinia imbricata* [123842]. The holotype was described by Schuster (1995: 243) as “consisting of very few isolated plants” whereas the species is abundant in the specimen reported here and has sporophytes which have not previously been recorded for it.
- G. obtusum* Lindb. (per., andr.) – VI, X(1,2), 950–1200 m a.s.l.: on rocks in crevice on boulders in rock field, in alpine tundra meadow [123809]. **New to MS.**
- G. pacificum* Grolle – X(1), 1000 m a.s.l.: field of large boulders, in alpine tundra meadow, late snow bed, in crevice on boulder, just on rock [123810]. **New to MS.**
- Gyrothyra underwoodiana* M.Howe (gyn.) – VII, 60 m a.s.l.: on humus soil, on slope to the road [124318].
- Harpanthus flotovianus* (Nees) Nees – VII, IX, X(2), 950–1200 m a.s.l.: on soil in intermediate fens, *Salix* thickets along streams, on banks of streams, seepages on slopes [123881]. **New to AN, KE, MS.**
- Isopaches bicrenatus* (Schmidel ex Hoffm.) H.Buch – IX: on soil covered rock in deep cave on dry cliffs near the trail several stems in mats with *Calycularia laxa*, *Diplophyllum taxifolium*, *Scapania scandica* [123752].
- Jungermannia borealis* Damsh. & Váňa – IX, X(2), 800–1200 m a.s.l.: on soil and rocks in and along streams [123765]. **New to AN, MS.**
- J. eucordifolia* Schljakov – IX, X(2), 800–1200 m a.s.l.: on rock in stream, submerged and in seepages and streams [123883]. **New to MS.**
- J. cf. pumila* With. – IX, X(2), 1070 m a.s.l.: rich vegetation below snow field along the stream, on bank of stream [123783]. **New to MS.**
- Kurzia pauciflora* (Dicks.) Grolle – IX, 1000 m a.s.l.: on the dying turf of mosses in a field of large boulders, in alpine tundra meadow [123791]. Dominated in mats with admixture of *Sphenolobus minutus*, *Fuscocephaloziopsis leucantha*, *Scapania scandica*, *Calycularia laxa*. **New to AN.**
- Lophocolea heterophylla* (Schrad.) Dumort. – VII: on decaying wood on bank of rivulet; XI: on soil in dense thickets of *Salix* with *Equisetum arvense* L., *Valeriana* sp., *Mertensia paniculata* (Aiton) G. Don, along small stream [123785]. **New to MS.**
- Lophozia guttulata* (Lindb. & Arnell) A.Evans – VIII, 60 m a.s.l.: on rotting wood in thickets mixed with *Riccardia palmata*, *Calypogeia azurea*, *Fuscocephaloziopsis lunulifolia* [124319]. **New to AN.**
- L. longiflora* (Nees) Schiffn. (per., gem.) – II, VII, VIII: among bryophytes in intermediate and poor fens, on rotting wood in *Picea sitchensis* boggy forest and in dwarf shrub – *Sphagnum* bogs [123968]. **New to AN, KE.**
- L. murmanica* Kaal. (per., spor., andr., gem.) – III, VI, IX, X(1,2), 125–1200 m a.s.l.: on peat soil between hummocks and on hummocks in sedge – *Sphagnum* dwarf shrub – *Sphagnum* bogs, on soil and rocks in *Salix* thickets along streams, on bank of streams, in late snow beds [123915]. **New to AN, MS.**
- L. silvicoloides* N.Kitag. (per., spor., andr.) – VIII, 125–1200 m a.s.l.: intermediate fen, on rotting wood, mixed with *Mylia taylora*, *Fuscocephaloziopsis leucantha*, *Blepharostoma trichophyllum*, *Scapania umbrosa* [123922]. All specimens from Alaska collected by me were referred to this species based on identification by Bakalin (Bakalin, 2005a).
- L. ventricosa* (Dicks.) Dumort. s.lat. (per., andr., gem.) – V, VI, VII, VIII: at base of slope, in the thickets of *Spirea* and ferns, plot with *Betula nana*, *Vaccinium*, *Rubus chamaemorus*, *Cornus suecicus*, at the base of the *Sphagnum* hummock, on side of trail in spruce-moss forest [123962].
- Lophoziopsis excisa* (Dicks.) Konstant. & Vilnet (per., spor., andr., gem.) – VI, IX(2,3), X(1,2), 900–1200 m a.s.l.: on soil in irrigated bed of stream below snow field, in moist tundra among mosses, along stream, on banks of streams, on rock in a field of large boulders, in alpine tundra meadow, on sandy soil along trail [123769]. **New to AN, KE, MS.**
- L. longidens* (Lindb.) Konstant. & Vilnet (gem.) – X(1), 1000 m a.s.l.: on boulder under overhanging plants in a field of large boulders, in alpine tundra meadow, mixed with *Barbilophozia hatcheri*, *Pseudolophozia debiliformis* [123819]. **New to MS.**
- L. rubrigemma* (R.M.Schust.) Konstant. & Vilnet (gem.) – X(2), 1200 m a.s.l.: siliceous outcrops on tundra slopes, frost boils, rock field, in crevices, single shoots mixed with *Douinia imbricata* [123858]. The species was recorded for Alaska by Bakalin (2004, 2011) based on this specimen.
- Marchantia polymorpha* L. subsp. *montivagans* Bischl. & Boissel.-Dub. – V, VII, IX(1), XI: on soil in post fire *Salix* tickets, sandy soil on banks of creeks, on soil in alpine meadow [123957]. **New to AN, KE, MS.**
- M. quadrata* Scop. [*Preissia quadrata* (Scop.) Nees] – IX(3), X(2), 950–1200 m a.s.l.: peat soil in late snow melt, at base

