DET KONGELIGE DEPARTEMENT
FOR HANDEL, SJØFART, INDUSTRI, HÅNDVERK OG FISKERI

NORGES SVALBARD- OG ISHAVS-UNDERSØKELSER
LEDER: ADOLF HOEL

SKRIFTER OM SVALBARD OG ISHAVET

Nr. 62

P. F. SCHOLANDER

VASCULAR PLANTS FROM NORTHERN SVALBARD

WITH REMARKS ON THE VEGETATION IN NORTH-EAST LAND

WITH 61 FIGURES IN THE TEXT, 5 PLATES AND 2 MAPS

(SCIENTIFIC RESULTS OF THE
SWEDISH-NORWEGIAN ARCTIC EXPEDITION
IN THE SUMMER OF 1931. PART XIII)

OSLO
I KOMMISJON HOS JACOB DYBWAD
1934

Results of the Norwegian expeditions to Svalbard 1906—1926 published in other series. (See Nr. 1 of this series.)

The results of the Prince of Monaco's expeditions (Mission Isachsen) in 1906 and 1907 were published under the title of 'Exploration du Nord-Ouest du Spitsberg entreprise sous les auspices de S. A. S. le Prince de Monaco par la Mission Isachsen', in Résultats des Campagnes scientifiques, Albert Ier, Prince de Monaco, Fasc. XL—XLIV. Monaco.

ISACHSEN, GUNNAR, Première Partie. Récit de voyage. Fasc. XL. 1912. Fr. 120.00.

With map: Spitsberg (Côte Nord-Ouest). Scale 1 : 100 000. (2 sheets.) Charts: De la Partie Nord du Foreland à la Baie Magdalena, and Mouillages de la Côte Ouest du Spitsberg.

ISACHSEN, GUNNAR et ADOLF HOEL, Deuxième Partie. Description du champ d'opération. Fasc. XLI. 1913. Fr. 80.00.

HOEL, ADOLF, Troisième Partie. Géologie. Fasc. XLII. 1914. Fr. 100.00.

SCHETELIG, JAKOB, Quatrième Partie. Les formations primitives. Fasc. XLIII. 1912. Fr. 16.00.

RESVOLL HOLMSEN, HANNA, Cinquième Partie. Observations botaniques. Fasc. XLIV. 1913. Fr. 40.00.

A considerable part of the results of the ISACHSEN expeditions in 1909 and 1910 has been published in Videnskapsselskapets Skrifter. I. Mat.-Naturv. Klasse, Kristiania (Oslo).

ISACHSEN, GUNNAR, Rapport sur l'Expédition Isachsen au Spitsberg. 1912, No. 15. Kr. 5,40.

ALEXANDER, ANTON, Observations astronomiques. 1911, No. 19. Kr. 0,40.

GRAARUD, AAGE, Observations météorologiques. 1913, No. 1. Kr. 2,40.

HELLAND-HANSEN, BJØRN and FRIDTJOF NANSEN, The sea west of Spitsbergen. 1912, No. 12. Kr. 3,60.

ISACHSEN, GUNNAR, The hydrographic observations. 1912, No. 14. Kr. 4,20.

With chart: Waters and anchorages on the west and north coast. Publ. by the Norw. Geogr. Survey, No. 198.

HOEL, A. et O. HOLTEDAHL, Les nappes de lave, les volcans et les sources thermales dans les environs de la Baie Wood au Spitsberg. 1911, No. 8. Kr. 4,00.

GOLDSCHMIDT, V. M., Petrographische Untersuchung einiger Eruptivgesteine von Nordwestspitzbergen. 1911, No. 9. Kr. 0,80.

BACKLUND, H., Über einige Olivinknollen aus der Lava von Wood-Bay, Spitzbergen. 1911, No. 16. Kr. 0,60.

HOLTEDAHL, OLAF, Zur Kenntnis der Karbonablagerungen des westlichen Spitzbergens. I. Eine Fauna der Moskauer Stufe. 1911, No. 10. Kr. 3,00. II. Allgemeine stratigraphische und tektonische Beobachtungen. 1912, No. 23. Kr. 5,00.

HOEL, ADOLF, Observations sur la vitesse d'écoulement et sur l'ablation du Glacier Lilliehöök au Spitsberg 1907—1912. 1916, No. 4. Kr. 2,20.

VEGARD, L., L'influence du sol sur la glaciation au Spitsberg. 1912, No. 3. Kr. 0,40.

ISACHSEN, GUNNAR, Travaux topographiques. 1915, No. 7. Kr. 10,00.

With map: Spitsberg (Partie Nord-Ouest). Scale 1 : 200 000 (2 sheets).

GUNNAR ISACHSEN has also published: Green Harbour, in *Norsk Geogr. Selsk. Aarb.*, Kristiania, 1912—13, Green Harbour, Spitsbergen, in *Scot. geogr. Mag.*, Edinburgh, 1915, and, Spitsbergen: Notes to accompany map, in *Geogr. Journ.*, London, 1915.

All the above publications have been collected into two volumes as Expédition Isachsen au Spitsberg 1909—1910. Résultats scientifiques. I, II. Christiania 1916.

As the result of the expeditions of ADOLF HOEL and ARVE STAXRUD 1911—1914 the following memoir has been published in Videnskapsselskapets Skrifter. I. Mat.-Naturv. Klasse.

HOEL, ADOLF, Nouvelles observations sur le district volcanique du Spitsberg du Nord. 1914, No. 9. Kr. 2,50.

The following topographical maps and charts have been published separately:

Maps:

Bear Island. 1 : 25 000. 1925. Kr. 10,00.

Bear Island. 1 : 10 000. (In six sheets). 1925. Kr. 30,00.

East Greenland. Eirik Raudes Land from Sofiasund to Youngsund. 1 : 200 000. 1932. Kr. 5,00

Charts:

No. S. 1. Bear Island. 1 : 40 000. 1932. Kr. 4,00.
„ S. 2. Bear Island Waters. 1 : 350 000. 1931. Kr. 5,00.
„ S. 3. From Bellsound to Foreland Reef with the Icefjord. 1 : 200 000. 1932. Kr. 5,00.
„ S. 5. Norway—Svalbard, Northern Sheet. 1 : 750 000. 1933. Kr. 4,00.
„ S. 6. Norway—Svalbard, Southern Sheet. 1 : 750 000. 1933. Kr. 4,00.

A preliminary edition of topographical maps (1 : 50 000) covering the regions around Kings Bay, Ice Fjord, and Bell Sound, together with the map of Bear Island (1 : 25 000), is published in:

Svalbard Commissioner [Kristian Sindballe], Report concerning the claims to land in Svalbard. Part I A, Text; I B, Maps; II A, Text; II B, Maps. Copenhagen and Oslo 1927. Kr. 150,00.

DET KONGELIGE DEPARTEMENT
FOR HANDEL, SJØFART, INDUSTRI, HÅNDVERK OG FISKERI

NORGES SVALBARD- OG ISHAVS-UNDERSØKELSER
LEDER: ADOLF HOEL

SKRIFTER OM SVALBARD OG ISHAVET

Nr. 62

P. F. SCHOLANDER

VASCULAR PLANTS FROM NORTHERN SVALBARD

WITH REMARKS ON THE VEGETATION IN NORTH-EAST LAND

WITH 61 FIGURES IN THE TEXT, 5 PLATES AND 2 MAPS

(SCIENTIFIC RESULTS OF THE
SWEDISH-NORWEGIAN ARCTIC EXPEDITION
IN THE SUMMER OF 1931. PART XIII)

OSLO
I KOMMISJON HOS JACOB DYBWAD
1934

PRINTED WITH CONTRIBUTION FROM
ANDRÉEFONDET AND NANSENFONDET

A. W. BRØGGERS BOKTRYKKERI A/S

Contents.

Maps of Botanical Localities

Preface.

In the summer of 1931 I was given the opportunity of accompanying, as one of the Norwegian members, The Swedish-Norwegian Arctic Expedition in the S/S "Quest" to North-East Land and adjacent tracts of Svalbard, under the leadership of Professor Hans W:son Ahlmann. Norwegian participation in the expedition was ensured by a grant made by the Norwegian Government.

The original plan of the expedition was of a purely physico-geographical character, and it was mainly due to the initiative of my friend, Docent Dr. Bernt Lynge, that also botany was permitted to be represented. The phanerogamous flora within the area in which I was to work has previously been studied by several prominent botanists so that there seemed to be slight possibilities for adding anything new to the facts already known. The main object of my botanical work was to study the incompletely known, but comparatively rich, lichen flora within this extreme arctic area. The task was all the more interesting as I had in the previous year had the opportunity of studying the lichen flora of North-East Greenland. During the 1931 expedition there was, however, as a rule ample time at my disposal also for the examination of the relatively poor, but interesting, phanerogamous flora in northernmost Svalbard, and it is chiefly the result of this work which I am presenting in this paper. The lichens will be dealt with in a later publication.

Many and good papers have already been published on the flora and vegetation of these regions, but a weak feature in most of the older works seems to me to be the lack of detailed and exact indications of localities. It has therefore been my task to collect as much material as possible and then to endeavour to give a statistical survey in the greatest possible detail of my own and previous discoveries. Regarding North-East Land with adjacent islands, and Sorgfjorden and Lomfjorden in West Spitsbergen all the published data from earlier expeditions and those extractable from the extensive collections in the Botanical Museum of Oslo are given. Only in a few cases as *Festuca brachyphylla*, *Festuca vivipara*, *Phippsia algida* and *Phippsia concinna* (incl. *Puccinellia vacillans*)

I have had the opportunity of revising also the Danish material. For this I wish to express my cordial thanks to the Director of the Botanical Museum of Copenhagen. Further, I have tried to form an opinion on some of the many taxonomical problems bearing upon the flora in these regions.

I am deeply indebted to Docent Dr. Bernt Lynge and Docent Adolf Hoel, the leader of *Norges Svalbard- og Ishavs-undersøkelser*, for arranging my participation in The Swedish-Norwegian Arctic Expedition of 1931. I am also very grateful to Professor Hans W:son Ahlmann, leader of the expedition, for being so accomodating on all points, and for permitting me to join the well-planned expedition.

Further, I wish to tender my best thanks to my friend, Dr. Oskar Kulling, who led our small geological-botanical boat party, for the best of co-operation and for always endeavouring to the utmost to ensure the best possible working conditions for the geological as well as the botanical investigations, and who has later given me valuable advice with regard to the maps and geological data given in this paper. We cannot find adequate appreciation of the services of a so experienced and helpful arctic sailor as Sevrin Skjelten, our assistant. It is in no small degree due to him that our small section of the expedition was able without mishap to effect the many excursions in these waters in an open boat.

