

MOSES OF THE FRANZ JOSEF LAND ARCHIPELAGO (RUSSIAN ARCTIC)
МХИ АРХИПЕЛАГА ЗЕМЛЯ ФРАНЦА ИОСИФА (РОССИЙСКАЯ АРКТИКА)

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Abstract

Moss flora of the Franz Josef Land Archipelago is studied. The paper was compiled based on examination of recent collections, revision herbarium material and summarizing literature data. An annotated list includes 156 species, 18 of them are new for the archipelago. The interesting records are *Arctoa anderssonii*, *Pohlia beringiensis*, *Schistidium abrupticostatum*, *S. andreaeopsis*.

Резюме

Представлены результаты изучения флоры мхов архипелага Земля Франца Иосифа. Статья основана на результатах обработки коллекций, собранных в последнее время, учтены все ранее опубликованные данные и гербарные материалы. Аннотированный список включает 156 видов, из них 18 приводятся для архипелага впервые. Особый интерес представляет находки редких видов *Arctoa anderssonii*, *Pohlia beringiensis*, *Schistidium abrupticostatum*, *S. andreaeopsis*.

KEYWORDS: mosses, flora, Arctic, Franz Josef Land Archipelago, rare species

INTRODUCTION

Franz Josef Land Archipelago is the most northern part of Eurasia, being at its northern part less than 1000 km apart from the North Pole. This area is exceedingly difficult to access, and it remains almost uninhabited and poorly explored.

The beginning of bryophyte exploration can be attributed to L.V. Palibin, who participated the expedition on the icebreaker “Ermak” to the Barents Sea in 1901. He published records of 12 moss species, collected mainly at the Flora Cape, Northbrook Island, and also small collections in Hochstetter Island (Palibin, 1903–1906). He also provided a detailed historical overview of floristic research at the archipelago, with solitary bryophyte records from the Austrian expeditions on the ship “Tegetthoff” (1872–1874), collections of Payer; the English expedition in 1894–1897, collections of H. Fischer; and Italian expedition on the ship “Stella Polare” (1899–1900), collections of Cavalli-Molinelli at Rudolf Island. Altogether 14 moss species were listed by Palibin (1903–1906).

In 1929, I.V. Ivanov during polar expedition on the icebreaker “Georgy Sedov” collected mosses mainly on Hooker Island, and small collections were made also on Northbrook and Rudolf islands. The specimens were identified by L.I. Savicz (1932), who listed 37 moss species and one liverwort. In 1930, V.P. Savicz participated in the All-Union Arctic Expedition on the icebreaker “Georgy Sedov”. He visited Aagaard, Alger, Bell, Hooker,

McClintońk, Northbrook and Scott-Keltie islands, and made an extensive collection of mosses. Specimens were identified by L.I. Savicz, along with collections of I.I. Present in 1932 at Northbrook and Rudolf islands. Thus the list of mosses of the archipelago increased up to 75 species (Savicz, 1936). This list is thoroughly annotated with information about habitats and various notes on some features of individual species in the high Arctic, lists of mosses for each island were also provided. Later, all these data with some additions were included in “Handbook of mosses of Arctic of the USSR” (Abramova *et al.*, 1961) and “Handbook of mosses of the USSR. The mosses acrocarpous.” (Savicz-Ljubitzkaja & Smirnova, 1970).

In 1930, O. Hanssen collected mosses at Alexandra Land, Alger, George Land, Graham Bell, Northbrook islands. These specimens were identified by P. Størmer, who listed 28 species of moss and 2 species of liverworts (Størmer, 1940). Thus, 95 species of mosses were known from the archipelago according to literature at the time.

Some contribution to the study of mosses of the archipelago was made by geobotanists. In 1959, a vegetation study was conducted on Alexandra Land Island by V.D. Aleksandrova. She collected very thoroughly bryophytes and lichens on relevé plots. Collections of mosses and liverworts were identified by A.L. Abramova and R.N. Schljakov, and published in vegetation overview of Alexandra Land Island (Aleksandrova, 1977, 1981) and included also in the monograph “Polar desert vegetation” (Aleksandrova, 1983). Unfortunately, the specimens that

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were collected for these relevés have not been preserved and can not be re-examined. In 1979, I.N. Safronova conducted geobotanical studies on Meibel and Hooker islands. Her moss collection was identified by O.M. Afonina and I.V. Czernyadjeva, and the results have been published in two papers (Safronova, 1986; Czernyadjeva, 1992).

In 1995, the check-list of the mosses of the Russian Arctic was published (Afonina & Czernyadjeva, 1995) and 103 moss species were listed there for Franz Josef Land based on literature data. In 1996, A.M. Odasz published a paper, in which 47 species were reported for Hooker Island (Odasz, 1996). In 2015, the monograph "Plants and fungi of polar deserts of the Northern Hemisphere" was published under the editorship of N.V. Matveeva; in this publication, the section on mosses was prepared by O.M. Afonina (Afonina, 2015). This publication provides a general list of mosses based on all available literature on different polar desert regions, including the Franz Joseph Land Archipelago, and also using the unpublished results of identifying of different collections. Thus, it contains previously unpublished data on the moss flora of Heiss Island, based on specimens collected by D.A. Walker in 2010 and identified by O.M. Afonina. The publications on taxonomy of certain groups of mosses, providing information about the distribution of species in the polar desert zone (Blom, 1996, 1998; Frisvoll, Lewinsky, 1981; Frisvoll, 1983a, b; Czernyadjeva, 2003; Afonina, 2004) were also accounted in this monograph. It also included amendments related to the revision of herbarium specimens, mainly concerning the genera *Bryum* (V.I. Zolotov) and *Schistidium* (E.A. Ignatova). As a result, 115 moss species were listed for the archipelago (Afonina, 2015).

In 2012, during the complex expedition of the national park "The Russian Arctic", extensive collections of liverworts and mosses were performed on the territory of Franz Josef Land by S.S. Kholod. The moss specimens from Northbrook Island was examined by I.V. Czernyadjeva, and check-list including 45 species was published (Czernyadjeva *et al.*, 2015). Additionally, some new findings from this collection have been published in the section "New records ..." (Ellis *et al.*, 2019a, 2019b, 2020; Safronova *et al.*, 2019a, 2019b; Czernyadjeva *et al.*, 2019). In 2016, D.S. Moseev carried out geobotanical research and collected mosses on Alger, Bell, Etheridge, Eva-Liv, Hooker, Kane, Heiss, Li-Smith, Meibel islands. The mosses were identified by E.Yu. Kuzmina, and the results were published (Moseev *et al.*, 2018, 2019). However, the records on *Campyllum pratense*, *Calliergon megalophyllum*, *C. richardsonii*, *Climacium dendroides*, *Drepanocladus aduncus*, *Sciuro-hypnum plumosum*, *Syntrichia norvegica* were erroneous.

STUDY AREA

Franz Josef Land is located in the western sector of the Russian Arctic, in the northeast of the Barents Sea. This is an archipelago of 196 islands separated by nu-

merous straits. Its natural features are largely determined by the hydrological and ice conditions of both the straits themselves and the surrounding marine bodies of water. The total area of the archipelago is 16096 km², of which 13690 km² (85.1 %) are glaciers. The archipelago is 375 km from West to East, and 234 km from North to South. Most of the islands of the archipelago are the remnants of an extensive basalt plateau, divided by tectonic faults into separate blocks, experiencing differentiated movements relative to each other with amplitudes of up to 1000 m. Terracing of plateau slopes is extremely characteristic, which was caused by intermittent uplift of the archipelago during the Late Pleistocene and Holocene. The relief of the islands is currently experiencing the influence of nival, permafrost-solifluction, gravitational-diluvial and aeolian processes, and extensive modern glaciation is its main physiographic feature.

The thickness and cohesion of the ice cover in the straits separating the islands and the distribution of water masses have a noticeable effect on the landscape conditions of the islands, determining the regime of temperature, precipitation, humidity, and the nature of glaciation. The degree of development of ice sheets is one of the most important landscape-forming factors that determine the natural features of Franz Josef Land. The most significant factor for the formation of the hydrological and ice regime of the straits is the influx of warm Atlantic and Barents Sea waters entering the archipelago from the north-west and the south. The meltwater of glaciers are the main sources for local rivers. Most rivers are characterized by the formation of estuarine spills, the growth of deltas, and a general increase in the length of river systems, which is expressed in lengthening of estuarine sections and the increase of floodplains in the lower reaches. Franz Josef Land has about a thousand freshwater lagoons and glacial lakes. The areas of some of them reach 2 km², and the depths are up to 10 m. (Govorukha, 1968).

Franz Josef Land belongs to the Atlantic-European climatic region of the Arctic and is located in the zone of the marine Arctic climate, which by intense cyclonic activity, low average annual and summer air temperatures, significant cloud cover, frequent fogs, and high relative humidity. Frequent and strong (up to 40 m/s) winds in combination with temperatures to -52°C make the archipelago one of the most severe areas worldwide. Only two months a year, in July (warmest) and August, have the average month temperature above zero, but both below $+2^{\circ}\text{C}$, and number of days with the mean temperature above zero is 60 in the southern part of the archipelago, and only 41 in its northern part. The average annual temperature is -12°C (Govorukha, 1968).

The vegetation of the Franz Josef Land Archipelago belongs to the northern subzone of the polar desert zone. To date, only 57 species and varieties of vascular plants are known from its islands, among which the species of



Fig.1. Collecting localities and collectors of mosses in Franz Josef Land:

1. Alexandra Land Island: 1959 *Aleksandrova*.

1a. Alexandra Land Island, cape Meri Harmsworth, 80°36'N, 44°57'E: 1930 *Hanssen*; 2012 *Kholod*.

1b. Alexandra Land Island, to south of the polar station «Nagurskaya», 80°47'N, 47°35'E: 2012 *Kholod*.

1c. Alexandra Land Island, Severnaya Bay, 80°46'–80°47'N, 47°43'–47°54'E: 2019 *Konoreva, Chesnokov*.

1d. Alexandra Land Island, Zverboev Bay, 80°48'N, 48°08'E: 2019 *Konoreva, Chesnokov*.

2a. George Land Island, Stephens Cape: 1930 *Hanssen*.

2b. George Land Island, Forbes Cape: 1930 *Hanssen*.

2c. George Land Island, Nansen Cape, 80°27'N, 47°29'E: 1930 *Hanssen*; 2012 *Kholod*.

2d. George Land Island, Grey Bay, 80°14'N, 47°36'E: 2012 *Kholod*.

2e. George Land Island, Kalina Cape, 80°14'N, 47°28'E: 2012 *Kholod*.

2f. George Land Island, Krautera Cape, 80°09'N, 47°11'E: 2012 *Kholod*.

2g. George Land Island, northwestern part, 80°51'N, 49°52'E: 2012 *Kholod*.

2h. George Land Island, Armitage Peninsula, Bay of Geographers, 80°48'N, 50°28'E: 2019 *Konoreva, Chesnokov*.

3. Bell Island, 80°00'N, 49°15'E: 1930 *Savich*; 2016 *Moseev*.

4. Meibel Island, ~80°01'N, 49°22' E: 1979 *Safronova*; 2012 *Kholod*; 2016 *Moseev*.

5. Northbrook Island, Flora Cape, 79°57'N, 50°06'E: 1901 *Palibin*; 1929 *Ivanov*; 1930 *Savich*; 1930 *Hanssen*; 1932 *Prezent*; 2012 *Kholod*.

6. Scott-Keltie Island, 80°19'N, 52°40'E: 1930 *Savich*.

7. Hooker Island: 1929 *Ivanov*; 1930 *Savich*; 1991 *Odasz*; 1979 *Safronova*;

7a. Hooker Island, Cape Sedova, polar station Tikhaya Bay, ~80°20'N, 52°52'E: 1929 *Ivanov*; 1930 *Savich*; 2012 *Kholod*; 2016 *Moseev*; 2019 *Konoreva, Chesnokov*.