- of cliffs, on peat soil on edge of stream on slope [123856]. **New to MS, AN.**
- M. quadrata* Scop. subsp. *hyperborea* (R.M.Schust.) Borovich. [*Preissia quadrata* subsp. *hyperborea* R.M.Schust.] (spor.) – X(2), 1100–1200 m a.s.l.: at base of cliff in wet crevice dominate in mats with admixture of *Mesoptychia heterocolpos*, *Blepharostoma trichophyllum* [124856] and as admixture in several more specimens. Plants autoicous, green, spores ca. 50 (55) μm , characteristic male receptacle with nitid arched upward phalanges and carpocephalum with 4 sporophytes. Of several studied specimens only this one can for sure be referred to subsp. *hyperborea*. This subspecies was previously recorded in Arctic Alaska only (Potemkin, 1995). **New to MS.**
- Marsupella apiculata* Schiffn. – IX(1,3), 950–1000 m a.s.l.: bank of stream, late snow bed, in wet crevices among small rocks [123774], dry cliffs near the trail, in fragment of *Harimonella*-lichen tundra [123747]. **New to AN.**
- M. boeckii* (Austin) Lindb. ex Kaal. – X(1,2), 1000–1200 m a.s.l.: soil and rocks on siliceous outcrops on tundra slopes, rock outcrops in dwarf shrub tundra, on dry soil, in crevice on boulder in alpine tundra meadow [123810].
- M. sparsifolia* (Lindb.) Dumort. (per., andr.) – X(1), 1000 m a.s.l.: rock outcrops in dwarf shrub tundra, on dry soil [123820]. **New to MS.**
- M. cf. spiniloba* R.M.Schust. & Damsh. (per., andr.) – IX(1): dry cliffs near the trail, in fragment of *Harimonella*-lichen tundra [123753]. **New to AN.**
- M. sprucei* (Limpr.) Bernet (per., andr.) – X(2), 1200 m a.s.l.: siliceous outcrops on tundra slopes, in crevice on rock with *Gymnomitrium commutatum* [123847]. **New to MS.**
- Mesoptychia gillmanii* (Austin) L.Söderstr. & Vána (per., andr.) – VIII, IX, X(2), 60–1200 m a.s.l.: soil covered cliffs near waterfall, siliceous outcrops on tundra slopes on peat soil between boulders, rich vegetation below snow field along the stream, on bank of stream, irrigated bed of stream below snow field, on moist soil [123836]. **New to MS.**
- M. heterocolpos* (Thed. ex Hartm.) L.Söderstr. & Vána (per., gem.) – VIII, IX, X(2), 60–1200 m a.s.l.: on edges of streams, on soil in rich vegetation below snow fields, peat soil on bank of streams, on peat soil covered cliffs, outcrops on tundra slopes [123775]. **New to MS.**
- M. rutheana* (Limpr.) L.Söderstr. & Vána – II, 125 m a.s.l.: dwarf shrub – *Equisetum*-moss with hummocks mire, at base of hummock [123903]. **New to KE.**
- Moerckia flotoviana* (Nees) Schiffn. (andr.) – II, 125 m a.s.l.: dwarf shrub – *Equisetum*-moss with hummocks mire [123914].
- Mylia anomala* (Hook.) Gray (andr.) – II, III, VI, 60–125 m a.s.l.: on hummock in sedge – *Sphagnum* bog, between hummocks, in water in dwarf shrub – *Equisetum*-moss with hummocks mire, in plots of *Sphagnum* on steep slope with seepages [123947].
- M. taylorii* (Hook.) Gray – VII, VIII, IX(3), X(1,2), 60–1200 m a.s.l.: rock outcrops in tundra, field of large boulders, in alpine tundra meadow, in deep moist cleft, rotting wood on edges of fens, soil covered rocks on edges of streams [123777]. **New to AN, MS.**
- Nardia breidlerii* (Limpr.) Lindb. (per., spor.) – X(1,2), 1000–1200 m a.s.l.: sandy soil along trail, slopes to roads [123829]. **New to MS.**
- N. geoscyphus* (De Not.) Lindb. (per.) – VIII, IX(2,3), X(2), 60–1200 m a.s.l.: on soil and fine earth banks of streams, in small caves on cliffs near waterfall, seepages on slopes [123932]. **New to AN, MS.**