Professor Jens Holmboe, head of the Botanical Museum of the Royal Frederic University of Oslo, has with his usual courtesy placed all the facilities of the museum at my disposal, and has given me most valuable advice during the progress of the work. My friend Johannes Lid, Curator at the Botanical Museum of Oslo, has likewise rendered me invaluable assistance in giving me the benefit of his wide knowledge of the arctic flora, and he is perhaps better acquainted with the flora of Svalbard than any other botanist.

In compliance with the wishes of the *Norges Svalbard- og Ishavs-undersøkelser* I have adopted the Norwegian geographical names, which will be the norm employed in the future.

The drawings for this paper have been prepared by Miss Liv Barstad, the maps of distribution by Miss S. Friis-Schwenzen and the geographical maps by Mr. Th. Askheim, *Norges Svalbard- og Ishavs-undersøkelser*, to all of whom I whish to express my thanks. All photographs, except one (Fig. 2), have been taken by the author, the "micro"-photos in a very simple manner by the aid of a Leitz binocular microscope (Greenough 1932), fitted with a Leitz "Lucca" camera $4\,1/2 \times 6$ cm.

According to agreement the material will be distributed as follows: the first complete set will go to the Botanical Museum of Oslo, the second set, as complete as possible, to the *Kungliga Riksmuseet*, Stockholm. Duplicates will be shared between these two institutions.

Botanical Museum, Oslo, November 1933.

I. Botanical Investigations in Northern Svalbard.

The ground that was botanically worked in 1931 has previously been visited by several expeditions, and by many and prominent botanists. The following expeditions have published floristic data on North-East Land with adjacent islands, Sorgfjorden, Lomfjorden and Moffen island:

W. E. Parry 1827.

Our first knowledge of the flora in northernmost Svalbard is due to the collections made during Parry's expedition in 1827 in the "Hecla", on which he intended, via Spitsbergen, to reach the North Pole in smaller craft. During the northward passage of this boat party, phanerogams were collected on Lågøya and Waldenøya, mainly by Lieutenants Crozier and James C. Ross. In the meantime the southern party, and particularly Mr. James Halse, collected a fairly abundant material at Heclahamna in Sorgfjorden. This material was worked up and described by W. J. Hooker (1828 p. 207—220).

A. E. Nordenskiöld 1858.

On O. Torell's first expedition to Svalbard in the yacht "Frithjof", A. E. Nordenskiöld collected a number of plants (seven phanerogams) in Sjuøyane and also in a number of localities beyond our territory. This material was worked up and published by A. J. Malmgren (1862) along with his own collections from the 1861 expedition.

A. J. Malmgren 1861 and 1864.

The great Swedish expedition in 1861 in the schooner "Aeolus" and the sloop "Magdalena" operated to a great extent in the very same tracts as we did, and the botanical collections are primarily the work of that eminent biologist, A. J. Malmgren. The localities mentioned by him are in some instances very difficult or impossible to locate. His "Brännvinsbay" is in all likelihood identical with what we call Depotodden — on account of the depots which were laid here by the 1861 expedition, and also later. The description of this place (e. g. by

Chydénius 1865 p. 230—231 and Malmgren 1862 p. 266) agrees exactly with our locality, and there is also a remarkable conformity between the respective plant lists from that place. It is not possible to place his localities in Murchisonfjord, with the exception of "Stenø 7/7", which is probably Raudstupet (cf. Chydénius 1865 p. 165, 166). It was on the excursion to "Stenö" (peninsula north of Murchisonfjord) on July 7, 1861 that *Pagophila eburnea* was found breeding for the first time. It should be noted, however, that this bird was not observed breeding here during my brief visit to the southern part of the mountain. "Augustibay" is in all probability Idunfjellet on the north coast of Wahlenbergfjorden (cf. Malmgren 1862 p. 267). It has been impossible to determine the localities in Lomfjorden, with the exception that *Trisetum* was found at the head of this fjord on August 23, 1861 by Malmgren.

In addition to the plants collected by Malmgren, contributions were made also by other members of this expedition, of whom O. Torell, leader of the expedition, and K. Chydénius should be mentioned. The collections are described by A. J. Malmgren (1862 p. 229—268).

From the 1864 expedition in the schooner "Axel Thordsen", in which Malmgren again took part — this time under the leadership of N. Dunér and A. E. Nordenskiöld — only two flowering plants, viz. *Equisetum scirpoides* and *Puccinellia phryganodes*, have been published from the region dealt with in this paper (Malmgren 1867 p. 259).

Th. M. Fries 1868.

Under the leadership of A. E. Nordenskiöld the eminent Swedish botanist, Th. M. Fries, took part in the great expedition that year in the S/S "Sofia". Of his localities mentioned in the list on page 11—14, I have not been able to locate any others than his "Brandewijnebay", Sept. 5, which is the same as Malmgren's locality Depotodden (cf. Fries and Nyström 1869 p. 139), in addition to Nordkap and Castrénøyane which he visited on the following days. I cannot give any exact identification of the localities Murchisonbay, Stenö, Wahlenbergbay, Treurenbergbay, and Lommebay. The collection was worked up and described by Th. Fries (1869 p. 121—144).

A. E. Eaton 1873.

As a member of Captain B. Leigh Smith's expedition in 1873 in the steamer "Diana", Eaton collected at Spitsbergen in tracts including those dealt with in this paper. He brought back quite a considerable amount of botanical material, which is particularly valuable by reason of his accurate place indications within this area. The phanerogams were worked up by Mr. Marchant Moore and published by Eaton (1876 p. 41—44).

G. Andersson and H. Hesselman 1898.

These two scientists accompanied A. G. Nathorst's expedition of that year in the "Antarctic", and made collections within the area treated herein at Kvitøya, Karl XII Øy, and Heclahamna in Sorgfjorden. The botanical results of this expedition relative to phanerogams are published by Andersson and Hesselman (1900 p. 1—88).

Th. Wulff 1899.

He took part as botanist in the Swedish-Russian expedition under the command of E. Jäderin. The ships employed were the gunboat "Svensksund" and S/S "Rurik". In his paper (1902) Wulff gives only meagre plant lists from our area, viz., one from Murchisonfjorden (1902 p. 102) without any closer indication of the locality, and another list of the seven species he found new to Sorgfjorden; the latter species were probably collected at Heclahamna.

From this expedition there are likewise a number of plants collected by N. C. Ringertz, including some from Moffen. The two phanerogams which he reports from this very limited little patch of vegetation at the S. E. end of the island were not rediscovered in 1931, but, on the other hand, four new ones were found. The botanical results of this expedition were published by Th. Wulff (1902 p. 1—115).

C. S. Elton 1923 and 1924.

He participated as ecologist in the Oxford expeditions to the tract's around Hinlopenstredet in 1923 and 1924. The exact floristic data published from these expeditions are very meagre as far as our area is concerned, being confined to one plant list from some islands in Hinlopenstredet (Summerhayes and Elton 1928 p. 207) and one from Nordkapøya (idem p. 232), besides quite a few particulars to be inferred from the text and some photographs. It is a pity that this great ecological work does not disclose the material on which it is based, so that we might be able to judge of what is knowledge and what is assumption. It appears to me somewhat venturesome to make a phytogeographical map of regions such as, for instance, the north coast of North-East Land and the inner tracts of Brennevinsfjorden where, as far as my knowledge goes, practically nothing of an exact nature is yet known of either the topography or much the less so of the flora.

The results of the ecological investigations of the Oxford expeditions have been published by Summerhayes and Elton (1928 p. 193—268).

The Swedish-Norwegian Arctic Expedition 1931.

During the outward voyage to our destination, Sveanor in Murchisonfjorden, we made a short stay at the N. W. point of Amsterdamøya, also at one of the islets Ytterholmane off this island (cf. p. 105) and at Moffen. After a brief visit to Wahlenbergfjorden and to Torellneset our ship, the "Quest", left us at Sveanor in Murchisonfjorden, the station of our meteorological party. The geological-botanical party comprising Dr. O. Kulling as geologist and leader, the author as botanist, and S. Skjelten as our ever willing and capable assistant, made numerous excursions from Sveanor within an area extending from Depotodden in Brennevinsfjorden to Forsiusfjellet near Hinlopenstredet. For this purpose a "fangst"-boat fitted with an outboard motor was used. The various localities will be seen from the list on the following pages and from the maps. I am indebted to Professor H. W:son Ahlmann, leader of the glaciological party and of the expedition, for a plant collection secured during the difficult sledge journey through the Rijp district. I am also greatly obliged to Mr. S. Malmberg who, as a member of the maritime party on board the "Quest", contributed a collection of plants from Kvitøya, Storøya, Foynøya (no phanerogams), Karl XII Øy, and from Kap Nansen in Frans Josef Land (cf. p. 106).

When the four parties had again returned to Sveanor early in August, the whole expedition left that place and before finally returning home visited Lomfjorden and Sorgfjorden. During the homeward voyage a short detour was made to Raudfjorden, where the botanical results were, however, very small by reason of the newly fallen snow. A small collection from the mouth of Longyeardalen in Adventfjorden will be included in a comprehensive work on the flora of Svalbard in course of preparation by Johannes Lid.

A short, detailed account of The Swedish-Norwegian Arctic Expedition of 1931 was published by Professor H. W:son Ahlmann in Ymer 1931 (p. 1—31).

II. List of Botanical Localities.

The figure in the first column gives the number of species, including a few good varieties, now known from that locality or district, the figure in paranthesis gives the number previously recorded from it.

A. 67 (50) North-East Land.

22 (21) Northern Islands.

5 Kvitøya: Andersson and Hesselman 1898; Malmberg 15/7 1931.
1 Storøya: Malmberg 9/7 1931.
0 Foynøya: Malmberg 4/8 1931.
4 (4) Karl XII Øy: Andersson and Hesselman 20/8 1898; Malmberg 5/8 1931.
12 Waldenøya: Parry 23/6, 13/8 1827 (leg. Ross and Crozier) (Parry 1828 p. 53 and 121); Eaton 1873.
10 Nordkapøya (= Chermside Isl.): Fries 7/9 1868; Eaton 1873; Elton 1923.
3 Castrénøyane: Fries 6/9 1868.
12 (Sjuøyane (= Seven Ids.): Nordenskiöld 1858).

1 North Coast.

1 Extremhuken: Montague 1924 (Summerhayes and Elton 1928 p. 233).

42 (30) Brennevinsfjorden (= Brandewijne Bay).