8. Etheridge Island, 80°04'N, 59°21'E: 2016 *Moseev*.

9. Li-Smith Island, 80°12'N, 54°21': 2016 *Moseev*.

10. Nansen Island, 80°29'N, 54°07'E: 2012 *Kholod*.

11. Brice Island, 80°25' N, 55°10' E: 2012 *Kholod*.

12. Alger Island: 1930 *Savich*.

12a. Alger Island, 80°22'N, 56°03'E, Camp Ziegler: 1930 *Hanssen*; 2012 *Kholod*.

12b. Alger Island, Baldwin expedition winter field camp, 80°21'N, 56°13'E: 2012 *Kholod*.

12c. Alger Island, cape Podgorny: 2016 *Moseev*.

13. McClintock Island, Dillan Cape, 80°05'N, 55°48'E: 1930 *Savich*; 2012 *Kholod*.

14. Aagaard Island, 80°00'N, 56°20'E: 1930 *Savich*.

15. Hall Island, Cape Tegetthof, 80°05'N, 58°01'E: 2012 *Kholod*.

16. Wilczek Island, 79°53'N, 58°52'E: 2012 *Kholod*.

17. Lamont Island, 79°46'N, 58°40'E: 2012 *Kholod*.

18. Hochstetter Island, 80°11'N, 60°07'E: 1901 *Palibin*.

19. Heiss Island, 80°37'N, 58°03'E: 2007 *Zaverina*; 2016 *Moseev*.

20. Fersman Island, 80°38'N, 57°57'E: 2012 *Kholod*.

21. Champ Island, 80°40'N, 56°14'E: 2012 *Kholod*.

22. Wilczek Land Island, 80°48'N, 60°05'E: 2012 *Kholod*.

23. Wiener Neustadt Island, 80°51'N, 58°52'E: 2012 *Kholod*.

24a. Ziegler Island, surroundings of Cape Bryce, the site of an Austrian expedition field camp, 81°04'–81°06'N, 56°14'–56°18'E: 2012 *Kholod*; 2019 *Konoreva, Chesnokov*;

24b. Ziegler Island, in the surroundings of Rhodes strait, 80°52'N, 57°17'E: 2019 *Konoreva, Chesnokov*.

25. Greely Island, 80°56'N, 58°21'E: 2012 *Kholod*.

26. Kane Island, 81°06'N, 58°31'E: 2012 *Kholod*; 2016 *Moseev*.

27. Kuhn Island, 81°07'N, 58°28'E: 2012 *Kholod*; 81°07'N, 58°19'E: 2019 *Konoreva, Chesnokov*.

28. Apollonov Island, 81°10'N, 58°08'E: 2012 *Kholod*.

29. Gage Island, 80°52'N, 60°05' E: 2012 *Kholod*.

30. La Ronciere Island, 80°58'N, 60°00'E: 2012 *Kholod*.

31a. Jackson Island, Norway Cape, 81°12'N, 55°33'–55°37'E: 2012 *Kholod*; 2019 *Konoreva, Chesnokov*.

31b. Jackson Island, Bystrov Cape, 81°20'N, 55°41'E: 2012 *Kholod*.

32. Hoffmann Island, 81°17'N, 60°25'E: 2012 *Kholod*.

33a. Rudolf Island, Borok Cape: 1929 *Ivanov*; 1932 *Prezent*;

33b. Rudolf Island, near the polar station “Rudolph Island”, 81°48'–81°49'N, 57°55'–58°57'E: 2007 *Zaverina*; 2012 *Kholod*.

34. Eva-Liv Island, 81°38'N, 63°06'E: 2012 *Kholod*.

35. Graham Bell Island: *Hanssen*, 1930; 80°52'N, 64°17'E: 2007 *Zaverina*.

the families Poaceae, Juncaceae, Caryophyllaceae, Brassicaceae, Saxifragaceae predominate. The vegetation of the archipelago is characterized by a high degree of sparsity: extremely sparse groups with a projective cover of 2–4 % are occurred on sea terraces of different levels, on the slopes of hills, in areas recently released from under the glacier. The species composition of vascular plants usually does not exceed 5–7 species per relevé plot (e.g., *Papaver polare*, *Phippsia algida*, *Saxifraga cespitosa*, *S. nivalis*, *S. oppositifolia*, *Cerastium regelii* ssp. *caespitosum*, *Stellaria edwardsii*). The average height of plants is 12–15 cm, being taller only in grasslands, up to 20–25(–30) cm. A number of species grow in a cushion-shaped form (e.g., *Cerastium regelii* ssp. *caespitosum*, *C. arcticum*, *Saxifraga cespitosa*). Under the canopy of dwarf shrubs mosses and lichens form a shallow carpets. Various polygonal communities with an average coverage of 8–10 % are usually represented on loamy watersheds. Polygons usually have a diameter of 45–60 cm, being separated by hollows 15–20 cm wide. The polygons have a crust of liverworts, and inhabited by such vascular plants as *Papaver polare*, *Cerastium arcticum*, *Cochlearia groenlandica*, *Stellaria edwardsii*. Hollows have dense patches of lichens (e.g., *Flavocetraria nivalis*, *Pseudephebe pubescens*, *Alectoria nigricans*, *Cetraria islandica*, *Hypogymnia subobscura*), with overall , the projective coverage ca. 25%. Communities of the spotted polygonal type are also formed on the tops of loamy hills with species such as *Papaver polare*, *Alopecurus alpinus* subsp. *borealis*, *Luzula confusa*, *Poa abbreviata*, *Minuartia rubella*. Lichen coverage here is 30–40 % (e.g., *Stereocaulon alpinum*, *S. arcticum*, *Flavocetraria cucullata*, *Alectoria nigricans*, *Thamnolia vermicularis*).

Peculiar vegetation is formed on high sea terraces located below the cliffs-steep, steep rocks with sea birds nesting on them. A characteristic feature of the vegetation of such terraces is the exceptionally high projective coverage of mosses, which in some cases reaches up to 95 %. Here, moss turf is formed with a thickness of 8–12 cm. Most of species here are common in arctic tundra: *Aulacomnium turgidum*, *Hylocomium splendens*, *Tomentypnum involutum*, *Sanionia uncinata*, *Bryum* sp., associating with such vascular plants as *Alopecurus alpinus* subsp. *borealis* (12–15 %), and also *Poa arctica*, *Ranunculus sulphureus*, *Cochlearia groenlandica*, *Stellaria edwardsii*, *Saxifraga cernua*, *S. rivularis*. The abundance of lichens is always quite high (up to 55 %) in the marginal parts of the terraces adjacent to the coastal ledge, these are *Flavocetraria cucullata*, *Bryocaulon divergens*, *Stereocaulon botryosum*, *Umbilicaria proboscidea*, *Sphaerophorus globosus*, *Cetraria islandica*.

On the surface of a number of islands (at an altitude of 15–20 m above sea level), loamy soils with an admixture of gravel are present. Here, sparse groupings of lichens with vascular plants are common (e.g., *Poa abbreviata*, *Luzula confusa*, *Minuartia rubella*, *Cerastium*

arcticum). Large clusters of *Thamnolia vermicularis* lichen are common here. In areas of snow accumulation in the vast coastal plains, a unique vegetation is occurred, the basis of which is the crust of liverworts (*Gymnomitrium* sp.). The role of some vascular plants, in particular, *Phippsia algida*, *Cerastium regelii*, *Saxifraga hyperborea*, *Cochlearia groenlandica*, increases on coastal plains composed of sand deposits, the total coverage of which reaches 10%. Mosses and lichens cover the surface of large- and medium-sized blocky basalt ruins with a glandular crust. Large layers of the scale lichen *Porpidia melinodes* are formed on the surface of basalt blocks. In the clefts between the blocks, the moss *Racomitrium lanuginosum* with an admixture of *Oncophorus* sp. is common, while the black crust is composed of liverworts (*Gymnomitrium* sp.). On low sea terraces, large polygons sometimes develop with abundant lichen vegetation, with coverage in some areas up to 70–80 % (*Alectoria nigricans*, *Bryocaulon divergens*, *Pseudephebe pubescens*, *Sphaerophorus fragilis*, *S. globosus*, *Umbilicaria arctica*, *U. decussata*). In the valleys that divide polygons, a nival situation occurs, the sign of which is a certain set of mosses and lichens: (e.g., *Andreaea rupestris*, *Racomitrium lanuginosum*, *Cetrariella delisei*). On numerous taluses that overlap the slopes of the plateau and individual remains, extremely sparse vegetation is formed (projective coverage – 1–2 %), where 4–5 species of vascular plants are usually found (e.g., *Saxifraga cespitosa*). In the lower parts of the mobile scree, there is a blackening of the slope with a projective vegetation cover of up to 15–17 %. *Alectoria nigricans*, *Bryocaulon divergens*, *Luzula confusa* and *Potentilla hyperarctica* are common in the vegetation cover.

COLLECTIONS

The present publication is based on the identification of mosses collected by S.S. Kholod on 25 islands in Franz Josef Land Archipelago in 2012. The results of the identification of moss collections made in 2019 by L.A. Konoreva and S.V. Chesnokov on Alexandra Land, George Land, Hooker, Ziegler, Kuhn and Jackson islands are included, as well as the small collection of Zaverin from Heiss, Rudolf, Graham Bell islands made in 2007. In total, over 1800 moss specimens were studied. The old collections of mosses from the archipelago, stored in the LE, were also revised, taking into account the latest taxonomic updates. All literature sources were considered. The species of genus *Schistidium* are given according to revision of herbarium materials (LE) by E.A. Ignatova.

LIST OF SPECIES

The annotated list of mosses is given in alphabetical order, it includes 157 species. The nomenclature generally follows Ignatov *et al.* (2006) with some updates from recent literature. Annotation of each species includes some synonyms that are common in some Russian publications (in brackets). After the species name the presence of reproductive structure is given in parentheses (spor. – sporophytes;