- N. pacifica* Bakalin (per., andr., spor.) – X(2), 1100–1200 m a.s.l.: on frost boil in late snow bed [123875] dominated in mats with admixture of *Solenostoma sphaerocarpum*, *Neorothocaulis floerkei*, *Anthelia juratzkana*, *Pleurocladula albescens*; on edge of frost boil on steep slope, on peat soil, dominated in mats with admixture of *Barbilophozia sudetica*, *Pleurocladula albescens*, *Anthelia juratzkana* [123884]. Recently described species (Bakalin & Klimova, 2016). **New to Alaska and North America.**
- N. scalaris* Gray (per.) – V, IX(1,2), X(1,2), 60–1200 m a.s.l.: on sandy soil and fine earth along the trails in mountains, edge of stream, in alpine meadow, on siliceous outcrops, in crevices of cliffs on tundra slopes, on frost boils [123876]. **New to AN, MS.**
- Neorothocaulis attenuatus* (Mart.) L.Söderstr., De Roo & Hedd. – VII: edge of fen, on side covered by mosses log [123969]. **New to KE.**
- N. floerkei* (F.Weber & D.Mohr) L.Söderstr., De Roo & Hedd. (per.) – VII, IX(2), X(2), 800–1200 m a.s.l.: intermediate and poor fens on covered by vegetation rocks on siliceous outcrops on tundra slopes, peat soil along streams [123877]. **New to AN.**
- Odontoschisma elongatum* (Lindb.) A.Evans – IX(3), 950 m a.s.l.: on soil covered rock on edge of stream, admixture in mats dominated by *Mylia taylorii* [123777]. **New to AN.**
- O. fluitans* (Nees) L.Söderstr. & Vána – VII: in the depression in the fen in mats mixed with *Scapania paludicola* [123965].
- O. macounii* (Austin) Underw. – IX(3), 1070 m a.s.l.: rich vegetation below snow field along the stream, on bank of stream [123782]. **New to AN.**
- Pellia neesiana* (Gottsche) Limpr. – II, V, VII, X(1,2), 60–1200 m a.s.l.: bank of creek in *Salix* thickets, on soil in alpine meadow, in depressions in fens, in late snow bed [123917]. **New to MS.**
- Peltolepis quadrata* (Saut.) Müll.Frib. – X(2), 1200 m a.s.l.: late snow melt, between boulders with *Mesoptychia gillmanii*, *Fuscocephaloziopsis albescens*, *F. pleniceps*, etc. [123836]. **New to MS.**
- Protochilopsis grandiretis* (Lindb. ex Kaal.) A.V.Troitsky, Bakalin & Fedosov [*Schistochilopsis grandiretis* (Lindb. ex Kaal.) Konstant.] – IX(3), 1070 m a.s.l.: rich vegetation below snow field along the stream, on peat, on bank of stream [123781]. **New to AN.**
- Pseudomoerckia blyttii* (Mørch) Vilnet, Konstant., D.G.Long, N.D.Lockh. & Mamontov [*Moerckia blyttii* (Mørch) Brockm.] – IX, X(1), 800–1200 m a.s.l.: siliceous outcrops on tundra slopes, in *Salix* thickets along stream, slope to the stream, on peat soil [123763]. **New to AN, MS.**
- Ptilidium californicum* (Austin) Underw. & O.F.Cook (per.) – VII, VIII, 60 m a.s.l.: on the bark of spruce, *Tsuga mertensiana*, *Alnus* sp. in *Picea sitchensis* forests, on edges of fens [123958]. **New to AN.**
- P. ciliare* (L.) Hampe – II, III, 60–125 m a.s.l.: dwarf shrub – *Equisetum*-moss with hummocks mire, at base and side of hummock [123910], on trail in open spruce dwarf shrub – *Sphagnum* bog.
- P. pulcherrimum* (Weber) Vain. (per.) – II, VII, VIII, 60–125 m a.s.l.: on bark of trees and on logs on border of *Picea sitchensis* forest and fens, in *Betula nana* thickets [123902]. **New to AN.**
- Radula prolifera* Arnell – IX(3), 1070 m a.s.l.: rich vegetation below snow field along the stream, on bank of stream [123783]. **New to AN.**
- Riccardia palmata* (Hedw.) Carruth. (andr.) – VIII, 60 m a.s.l.:

- Picea sitchensis* forest bordering intermediate fen, on rotting wood, several specimens [123920]. **New to AN.**
- Saccobasis polita* (Nees) H.Buch – IX (2,3), X(2), 800–1200 m a.s.l.: on soil and rocks in *Salix* tickets, on peat soil on edge of stream [123771]. **New to AN, MS.**
- Scapania bolanderi* Austin (per.) – VIII, 60 m a.s.l.: *Picea sitchensis* forest bordering intermediate fen, on the bark of a dead spruce in pure mats [123927] and on bark of log mixed with *Blepharostoma trichophyllum*, *Lophozia ventricosa*, *Ptilidium pulcherrimum* [123923]. **New to AN,**
- S. curta* (Mart.) Dumort. (per., andr., spor.) – VII, IX(2,3), X: 2, 800–1200 m a.s.l.: path in fens, on soil in moist tundra, on slopes to the streams, in late snow bed, on sandy soil along the trail [123874]. **New to AN, MS, KE.**
- S. cuspiduligera* (Nees) Müll.Frib. – IX(3), X(2), 1070–1200 m a.s.l.: on bank of stream. rich vegetation below snow field [123856], late snow melt, at base of cliff [123780]. **New to AN, MS.**
- Scapania irrigua* (Nees) Nees – III, IX: banks of creeks in *Salix* thickets along the creek, along the trail in fen [123917].
- S. obcordata* (Berggr.) S.W.Arnell – X (1), 1000 m a.s.l.: along trail, on sandy soil [123829]. **New to MS.**
- S. obscura* (Arnell & C.E.O.Jensen) Schiffn. – X(2), 1200 m a.s.l.: on soil and rocks in *Salix* thickets along stream with *Barbilophozia sudetica* [123870]. **New to MS and the first exact locality for Alaska.** This was recorded earlier for Alaska by Konstantinova (2000: dot on the map) based on this specimen but without exact locality and link to herbarium specimen.
- S. paludicola* Loeske & Müll.Frib. – I, II, III, VII, near sea level-125 m a.s.l.: rich and intermediate fen, at bases and sides of hummocks, between hummocks, along trail in fens [123887]. **New to KE.**
- S. paludosa* (Müll.Frib.) Müll.Frib. – V, IX(1): on rocks on banks of streams [123745]. **New to KE.**
- S. scandica* (Arnell & H.Buch) Macvicar – II, IX(1), X(1), 125 - 1000 m a.s.l.: on the dying turf of mosses in a field of large boulders, in alpine tundra meadow, in microdepression in dwarf shrub – *Sphagnum* bog, on soil covered rock on dry cliffs near the trail, as admixture in mats of other liverworts [123792]. **New to AN, MS, KE.**
- S. subalpina* (Nees ex Lindenb.) Dumort. (per., spor.) – VIII, IX(1, 2), 60 - 800 m a.s.l.: on banks of streams, in *Salix* thickets along the creeks [123928].
- S. uliginosa* (Lindenb.) Dumort. – X(2), 1200 m a.s.l.: on soil and rocks in *Salix* thickets along the stream [123872]. **New to MS.**
- S. umbrosa* (Schrad.) Dumort. (per.) – VIII, 60 m a.s.l.: on rotting wood in *Picea sitchensis* forest on rotting wood on the ledge in cliffs near waterfall [123935]. **New to AN.**
- S. undulata* (L.) Dumort. – VII, X(1), 1200 m a.s.l.: on soil and rocks along streams, on log on bank of stream in the spray area [123868]. **New to MS.**