37 (30) Depotodden: Malmgren 27/7 1861 (cf. Malmgren 1862 p. 266); Torell 27/7 1861 (cf. Chydenius 1865 p. 230—231); Malmgren 1864; Fries 5/9 1868; Scholander 8/7 1931.
7 Zeipelbukta, south side: Scholander 8/7 1931.
19 Kontaktberget: Scholander 8/7 1931.
2 Franklindalen, east end: Scholander 8/7 1931.
19 5 km south east of Cape Hansteen (Fig. 1): Scholander 8/7 1931.
16 2.5 km south east of Cape Hansteen (Fig. 1): Scholander 7/7 1931.
14 Cape Hansteen: Scholander 8/7 1931.

42 (13) Lady Franklinfjorden.

8 Franklindalen, west end: Scholander 9/7 1931.
20 Franklinfjellet, west side: Scholander 9/7, 10/7 1931.
19 Shore plain west of Franklinfjellet (Fig. 51 p. 113): Scholander 13/7 1931.
18 Hansøya: Scholander 13/7 1931.
31 Gerardodden: Scholander 13/7 1931.
23 Lady Franklinfjorden, inner west side: Kulling 11/7 1931; Scholander 22/7 1931.
10 Persberget: Scholander 11/7 1931.
26 Westmanbukta: Scholander 11/7, 14/7 1931.
11 Tombolaøya: Scholander 10/7, 14/7 1931.
13 Lågøya (= Low Isl.): Parry 22/6, 15/8, 16/8 1827 (Parry 1828 p. 52 and 123); Malmgren 1861.
11 Basisøya: Scholander 15/7 1931.

Fig. 1. 5 km SE of C. Hansteen, in the background the bird-cliff 2.5 km SE of C. Hansteen. Brennevinsfjorden 8/7 1931.

62 (35) Murchisonfjorden (= Murchison Bay).

8 Detterbukta: Scholander 15/7 1931.
3 Claravågsundet, south side: Scholander 16/7 1931.
3 Kinnvika (Fig. 60 and 61 p. 132, 133): Scholander 24/7 1931.
26 Raudstupet: Scholander 24/7 1931.
48 Floraberget (Fig. 56 p. 124): Scholander 23/7, 24/7, 3/8, 4/8; Kulling 26/7 1931.
2 Wargentinfjellet: Scholander 3/8 1931.
12 Norvika, north side: Scholander 23/7 1931.
30 Wargentindalen (Fig. 52 p. 114): Scholander 22/7 1931.
26 Celsiusfjellet: Scholander 27/7 1931.
37 Snaddvika, north side: Scholander 27/7, 7/8 1931.
24 Snaddvika, south side: Scholander 7/8 1931.
17 Kvalrosshalvøya, north point: Scholander 22/7 1931.
37 Triodalen: Scholander 20/7, 29/7, 7/8 1931.
4 Camp at the inland-ice 170 m: Scholander 20/7 1931.
11 Krykjeslukta (transl. Kittiwake-canyon): Scholander 29/7 1931.
14 Krykjevatnet: Scholander 29/7, 7/8 1931.
28 Sveanor: Scholander 26/6, 26/7, 28/7 1931.

(35) (Murchison Bay: Malmgren 30/7, 15/8 1861; Fries 1868; Ringertz 27/8 1899; Wulff 1899; Elton 1923, 1924).
(North-East Land 80°: Malmgren 4/7, 7/7 1861).
(Stenö: Malmgren 7/7 1861 (= most probably Raudstupet); Fries 1868).

26 Islands in Murchisonfjorden.

10 Ringertzøya: Scholander 16/7 1931.
3 Depotøya: Scholander 6/7, 21/7 1931.
5 Nordre Russøya: Scholander 6/7 1931.
4 Kvaløya: Scholander 16/7 1931.

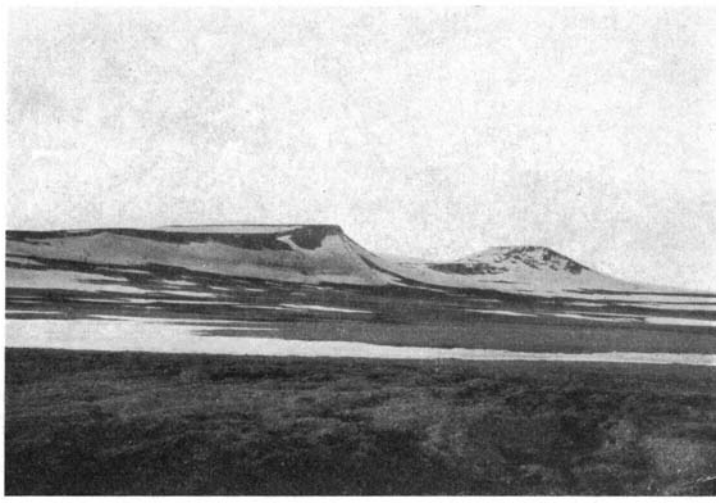


Fig. 2. Torellneset 5/7 1931. Phot. O. Kulling.

7 Flyndra (= Flundran): Scholander 21/7 1931.
16 Oskarøya: Scholander 21/7 1931.
3 Teltøya: Scholander 21/7 1931.
1 Gråøya: Scholander 22/7 1931.
24 Søre Russøya: Scholander 24/6, 17/7 1931.
4 Krossøya: Scholander 6/7 1931.

49 (39) Hinlopenstredet (= Hinlopen Strait).

15 Cape Sparre: Scholander 18/7, 2/8 1931.
10 Kalkstranda at Forsiusfjellet: Scholander 1/8 1931.
3 Forsiusfjellet: Scholander 1/8 1931.
24 Augusti Bay (= Idunfjellet in Wahlenbergfjorden (cf. Malmgren 1862 p. 267)): Malmgren 4/8, 5/8 1861.
1 Oxfordhalvøya: H. M. Clutterbuck 1924 (Elton 1925, p. 112).
8 Rijpdalen: Ahlmann 13/7, 14/7 1931.
21 Gyldénøyane (= Gyldén Islands): Elton 1923, 1924.
30 Rundhaugen (= Round Hill): Scholander 2/7, 3/7 1931.
27 Ismåsefjellet (Fig. 3) (= Ivory Gull Cliff): Scholander 3/7 1931.
24 (1) Torellneset (Fig. 2) (= Cape Torell): Elton 1923, 1924; Scholander 4/7 1931.
8 Ulvebukta (= Ulve Bay): Elton 1923, 1924.
7 Perthesøya: Malmberg 3/7 1931.
14 Von Otterøya (= Von Otter Island): Elton 1923, 1924.
(3) (Wahlenbergfjorden (= Wahlenberg Bay): Fries 1868).

B. West-Spitsbergen.

6 (2) Moffen (= Moffen Island): Ringertz 12/7 1899; Scholander 24/6 1931.
Amsterdamøya, north west point: Scholander 23/6 1931 (see p. 105).
2 Ytterholmane: Scholander 23/6 1931 (see p. 105).
Raudfjorden (= Red Bay), Alicehamna: Scholander 19/8 1931 (see p. 105).

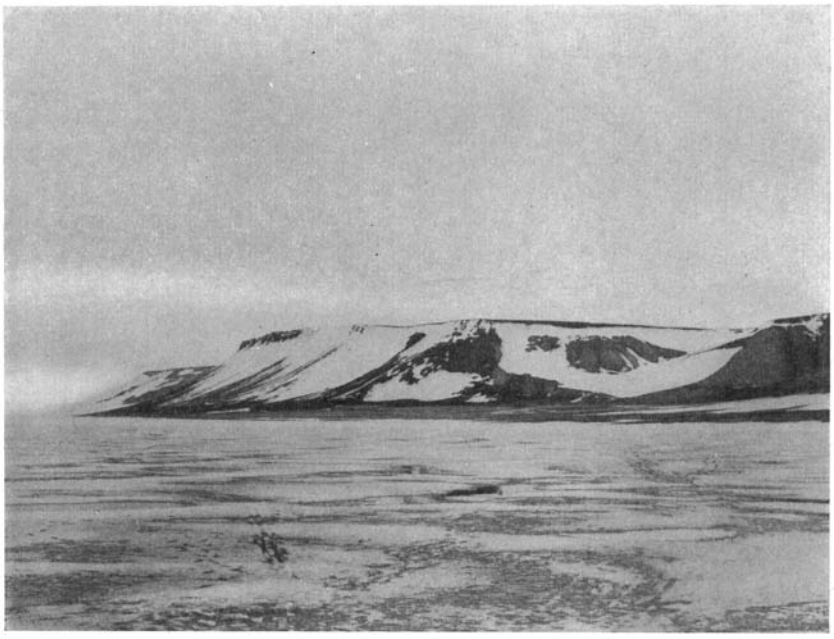


Fig. 3. Ismåsefjellet in Wahlenbergfjorden 2/7 1931.

80 (67) Sorgfjorden (= Treurenberg Bay).

65 Heklahamna (= Hecla Cove): Parry 1827 (leg. Halse); Malmgren 25/6—28/6, 1/7, 3/7, 6/7, 7/7 1861 (cf. Malmgren 1862 p. 235); Eaton 1873; Andersson and Hesselman 22/8 1898; Wulff 1899; Elton 1923, 1924.

61 Inner west side (Fig. 32 p. 64): Scholander 15/8, 16/8 1931.

(3) (Treurenberg Bay: Fries 1868).

72 (49) Lomfjorden (= Lomme Bay).

41 Faxedalen: Scholander 14/8 1931.

21 Faxefjellet: Scholander 14/8 1931.

35 Dvergbreen: 14/8 1931.

61 Lomfjordbotnen: Malmgren 23/8 1861; Elton 1923, 1924; Scholander 13/8 1931.

4 Cape Fanshawe: Malmgren 18/8 1861.

(48) (Lomme Bay: Chydenius 20/8 1861; Malmgren 23/8, 24/8, 28/8 1861; Fries 24/8, 10/9 1868; (Kjellman 23/8 1872 ?); Eaton 1873).

C. Frans Josef Land.

Cape Nansen: Malmberg 25/7 1931 (see p. 106).

The localities in paranthesis cannot be more precisely placed. In the following text an (S) indicates that the plant has been collected or noted by the author.

III. Enumeration of Vascular Plants and their Distribution.

PTERIDOPHYTA

Lycopodiaceae.

1. *Lycopodium Selago* L. Pl. I.

Murchisonfj. Snaddvika, north side (S). *Sorgfj.* Heclahamna (Parry). Hooker 1828 p. 213.