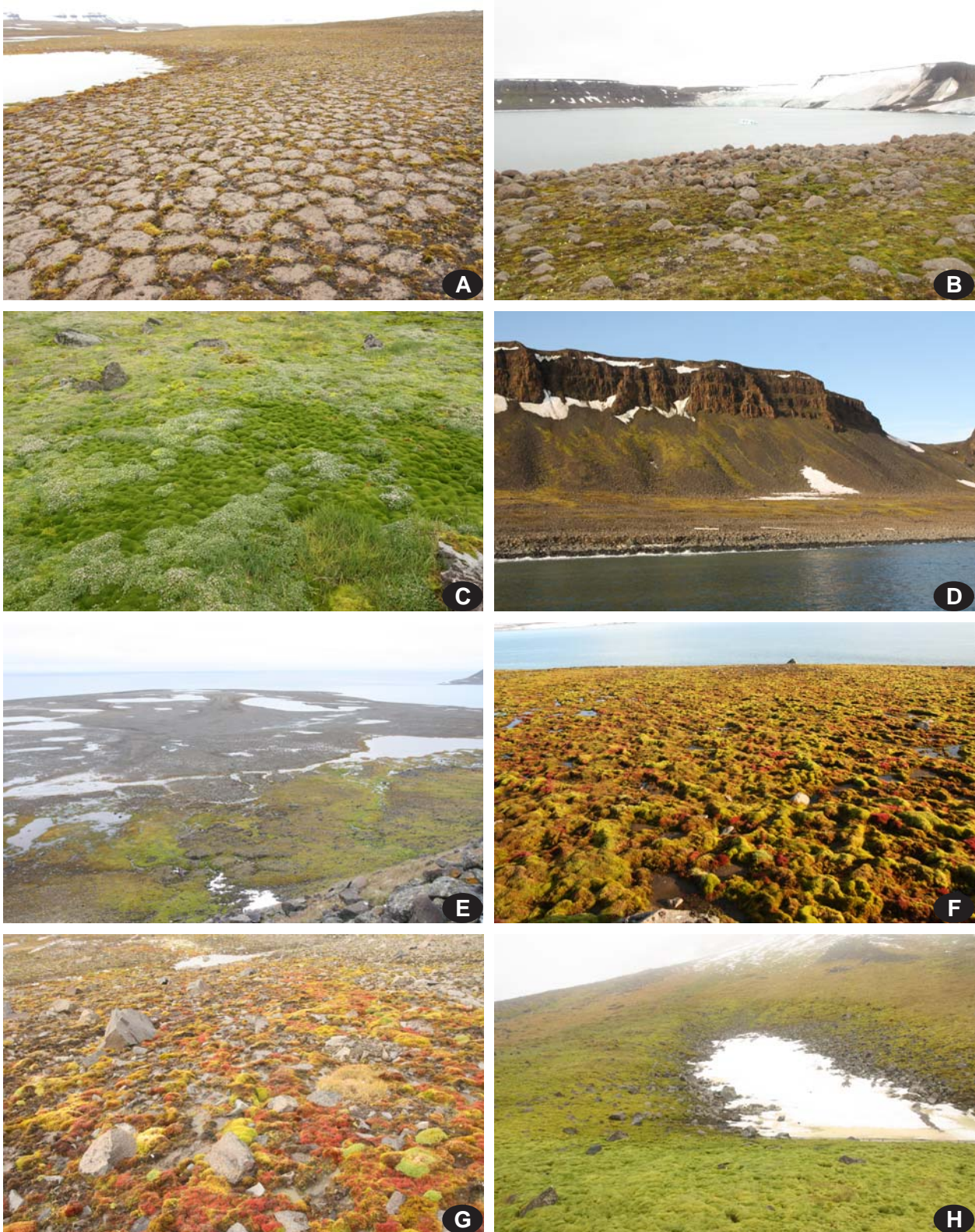


Fig. 2: Franz Josef Land vegetation types (photos of Kholod). **A:** Nansen Island, polygonal *Phippsia algida*-moss (*Campylium stellatum*, *Distichium capillaceum*, *Flexitrichum flexicaule*) community; **B:** George Land Island, moss (*Hygrohypnella polare*, *Drepanocladus arcticus*, *Sanionia uncinata*) community on a high sea terrace; **C:** George Land Island, *Saxifraga rivularis*-moss (*Aplodon wormskioldii*, *Aulacomnium palustre*, *Warnstorfia sarmentosa*) community; **D:** George Land Island; **E:** Meibel Island; **F:** George Land Island, moss (*Bryum cryophyllum*, *Orthothecium* sp.) community near the seashore; **G:** Northbrook Island, Flora Cape, stony-gravelly moss (*Bryum cryophyllum*, *Brachythecium turgidum*, *Orthothecium* sp.) community; **H:** Northbrook Island, Flora Cape, moss (*Warnstorfia sarmentosa*, *Brachythecium turgidum*, *Aulacomnium palustre*) community near snowfields.

gem. – gemmae); then literature cited are given, frequency of occurrence, localities, habitats, often accompanying species. The localities are listed according to Fig. 1; localities confirmed by the herbarium specimens are boldfaced, while literature records are given in italics. Species new for the Franz Josef Land Archipelago are marked with asterisk (*). All specimens are deposited in LE.

Amblystegium serpens* (Hedw.) Schimp. – Rare: **5.

Andreaea papillosa Lindb. (spor.) – Savicz, 1936; Abramova et al., 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995; Afonina, 2015. Sporadic: **1**, **1c**, **7a**, **7c**, **17**, **24a**, **33a**, **33b**. On soil in moss-lichen community; on rocks, boulders, fine earth between boulders.

A. rupestris Hedw. (spor.) – Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Moseev et al., 2019. Rare: **4**, **7**, **33a**. On fine earth between boulders.

Aplodon wormskioeldii (Hornem.) R. Br. (spor.) – Palibin, 1903-1906; Savicz, 1936; Størmer, 1940; Abramova et al., 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva et al., 2015. Sporadic: **2f**, **4**, **5**, **6**, **7**, **24b**, **33a**, **33b**. In *Papaver polare* open plant community, grass-moss, *Saxifraga*-moss, *Salix polaris*-moss-lichen communities.

Arctoa anderssonii Wich. (spor.) – Ellis et al., 2019b. Rare: **4**, **26**, **30**. In moss, lichen-moss-liverwort polygonal communities and *Papaver*-moss-lichen open plant community.

Aulacomnium palustre (Hedw.) Schwägr. – Savicz, 1932, 1936; Størmer, 1940; Abramova et al., 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015; Czernyadjeva et al., 2015. Frequent: **2a**, **2b**, **2e**, **2f**, **4**, **5**, **6**, **7**, **12a**, **13**, **15**, **24b**. In grass-lichen-moss, *Saxifraga*-moss, herb-lichen, *Salix polaris*-lichen-moss communities; with *Straminergon stramineum*, *Warnstorfia sarmentosa* etc.

A. turgidum (Wahlenb.) Schwägr. – Palibin, 1903-1906; Savicz, 1932, 1936; Størmer, 1940; Abramova et al., 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva et al., 2015; Moseev et al., 2019. Common: **1**, **2a**, **2b**, **2c**, **2e**, **2f**, **3**, **4**, **5**, **6**, **7**, **7a**, **10**, **11**, **12**, **12a**, **13**, **15**, **18**, **23**, **24a**, **25**, **26**, **27**, **30**, **31a**, **31b**, **32**, **33a**, **33b**, **34**. In various grass-moss-lichen, herb-moss-lichen-liverwort, forb-lichen-moss-liverwort, graminoids-lichen-moss communities and moss-lichen polygonal open plant communities.

Bartramia ithyphylla Brid. (spor.) – Savicz, 1932, 1936; Abramova et al., 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva et al., 2015; Moseev et al., 2019.

Common: **1**, **1b**, **2e**, **4**, **5**, **6**, **7**, **10**, **12a**, **15**, **16**, **19**, **20**, **22**, **23**, **24a**, **26**, **27**, **31b**. In forb-lichen-moss-liverwort, herb-moss-lichen, moss-lichen-liverwort, *Saxifraga*-lichen-moss communities and *Phippsia*-lichen-moss polygonal open plant communities; on loamy-gravelly area; with *Myurella julacea*, *Pohlia cruda*, *Niphotrichum pan-shii*, *Polytrichastrum septentrionale* etc.

Blindia acuta (Hedw.) Bruch & Schimp. – Sofronova et al., 2019a. Rare: **1b**, **12b**, **15**. In moss-lichen-liverwort, moss-lichen and lichen communities.

Blindiadelphus polaris (Berggr.) Fedosov & Ignatov (*Seligeria polaris* Berggr.) – Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **1**, **7**. The genus *Blindiadelphus* was segregated from *Seligeria* on the basis of morphological and molecular evidence (Fedosov et al. 2017). The species is given for the archipelago according to A.M. Odasz (1996).

Brachythecium cirrosum (Schwägr.) Schimp. – Savicz, 1932, 1936; Størmer, 1940; Abramova et al., 1961; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Moseev et al., 2019. Sporadic: **1**, **4**, **5**, **7**, **12a**, **12c**, **13**, **19**. In stony forb-lichen and damp herb-moss communities.

B. mildeanum (Schimp.) Schimp. ex Milde – Savicz, 1936; Abramova et al., 1961; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **5**, **7**. On stream bank.

B. salebrosum (F. Weber & D. Mohr) Schimp. – Abramova et al., 1961; Afonina & Czernyadjeva, 1995; Sofronova et al., 2019b. Rare: **28**. On loamy-gravelly soil near shore of sea, with *Pohlia cruda*. Det. Ignatov.

B. turgidum (Hartm.) Kindb. – Palibin, 1903-1906; Størmer, 1940; Abramova et al., 1961; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015; Czernyadjeva et al., 2015. Common: **1b**, **1c**, **2a**, **2b**, **2c**, **2f**, **4**, **5**, **7**, **7a**, **10**, **12a**, **13**, **15**, **19**, **20**, **21**, **22**, **25**, **27**, **30**, **31a**. In various grass-moss-lichen, herb-moss-lichen-liverwort, forb-lichen-moss-liverwort, graminoids-lichen-moss, *Phippsia*-moss, *Papaver*-lichen-moss communities; in *Phippsia*-lichen-moss and moss-lichen polygonal open plant communities.

B. udum I. Hagen – Afonina, 2015; Czernyadjeva et al., 2015. Rare: **5**. In *Saxifraga*-moss communities; with *Bryum* sp., *Syntrichia ruralis*.

Bryoerythrophyllum ferruginascens (Stirt.) Giacom. – Savicz, 1936; Abramova et al., 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **1**, **7**, **22**, **27**, **31a**. In forb-moss-lichen and *Phippsia*-lichen-moss communities with *Distichium capillaceum*, *Eurhynchiastrum pulchellum*, *Flexitrichum flexicaule*, *Sanionia uncinata*.

B. recurvirostrum (Hedw.) P.C. Chen – Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **7**, **19**, **22**. In *Salix*-herb-lichen-moss, *Phippsia*-moss-lichen communities with *Distichium capillaceum*, *Myurella tenerrima*, *Oncophorus wahlenbergii*.

Bryum arcticum (R. Br.) Bruch & Schimp. (spor.) – Savicz, 1936; Abramova *et al.*, 1961; Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015. Sporadic: **1, 3, 4, 5, 7, 14**. In *Salix*-herb-lichen-moss, herb-lichen-moss, forb-lichen communities.

B. argenteum Hedw. – Savicz, 1936; Abramova *et al.*, 1961; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015. Rare: **5, 7, 13, 14**. On rocks and gravelly scree.

B. cryophilum Mårtensson – Palibin, 1903-1906; Savicz, 1932, 1936; Størmer, 1940; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015; Moseev *et al.*, 2019. Frequent: **1, 2e, 4, 5, 6, 7, 7a, 12a, 12c, 13, 18, 26, 31a**. In damp grass-moss, forb-moss, *Saxifraga*-lichen-moss, moss-lichen communities, on shore of stream with *Orthothecium* sp., *Philonotis fontana*, *P. tomentella*, *Scorpidium revolvens*, *Warnstorfia sarmentosa* etc.

B. cyclophyllum (Schwägr.) Bruch & Schimp. (gem.) – Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **1, 12, 31a, 33a**. In *Saxifraga*-moss, moss-lichen communities with *Drepanocladus arcticus*, *Flexitrichum flexicaule*, *Polytrichastrum septentrionale*.

B. cf. elegans* Nees – Sporadic: **1b, 4, 20, 26, 30. In *Saxifraga*-moss, moss-liverwort, forb-moss-lichen, herb-lichen-moss communities; *Papaver*-moss-lichen open plant communities with *Flexitrichum flexicaule* etc.

B. neodamense Itzigs. – Aleksandrova, 1983; Afonina, 2015. Rare: **1, 24a, 27**. In damp moss-lichen polygonal communities with *Hygrohypnella polare*, *Scorpidium revolvens*, *Warnstorfia sarmentosa*.

B. nitidulum Lindb. (spor.) – Savicz, 1936; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995. Rare: **14**.

B. pallescens Scheich. ex Schwägr. – Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **1**. In moss-lichen community.

B. pseudotriquetrum (Hedw.) P. Gaertn., B. Mey. & Scherb. – Palibin, 1903-1906; Abramova *et al.*, 1961; Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015; Czernyadjeva *et al.*, 2015. Rare: **1, 2c, 5, 19**. In *Saxifraga*-moss, grass-moss communities; herb-moss-lichen open plant community.

B. rutilans Brid. (gem.) – Savicz, 1932, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015; Czernyadjeva *et al.*, 2015. Frequent: **1, 1b, 1c, 2e, 2f, 2g, 5, 6, 7, 11, 12, 12b, 19, 22, 24a, 24b, 25, 31a, 31b, 33a, 33b**. In different *Phippsia*-lichen-liverwort polygonal, *Salix polaris*-moss-lichen, grass-moss, herb-moss, moss-lichen, moss-liverwort communities; *Saxifraga*-moss open plant community; on fine earth between boulders near shore of sea; with *Ceratodon heterophyllus*, *Hygrohypnella polare*, *Pohlia cruda*, *Sanionia uncinata* etc.

B. teres Lindb. – Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015; Czernyadjeva *et al.*, 2015. Rare: **1, 5, 13**. In herb-liverwort-moss, lichen-moss-liverwort and *Phippsia*-lichen-moss communities.

Buckia vaucheri (Lesq.) D. Ríos, M.T. Gallego & J. Guerra [*Stereodon vaucheri* (Lesq.) Lindb. & Broth.] – Rare: **7a, 15**. In moss-herb and herb-lichen-liverwort communities; with *Drepanocladus arcticus*, *Flexitrichum flexicaule*. The genus *Buckia* was established by Câmara *et al.* (2018) to accommodate *Hypnum vaucheri*.