- Schistochilopsis* cf. *hyperarctica* Konstant. & L.Söderstr. – X(1) 31-2-92. on edge of frost boil on steep slope, on peat soil, sporadic in mats dominated by *Nardia pacifica*. **New to MS.**
- S. incisa* (Schrad.) Konstant. (per., spor.) – V, VII, VIII: on stumps, peat soil rotting wood, roots of *Picea sitchensis* in fens, moist *Picea sitchensis* forests, sometimes on path in fens [123954]. **New to AN.**
- S. opacifolia* (Culm. ex Meyl.) Konstant. – IX(2,3), X(1,2), 900–1200 m a.s.l.: on peat soil in late snow melt, on soil in moist tundra among mosses, on edges of frost boil, on banks of streams ones on *Sphagnum* in deep clefts in a field of large (to 0.9–3.5 m in diam.) boulders, in alpine tundra meadows [123772]. **New to AN, MS.**
- Schljakovia kunzeana* (Huebener) Konstant. & Vilnet (gem., andr.) – II, IX(3), 125–950 m a.s.l.: at base and side of hummocks in dwarf shrub-*Equisetum*-moss mire, in dwarf shrub-*Sphagnum* bog, on soil covered rocks and on hillocks in late snow bed [123910]. **New to AN, KE.**
- Schljakovianthus quadrilobus* (Lindb.) Konstant. & Vilnet – IX(2,3), 800–1070 m a.s.l.: on peat soil on banks of streams below snow fields in late snow beds, on soil in moist tundra [123779]. **New to AN.**
- Solenostoma confertissimum* (Nees) Schljakov (per., spor.) – VII, X(1,2), 1000–1200 m a.s.l.: on sandy soil along trail in mountains, on frost boils in late snow bed [123875]. **New to MS.**
- Solenostoma hyalinum* (Lydell) Mitt. (per., andr., dioicous) – III: on sandy soil on the slope to the road [124322], **New to KE**
- S. obovatum* (Nees) C.Massal. (per., andr.) – VIII, IX(2), X(1), 60–1000 m a.s.l.: on soil covered cliff near waterfall, peaty soil in clefts in a fields of large boulders, in alpine tundra meadow, moist soil along irrigated bed of stream below snow field [123817]. **New to AN, MS.**
- S. sphaerocarpum* (Hook.) Steph. (per., andr., spor.) – IX(2), X(1), 800–1200 m a.s.l.: deep cleft at base of slope, on peat soil in late snow melt, on edge of stream [123885]. **New to MS.**
- Sphenobolus minutus* (Schreb.) Berggr. (per.) – VI, VII, IX(3), X(1). 1000–1070 m a.s.l.: on soil covered rocks in the forests, on boulders and rock outcrops in tundras and in fields of large boulders in alpine tundra meadow, in crevices on rocks. on bank of streams, on peat soil at the base of the sphagnum hummocks in bogs, in late snow bed [123959]. **New to AN, MS.**
- Tetralophozia setiformis* (Ehrh.) Schljakov – X(1), 1000 m a.s.l.: on rocks in field of large boulders, in alpine tundra meadow [123814].
- Trilophozia quinquedentata* (Huds.) Bakalin (per., andr.) – VI, VII, IX(2,3), X(1, 2), 800–1200 m a.s.l.: on peat soil in intermediate fens, in crevices and on dry rocks. Late snow melt, in deep moist clefts and crevices on boulder on fields of large boulders, on soil covered boulders in alpine tundra meadow, on soil in late snow bed, on peat soil on banks of stream, on soil in moist tundra [123967].
- Tritomaria exsecta* (Schmidel) Schiffn. – X(2), 1200 m a.s.l.: siliceous outcrops on tundra slopes, at base of cliff [123856]. **New to MS.**