New to North-East Land, where it was found only in one locality. Here it grew in a sunny slope facing southwards, in association with *Salix polaris* and *Polygonum viviparum* and some rare species in North-East Land viz. *Pedicularis hirsuta*, *Carex nardina*, *C. misandra* and *C. rupestris*. The specimens are 2—5 cm high, fertile, belonging to the small arctic f. *apressa* Desv.

Its northernmost locality is in Arctic America in Grinnell Land at Discovery Harbour 81° 43′ (Simmons 1906 p. 179). It has not been found on the north coast of Greenland or in Frans Josef Land.

Equisetaceae.

2. *Equisetum arvense* L. Pl. I.

Sorgfj. Inner west side (S), (*Lomfj.* (Fries)).

Fries 1869 p. 144.

Grows sparsely in moist depressions on the shore plain on the west side of Sorgfjorden. The few specimens found were all sterile, branched below, and creeping, belonging to the f. *decumbens* C. F. W. Mey. Its northern limit is on the north coast of Greenland, viz., Sommerdalen 82° 29′ (Ostenfeld 1923 p. 228).

3. *Equisetum scirpoides* Michx. Pl. I.

Sorgfj. Heclahamna (Andersson and Hesselman)[1], Inner west side (S). (*Lomfj.* (Chydenius, Malmgren, Fries)).

Malmgren 1867 p. 259; Nathorst 1883 p. 40; Andersson and Hesselman 1900 p. 85; Asplund 1918 p. 8.

Only one specimen was found growing together with the foregoing species. Sorgfjorden is the northernmost locality known for this species.

[1] Possibly wrong, as it is not mentioned in the revised list of Asplund (1918 p. 8).

4. **Equisetum variegatum* Schleich. Pl. I.

Sorgfj. Heclahamna (Parry). Inner west side (S). *Lomfj.* Faxedalen (S), Lomfjordbotnen (S), (Lomfjorden (Fries)).

Hooker 1828 p. 213; Fries 1869 p. 144.

Occurred sparingly in the localities mentioned. Our plants, as is usual, vary greatly in size, from the slender f. *anceps* Milde to thick and fertile specimens with as many as eight ribs. The northern limit is on the north coast of Greenland: S. W. Coast of Hendrik Island 82° 3′ (Ostenfeld 1923 p. 228).

SPERMATOPHYTA

Dicotyledones.

Ranunculaceae.

5. *Ranunculus hyperboreus* Rottb. Pl. I.

Brennevinsfj. Depotodden (Malmgren). *Murchisonfj.* Floraberget (S), Snaddvika, north side (S). *Sorgfj.* Inner west side (S).

Malmgren 1862 p. 236.

In North-East Land rare, and apparently mostly sterile. Its leaves were found floating among mosses in small swamps often together with sterile leaves of the equally rare *Cardamine pratensis*. Flowering specimens were found in the *Eriophorum Scheuchzeri* swamps on the shore plain on the west side of Sorgfjorden. Its northern limit is in Sommerdalen 82° 29′ on the north coast of Greenland (Ostenfeld 1923 p. 238).

6. *Ranunculus nivalis* L. Fig. 4 and Pl. I.

Murchisonfj. Floraberget (S). *Sorgfj.* Heclahamna (Parry).

Hooker 1828 p. 208.

New to North-East Land. On the terraces forming the western decline of the bird-cliff Floraberget quite a number of tufts of this species were found growing together with *Ranunculus pygmaeus*, *R. sulphureus* and others. As late as August 4 most of them were past flowering, some of them having already ripe fruits. Our largest specimen attains a height of nearly 23 cm. Its northern limit is on the north coast of Ellesmere Land at Floeberg Beach 82° 27′ (Simmons 1906 p. 110).

7. *Ranunculus pygmaeus* Wahlenb. Fig. 4 and Pl. I.

Brennevinsfj. Depotodden (Malmgren), Kontaktberget (S), 2.5 km SE of Cape Hansteen (S). *Murchisonfj.* Floraberget (S). *Hinlopenstr.* Torellneset (S). *Sorgfj.* Heclahamna (Wulff), Inner west side (S). *Lomfj.* Dvergbreen (S).

Malmgren 1862 p. 236; Wulff 1902 p. 102.

Was found especially in the upper part of the talus under bird-cliffs. Most of our specimens are only some few cm long but they may even in this high latitude in favourable places attain more than 10 cm in length, e. g. in Floraberget. The northernmost locality known for this plant is Malmgren's locality in Brennevinsfjorden.

Fig. 4. *Ranunculus nivalis* L. and *R. pygmaeus* Wahlenb. Floraberget 4/8 1931.

8. *Ranunculus sulphureus* Soland. Pl. I.

Northern Ids. Waldenøya (Parry, Eaton), (Sjuøyane (Nordenskiöld)). *Brennevinsfj.* Depotodden (Malmgren, S), Kontaktberget (S), Cape Hansteen (S). *Lady Franklinfj.* Franklinfjellet, west side (S), Inner west side (S). *Murchisonfj.* Raudstupet (S), Floraberget (Kulling, S), Wargentindalen (S), Snaddvika, north side (S), Triodalen (S), Sveanor (S), (NE Land 80° (Malmgren)). *Hinlopenstr.* Augusti Bay (Malmgren), Rundhaugen (S), Ismåsefjellet (S), Torellneset (S), (Hinlopenstr. 1000 f. (Malmgren)). *Sorgfj.* Heclahamna (Malmgren, Eaton, Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjell 340 m (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Eaton)).

Hooker 1828 p. 208; Malmgren 1862 p. 237; Eaton 1876 p. 42; Andersson and Hesselman 1900 p. 49.

Not rare on the fertile talus slopes below bird-cliffs, where they may reach a height of more than 25 cm. In other habitats it is rare in North-East Land where it then often occurs as a dwarfed form only a few cm high and with the large flowers mostly on the same level as the wet mosses around. Flowering specimens were seen in Adventfjorden June 21 and at Rundhaugen July 2. It is generally distributed in Frans Josef Land (cf. Hanssen and Lid 1932 p. 18) and reaches its northern limit on the north coast of Greenland at Low Point 83° 6′ (Wulff) (Ostenfeld 1923 p. 238).

Saxifragaceae.

9. *Chrysosplenium tetrandrum* (Lund) Th. Fries. Pl. I.

Murchisonfj. Floraberget (S).

New to North-East Land, where it is undoubtedly very rare. It was found in abundance in the upper part of the slope under the bird-

cliff Floraberget in a dense carpet chiefly consisting of *Carex maritima* Gunn., *Cerastium alpinum*, *Festuca rubra* v., *Alopecurus alpinus*, *Poa rigens* and *Polygonum viviparum*.

All our plants are rather small and slender, with only four stamens and accordingly belonging to the arctic form *C. tetrandrum*. The correlation between an arctic latitude and four stamens is not absolute, as specimens with eight stamens (*C. alternifolium* L.) is not rarely seen in material from Novaya Zemlya, e. g. in Dr. Lynge's collections. Opinions differ regarding the systematic rank of this plant. Thus, authors like Franchet, Simmons, Hegi and others do not consider it to be sufficiently well founded to be regarded as a separate species. However, considering the small, slender habit of *C. tetrandrum*, its arctic distribution and the fact that intermediates with 5—7 stamens are certainly rare, if they are found at all, there seems to be a great deal of justification in the opposite view. It would be of considerable interest to know the chromosome numbers of this little four-staminate form as compared with the southern larger and eight-staminate *C. alternifolium*. It would not be very surprising if the latter may be tetraploid as compared with the former.

With the discovery of this species in Greenland (cf. Vaage 1932 p. 22) the largest gap in its circumpolar distribution was bridged. Its northern limit is Floraberget in Murchisonfjorden.

10. *Saxifraga aizoides* L. Pl. I.

Sorgfj. Heclahamna (Parry), Inner west side (S). *Lomfj.* Faxedalen (S), Lomfjordbotnen (S), (Lomfjorden 2—300 f. s. m. (Malmgren)).

Hooker 1828 p. 210; Malmgren 1862 p. 245.

Rather rare in the fjords mentioned, and not yet found in North-East Land. Only pale-yellow forms were seen. Its northern limit is Sorgfjorden.

11. *Saxifraga cernua* L.

Northern Ids. Kvitøya (Malmberg), Waldenøya (Parry), (Sjuøyane (Nordenskiöld)). *Brennevinsfj.* Depotodden (S), Kontaktberget (S), 2.5 km SE of Cape Hansteen (S), Cape Hansteen (S). *Lady Franklinfj.* Franklinfjellet, west side (S), Shore plain west of Franklinfjellet (S), Hansøya (S), Gerardodden (S), Inner west side (S), Persberget (S), Westmanbukta (S), Tombolaøya (S), Lågøya (Parry), Basisøya (S). *Murchisonfj.* Detterbukta (S), Raudstupet (S), Floraberget (S), Norvika, north side (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Camp at the inland ice 170 m (S), Krykjeslukta (S), Krykjevatnet (S), Sveanor (S), (North-East Land 80°, 1000 f. (Malmgren), Murchison Bay (Wulff)). *Ids. in Murchisonfj.* Flyndra (S), Oskarøya (S), S. Russøya (S), Krossøya (S). *Hinlopenstr.* Cape Sparre (S), Kalkstranda at Forsiusfjellet (S), Rijpdalen (Ahlmann), Gyldénøyane (Elton), Rundhaugen (S), Ismåsefjellet (S), Torell-

neset (S), Ulvebukta (Elton), Von Otterøya (Elton). *Sorgfj.* Heclahamna (Parry, Malmgren, Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjell (S), Dvergbreen (S), Lomfjordbotnen (S).

Hooker 1827 p. 211; Malmgren 1862 p. 245, 246; Andersson and Hesselman 1900 p. 28; Wulff 1902 p. 102; Summerhayes and Elton 1928 p. 207.

One of the most common plants in North-East Land, where it is also one of the few plants that give life to the great and incredibly sterile dolomite areas at Murchisonfjorden and adjacent parts of the eastern shore of Hinlopenstredet. In the good summer of 1931 the optimal flowering-time in North-East Land was not until the last days of July, and seemed to last all August. Fruiting specimens were not seen, the vegetative spreading by bulblets being the only means of spreading so far known for this saxifrage in the Arctic as elsewhere. It is one of the most common vascular plants in high arctic latitudes, probably found as far north as there is bare ground. It has farthest north been collected by Th. Wulff on Low Point 83° 6′ on the north coast of Greenland (Ostenfeld 1923 p. 240).

12. *Saxifraga comosa* (Retz.) Fellm. Fig. 5 and Pl. I.