Bucklandiella sudetica* (Funck) Bednarek-Ochyra & Ochyra – Rare: **31a. On bare soil by shore of sea.

Calliergon cordifolium (Hedw.) Kindb. – Rare: **4**. In grass-moss community.

C. giganteum (Schimp.) Kindb. – Savicz, 1936; Abramova *et al.*, 1961; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **4, 6, 7**. On damp *Salix*-herb-moss, herb-lichen-moss communities; on stream bank.

Campylium bambergeri (Schimp.) Hedenäs, Schlesak, D. Quandt [*Stereodon bambergeri* (Schimp.) Lindb.] – Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **7, 10, 20, 31a**. In forb-liverwort-lichen, moss-lichen and spotty *Salix*-herb-lichen-moss communities; on bare loamy-gravelly soil; with *Distichium capillaceum*, *Flexitrichum flexicaule*.

C. stellatum (Hedw.) C.E.O. Jensen – Savicz, 1932; Abramova *et al.*, 1961; Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015. Sporadic: **1, 1b, 7a, 10, 22, 33b**. In *Phippsia*-moss-lichen, herb-moss, moss-liverwort communities; *Phippsia*-lichen-moss polygonal open plant community; with *Flexitrichum flexicaule*, *Orthothecium* sp.

Ceratodon heterophyllus Kindb. – Savicz, 1936; Savicz-Ljubitzkaja & Smirnova, 1970; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015. Sporadic: **2, 5, 7, 12, 12b, 13, 19, 22, 24a, 33b, 35**. In *Phippsia*-moss, moss-lichen communities; with *Bryum rutilans*, *Pohlia cruda*, *Polytrichastrum septentrionale*.

C. purpureus (Hedw.) Brid. (spor.) – Palibin, 1903-1906; Savicz, 1936; Størmer, 1940; Abramova *et al.*, 1961; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015; Czernyadjeva *et al.*, 2015. Sporadic: **1a, 2c, 2f, 2g, 4, 5, 7, 13, 14, 17, 18, 32, 34**. In *Poa arctica*-lichen-moss, *Phippsia*-moss-liverwort, herb-moss communities; *Saxifraga*-moss open plant communities; on bare soil among boulders; with *Ceratodon heterophyllus*, *Syntrichia ruralis* etc.

Cinclidium arcticum (Bruch & Schimp.) Schimp. – Odasz, 1996; Afonina, 2015. Rare: **7**. The species is given for the archipelago according to A.M. Odasz (1996).

Conostomum tetragonum (Hedw.) Lindb. – Safronova *et al.*, 2019a. Rare: **12b**. In moss-liverwort community.

Cratoneuron curvicaule (Jur.) G. Roth – Savicz, 1932, 1936; Abramova *et al.*, 1961; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **7, 13, 19**. On gravelly slope.

Dicranella subulata (Hedw.) Schimp. (spor.) – Czernyadjeva *et al.*, 2015. Rare: **5**. In lichen-moss-liverwort community.

Dicranum acutifolium* (Lindb. & Arnell) C.E.O. Jensen – Sporadic: **4, 6, 7, 11, 12a, 24a, 26, 30, 31a. In *Saxifraga*-lichen, herb-moss-lichen, moss-lichen communities; *Papaver*-moss-lichen open plant communities; with *Aulacomnium turgidum*, *Sanionia uncinata*, *Tomenypnum involutum* etc.

D. elongatum Schleich. ex Schwägr. – Savicz, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015; Czernyadjeva *et al.*, 2015. Common: **1, 1c, 2f, 4, 5, 7, 11, 12a, 13, 16, 22, 24a, 26, 30, 31a, 31b**. In differently *Poa arctica*-lichen-moss, herb-moss-lichen, forb-lichen-moss-liverwort, grass-lichen-moss, moss-liverwort-lichen polygonal communities; moss-lichen polygonal open plant communities.

D. groenlandicum Brid. – Czernyadjeva *et al.*, 2019. Rare: **13**. In grass-lichen-moss community.

D. laevidens R.S. Williams – Afonina, 2015; Czernyadjeva *et al.*, 2015. Frequent: **2f, 4, 5, 7, 7a, 12a, 15, 22, 26**. In *Salix polaris*-lichen-moss, *Saxifraga*-lichen-moss, herb-moss-lichen, grass-moss communities; *Papaver*-moss-lichen open plant communities; with *Aulacomnium turgidum*, *Sanionia uncinata*, *Stereodon holmenii* etc.

D. leioneuron* Kindb. – Rare: **7. This species is given on base of reidentification of one specimen collected by I.M. Ivanov in 1929 on Hooker Land Island and identified by L.I. Savicz as *D. scoparium* Hedw. var. *integrifolium* Lindb.

D. scoparium Hedw. (*D. scoparium* var. *integrifolium* Lindb.) – Størmer, 1940. Rare: **5**. This species was recorded from Franz Jozef Land also by L.I. Savicz (1932) and Savicz-Ljubitzkaja & Smirnova, (1970) as *D. scoparium* var. *integrifolium* Lindb. However, during the revision the so-named specimens were reidentified as *D. laevidens*; Størmer's record needs confirmation.

D. spadiceum J.E. Zetterst. – Czernyadjeva *et al.*, 2019. Rare: **2e, 4, 12a**. In *Saxifraga*-lichen-moss, herb-moss-lichen communities.

Didymodon icmadophillus* (Schimp. ex Müll. Hal.) R.H. Zander – Rare: **7. In spotty forb-lichen community; with *Distichium inclinatum*.

D. vinealis* (Brid.) R.H. Zander – Rare: **7. In *Salix polaris*-herb-lichen-moss community; with *Distichium capillaceum*, *Flexitrichum flexicaule*. Earlyly for Hooker Island *D. rigidulus* was recorded (Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015), but later the specimen was reidentified as *D. vinealis* by J. Kučera.

Distichium capillaceum (Hedw.) Bruch & Schimp. (spor.) – Palibin, 1903-1906; Savicz, 1932; Savicz, 1936; Abramova *et al.*, 1961; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*,

2015. Common: **1, 1b, 2c, 2e, 4, 5, 6, 7, 7a, 10, 11, 12a, 13, 15, 16, 19, 20, 21, 22, 23, 24a, 26, 27, 29, 30, 31a, 33a**. In different *Saxifraga*-moss-liverwort, *Salix polaris*-herb-lichen-moss, *Papaver*-lichen-moss, *Phippsia*-moss-lichen, herb-moss-lichen, forb-lichen-moss communities; forb-moss and *Phippsia*-lichen-moss polygonal open plant communities.

D. hagenii Ryan ex H. Philib. – Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995. Rare: **7**. On a rocky southern slope.

D. inclinatum* (Hedw.) Bruch & Schimp. (spor.) – Rare: **7. In spotty forb-lichen community; with *Didymodon icmadophillus*.

Drepanocladus arcticus (Williams) Hedenäs – Savicz, 1936; Størmer, 1940; Abramova *et al.*, 1961; Afonina, 2015; Czernyadjeva *et al.*, 2015; Moseev *et al.*, 2019. Common: **1, 2c, 2d, 2e, 2f, 2g, 3, 4, 5, 6, 7, 7a, 12b, 19, 21, 22, 23, 25, 26, 27, 30, 31a**. In various herb-lichen-moss-liverwort, lichen-moss-liverwort polygonal, forb-liverworts, *Phippsia*-lichen-moss, lichen-moss communities; *Phippsia*-lichen-moss-liverwort and polygonal herb-moss-lichen open plant communities.

D. polygamus (Schimp.) Hedenäs – Afonina & Czernyadjeva, 1995; Moseev *et al.*, 2018, 2019. Rare: **4, 7, 30**. In grass-moss and herb-moss-lichen communities; with *Sanionia uncinata*, *Stereodon holmenii*.

D. sendtneri (Schimp.) Warnst. – Savicz, 1936; Abramova *et al.*, 1961; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **1, 6, 7, 19**. On stream bank; on gravelly scree; with *Flexitrichum flexicaule*, *Orthothecium* sp., *Warnstorfia sarmentosa* etc.

Ecalypta alpina Sm. (spor.) – Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015. Rare: **1, 7, 10, 19, 21**. In forb-liverworts and herb-liverwort-lichen communities; with *Distichium capillaceum*.

E. rhamnoides (Schimp.) Schwägr. (spor.) – Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015. Sporadic: **1, 1b, 7, 14, 15, 29, 31a**. In forb-moss-lichen communities; on fine earth between stones.

E. trachymitria Ripart (spor.) – Savicz, 1932, 1936; Størmer, 1940; Abramova *et al.*, 1961; Afonina & Czernyadjeva, 1995. Rare: **5, 7, 13**. On fine earth between stones; on gravelly slope; with *Orthothecium strictum*, *Syntrichia ruralis*.

Eurhynchiastrum pulchallum (Hedw.) Ignatov & Huttunen – Savicz, 1936; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Sporadic: **7, 7a, 13, 24a, 26, 31a**. In forb-lichen-moss-liverworts, herb-moss-lichen, moss-lichen communities; *Papaver*-moss-lichen open plant community; with *Distichium capillaceum*, *Pohlia cruda*, *Sanionia uncinata*, *Roaldia revoluta*, *Timmia austriaca*.

Flexitrichum flexicaule (Schwägr.) Ignatov & Fedosov [*Ditrichum flexicaule* (Schwägr.) Hampe] – Savicz,

1932, 1936; Størmer, 1940; Abramova et al., 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva et al., 2015; Moseev et al., 2019. Common: **1, 1b, 1c, 2c, 2e, 2g, 4, 5, 6, 7, 7a, 10, 12, 12a, 12c, 13, 14, 16, 19, 20, 21, 22, 23, 24a, 27, 30, 31a, 32, 33a, 33b, 34**. In different *Saxifraga*-moss-liverwort, *Phippsia*-lichen-moss, forb-lichen-moss-liverwort, grass-lichen-moss, herb-moss-lichen communities; moss-lichen polygonal and lichen-moss-liverwort polygonal open plant communities.

F. gracile (Mitt.) Ignatov & Fedosov [*Ditrichum gracile* (Mitt.) Kuntze]. – Czernyadjeva et al., 2019. Sporadic: **1c, 4, 10, 11, 16, 22, 31a**. In *Phippsia*-moss-lichen, herb-lichen-moss, lichen-moss communities; forb open plant community; with *Pohlia cruda*, *Sanionia uncinata*, *Syntrichia ruralis*, *Tomentypnum involutum* etc.

Hennediella heimii (Hedw.) R.H. Zander var. *arctica* (Lindb.) R.H. Zander (spor.) – Savicz, 1936; Abramova et al., 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **5, 7, 7a**. In moss-lichen communities.

Hygrohypnella polare (Lindb.) Ignatov & Ignatova – Savicz, 1932, 1936; Størmer, 1940; Abramova et al., 1961; Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Frequent: **1, 1a, 1b, 2c, 2e, 2f, 2g, 3, 6, 7, 11, 12, 13, 14, 16, 22, 27**. In different *Phippsia*-lichen-liverwort polygonal, grass-lichen-moss, lichen-liverwort, forb-moss, moss-lichen communities; *Saxifraga*-moss and moss-lichen polygonal open plant communities.

Hygrohypnum luridum (Hedw.) Jenn. – Afonina, 2015. Rare: **4, 7**. In *Salix*-herb-lichen-moss and gravelly herb-lichen-moss communities.

Hylocomium splendens Schimp. – Palibin, 1903-1906; Savicz, 1932, 1936; Størmer, 1940; Abramova et al., 1961; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva et al., 2015. Frequent: **1, 2e, 2f, 4, 5, 7, 7a, 10, 11, 12, 15, 22, 24a, 26, 27, 31a, 33a**. In different *Poa arctica*-lichen-moss, *Phippsia*-moss-lichen, *Saxifraga*-moss-liverwort, grass-moss, herb-lichen-moss, moss-lichen communities; herb-moss-lichen open plant communities.