DISCUSSION

As was shown by Söderström *et al.* (2015), the flora of Alaska liverworts has been studied very unevenly and completely insufficiently. The territories we studied are among the least explored. So, only 22 species were known for Matanuska-Susitna Borough, and the vast majority of species known for this borough are liverworts published earlier based on the first obtained results of this trip (Schuster, 1993, 1995; Schuster & Konstantinova, 1995). Here I present an additional 59 species new to MS and, thus, the known diversity of liverworts of this area is currently 81 species. The known flora of Anchorage Borough has been increased by us with 51 species and thus counts 86 species by now, and the flora of Kenai Borough has been supplemented with 20 species and currently counts 102 species. These figures are obvious-

ly still far from the real number of species, which occur in the discussed regions. This follows both from the slightly greater diversity of liverworts in some areas surrounding these regions, e.g. 119 species in Denali Borough, 97 in Valdez-Cordova Census Area (see Söderström *et al.*, 2015, Fig. 2) and from general patterns stating a high diversity of liverworts in the mountain ranges located in the Subarctic, especially situated close to the ocean. Since the flora of the studied areas obviously is not fully known and since the territories are not naturally delimited (they are just administrative boroughs), the traditional analysis of flora does not make sense and here I will focus only on discussing the most interesting discoveries and on some characteristic features of the flora as a whole.

Two species are reported here as new to Alaska. One of them is *Cephalozia otaruensis* that recently was synonymized with *Cephalozia hamatiloba* (Vána, 1988; Potemkin & Sofronova, 2013; Söderström *et al.* 2015). This taxon is mostly amphipacific (Potemkin & Sofronova, 2013) with disjunct localities in eastern North America (Schuster, 1974). Both the understanding of the taxon's borders and its taxonomic status need special study. A specimen from Alaska is attributed to this species both based on the fact that male plants predominate in the specimen, i.e. it is clearly dioecious, and on the general appearance of plants.

The second species, previously not recorded for Alaska has recently been described as *Nardia pacifica*. Immediately upon arrival from the field, I studied and described oil bodies in some of the specimens referred by me at first glance to *Nardia japonica*. But homogeneous oil-bodies along with some other features did not allow these plants to be attributed to *N. japonica*. After the description of *N. pacifica* (Bakalin & Klimova, 2016), it became obvious that the morphological characteristics of the species correspond to this species. Thus, the assumption of Bakalin & Klimova (l.c.) that the species occurs in Western America is supported. A few more specimens in which oil bodies have not been studied still need confirmation and I do not cite them here.