Brennevinsfj. Depotodden (S), 5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Shore plain west of Franklinfjellet (S), Westmanbukta (S). *Murchisonfj.* Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S). *Hinlopenstr.* Ismåsefjellet (S), Torellneset (S). *Sorgfj.* Heclahamna (Parry), Inner west side (S). *Lomfj.* Lomfjordbotnen (S).

Hooker 1828 p. 210.

Seems to be rather rare in North-East Land, where it was found growing among wet mosses. Flowering specimens were not seen. As to the value of the bulbils as a systematic character in distinguishing this form from *S. stellaris*, opinions differ. As far as I know, it is not yet settled whether this character is hereditarily constant, or perhaps dependent upon external factors and reversible. The latter appears, however, never to have been observed. In contradistinction to the common occurrence of vivipary in grasses, this form of vivipary in the genus *Saxifraga* is very rare (cf. Engler 1919 p. 8), and is not a thing that happens occasionally in most saxifrages. Except in the Arctic, specimens are not seldom seen with a simultaneous development of bulbils as well as some flowers, which are generally apical. As regards the correct interpretation of such forms, it seems to me to be always evident that these are accidentally flowering *S. comosa*, and not *S. stellaris* with a fortuitous development of some bulbils. This clearly appears from the fact that the bulbils, if present, are always developed in such great quantities that it is impossible to speak of any numerical transition in this respect between *S. stellaris* and flowering *S. comosa*. The plant is either decidedly and completely a *S. comosa*, flowering or

Fig. 5. Flowering specimens of *Saxifraga stellaris* L. and *S. comosa* (Retz.) Fellm. Note the great number of bulbils in *S. comosa* and the distinct and elongated middleaxis of its inflorescence. No organs is seen in *S. stellaris* which by a direct transformation may have resulted in the bulbils of *S. comosa*. Specimens from Norway. Natural size.

not, with the inflorescence studded with bulbils, or it is entirely a *S. stellaris* without any bulbils whatever.

Hegi (Bd. IV_2 p. 625) points out the fact that the parallelism between a hard climate and the occurrence of *S. comosa* is not absolute, seeing that in the Alps *S. stellaris* extends to a considerably higher altitude than *S. comosa*. It is hardly justifiable merely to draw a comparison between a southern high-alpine climate and a high-arctic climate, but however this may be, it does not seem possible to me that the geographical distribution of *S. comosa* compared with that of *S. stellaris* can ever elucidate their mutual taxonomical position. The arctic climate may be considered able to transform *S. stellaris* into a *S. comosa*, which conception seems to be shared by most scientists. But the case may be seen quite as naturally from the other side, viz., that *S. comosa*, in virtue of its vegetative and hardy means of spreading is able to penetrate much farther north than its flowering relative. This is in full analogy with the many other viviparous plants in the Arctic, such as *Saxifraga cernua*, *Polygonum viviparum*, *Festuca vivipara* and others, which have not acquired their vivipary on account of the arctic climate, but which may probably be able to retain life from year to year in those latitudes thanks to their vegetative reproduction.

A morphological peculiarity which has already been pointed out by Warming (1909 p. 218, 219) deserves attention in this connection. And that is the remarkably great number of bulbils occurring on the branches. I consider these hardly to be interpreted as mere transformations of organs normally present in a *S. stellaris*, but they must on the contrary, be regarded as something new and additional. In this respect they differ considerably from the grasses with viviparous parallel forms, where the visible parts of the bulbil — as will be more thoroughly dealt with later — are nothing but a vegetative metamorphosis of some of the normal floral organs of the spikelet.

The type of inflorescence in these two species is also considerably different. In *S. comosa* there is a marked centralization around an elongated and often thick, middle axis, whereas in *S. stellaris* the middle axis is thin and inconspicuous with its apical flower or capsule being most often overtopped by the elongated lateral ramifications of the inflorescence (cf. Fig. 5).

Even if a genetic connection between these two species seems probable in view of the close similarity of their vegetative parts it appears to me to be most cautious not to express this supposition in the form of a variety name. Besides being a distinct morphological unit which will never raise any differential diagnostic difficulties as compared with *S. stellaris*, it is characterized by its distribution in high arctic latitudes where *S. stellaris* is lacking.

Vivipary is a phenomenon of considerable general biological interest, not in the least for taxonomical research. If, for instance, it could be demonstrated that external factors such as arctic climate, X-rays, and the like, could permanently and irreversibly transform a *S. stellaris* into a *S. comosa*, we should have before us a recent example of the strange phenomenon called by the palaeontologists iterative origin of species. The probability seems to be remote.

Northern limit is Low Point (Wulff) 83° 6′ on the north coast of Greenland (Ostenfeld 1923 p. 241).

13. *Saxifraga flagellaris* Willd. Fig. 6 and Pl. I.

Brennevinsfj. Depotodden (Malmgren). *Lady Franklinfj.* Hansøya (S), Gerardodden (S), Inner west side (S), Westmanbukta (S), Lågøya (Parry). *Murchisonfj.* Floraberget (S), Wargentindalen (S), Snaddvika, north side (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Krykjevatnet (S), Sveanor (S), (Stenö (Malmgren), North-East Land 80° (Malmgren), Murchisonfjorden (Wulff)). *Ids. in Murchisonfj.* S. Russøya (S). *Hinlopenstr.* Augusti Bay (Malmgren), Rundhaugen (S). *Sorgfj.* Heclahamna (Parry, Malmgren, Eaton), Inner west side (S). *Lomfj.* Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren, Eaton)).

Hooker 1828 p. 210; Malmgren 1862 p. 245; Eaton 1876 p. 42; Wulff 1902 p. 102.

Fig. 6. *Saxifraga flagellaris* Willd. with young bulbils. Sveanor 26/7 1931.

Fairly common in North-East Land, except in the pure dolomite areas, where it is almost lacking. It was found mostly near the shore. The first flowering specimens were seen on July 13 on Hansøya in Lady Franklinfjorden. Capsules with ripe seeds were not found by us, and seem to be extremely rare in Svalbard (Andersson and Hesselman 1900 p. 27)

Northern limit is Cape Benet (Wulff) 83° 2′ on the north coast of Greenland (Ostenfeld 1923 p. 241).

14. *Saxifraga groenlandica* L. Fig. 7 and Pl. I.

Northern Ids. Waldenøya (Parry), (Sjuøyane (Nordenskiöld)). *Brennevinsfj.* Depotodden (Malmgren), Kontaktberget (S), 5 km SE of Cape Hansteen (S), Cape Hansteen (S). *Lady Franklinfj.* Franklinfjellet, west side (S), Shore plain west of Franklinfjellet (S), Hansøya (S), Inner west side (S), Westmanbukta (S), Tombolaøya (S), Lågøya (Parry). *Murchisonfj.* Detterbukta (S), Claravågsundet, south side (S), Raudstupet (S), Floraberget (S), Norvika, north side (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Krykjeslukta (S), Krykjevatnet (S), Sveanor (S), (Murchisonfjorden (Wulff)). *Ids. in Murchisonfj.* Ringertzøya (S), N. Russøya (S), Oskarøya (S), S. Russøya (S). *Moffen.* South east end (S). *Hinlopenstr.* Augusti Bay (Malmgren), Gyldénøyane (Elton), Rundhaugen (S), Ismåsefjellet (S), Torellneset (S), Ulvebukta (Elton). *Sorgfj.* Heclahamna (Parry, Malmgren, Eaton), Inner west side (S). *Lomfj.* Lomfjordbotnen (S).

Hooker 1828 p. 210; Malmgren 1862 p. 246, 267; Eaton 1876 p. 42; Wulff 1902 p. 102; Summerhayes and Elton 1928 p. 207.

Common throughout the whole of the investigated area except on a dolomite substratum. Nearly all our specimens from North-East Land, with the exception of a few collected in the bird-cliffs, belong to the typical low and densely pulvinate form var. *uniflora* (R. Br.) Simm.

Fig. 7. *Saxifraga groenlandica* L. var. *uniflora* (R. Br.) Simm. Sveanor 26/7 1931.

From Triodalen we have beautiful examples of the well known abnormity of var. *uniflora* presenting itself as an incomplete differentiation into stamens and petals. The petals are very inconspicuous and small, of a yellowish-green colour, and show every transitory forms to normal stamens, f. *cryptopetala* (Berlin). A further and complete metamorphosis of all petals into ± normally developed stamens leads without any discontinuity to f. *apetala* Andersson et Hesselman. These

interesting forms have been treated in detail by various authors e. g. Engler 1919 p. 371, and Warming 1909 p. 191 Fig. 16 and p. 193. To judge from the capsules with ripe seeds from the previous year the f. *cryptopetala* is fully fertile.

Northern limit is on the north coast of Greenland, Cape Black 83° 1′ (Wulff) (Ostenfeld 1923 p. 241).

Fig. 8. *Saxifraga hieraciifolia* Waldst. et Kit. Sorgfjorden, inner west side. 15/8 1931.

15. *Saxifraga hieraciifolia* Waldst. et Kit. Fig. 8 and Pl. I.

Sorgfj. Heclahamna (Andersson and Hesselman, Wulff), Inner west side (S). *Lomfj.* Faxefjell 200 m (S).

Andersson and Hesselman 1900 p. 22; Wulff 1902 p. 106.

Fairly common in Sorgfjorden, where the largest specimen found measures 15 cm. In Lomfjorden only one sterile leaf-rosette was found on Faxefjell at a little lake about 200 m above sea level.

The northern limit for this beautiful saxifrage is in Sorgfjorden.

16. *Saxifraga hirculus* L. Pl. I.

Murchisonfj. Triodalen (S). *Hinlopenstr.* Augusti Bay (Malmgren), Ismåsefjellet (S). *Sorgfj.* Heclahamna (Eaton). (*Lomfj.* (Malmgren, Eaton)).

Malmgren 1862 p. 245; Eaton 1876 p. 42.

Appears to be very rare in North-East Land. At Rundhaugen as early in the year as July 2 only some withered tufts from the previous year were found. It had just begun to flower on July 29 in Triodalen, which is its northern limit.

17. *Saxifraga nivalis* L.

Brennevinsfj. Depotodden (Malmgren, S), Cape Hansteen (S). *Lady Franklinfj.* Franklinfjellet, west side (S), Gerardodden (S), Westmanbukta (S), Tombolaøya (S). *Murchisonfj.* Raudstupet (S), Floraberget (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S), Triodalen (S), Sveanor (S), (North-East Land 80° (Malmgren), Murchisonfjorden (Wulff)). *Ids. in Murchisonfj.* S. Russøya (S). *Hinlopenstr.* Augusti Bay, 600 f. (Malmgren), Gyldénøyane (Elton), Ismåsefjellet (S), Torellneset (S), Von Otterøya (Elton). *Sorgfj.* Heclahamna (Parry, Andersson

and Hesselman, Wulff), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjell 200 m (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Eaton)).