Hymenoloma crispula (Hedw.) Ochyra (spor.) – Savicz, 1932, 1936; Størmer, 1940; Abramova et al., 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Moseev et al., 2019. Common: **1a, 1b, 2c, 2g, 4, 5, 6, 7, 7a, 8, 11, 16, 17, 20, 22, 24a, 25, 26, 27, 31b, 32, 33b, 34**. In *Saxifraga*-moss-liverwort, forb-lichen, lichen-moss-liverwort communities; moss-lichen polygonal open plant communities.

Hypnum cupressiforme Hedw. – Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare:

2f, 7. In *Saxifraga*-moss open plant community with *Sanionia uncinata*.

Isopterygiella pulchella (Hedw.) Ignatov & Ignatova [*Isopterygiopsis pulchella* (Hedw.) Z. Iwats.]. – Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Sporadic: **1b, 2e, 4, 7, 23, 24a, 30, 31a, 33b**. In forb-moss-lichen, herb-lichen-moss-liverwort, moss-lichen communities with *Bartramia ithyphylla*, *Dicranum spadiceum*, *Flexitrichum flexicaule*, *Pohlia cruda*, *Sanionia uncinata*, *Timmia austriaca* etc.

Kiaeria glacialis* (Berrgr.) I. Hagen – Rare: **1a, 1c. In lichen polygonal open plant community; on rocks.

K. starkei (F. Weber & D. Mohr) I. Hagen – Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **1**. The species is given for the archipelago according to V.D. Aleksandrova (1983).

Leptobryum pyriforme* (Hedw.) Wilson – Rare: **5. On gravelly slope; with *Tayloria acumanata*, *Tortula leucostoma*.

Leptodictyum riparium (Hedw.) Warnst. – Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **7**. In lichen-herb community with *Distichium capillaceum*.

Lewinskya pylaisii (Brid.) F. Lara, Garilleti & Goffinet [*Orthotrichum pylaisii* Brid.] (spor.) – Savicz, 1936; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015. Rare: **7**. On gravelly scree on slope; on rocks near waterfall.

Loeskyppnum badium (C.C. Hartm.) Paul. – Czernyadjeva et al., 2019. Rare: **24a, 24b, 33b**. In *Salix polaris*-moss-lichen and moss-lichen polygonal communities; on fine earth between boulders; with *Bryum* sp., *Scorpidium revolvens*, *Warnstorfia sarmentosa*.

Meesia triquetra (Jolycl.) Ĺngstr. – Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015; Moseev et al., 2019. Rare: **4, 7, 12c, 24b**. In *Salix polaris*-moss-lichen communities.

Mnium blyttii Bruch & Schimp. – Aleksandrova, 1983; Afonina, 2015. Rare: **1**. The species is given for the archipelago according to V.D. Aleksandrova (1983).

M. cf. lycopodioides* Schwägr. – Rare: **30. In *Salix polaris*-moss-lichen community with *Flexitrichum flexicaule*, *Pohlia cruda*.

Myurella julacea (Schwägr.) Schimp. – Savicz, 1932, 1936; Abramova et al., 1961; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva et al., 2015. Frequent: **1, 1b, 2c, 4, 5, 7, 7a, 10, 13, 19, 23, 27, 30, 31a**. In *Papaver*-lichen-moss, forb-moss-lichen, herb-lichen-moss-liverwort, grass-moss communities; *Phippsia*-lichen-moss polygonal, herb-moss-lichen and forb open plant communities; with *Bartramia ithyphylla*, *Distichium capillaceum*, *Flexitrichum flexicaule*, *Orthotrichum chryseon*, *Pohlia cruda*, *Timmia austriaca*.

M. tenerrima (Brid.) Lindb. – Savicz, 1936; Abramova et al., 1961; Aleksandrova, 1983; Safronova, 1986;

Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Sporadic: **1, 1b, 2h, 7, 7a, 21, 30, 31a, 33b**. In forb-moss-lichen, forb-liverworts, moss-lichen communities; with *Distichium capillaceum*, *Flexitrichum flexicaule*, *Orthothecium* sp., *Pohlia cruda*, *Roaldia revoluta*, *Timmia austriaca*.

Niphotrichum canescens (Hedw.) Bednarek-Ochyra & Ochyra – Savicz, 1932; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015. Sporadic: **1, 1b, 4, 7, 11, 22, 23, 30, 32, 33b**. In *Phippisia*-lichen-liverwort, herb-lichen-moss-liverwort polygonal, moss-lichen, herb-moss-lichen communities; on fine earth between boulders; with *Hymenoloma crispulum*, *Flexitrichum flexicaule*, *Orthothecium* sp.

N. canescens subsp. *latifolium* (C.E.O. Jensen) Bednarek-Ochyra & Ochyra – Afonina, 2015. Rare: **4, 7, 33a**.

N. ericoides (Brid.) Bednarek-Ochyra & Ochyra – Savicz, 1936; Afonina & Czernyadjeva, 1995; Afonina, 2015. Sporadic: **1b, 1c, 2g, 4, 6, 7, 15, 25, 27**. In moss-lichen polygonal, herb-lichen-moss, grass-lichen-moss, moss-lichen-liverwort communities; forb-lichen open plant communities; with *Aulacomnium turgidum*, *Flexitrichum flexicaule*, *Orthothecium* sp.

N. panschii (Müll. Hal.) Bednarek-Ochyra & Ochyra – Afonina, 2015. Sporadic: **1a, 1b, 1c, 7, 7a, 15, 19, 21, 22, 23, 24a, 26, 27**. In forb-moss-lichen, herb-lichen-liverwort, gravelly moss-lichen, communities; moss-lichen polygonal open plant communities; with *Flexitrichum flexicaule*, *Sanionia uncinata*.

Oncophorus demetrii* (Renauld & Cardot) Hedenäs – Rare: **12a, 15, 27. In *Saxifraga*-lichen-moss, *Salix polaris*-lichen-moss, *Phippisia*-lichen-moss, moss communities; with *Distichium capillaceum*, *Flexitrichum flexicaule*. *O. demetrii* was recognised as a species by Hedenäs (2018).

O. integerrimus* Hedenäs – Sporadic: **4, 7a, 10, 23, 31a. In herb-lichen-moss-liverwort, grass-moss, moss-lichen communities; *Phippisia*-lichen-moss polygonal open plant community; *Drepanocladus arcticus*, *Orthothecium* sp., *Scorpidium revolutus*, *Warnstorfia sarmen-tosa*. *O. integerrimus* was recognised at species level by Hedenäs (2017).

O. virens (Hedw.) Brid. – Savicz, 1936; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015; Czernyadjeva *et al.*, 2015. Sporadic: **1, 5, 6, 7, 12, 12a, 19**. In *Saxifraga*-lichen-moss communities; with *Distichium capillaceum*.

O. wahlenbergii Brid. [*O. compactus* (Bruch et Schimp.) De Not.] – Savicz, 1936; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015. Sporadic: **1, 1c, 1d, 2h, 6, 12, 22, 24a, 24b, 31a, 31b**. In *Phippisia*-moss-lichen, forb-

lichen-moss-liverwort, gravelly lichen, moss-lichen communities; with *Distichium capillaceum*, *Flexitrichum flexicaule*, *Pohlia cruda* etc.

Orthothecium chryseon (Schwägr.) Schimp. – Savicz, 1932, 1936; Abramova *et al.*, 1961; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015; Moseev *et al.*, 2019. Common: **1, 1b, 2c, 4, 5, 6, 7, 7a, 8, 10, 11, 12, 12a, 12c, 15, 16, 19, 21, 22, 23, 25, 26, 31a, 33b, 34**. In different *Saxifraga*-lichen-moss, *Phippisia*-lichen-moss, forb-moss-lichen, forb-liverwort, herb-lichen-moss-liverwort, moss-lichen communities; *Phippisia*-lichen-moss polygonal and forb-lichen open plant communities.

O. remotifolium* Ignatov & Ignatova – Rare: **6, 7. Moss community on the terrace with *Myurella julacea*, *Pohlia cruda*, *Sanionia uncinata* etc. Det. E.A. Ignatova. This species and the next are given according to Ignatov *et al.*, 2020.

O. retroflexum* Ignatov & Ignatova – Sporadic: **2e, 2g, 4, 6, 7, 7f, 24b, 27, 31a, 33. In moss and moss-lichen communities; *Papaver polare* open plant communities; swampy moss-lichen communities with *Salix polaris*.

O. strictum Lorentz – Savicz, 1932, 1936; Abramova *et al.*, 1961; Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015. Sporadic: **1, 1b, 2c, 2g, 7a, 13, 16, 19, 20, 22, 30, 33a**. In *Papaver*-lichen-moss, *Phippisia*-moss-lichen, forb-moss-lichen communities; herb-moss-lichen open plant communities; on fine earth between stones.

Orthotrichum pellucidum Lindb. – Odasz, 1996; Afonina, 2015. Rare: **7**. The species is given for the archipelago according to A.M. Odasz (1996).

Philonotis fontana (Hedw.) Brid. – Savicz, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015; Czernyadjeva *et al.*, 2015. Sporadic: **2e, 2g, 4, 5, 7, 7a, 31a**. In grass-moss, herb-moss, moss communities; with *Bryum cryophilum*, *Flexitrichum flexicaule*, *Orthothecium* sp.

P. tomentella Molendo – Savicz, 1932, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015. Sporadic: **1, 2e, 2f, 4, 5, 7, 11, 13**. In forb-lichen-moss, herb-moss-lichen, forb-liverwort, liverwort-moss communities; *Saxifraga*-moss and forb-lichen open plant communities.

Plagiomnium curvatulum* (Lindb.) Schljakov – Rare: **1c. In gravelly moss-lichen community; with *Bryum* sp., *Drepanocladus arcticus*.

P. ellipticum (Brid.) T.J. Kop. – Palibin, 1903-1906; Savicz, 1936; Størmer, 1940; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015;

Czernyadjeva *et al.*, 2015. Sporadic: **1, 2e, 2f, 4, 5, 12a, 13**. In *Saxifraga*-lichen-moss, herb-moss, grass-moss communities; with *Brachythecium turgidum*, *Rhizomni-um pseudopunctatum*, *Sanionia uncinata*.

Plagiothecium berggrenianum Frisvoll – Czernyadjeva *et al.*, 2015. Rare: **5**. In grass-moss community; with *Dicranum laevidens*, *Pohlia nutans*, *Sanionia uncinata*.

Platydictya jungermannioides (Brid.) H.A. Crum – Savicz, 1936; Abramova *et al.*, 1961; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015. Rare: **7, 12a, 13**. In *Saxifraga*-lichen-moss and gravelly herb-lichen-moss communities; with *Distichium capillaceum*, *Drepanocladus arcticus*, *Flexitrichum flexicaule*, *Orthothecium* sp.

Pogonatum dentatum (Brid.) Brid. – Sofronova *et al.*, 2019b. Rare: **1a**. In moss-lichen community.

P. urnigerum (Hedw.) P. Beauv [*P. urnigerum* var. *subintegrifolium* (Arnell & C.E.O. Jensen) H.A. Möller] – Savicz, 1936; Aleksandrova, 1983; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **1, 1c, 3, 11, 19, 34**. In herb-moss-lichen and lichen communities; on rocks.

Pohlia andrewsii A.J. Shaw (gem.) – Sofronova *et al.*, 2019a. Rare: **2e, 2f, 12b**. In lichen-liverwort and *Phippsia*-moss communities; *Saxifraga*-moss open plant community; with *Ceratodon purpureus*, *Pohlia drummondii*, *Psilopilum cavifolium*, *Sanionia uncinata*.

P. beringiensis A.J. Shaw (gem.) – Ellis *et al.*, 2019a. Rare: **1b, 30, 31b**. In lichen-moss-liverwort polygonal, moss-liverwort and moss communities; with *Aulacomnium turgidum*, *Bryum rutilans*, *Pohlia cruda*.