It is worth mentioning *Scapania obscura* as new to Alaska, which I earlier reported for Alaska without an exact location (Konstantinova, 2000). This is a little-known species that was considered amphiatlantic (l.c.) but recently was recorded as well from Siberia and the Far East of Russia (Konstantinova *et al.*, 2009; Potemkin & Sofronova, 2009). The location in Alaska is the first record for Western North America.

Of the three species described based on the results of our Alaska trip, *Apotreubia hortonae* has been reduced to a synonym with *A. nana* (Bakalin & Vilnet, 2017). *Gymnomitrium mucrophorum* was so far known only from the type collections that represent poor material without sporophytes (Schuster, 1995). Our specimen collected near the type locality consists of several almost pure mats with sporophytes and fits well in the description of Schuster (l.c.). A detailed study of the collected specimen, including its DNA loci, is

required to understand if *Gymnomitrium mucrophorum* is a good species and how clearly it differs from the somewhat similar *G. concinnatum* and *G. pacificum*.

The third species described based on the materials of the expedition is *Cephalozia pachycaulis*. About ten years after its description, it was found on the Asian Pacific coast, penetrating deep into Eurasia up to Lake Baikal (Konstantinova *et al.*, 2004). However, as far as I know, this species has not been found since then in Alaska and other regions of North America.

Of some interest are new findings of some amphipacific species. A number of them were described from the western coast of North America but then discovered on the Asian coast of the Pacific Ocean like *Cephalozia pachycaulis* mentioned above. Another species with an amphipacific distribution, *Fuscocephalozia monticola*, on the contrary, is not uncommon in the more southern areas on the coast of western America but is extremely rare on the Asian continent (Kamchatka Peninsula only, Bakalin, 2005b). In Alaska, this species is rare, and the locality in the Talkeetna Mountains is its northernmost known site. The second amphipacific liverworts not rare and often abundant in at least some areas studied by us is *Douinia imbricata*. Likewise *Fuscocephalozia monticola*, it was only recently found in the Kamchatka Territory (Choi & Bakalin, 2012). I collected another mainly Western American amphipacific species which is rare on the Asian coast – *Ptilidium californicum* – in most of the studied forest communities. One more amphipacific liverwort *Gymnomitrium pacificum* was described from Western America but is rather rare both in Alaska (Söderström *et al.*, 2015) and the Asian coast of Pacific (Bakalin, 2010).

Of particular interest are the numerous collections of *Calycularia laxa*. This arctomontane species has a predominantly amphipacific distribution but penetrates far into Eurasia mainly through the subarctic mountain systems. It was previously known in Alaska only from North Slope Borough, Panhandle and the Nome census area, but turned out to be frequent and abundant in the Kenai and Talkeetna Mountains.

Another interesting discovery is the worldwide rare *Gymnomitrium commutatum*, previously known in Alaska from single sites in the Nome census area and the Denali Borough (Söderström *et al.*, 2015). In this trip the species was repeatedly collected in KE and MS boroughs.

The list of collected specimens includes some poorly known taxa. One of these is *Marchantia quadrata* subsp. *hyperborea*. It was described by Schuster from West Greenland (Schuster, 1992). It has previously been recorded for Arctic Alaska (Potemkin, 1995). Most likely, this taxon is not uncommon in Alaska, however, its thorough identification is possible only in the presence of gametangia that occur rather rare, at least in herbaria.

Thus, the results of this short expedition show that the flora of Alaska liverworts being extremely rich is still far from being properly revealed and further thorough

bryological exploration of the Talkeetna and Chugach mountains is necessary; these areas, judging from my preliminary data, represent a hot spot for the liverwort diversity.

As part of this work, I did not test some questionable specimens molecularly. Further study of some questionable specimens based on an integrative approach is highly desirable and is planned at least for a number of specimens including those that are proposed to be new species. This is especially true of specimens from the genera *Solenostoma*, *Jungermannia*, *Nardia*, and *Gymnomitrium*, in which new species have recently been described. Integrative approach is important as well for taxa described from Alaska, including those that remain incompletely understood, e.g. *Gymnomitrium pacificum*.

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