Hooker 1828 p. 210; Malmgren 1862 p. 244; Eaton 1876 p. 43; Andersson and Hesselman 1900 p. 22; Wulff 1902 p. 102, 106; Summerhayes and Elton 1928 p. 207.

Rather common in North-East Land, especially in the bird-cliffs, where it may attain a height of nearly 20 cm. There is in our specimens often a marked tendency to have the usually headlike inflorescence more or less split up in single flowers. Many of our specimens from Floraberget are infected with a fungus parasite, *Puccinia Saxifragae.*

Northern limit is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 241).

18. *Saxifraga nivalis* L. var. *tenuis* Wahlenb.

Brennevinsfj. 5 km SE of Cape Hansteen (S), 2.5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Franklinfjellet, west side (S), Gerardodden (S), Westmanbukta (S). *Murchisonfj.* Floraberget (S), Celsiusfjellet (S), Snaddvika, south side (S), Snaddvika, north side (S), Triodalen (S), Sveanor (S). *Hinlopenstr.* Augusti Bay (Malmgren), Ismåsefjellet (S), Torellneset (S). *Moffen.* (Ringertz). *Sorgfj.* Inner west side (S). *Lomfj.* Lomfjordbotnen (S).

Malmgren 1862 p. 244; Andersson and Hesselman 1900 p. 22.

Rather common and often in company with the main form, but is also frequently found in places which are too barren for the latter to thrive. In our material transitory forms are rare. However, as long as its distinction from *S. nivalis* is solely built upon varying and relative characters, it may be a matter of opinion as to what value we may ascribe to the nana form var. *tenuis.* The difficulty in regarding this as a separate species would seem to increase with the degree of magnification used. Most botanists in the Arctic have paid little attention to this little form. Its northernmost locality given in literature is Gunnar Andersson Valley 82° 28′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 241).

19. *Saxifraga oppositifolia* L. Fig. 9.

Northern Ids. Kvitøya (Malmberg), Waldenøya (Parry), (Sjuøyane (Nordenskiöld)). *Brennevinsfj.* Depotodden (see Nathorst 1883 p. 45). Kontaktberget (S), 5 km SE of Cape Hansteen (S), 2.5 km SE of Cape Hansteen (S), Cape Hansteen (S). *Lady Franklinfj.* Franklinfjellet, west side (S), Shore plain west of Franklinfjellet (S), Hansøya (S), Gerardodden (S). Inner west side (S), Persberget (S), Westmanbukta (S), Tombolaøya (S), Lågøya (Parry), Basisøya (S). *Murchisonfj.* Detterbukta (S), Claravågsundet, south side (S), Kinnvika (S), Raudstupet (S), Floraberget (S), Norvika, north side (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Camp at the inland ice 170 m (S), Krykjeslukta (S), Krykjevatnet (S), Sveanor (S), (Murchisonfjorden (Wulff)). *Ids. in Murchisonfj.* Ringertzøya (S), N. Russøya (S), Kvaløya (S), Flyndra (S), Oskarøya (S), S. Russøya (S), Krossøya (S).

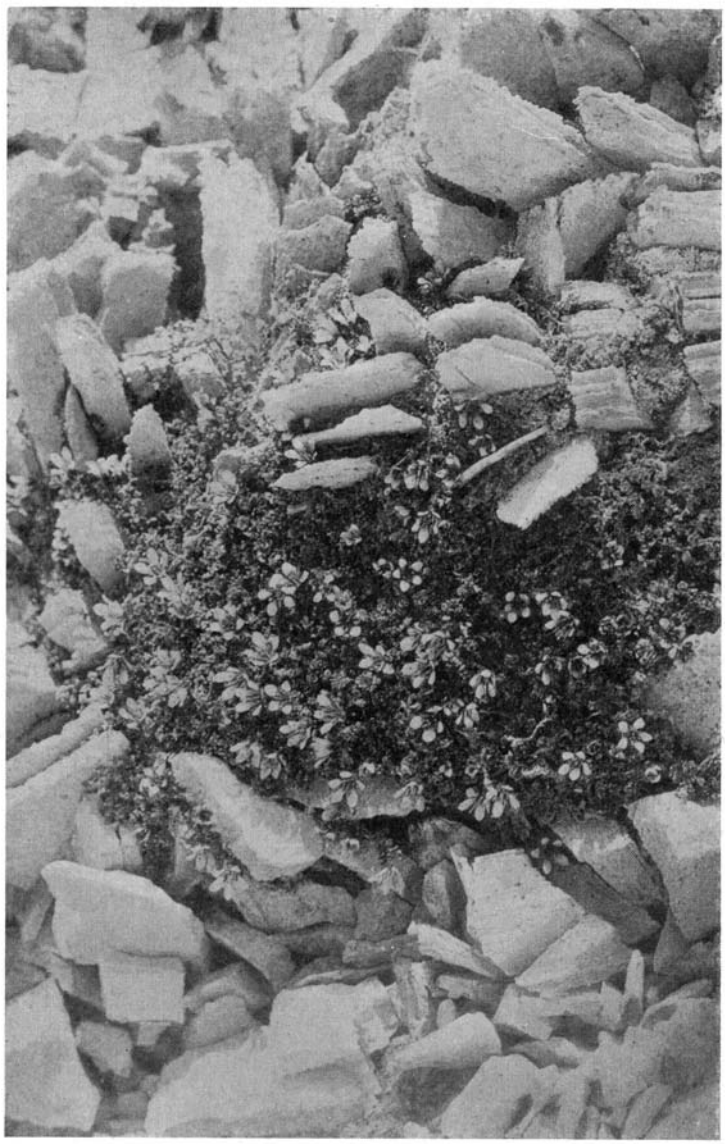


Fig. 9. *Saxifraga oppositifolia* L. f. *reptans* And. et Hesselm. growing on typical dolomite limestone ground. Sveanor 26/7 1931.

Hinlopenstr. Cape Sparre (S), Kalkstranda at Forsiusfjellet (S), Forsiusfjellet (S), Gyldénøyane (Elton), Rijpdalen (Ahlmann), Rundhaugen (S), Ismåsefjellet (S), Torellneset (S), Perthesøya (Malmberg), Von Otterøya (Elton), *Sorgfj.* Heclahamna (Parry, Malmgren, Eaton), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjell (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Elton)).

Hooker 1828 p. 210; Malmgren 1862 p. 245; Eaton 1876 p. 43; Nathorst 1883 p. 45; Wulff 1902 p. 102; Summerhayes and Elton 1928 p. 207.

The most common plant in the area investigated by us in North-East Land. Here its abundantly flowering tussocks may in some places, in pure stands, occupy large areas. It varies a great deal. The flat and loosely tufted f. *reptans* And. et Hesselm., often with very narrow petals, occurs especially in dry and stony places with a meagre substratum, as in the dolomite areas (cf. Fig. 9 and 61). In more favourable places and especially on the manured soil under bird-cliffs and on bird islets the dense tussocks of f. *pulvinatum* And. et Hesselm. dominate. However, every intermediate between these two extreme types is seen. It is one of the plants to flower earliest and was flowering everywhere on our arrival in the last days of June, even in such exposed places as the southern precipitous edge of Ismåsefjellet at an altitude of 270 m above sea level, this being a considerable elevation on the low North-East Land. Flowering specimens were seen the whole summer, but each tussock seems to have a rather short flowering period, hardly as much as a fortnight. Thus, when I visited the small Tombolaøya on July 10, its surface was quite red with flowering *S. oppositifolia*, which were nearly all withered only four days later when I again landed on the islet in order to get a photo of them.

Like so many of the other phanerogams in North-East Land, they have certainly no climatic northern limit. *S. oppositifolia* is one of the nine plants known from the northernmost botanical locality on earth viz. Frederic E. Hyde Fjord 83° 15′ (I. P. Koch) on the north coast of Greenland (Ostenfeld and Lundager 1910 p. 25).

20. *Saxifraga rivularis* L.

Northern Ids. Karl XII Øy (Andersson and Hesselman, Malmberg), Waldenøya (Parry), Nordkapøya (Elton), (Sjuøyane (Nordenskiöld)). *Brennevinsfj.* Depotodden (Malmgren), Zeipelbukta (S), Kontaktberget (S), 5 km SE of Cape Hansteen (S), 2.5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Franklinfjellet, west side (S), Hansøya (S), Gerardodden (S), Westmanbukta (S). *Murchisonfj.* Detterbukta (S), Floraberget (S), Snaddvika, north side (S), Snaddvika, south side (S), (Murchisonfjorden (Wulff)). *Ids. in Murchisonfj.* Ringertzøya (S), Depotøya (S), N. Russøya (S), Flyndra (S). *Moffen.* South east end (S). *Hinlopenstr.* Augusti Bay (Malmgren), Ismåsefjellet (S), Torellneset (S), Perthesøya (Malmberg), Von Otterøya (Elton). *Sorgfj.* Heclahamna (Parry, Malmgren), Inner west side (S). *Lomfj.* Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Nathorst 1883 p. 45)).

Hooker 1828 p. 210; Malmgren 1862 p. 246, 267; Nathorst 1883 p. 45; Andersson and Hesselman 1900 p. 29; Wulff 1902 p. 102; Summerhayes and Elton 1928 p. 207.

Fairly common in North-East Land, especially on the bird-cliffs. The northern limit is in Frans Josef Land at Alkeneset in Rudolføya 81° 45′ (Hanssen and Lid 1932 p. 21), this being practically the same latitude as in Discovery Harbour (Simmons 1906 p. 77) in Grinnell Land, Arctic America.

Rosaceae.

21. *Dryas octopetala* L. Fig. 10 and Pl. II.

Brennevinsfj. Depotodden (Malmgren). *Lady Franklinfj.* Hansøya (S), Gerardodden (S). *Murchisonfj.* Raudstupet (S), Floraberget (S), Norvika, north side (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Kvalrosshalvøya (S), Triodalen (S), Krykjevatnet (S), Sveanor (S). (Murchisonfjorden (Wulff), North-East Land 80° (Malmgren)). *Hinlopenstr.* Oxfordhalvøya (Clutterbuck), Ismåsefjellet (S). *Sorgfj.* Heclahamna (Parry, Eaton, Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet 360 m (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Eaton, Fries, Elton)).[1]

Hooker 1828 p. 211; Malmgren 1862 p. 243; Eaton 1876 p. 42; Andersson and Hesselman 1900 p. 20; Wulff 1902 p. 102; Elton 1925 p. 112; Summerhayes and Elton 1928 p. 211.