P. cruda (Hedw.) Lindb. (spor.) – Palibin, 1903-1906; Savicz, 1932, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015; Moseev *et al.*, 2019. Common: **1, 1a, 1b, 2c, 2d, 2e, 2f, 2g, 3, 4, 5, 6, 7, 7a, 9, 10, 11, 12a, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24a, 26, 27, 28, 30, 31a, 31b, 32, 33a, 33b, 34**. In different *Phippsia*-lichen-liverwort polygonal, *Salix polaris*-lichen-moss, *Poa arctica*-lichen-moss, *Phippsia*-lichen-moss, forb-liverworts, forb-lichen-moss, herb-lichen-moss-liverwort, grass-moss, liverwort-lichen, moss-liverwort communities; moss-lichen polygonal, *Saxifraga*-moss, *Papaver polare*-moss and forb-lichen open plant communities.

P. crudoides (Sull. & Lesq.) Broth. – Sofronova *et al.*, 2019b. Rare: **31b**. In moss-liverwort-lichen polygonal community; with *Timmia austriaca*.

P. drummondii (Müll. Hal.) A.L. Andrews (gem.) – Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015; Czernyadjeva *et al.*, 2015. Frequent: **1, 2d, 2e, 2f, 2g, 4, 5, 7, 9, 11, 12a, 12b, 15, 16, 19, 22, 24a, 31a, 33b**. In *Phippsia*-moss, lichen-liverwort, moss-lichen, grass-moss, herb-lichen communities; *Saxifraga*-moss and moss-lichen polygonal open

plant communities; with *Bartramia ithyphylla*, *Bryum* sp., *Flexitrichum flexicaule*, *Pohlia cruda*, *Psilopilum cavifolium*, *Sanionia uncinata* etc.

P. nutans (Hedw.) Lindb. (spor.) – Savicz, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015. Frequent: **1, 1b, 2d, 2f, 4, 5, 6, 7, 11, 12a, 13, 16, 20, 24a, 24b, 26, 28, 31a**. In *Salix polaris*-lichen-moss, lichen-moss-liverwort polygonal, forb- lichen-moss-liverwort, herb-moss, moss-lichen communities; with *Dicranum elongatum*, *D. laevidens*, *Pohlia cruda*, *Stereodon holmenii*.

P. obtusifolia (Vill. ex Brid.) L.F. Koch – Savicz, 1932; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015. Sporadic: **1, 1b, 2c, 7, 11, 12, 33b**. In moss communities; on fine earth between boulders; with *Polytrichastrum fragile*.

P. prolifera (Kindb.) Lindb. & Broth. (gem.) – Savicz, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **2e, 5, 12a, 25**. In lichen-liverwort, herb-lichen, grass-moss communities; with *Drepanocladus arcticus*, *Polytrichastrum alpinum*.

P. wahlenbergii (F. Weber & D. Mohr) A.L. Andrews – Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **4**. In moss community on shore of stream; with *Sanionia uncinata*.

Polytrichastrum alpinum (Hedw.) G.L. Sm. – Savicz, 1932, 1936; Størmer, 1940; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015. Frequent: **1, 2b, 2c, 2e, 4, 5, 6, 7, 7a, 10, 11, 12, 12a, 13, 15, 16, 19, 20, 24b, 25, 31a, 31b, 33a**. In different *Salix polaris*-moss-lichen, herb-moss-lichen, grass-moss, moss-liverwort, lichen-liverwort communities; *Phippsia*-lichen-moss polygonal open plant communities.

P. fragile (Bryhn) Schljakov – Savicz, 1932, 1936; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015; Czernyadjeva *et al.*, 2015. Frequent: **1, 1b, 1c, 2c, 2d, 2e, 2g, 5, 6, 7, 12a, 12b, 13, 14, 16, 17, 19, 22, 24a, 26, 28**. In *Phippsia*-lichen-moss, forb-lichen, grass-lichen-moss, herb-moss, lichen-moss-liverwort, gravelly moss-lichen communities; moss-lichen polygonal and forb-lichen open plant communities.

P. septentrionale (Brid.) E.I. Ivanova, N.E. Bell & Ignatov – Czernyadjeva *et al.*, 2015. – Common: **1b, 2c, 2e, 2f, 2g, 4, 5, 7, 12b, 14, 16, 22, 23, 24a, 25, 26, 27, 31b, 32**. In *Phippsia*-lichen-liverwort polygonal, *Poa arctica*-lichen-moss, *Phippsia*-moss, herb-lichen-moss-liverwort, forb- lichen-moss-liverwort, grass-moss, moss-lichen communities; herb-moss-lichen, moss-lichen polygonal and forb-lichen open plant communities.

P. sexangulare (Brid.) G.L. Sm. – Odasz, 1996; Afonina & Czernyadjeva, 1995. 7. The species is given for the archipelago according to A.M. Odasz (1996).

Polytrichum hyperboreum R. Br. – Czernyadjeva *et al.*, 2015; Afonina, 2015. Rare: **1b, 5**. In lichen-moss-liverwort and moss communities.

P. jensenii I. Hagen – Savicz, 1936; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995; Abramova *et al.*, 1961; Afonina, 2015. Rare: 7. On gravelly scree on rock.

P. juniperinum Hedw. – Czernyadjeva *et al.*, 2015; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **2e, 5**. In herb-moss community.

P. piliferum Hedw. – Savicz, 1936; Størmer, 1940; Savicz-Ljubitzkaja & Smirnova, 1970; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **1a, 4, 7, 14, 31b**. In moss-liverwort-lichen polygonal community with *Dicranum elongatum*.

P. strictum Brid. – Savicz, 1936; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015. Sporadic: **1, 2f, 4, 6, 7, 24a**. In *Poa arctica*-lichen-moss, moss-lichen polygonal and herb-moss-lichen communities; with *Dicranum elongatum*, *Pohlia cruda*, *P. drummondii*, *Racomitrium laniginosum*.

Pseudocalliergon brevifolium (Lindb.) Hedenäs – Savicz, 1936; Abramova *et al.*, 1961; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015. Common: **4, 7, 7a, 10, 12a, 24a, 24b, 27**. In *Phippsia*-lichen-moss, *Saxifraga*-lichen-moss, *Salix polaris*-moss-lichen, moss-lichen polygonal, grass-moss, moss-lichen communities; *Phippsia*-lichen-moss polygonal open plant community; on lake shore; with *Bryum cryophilum*, *Drepanocladus arcticus*, *Flexitrichum flexicaule*, *Scorpidium revolvens* etc.

P. turgescens (T. Jensen) Loeske – Savicz, 1936; Størmer, 1940; Abramova *et al.*, 1961; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995. Afonina, 2015; Czernyadjeva *et al.*, 2015; Moseev *et al.*, 2019. Sporadic: **1, 1a, 1d, 2c, 2g, 5, 6, 7, 7a, 10, 17, 26, 27**. In forb-liverwort-lichen, herb-moss-lichen, gravelly lichen, grass-moss, moss-lichen communities; forb-lichen open plant community; on lake shore; with *Drepanocladus arcticus*, *Flexitrichum flexicaule*, *Pohlia cruda*, *Orthothecium chryseon*, *Sanionia nivalis*.

Psilopilum cavifolium (Wilson) I. Hagen – Savicz, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **1, 1b, 2e, 19, 33a**. In moss-lichen-liverwort and moss-lichen communities; with *Dicranum elongatum*, *Pohlia cruda*, *Polytrichastrum fragile*.

Racomitrium lanuginosum (Hedw.) Brid. – Palibin, 1903-1906; Savicz, 1932, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina &

Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015. Common: **1, 1a, 1b, 2c, 2e, 4, 5, 6, 7, 7a, 12, 16, 17, 18, 20, 21, 22, 24a, 26, 31a, 31b, 33a, 33b, 34**. In *Phippsia*-moss-lichen, *Poa arctica*-lichen-moss, herb-moss-lichen, forb-lichen-moss-liverwort, forb-liverworts, moss-lichen communities; *Papaver polare* and lichen polygonal open plant communities.

Rhizomnium pseudopunctatum (Bruch & Schimp.) T.J. Kop. – Czernyadjeva *et al.*, 2015. Rare: **4, 5**. In grass-moss communities; with *Brachythecium turgidum*, *Plagiomnium ellipticum*.

Roaldia revoluta (Mitt.) P.E.A.S. Câmara & Carv.-Silva (*Stereodon revolutus* Mitt.) – Savicz, 1932, 1936; Abramova *et al.*, 1961; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015. Common: **1, 1a, 1b, 2c, 2g, 4, 5, 6, 7, 7a, 10, 13, 14, 16, 19, 20, 21, 22, 23, 24a, 25, 26, 28, 29, 30, 31a**. In *Saxifraga*-moss-liverwort, forb-moss-lichen-liverwort, lichen-moss-liverwort polygonal, herb-lichen-moss, graminoids-lichen-moss, grass-moss, moss-lichen communities; *Papaver*-moss-lichen, herb-moss-lichen and lichen open plant communities. The genus *Roaldia* was established to accommodate *Hypnum revolutum* s.lat. (Câmara *et al.* 2018).

Saelania glaucescens (Hedw.) Broth. – Safronova *et al.*, 2019a. Rare: **20, 23, 27**. In *Phippsia*-lichen-moss, moss-lichen polygonal, herb-lichen-moss-liverwort communities; on fine earth between boulders; with *Bartramia ithyphylla*, *Isopterygiella pulchella*.

Sanionia nivalis* Hedenäs – Sporadic: **1a, 1c, 1d, 11, 25, 27, 31b, 33b. In gravelly moss-lichen, moss-lichen polygonal, moss-liverwort communities; on fine earth between boulders; with *Hygrohypnella polaris*, *Pohlia cruda*, *Pseudocalliergon turgescens*, *Warnstorfia sarmentosa*.

S. orthothecioides (Lindb.) Loeske – Palibin, 1903-1906; Savicz, 1936; Odasz, 1996; Afonina, 2015. Rare: **3, 5, 6, 7, 7a, 13**. In *Papaver*-lichen-moss, moss-lichen communities; with *Roaldia revoluta*, *Syntrichia ruralis*.

S. uncinata (Hedw.) Loeske – Palibin, 1903-1906; Savicz, 1932, 1936; Størmer, 1940; Abramova *et al.*, 1961; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015; Moseev *et al.*, 2019. Common: **1, 1a, 1b, 2a, 2c, 2d, 2e, 2f, 2g, 3, 4, 5, 6, 7, 7a, 8, 10, 12a, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24a, 25, 26, 27, 29, 31a, 33a, 34**. In various *Poa arctica*-lichen-moss, *Saxifraga*-lichen-moss, *Phippsia*-lichen-liverwort polygonal, herb-moss-lichen-liverwort, forb-moss-lichen-liverwort, grass-lichen-moss communities; moss-lichen polygonal, *Saxifraga*-moss open plant communities.

Schistidium abrupticostatum (Bryhn) Ignatova & H.H. Blom (spor.) – Afonina, 2015. Rare: 7. On rocks. Det. E.A. Ignatova.

S. andreaeopsis* (Müll. Hal.) Laz. – Rare: **24b. In *Salix polaris*-moss-lichen community; with *Distichium capillaceum*, *Pseudocalliergon brevifolium*.

S. flexipile (Lindb. ex Broth.) G. Roth – Afonina, 2015. Rare: **7, 13**. On rocks.

S. frigidum H.H. Blom (spor.) – Afonina, 2015. Rare: **1c, 2h, 7, 13, 15**. In gravelly moss-lichen, moss-lichen-liverwort and moss-lichen communities; with *Bryum* sp., *Polytrichastrum alpinum*.

S. grandirete H.H. Blom (spor.) – Sofronova *et al.*, 2019b. Rare: **1a, 2g, 15, 27**. In herb-moss-lichen and grass-lichen-moss communities; forb-lichen and lichen open plant community; with *Orthothecium* sp., *Pseudocalliergon turgescens*, *Sanionia uncinata*.

S. holmenianum* Steere & Brassard – Rare: **27. In moss-lichen polygonal community.

S. papillosum Culm. (spor.) – Afonina, 2015. Sporadic: **5, 7, 7a, 25, 31a**. In forb-moss-lichen and moss-lichen communities; with *Pohlia cruda*, *Sanionia uncinata*. Det. E.A. Ignatova.

S. plathyphyllum* (Mitt.) H. Perss (spor.) – Rare: **7. On rocks.

Sciuro-hypnum glaciale (Schimp.) Ignatov & Hutunen – Odasz, 1996; Afonina, 2015. Rare: **1c, 5, 7**. In grass-moss and moss communities; with *Brachythecium turgidum*, *Drepanocladus arcticus*, *Sanionia uncinata*.