Rather rare in North-East Land and grows preferably in the inner parts of the fjords.

All our specimens belong to the small and yellowish coloured var. *minor* Hook. (cf. Lynge 1923 p. 61 and Pl. XXIII—XXIV). The first flowering specimen in North-East Land was found on July 13 in Hansøya.

Northern limit is in Peary Land on the north coast of Greenland, where I. P. Koch collected it in Frederic E. Hyde Fjord 83° 15′ (Ostenfeld and Lundager 1910 p. 28).

22. *Potentilla emarginata* Pursh. Pl. II.

(*Northern Ids.* Sjuøyane (Nordenskiöld)). *Brennevinsfj.* Depotodden (Malmgren, S), Kontaktberget (S), 5 km SE of Cape Hansteen (S), 2.5 km SE of Cape Hansteen (S), Cape Hansteen (S). *Lady Franklinfj.* Franklinfjellet, west side (S), Hansøya (S), Gerardodden (S), Inner west side (S), Westmanbukta (S). *Murchisonfj.* Floraberget (S), Norvika, north side (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Triodalen (S), (NE Land 80° (Malmgren)). *Hinlopenstr.* Gyldénøyane (Elton). *Sorgfj.* Heclahamna (Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren)).

Malmgren 1862 p. 244; Andersson and Hesselman 1900 p. 20, sub nom. *P. fragiformis* Willd f. *parviflora* Trautw.; Summerhayes and Elton 1928 p. 207.

Not common in North-East Land, where it grows in dry and sunny slopes, especially in the inner fjord districts and often in company with *Dryas octopetala.* It was never seen on dolomite ground. In the

[1] Summerhayes and Elton (1928, map p. 194) record on their map of distribution *Dryas* from the inner parts of Lady Franklinfjorden, and also from the inner parts of Brennevinsfjorden. These records, which are altogether right, must in fact be due to observations made from a sea-plane in 1924, as no old-time land-crab botanist has before 1931 visited these tracts.

Fig. 10. *Dryas octopetala* L. var. *minor* Hook., with *Thamnolia vermicularis* (Sw.) Ach. scattered on the ground. Wargentindalen 22/7 1931.

bird-cliffs, e. g. Floraberget, luxuriant specimens were found with stems up to 18 cm in length and corresponding to the var. *elatior* Abr. (Wolf 1908 p. 535).

Northern limit is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 239).

23. *Potentilla nivea* L.

Not seen by us, previously found (Hooker 1828 p. 211): *Sorgfj.* Heclahamna (Parry).

Northern limit is Gunnar Andersson Valley 82° 28′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 239).

24. *Potentilla pulchella* R. Br. Pl. II.

Brennevinsfj. Kontaktberget (S). *Sorgfj.* Heclahamna (Parry, Malmgren, Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren)).

Hooker 1828 p. 211; Malmgren 1862 p. 244; Andersson and Hesselman 1900 p. 7.

New to North-East Land, where it seems to be very rare. Only two specimens were found both flowering and growing on the fertile talus slope under Kontaktberget in Brennevinsfjorden. In Sorgfjorden and Lomfjorden, especially in the sandy Faxedalen it grows in great numbers together with *P. emarginata*, often in large tufts.

P. pulchella is known farthest north from Frederic E. Hyde Fjord 83° 15′ (I. P. Koch) in Peary Land on the north coast of Greenland (Ostenfeld and Lundager 1910 p. 27).

Papaveraceae.

25. *Papaver radicatum* Rottb. Fig. 55.

Northern Ids. Waldenøya (Parry), (Sjuøyane (Nordenskiöld)). *Brennevinsfj.* Depotodden 1500 f. (Torell), Kontaktberget (S), Franklindalen, east end (S), 5 km SE of Cape Hansteen (S), 2.5 km SE of Cape Hansteen (S), Cape Hansteen (S). *Lady Franklinfj.* Franklindalen, west end (S), Franklinfjellet, west side (S), Shore plain west of Franklinfjellet (S), Hansøya (S), Gerardodden (S), Inner west side (S), Persberget (S), Westmanbukta (S), Tombolaøya (S), Lågøya (Parry), Basisøya (S). *Murchisonfj.* Detterbukta (S), Claravågsundet, south side (S), Kinnvika (S), Raudstupet (S), Floraberget (S), Wargentinfjellet 230 m (S), Norvika, north side (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Camp at the inland ice 170 m (S), Krykjeslukta (S), Krykjevatnet (S), Sveanor (S), (Murchisonfjorden (Wulff, Elton)). *Ids. in Murchisonfj.* Ringertzøya (S), Flyndra (S), Oskarøya (S), Teltøya (S), S. Russøya (S). *Hinlopenstr.* Cape Sparre (S), Kalkstranda at Forsiusfjellet (S), Rijpdalen (Ahlmann), Gyldénøyane (Elton), Rundhaugen (S), Ismåsefjellet (S), Torellneset (Elton, S), Ulvebukta (Elton), Perthesøya (Malmberg), Von Otterøya (Elton). *Sorgfj.* Heclahamna (Parry, Eaton, Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet 340 m (S), Dvergbreen (S), Lomfjordbotnen (S).

Hooker 1828 p. 208; Malmgren 1862 p. 237; Chydenius 1865 p. 231; Eaton 1876 p. 42; Andersson and Hesselman 1900 p. 41; Wulff 1902 p. 102; Summerhayes and Elton 1928 p. 201, 207.

Very common almost everywhere, often in great quantities. A somewhat aberrant form was found in the drift-sand fields in Faxedalen. It is characterized by its long and narrow leaf-lobes, the conspicuous, reddish brown pubescence on the living culm, and the strongly sulphur-yellow colour of the petals which are otherwise generally very pale yellow to whitish in North-East Land. The form seems to be caused by the sandy substratum. The milk-juice is, as usually in the Arctic, very sparse. It is slightly dreggy and of a colour which is neither decidedly yellow nor white. Flowering poppies were seen all the time we stayed in Svalbard.

Any further subdivision of the arctic poppy I dare not propose here. *Papaver radicatum* Rottb. is considerably variable, especially well shown when specimens from different geographical areas are compared e. g. those from Svalbard with those from Greenland. Nordhagen has in a preliminary paper (1931) pointed out that considerable difference is present also between the different isolated local stocks of this poppy in Scandinavia, some of which he considers to be even good, distinct species. But because these forms or species in Scandinavia, seem distinctly to have the appearance of being very local races, produced by inbreeding as a result of prolonged isolation, I do not for the present wish to offer any opinion on the taxonomical value of these forms as seen in a wider, circumpolar connection. This I do so much the more

as a monographic treatment of the arctic poppy on a broad base has already been taken up by Nordhagen. Until such a revision of the whole circumpolar material has been undertaken, it can hardly be expected that any definite conclusions may be reached with regard to the further subdivisions of the *P. radicatum* complex into species, subspecies etc. The arctic *Papaver* material is exceedingly rich and considerably polymorphous so that the final results of a very desirable circumpolar monograph may be anticipated with the greatest interest.

Papaver radicatum has been collected farthest north in Frederic E. Hyde Fjord 83° 15′ (Wulff) on the north coast of Greenland (Ostenfeld and Lundager 1910 p. 22).

Cruciferae.

26. *Braya purpurascens* (R. Br.) Bunge. Pl. II.

Sorgfj. Heclahamna (Parry), Inner west side (S). *Lomfj.* Faxedalen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren)).

Hooker 1828 p. 209, sub nom. *Platypetalum purpurascens* Brown; Malmgren 1862 p. 238; Fries 1869 p. 129.

Grows in sandy places and was rare except in the drift-sand fields at Faxedalen, where the sand had almost buried the numerous tufts of this species as well as the tufts of *Puccinellia angustata* and *P. Vahliana*, *Papaver*, *Cerastium alpinum*, and *Carex nardina* growing here. All our specimens, except one from Sorgfjorden, have pubescent pods with the hairs mostly unbranched.

The northern limit is Gunnar Andersson Valley 82° 28′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 235).

27. *Cardamine bellidifolia* L. Pl. II.

Northern Ids. Waldenøya (Parry), (Sjuøyane (Nordenskiöld)). *Brennevinsfj.* Depotodden (S), 5 km SE of Cape Hansteen (S), 2.5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Shore plain west of Franklinfjellet (S), Hansøya (S), Inner west side (S) Persberget (S), Lågøya (Parry). *Murchisonfj.* Floraberget (S), Wargentindalen (S), Snaddvika, north side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Sveanor (S), (Murchisonfjorden (Ringertz, Wulff)). *Ids. in Murchisonfj.* S. Russøya (S). *Hinlopenstr.* Cape Sparre (S), Gyldénøyane (Elton), Rundhaugen (S), Ismåsefjellet (S), Torellneset (S), Von Otterøya (Elton), (Hinlopenstredet (Malmgren)). *Sorgfj.* Heclahamna (Parry, Andersson and Hesselman).

Hooker 1828 p. 209; Malmgren 1862 p. 238; Andersson and Hesselman 1900 p. 33, 34; Wulff 1902 p. 102; Summerhayes and Elton 1928 p. 207.

Fairly common in talus, crevices and similar habitats, but not found on a dolomite substratum where, like so many other plants, it cannot thrive. The branching nodes of the stem, and the sceletoned leaves of previous years much like those for instance seen in *Draba subcapitata*

always make it easily distinguishable from sterile tufts of *Cochlearia* which may habitually resemble it very closely. The whole plant, and especially the leaves, are in North-East Land not uncommonly deformed by a parasite (virus?).

The northern limit is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 235).

28. *Cardamine pratensis* L. Pl. II.

Murchisonfj. Floraberget (S), Snaddvika, north side (S). *Sorgfj.* Inner west side (S).

New to the investigated area. In the localities in North-East Land only sterile leaves and leaf-rosettes were found, growing among wet mosses in company with *Saxifraga rivularis*, *Ranunculus hyperboreus*, *Sagina intermedia*, and *Luzula nivalis*. In the *Eriophorum Scheuchzeri* swamps on the west side of Sorgfjorden west of the lagoon (see Fig. 32 p. 64) some flowering specimens with very poorly developed siliques were found. They were growing at the border of some small ponds in the swamp and in company with some other rare species viz. *Ranunculus hyperboreus*, *Carex subspathacea*, *Carex saxatilis*, great quantities of the contracted form of *Dupontia* abundantly flowering, and *Juncus biglumis*.