Scorpidium cossonii (Schimp.) Hedenäs – Moseev *et al.*, 2018, 2019. Sporadic: **1c, 7a, 10, 12c, 21, 33b**. In forb-lichen-moss, herb-moss, gravelly moss-lichen, moss-lichen communities; *Phippsia*-lichen-moss polygonal open plant community; with *Brachythecium turgidum*, *Flexitrichum flexicaule*, *Orthothecium* sp.

S. revolvens (Sw.) Rubers – Savicz, 1932, 1936; Abramova *et al.*, 1961; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015; Moseev *et al.*, 2019. Sporadic: **1, 1a, 4, 5, 6, 7, 7a, 12c, 24b, 26, 27**. In *Salix polaris*-moss-lichen, *Phippsia*-lichen-moss, grass-moss, herb-moss communities; with *Flexitrichum flexicaule*, *Orthothecium* sp., *Pseudocalliergon brevifolium*.

Splachnum vasculosum Hedw. – Savicz, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **13**. On gravelly slope; with *Philonotis tomentella*.

Stegonia latifolia (Schwägr.) Venturi ex Broth. (spor.) – Abramova *et al.*, 1961; Savicz, 1936; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **7**. On southern gravelly slope.

Stereodon callichroum (Brid.) Braithw. – Odasz, 1996; Afonina, 2015. Rare: **7**. The species is given for the archipelago according to A.M. Odasz (1996).

S. hamulosum* (Schimp.) Lindb. – Rare: **12a. In *Saxifraga*-lichen-moss community; with *Bartramia ithyphylla*, *Bryum* sp., *Distichium capillaceum*, *Flexitrichum flexicaule*.

S. holmenii (Ando) Ignatov & Ignatova – Afonina, 2015. Rare: **4, 7, 15, 24a**. In moss-lichen polygonal and

grass-moss communities; with *Drepanocladus polygamus*, *Pohlia nutans*, *Sanionia uncinata*, *Tomentypnum involutum*.

Straminegron stramineum (Dicks. ex Brid.) Hedenäs – Savicz, 1936; Størmer, 1940; Abramova *et al.*, 1961; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015. Sporadic: **2b, 2d, 2f, 4, 7, 11, 13, 31a**. In herb-moss and grass-moss communities; with *Aulacomnium palustre*, *Sanionia uncinata*.

Syntrichia ruralis (Hedw.) F. Weber & D. Mohr – Palibin, 1903-1906; Savicz, 1932, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015; Moseev *et al.*, 2019. Common: **1, 1b, 2c, 2e, 2f, 2g, 4, 5, 7, 7a, 8, 9, 10, 13, 14, 15, 16, 17, 19, 20, 22, 24a, 26, 29, 30, 31a, 34**. In *Poa arctica*-lichen-moss, *Saxifraga*-moss-liverwort, lichen-moss-liverwort polygonal, forb-lichen-moss-liverwort, herb-lichen-moss, graminoids-lichen-moss, grass-moss communities; *Papaver*-moss-lichen and forb-lichen open plant communities; on fine earth between stones; on bare loamy-gravelly soil.

Tayloria acuminata Hornsch. (spor.) – Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995. Rare: **4, 5**. In graminoids-lichen-moss communities; on gravelly slopes; with *Leptobryum pyriforme*, *Tortula leucostoma*.

Tetraplodon mnioides (Hedw.) Bruch & Schimp. (spor.) – Savicz, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995; Afonina, 2015. – Rare: **5, 13**. On slope on fine earth.

Timmia austriaca Hedw. – Savicz, 1932; Størmer, 1940; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015; Moseev *et al.*, 2019. Common: **1, 1b, 2c, 2e, 2f, 4, 5, 6, 7, 7a, 10, 11, 12a, 15, 16, 20, 21, 22, 23, 24a, 26, 28, 29, 30, 31a, 31b, 33b, 35**. In differently *Salix polaris*-lichen-moss, *Phippsia*-lichen-liverwort, *Saxifraga*-moss-liverwort, moss-liverwort-lichen polygonal, graminoids-lichen-moss, forb-lichen-moss, herb-lichen-moss-liverwort communities; *Papaver*-moss-lichen and herb-moss-lichen open plant communities; on bare loamy-gravelly soil.

T. bavarica* Hessel. – Rare: **29. In forb-lichen open plant community; with *Roaldia revoluta*.

T. norvegica J.E. Zetterst. – Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015; Czernyadjeva *et al.*, 2015. Rare: **4, 5, 7**. In spotty *Salix*-herb-lichen-moss, herb-moss, gravelly herb-lichen moss and gravelly moss communities; with *Bryum* sp., *Distichium capillaceum*, *Flexitrichum flexicaule*, *Orthothecium* sp., *Pohlia drummondii*.

Tomentypnum involutum (Limpr.) Hedenäs & Ignatov [*Tomentypnum nitens* (Hedw.) Loeske var. *involutum*

(Limpr.) C.O.E. Jensen] – Aleksandrova, 1983; Common: **1b, 2c, 2e, 2f, 2g, 4, 5, 7, 7a, 11, 12a, 13, 15, 22, 23, 24b, 27, 30, 31a**. In different *Salix polaris*-moss-lichen, *Saxifraga*-lichen-moss-liverwort, forb-moss-lichen, herb-lichen-moss-liverwort, graminoids-lichen-moss, moss-lichen polygonal, grass-moss communities; moss-lichen polygonal, herb-moss-lichen open plant communities.

T. nitens (Hedw.) Loeske – Rare: **2a**. Moss community on the terrace near the bird colony. Det. M.S. Ignatov. Numerous indications of this species (Savicz, 1932, 1936; Størmer, 1940; Aleksandrova, 1983; Safronova, 1986; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015; Moseev *et al.*, 2019), according to the last treatment (Hedenäs *et al.*, 2020), refer to *Tomentypnum involutum*.

Tortula leucostoma (R. Br.) Hook. (spor.) – Savicz, 1936; Abramova *et al.*, 1961; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **5**. On fine earth and gravelly slopes; with *Leptobryum pyriforme*, *Pohlia prolifera*, *Tayloria acumanata*.

T. mucronifolia var. *aristata* Müll. Hal. ex Warnst. (spor.) – Savicz, 1936; Abramova *et al.*, 1961; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995; Afonina, 2015. Rare: **6, 7, 14, 22**. On rocky slope; on border along edge of puddle; with *Distichium capillaceum*, *Orthothecium strictum*; in forb-moss-lichen community; with *Roaldia revoluta*.

Warnstorfia pseudostraminea* (Müll. Hal.) Tuom. & T.J. Kop. – Rare: **7. With *Aulacomnium turgidum*.

W. sarmentosa (Wahlenb.) Hedenäs – Savicz, 1936; Størmer, 1940; Aleksandrova, 1983; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Odasz, 1996; Afonina, 2015; Czernyadjeva *et al.*, 2015; Moseev *et al.*, 2019. Frequent: **1, 1a, 1b, 2c, 2d, 2f, 2g, 3, 4, 5, 6, 7, 7a, 11, 15, 26, 31a, 31b, 33b**. In *Saxifraga*-moss, lichen-moss-liverwort, grass-moss, herb-moss, moss-lichen communities; *Papaver polare* open plant communities; with *Aulacomnium palustre*, *Bryum cryophilum*, *Orthothecium* sp., etc.

EXCLUDED TAXA

Calliergon megalophyllum Mikut. – This species was erroneously reported for Hooker and Alger islands (Moseev *et al.*, 2018, 2019). The specimens were reidentified as *Calliergon giganteum* by Czernyadjeva.

Calliergon richardsonii (Mitt.) Kindb. – This species was erroneously reported for Meibel Island (Moseev *et al.*, 2018, 2019). The specimens were reidentified as *Calliergon cordifolium* by M.S. Ignatov.

Campyliadelphus chrysophyllus (Brid.) R.S. Chopra – The records of this species for archipelago (Afonina & Czernyadjeva, 1995) are erroneous.

Campylium protensum (Brid.) Kindb. – This species was erroneously reported for Kane Island (Moseev *et al.*, 2018, 2019). The specimens belong to *Drepanocladus arcticus*.

Catoscopium nigratum (Hedw.) Brid. – The record of this species for archipelago in Moss Flora of Russia (Ignatov & Ignatova, 2017) is erroneous.

Climacium dendroides (Hedw.) F. Weber & D. Mohr – This species was erroneously reported for Maybell Island (Moseev *et al.*, 2018, 2019). The specimen was reidentified as *Drepanocladus arcticus* by Czernyadjeva.

Dicranum angustum Lindb. – Previously, this species was reported from archipelago as common (Czernyadjeva, 1992; Odasz, 1996; Afonina & Czernyadjeva, 1995); later the materials were reidentified by Afonina as *D. laevidens* according to Nyholm (1986).

Dicranum flexicaule Brid. (*D. congestum* auct. non Brid.) – Previously *Dicranum congestum* was reported for archipelago (Savicz, 1932, 1936; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995). Later it was synonymized with *D. flexicaule* and under this name was recorded for archipelago (Afonina, 2015). These specimens were later reidentified as *D. acutifolium* by Afonina.

Didymodon rigidulus Hedw. – This species was erroneously reported for Hooker Island (Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015), the specimen was reidentified as *D. vinealis* by J. Kučera.

Drepanocladus aduncus (Hedw.) Warnst. – This species was erroneously reported for Heiss Island (Moseev *et al.*, 2018, 2019), the specimen was reidentified as *Sanionia uncinata* by Czernyadjeva.

Ochyraea alpestris (Hedw.) Ignatov & Ignatova – The record of this species from Hooker and Meibel Islands (Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995) was based on erroneously identified specimens. They were reidentified as *Hygrohypnum luridum* by Czernyadjeva.

Orthothecium complanatum Kindb. – The record of this species from Hooker Island (Czernyadjeva, 1992) is erroneous. The specimens were reidentified as *O. strictum* by Afonina.

Plagiomnium affine (Blandow ex Funck) T.J. Kop. – The record of this species from archipelago (Afonina & Czernyadjeva, 1995) belongs to *P. ellipticum*.

Pohlia filum (Schimp.) Mårtensson – This species was erroneously recorded from Hooker Island (Savicz, 1936; Savicz-Ljubitzkaja & Smirnova, 1970; Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995; Afonina, 2015). The specimens were reidentified as *P. drummondii* by Czernyadjeva.

Sanionia georgicouncinata (Müll. Hal.) Ochyra & Hedenäs – So-named specimens from Hooker Island (Afonina, 2015) belong to *Sanionia nivalis*.

Schistidium apocarpum (Hedw.) Bruch & Schimp. – According Ignatova & Blom (2017), this species does not occur in Franz Josef Land Archipelago; all so-named specimens were reidentified as *S. plathyphyllum*, *S. flexipile*, *S. frigidum*, and *S. abruticostatum* by E.A. Ignatova.

Schistidium confertum (Funck) Bruch & Schimp. – The record of this species on McClintońk Island (Savicz, 1936; Savicz-Ljubitzkaja & Smirnova, 1970; Afonina & Czernyadjeva, 1995) is erroneous. The specimens were reidentified as *S. frigidum* by E.A. Ignatova.

Schistidium gracile (Röhl.) Limpr. – The record of this species on Hooker and Northbrook islands (Savicz, 1932, 1936; Alexandrova, 1983) is erroneous. The specimens were reidentified as *S. papillosum* by E.A. Ignatova.

Schistidium pulchrum H.H. Blom – This species was reported for McClintońk Island (Afonina, 2015), later the specimen was reidentified as *S. frigidum* by E.A. Ignatova.

Schistidium rivulare (Brid.) Podp. – The record of this species on Hooker Island is erroneous (Czernyadjeva, 1992; Afonina & Czernyadjeva, 1995). The specimens were reidentified as *Schistidium abrupticostatum* by E.A. Ignatova.

Schistidium strictum (Turner) Loeske ex Mårtensson – This species was recorded from the archipelago by Savicz-Ljubitzkaja & Smirnova (1970), Aleksandrova (1983), and Odasz (1996). However, according to Ignatova & Blom (2017), it does not occur in Russia.

Sciuro-hypnum plumosum (Hedw.) Ignatov & Huttunen – The record of this species on Hooker Island (Moseev *et al.*, 2018, 2019) is erroneous. The specimen was reidentified as *Sanionia uncinata* by Czernyadjeva.

Syntrichia norvegica F. Weber – The record of this species on Hayes Island (Moseev *et al.*, 2018, 2019) is erroneous. The specimen was reidentified as *S. ruralis* by Afonina.

Warnstorfia tundrae (Arnell) Loeske – This species was recorded for Hooker Island by Savicz (1936) as *Drepanocladus exannulatus* (Bruch *et al.*) Warnst. var. *tundrae* (Arnell) Dietz., and subsequently it was reported for archipelago as *Warnstorfia exannulata* by Afonina & Czernyadjeva (1995); however, later the specimen was reidentified as *W. pseudostraminea*.

DISCUSSION

Mosses (comprising 270 species and 8 intraspecific taxa) in the polar desert zone are the richest group of plants in terms of the species number (Afonina, 2015). The diversity of mosses in this region exceeds the diversity of vascular plants by more than two times. This ratio is one of the characteristic features of the polar desert zone (Matveeva, 2015).

At the present time the list of mosses of Franz Josef Land Archipelago, based on identification of recent collections, revision of herbarium materials and literature data, includes 156 species and one variety; 18 species are listed for archipelago for the first time, and 6 species are included based on literature records. The moss species diversity of the archipelago is thus nearly three times more than that of vascular plants (57 taxa) (Safronova *et al.*, 2020).

The largest number of species was recorded for Hooker (101 species), Alexandra Land (73), Northbrook (62), Meibel (58), George Land (53), Alger (46), Jackson (44) islands. Less than 40 species were collected on the remaining islands, and less than 10 species were listed for 9 islands (Table 1). This difference in species richness between the islands was attributed primarily to the duration of collection trips, as visits to some islands were short and mostly random.

The families Polytrichaceae (13 species), Grimmiaceae (13), and Pottiaceae (8) dominate the moss flora of the archipelago, which is due to the wide distribution of stony-gravelly substrates on the islands. The genera *Bryum* (11 species), *Pohlia* (9), *Schistidium* (8) and *Dicranum* (7) are fairly well represented in the flora, whereas the genera *Sphagnum* and *Grimmia* were not recorded. The absence of species of the genus *Sphagnum* was expected because in polar deserts they are very rare. Species of the genus *Grimmia* also were not collected on archipelago, apparently due to overlooking during geobotanical exploration, as these species prefer rocky substrates. It should be noted that species of the genus *Cinclidium* are weakly represented in the archipelago. In tundra zone, they are usually common and often constitute an important component of moss cover. However, in the archipelago only *Cinclidium arcticum* was reported from Hooker Island by A.M. Odaz (1996).

The moss flora in the archipelago is dominated by arctic-montane species (49) and arctic species (24), whereas holarctic polyzonal (22), omni-holarctic polyzonal (21), bipolar (22), and cosmopolitan (4) species are less abundant. The geographical distribution was not established for nine species.

Eighteen species are widely distributed and found on most islands, where they constitute an important component of the vegetation in polar deserts: *Aulacomnium turgidum*, *Bartramia ithyphylla*, *Brachythecium turgidum*, *Dicranum elongatum*, *Distichium capillaceum*, *Drepanocladus arcticus*, *Flexitrichum flexicaule*, *Hymenoloma crispula*, *Orthothecium chryseon*, *Pohlia cruda*, *Polytrichastrum septentrionale*, *Pseudocalliergon brevifolium*, *Racomitrium lanuginosum*, *Roaldia revoluta*, *Sanionia uncinata*, *Syntrichia ruralis*, *Timmia austriaca*, *Tomentypnum involutum*. An important components of the moss communities are *Aulacomnium palustre*, *Bryum rutilans*, *Dicranum laevidens*, *Hygrohypnella polare*, *Hylacomium splendens*, *Polytrichastrum alpinum*, and *P. fragile*. *Myurella julacea*, *Pohlia drummondii* and *P. nutans* are common, although they grow in small amount and usually in mixed tufts. Typical species of waterlogged habitats are *Bryum cryophilum*, *Philonotis fontana*, *P. tomentella*, *Pseudocalliergon turgescens*, *Warnstorfia sarmentosa*, *Andreaea papillosa*, *Ceratodon purpureus*, *Encalypta raptocarpa*, and *Niphotrichum canescens* are frequent on spots of bare soil.

Table 1. The number of moss species on the islands of Franz Josef Land Archipelago

Island [number in Fig. 1]	N species	Island [number in Fig 1]	N species	Island [number in Fig 1]	N species
Hooker [7]	101	Heiss [19]	27	Greely [25]	14
Alexandra Land [1]	73	Kane [26]	27	Eva-Liv [34]	10
Northbrook [5]	62	Kuhn [27]	27	Lamont [17]	9
Meibel [4]	58	Hall [15]	25	Hoffmann [32]	8
George Land [2]	53	Brice [11]	23	Bell [3]	7
Alger [12]	46	Nansen [10]	22	Gage [29]	7
Jackson [31]	44	La Ronciere [30]	22	Apollonov [28]	6
Ziegler [24]	37	Wilczek [16]	19	Hochstetter [18]	5
McClintock [13]	36	Wiener Neustadt [23]	18	Etheridge [8]	4
Scott-Keltie [6]	35	Fersman [20]	17	Li-Smith [9]	3
Wilczek Land [22]	32	Aagaard [14]	14	Graham Bell [35]	2
Rudolf [33]	30	Champ [21]	14		

Fifty eight percent of all species of the archipelago are rare. Of those, 12 species are included in “A miniature world in decline: European Red List of Mosses, Liverworts and Hornworts” (Hodgetts *et al.*, 2019): *Campylium bambergeri*, *Distichium inclinatum*, *Drepanocladus sendtneri*, *Encalypta raptocarpa*, *Loeskypnum badium*, *Meesia triquetra*, *Platydictya jungermannioides*, *Saelania glaucescens*, *Scorpidium cossonii*, *Stereodon holmenii*, *Tetraplodon mnioides*, and *Timmia bavarica*.

The following species can be noted as the most rare and interesting in moss flora of archipelago.

Arctoa anderssonii has a mostly arctic distribution. In European part of Russian Arctic it is recorded for the first time. In Asian Russia it is known from the Chelyuskin Cape on the Taimyr Peninsula, Bolshevik Island in the Severnaya Zemlya Archipelago, and in the mountain regions of the central part of the Kamchatka Peninsula (Czernyadjeva, 2012; Afonina, 2015). Outside Russia, it is known from Iceland, the Faroe Islands, Jan Mayen Island, Svalbard in Norway, Sweden, Greenland, Canadian Arctic Archipelago, Yukon and Alaska (Schofield *et al.*, 2004; Hallingbäck *et al.*, 2006; Newmaster, 2007).

Pohlia beringiensis is an arctic-montane species with main distribution in North America and Asia. The finding of this species in the Franz Josef Land Archipelago is the northernmost. It was recently identified in collections from the Prince Oscar Land, Svalbard (Belkina & Likhachev, 2013). In Asian Russia *P. beringiensis* is known from Arctic and Subarctic zones of Yamal and Taimyr Peninsulas, Anabar Plateau, Severnaya Zemlya Archipelago, Yakutia, Magadan Province, Commander Islands, Chukotka, Wrangel Island, and mountain regions of South Siberia (Altai, Kodar Range in Zabaikalsky Territory) (Afonina *et al.*, 2017; Czernyadjeva, 2018; Fedosov *et al.*, 2011). In European Russia it was recorded twice in the Nenets Autonomous Area: Bolshezemelskaya tundra and Vaygach Island (Afonina, 2006). Records of *P. beringiensis* for the Murmansk and Amur regions, Khabarovsk and Primorsky Territories in the «Moss Flora of Russia» (Czernyadjeva, 2018) are erroneous.

Schistidium abrupticostatum is distributed mostly in the Arctic and Subarctic. It is known from Svalbard, Sweden, Norway, arctic regions of North America; in Russia it was found on the Novaya Zemlya Archipelago, Taimyr Peninsula, Anabar Plateau, Severnaya Zemlya Archipelago, lower reaches of the Lena and Kolyma Rivers (Ignatova & Blom, 2017).

Schistidium andreaeopsis is an arctic species; its findings in archipelago are the most northern. It occurs in the Arctic and Subarctic of Asian Russia (Taimyr Peninsula, October Revolution and Bolshevik Islands of the Severnaya Zemlya Archipelago, Wrangel Island and Chukotka); it is known from a few localities in Yakutia, and from the Novaya Zemlya Archipelago in European Russia. In North America *S. andreaeopsis* is recorded from Canadian Arctic Archipelago: Prince Patrick and Ellef Ringnes Islands (Afonina *et al.* 2005; Afonina 2015; Ignatova & Blom, 2017).

Schistidium grandirete is an arctic species. In the High Arctic it is known from Chelyuskin Cape (Taimyr Peninsula), Bolshevik and October Revolution Islands (Severnaya Zemlya Archipelago), Amund Ringnes and Ellesmere Islands (Canadian Arctic Archipelago), Peary Land (Greenland) (Afonina, 2015), Svalbard and North of Scandinavia (Ignatova & Blom, 2017).

As a result of our study, a relatively high moss diversity was revealed in the archipelago. Its moss flora, 156 species, comprises 57.7 % of the total number of species (270) known in the polar desert zone (Afonina, 2015). For comparison, 149 species of mosses were recorded from Nordaustlandet, an island in the archipelago of Svalbard (Frisvoll, Elvebakk, 1996; Belkina, Likhachev, 2013), 135 species in the northern extremity of the Novaya Zemlya Archipelago (Fedosov *et al.*, 2019), 165 species in the Severnaya Zemlya Archipelago (Afonina, 2015), and 186 species in the Canadian Arctic Archipelago (Afonina, 2015).

A comparison of the moss flora of within the Barents Province (Nordaustlandet of Svalbard, Franz Josef Land, and Severny Island of Novaya Zemlya) revealed that 93 species are common for Franz Josef Land and Novaya

Table 2. The similarity of moss floras in the polar desert zone in Franz Josef Land (FJL), Novaya Zemlya (NZ) and Svalbard (Sv) by Sørensen-Czekanowski Index, C_{sc} ; [the numbers of species for areas and number of species in common are given in brackets]

	FJL	NZ	Sv
FJL [157]	–	0.325	0.32
NZ [135]	[93]	–	0.285
Sv [149]	[96]	[81]	–

$C_{sc} = 2c/a + b$, where a — is the number of species in flora one, b — is the number of species to another flora, c — is the number of shared species)

Zemlya, 96 species for Franz Josef Land and Svalbard, and 96 species for Novaya Zemlya and Svalbard; 68 species are distributed in all three regions. The pairwise comparison of the flora using Sørensen-Chekanovsky's Index of similarity (C_{sc}) revealed the same degree of similarity between the three floras (Table 2).

The more southern position of Novaya Zemlya and the influence of the Gulf Stream on Svalbard determined the presence of some boreal species, *i.e.* *Brachythecias-trum trachypodium*, *Dicranum bonjeanii*, *Pleurozium schreberi*, *Warnstorfia exannulata*, and *W. fluitans* in these territories. In addition, two species of the genus *Sphagnum* and the boreal species *Climacium dendroides* and *Plagiothecium denticulatum* were recorded on Svalbard. All these species are absent in the more northern Franz Josef Land. In contrast, a number of rare arctic species, such as *Arctoa anderssonii*, *Schistidium andreaeopsis*, and *S. grandirete*, have been collected only on Franz Josef Land. Also the arctic species *Drepanocladus arcticus*, which has not yet been documented in the polar deserts of Novaya Zemlya and Svalbard, is widespread and often abundant in Franz Josef Land.

It can be assumed that the revealed species richness of mosses on Franz Josef Land Archipelago is rather complete. However, the new species findings are possible; in addition, it should be take into account that some taxonomic changes that are currently taking place in connection with molecular phylogenetic studies.

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