Northern limit is Discovery Harbour 81° 43′ (Hart) in Grinnell Land, Arctic America (Simmons 1906 p. 96).

29. *Cochlearia officinalis* L. sens. lat.

Northern Ids. Karl XII Øy (Andersson and Hesselman, var. *groenlandica* et *oblongifolia*; Malmberg), Waldenøya (Eaton), Nordkapøya (Elton). *Brennevinsfj.* Depotodden (Malmgren; Fries, var. *groenlandica*; S), Kontaktberget (S), 5 km SE of Cape Hansteen (S), 2.5 km SE of Cape Hansteen (S), Cape Hansteen (S). *Lady Franklinfj.* Hansøya (S), Gerardodden (S), Inner west side (S), Westmanbukta (S), Tombolaøya (S), Basisøya (S). *Murchisonfj.* Detterbukta (S), Raudstupet (S), Floraberget (S). Norvika, north side (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Krykjeslukta (S), Sveanor (S), (Murchisonfjorden (Wulff)). *Ids. in Murchisonfj.* Depotøya (S), N. Russøya (S), Kvaløya (S), Flyndra (S), Oskarøya (S), S. Russøya (S), Krossøya (S). *Moffen.* South east end (S). *Hinlopenstr.* Cape Sparre (S), Augusti Bay (Malmgren), Gyldénøyane (Elton), Rundhaugen (S), Ismåsefjellet (S), Torellneset (S), Ulvebukta (Elton), Perthesøya (Malmberg), Von Otterøya (Elton). *Sorgfj.* Heclahamna (Malmgren), Inner west side (S), (Sorgfjorden (Fries)). *Lomfj.* Faxedalen (S), Faxefjellet (S), Lomfjordbotnen (S).

Malmgren 1862 p. 240; Eaton 1876 p. 42; Andersson and Hesselman 1900 p. 39, 40; Wulff 1902 p. 102; Summerhayes and Elton 1928 p. 207.

Very common throughout the investigated area whether on dolomite or not. It is found in the greatest quantities on the manured

ground on bird islets or especially in crevices and on small ledges in the bird-cliffs, where it thrives excellently in the fæces from countless birds.

As far as I can see every intermediate is present, from the var. *arctica* (Schlecht.) Gelert with the siliques oblong, acute, and the diaphragm ovate to lanceolate, through the var. *groenlandica* (L.) Gelert with the siliques ovoid, acute and the diaphragm broadly ovate, acute, to the var. *oblongifolia* (DC) Gelert with the siliques spherical or nearly spherical and somewhat grooved at the rounded, ovate diaphragm (cf. Gelert, in Andersson and Hesselman, 1900 p. 34—40). The great bulk of our material occupies the middle of this continuous series and belongs to the var. *groenlandica*. Some few specimens show, however, marked tendencies towards var. *oblongifolia* or more rarely towards var. *arctica*. I dare not express any personal opinion on the systematical value of these forms in the difficult genus *Cochlearia,* which also in southerly latitudes is critical.

The northernmost known locality for *Cochlearia* is in Gunnar Andersson Valley 82° 28′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 236). In Floeberg Beach (Hart), Arctic America, it has been found slightly more southerly 82° 27′ (Simmons 1910 p. 99).

30. *Draba alpina* L.[1]

Brennevinsfj. Depotodden (cf. Nathorst 1883 p. 45). *Lady Franklinfj.* Gerardodden (S). *Murchisonfj.* Floraberget (S), Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S), Krykjeslukta (S), (Murchisonfjorden (Wulff)). *Hinlopenstr.* Rundhaugen (S). *Sorgfj.* Heclahamna (Parry, Malmgren, Eaton, Wulff), Inner west side (S). *Lomfj.* Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Eaton)).

Hooker 1828 p. 208; Malmgren 1862 p. 238; Eaton 1876 p. 42; Nathorst 1883 p. 45; Wulff 1902 p. 102.

Seems to be rather rare in North-East Land, where as a rule, it is little and stunted and shows, as far as I can see, not uncommonly, ± marked transitions to the other members of chryso-*Draba*, viz. *D. Bellii* and sometimes *D. oblongata*. The distinction between these three species becomes very complicated when dealing with young material, on account of the fact that as well *D. oblongata* as especially *D. Bellii* are as a rule leio-carpous when young. In dealing with such material one should accordingly always try to find pods from the foregoing year, and decide the question of hairiness on the basis of these.

Mrs. E. Ekman (1931 p. 480) contrasts *D. alpina* with its nearest arctic relatives in the following way: "The leaves of its fertile rosette are all ciliate in 1 mm. long simple hairs in the margins. On some of

[1] The previous records of *Drabae* given here are exclusively based on literature, and will probably in many cases only approximately correspond to the results which will be obtained by a revision in accordance with present limitation of species.

the blades also simple hairs are found, on others only branched petiolate hairs. On the other hand, all the leaves of the sterile rosette are not ciliate in simple hairs all round the margins; in these leaves some simple hairs are only found on the petiole and their blades have branched hairs. By this different pubescence on the fertile and sterile rosette *D. alpina* is distinguished from most of its arctic relatives".

D. alpina is known farthest north from our localities in Lady Franklinfjorden.

31. *Draba Bellii* Holm. Fig. 11.

Northern Ids. Kvitøya (Malmberg). *Brennevinsfj.* Depotodden (S), Cape Hansteen (S). *Lady Franklinfj.* Franklindalen, west end (S), Shore plain west of Franklinfjellet (S), Gerardodden (S), Tombolaøya (S), Basisøya (S). *Murchisonfj.* Kinnvika (S), Raudstupet (S), Floraberget (S), Wargentindalen (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Camp at the inland ice 170 m (S), Sveanor (S), (Stenö (Fries)). *Ids. in Murchisonfj.* Ringertzøya (S), Oskarøya (S), Gråøya (S), S. Russøya (S). *Hinlopenstr.* Cape Sparre (S), Kalkstranda at Forsiusfjellet (S), Forsiusfjellet (S), Augusti Bay 600 f. (Malmgren), Rijpdalen (Ahlmann), Rundhaugen (S), Torellneset (S), (Wahlenbergfjorden (Fries)). (*Sorgfj.* (Fries)). *Lomfj.* Faxedalen (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Fries)).

Malmgren 1862 p. 239. sub nom. *D. glacialis Adams* v. *γ*; Fries 1869 p. 130, sub nom. *D. glacialis* Adams.

The rather polymorphous rest of yellow, lasio-carpous *Draba* remaining when *D. alpina* and *D. oblongata* have been separated from our material seems to me to be well deserving of a species name. As far as I can judge from a paper by Mrs. E. Ekman (1931), the following may be taken into consideration: *D. Bellii* Holm and the closely related *D. macrocarpa* Adams; *D. Kjellmanni* Lid being as it seems not yet sufficiently clear. The relation between the two first-mentioned, *D. Bellii* and *D. macrocarpa*, is somewhat unclear, as will appear from the following quotation (Ekman 1931 p. 476): "The pubescence on the upper surface of the leaf is the same as in *D. macrocarpa*, viz. simple hairs, but on the underside it consists mainly of branched hairs, in some leaves of only branched hairs. This characteristic does not fit in with the diagnoses by Adams and Tolmatchev. These specimens must therefore be referred to *D. Bellii* Holm". However, on the foregoing page (475) in the same paper the following is said about the hairiness of the leaves in the cited original diagnosis of *D. macrocarpa* Adams "Folia .... utrinque hispida margine ciliata, pilis simplicibus bi- v. trifidis albidis" a diagnosis which in this respect seems to include both *D. macrocarpa* and *D. Bellii.* However, as Tolmatchew himself does not mention *D. macrocarpa* from Spitsbergen, only *D. alpina* f. *hebecarpa*, and none of our specimens fits in with *D. macrocarpa* in the sense of Ekman, as they often have mixed hairs even on the upper

side of the leaves, I have referred them to *D. Bellii*. All our specimens have ± long, unbranched and marginal ciliae, also at the apex of the leaves (cf. Fig. 11), thus probably most closely corresponding to the var. *gracilis* Ekman, and not to f. *typica* in Fig. 1 p. 471 in the paper mentioned above.

In high arctic collections such as this one where a great number of the specimens are very young, one must often be grateful only to be able to distinguish between the three species *D. alpina*, *D. Bellii*, and *D. oblongata* and therefore I have tried no further subdivision.

The northern limit is I. P. Koch Fjord 82° 48′ (Wulff) on the north coast of Greenland (Ekman 1931 p. 472).

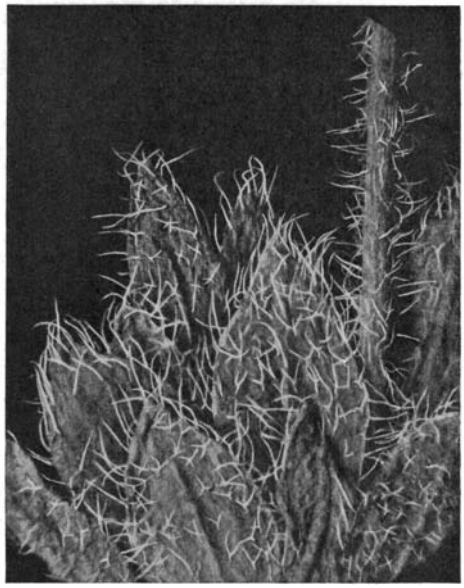


Fig. 11. *Draba Bellii* Holm. Leaves and stem with coarse and long unbranched ciliae mixed with rel. few stellate hairs. Spec. from Lomfjordbotnen, 13/8 1931. Hairs retouched. Magn. 7,5/1.

32. *Draba cinerea* Adams. Pl. II.

Murchisonfj. Floraberget (S).

New to North-East Land, where it seems to be very rare and was found only on ledges in the bird-cliff Floraberget. Here the large greyish tufts were flowering abundantly or partly fruiting. The pubescence of leaves, stems and capsules is very characteristically greyish of only stellulate hairs, whereas some few unbranched marginal ciliae may be found on leaf-stalks. Our specimens attain a height of about 10 cm.

Northern limit is Gunnar Andersson Valley 82° 28′ (Wulff) on the north coast of Greenland (Ekman 1929 p. 485).

33. *Draba lactea* Adams.

Brennevinsfj. 5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Gerardodden (S), Inner west side (S), Basisøya (S). *Murchisonfj.* Floraberget (S), Wargentindalen (S), Snaddvika, north side (S), Triodalen (S), Krykjevatnet (S). *Hinlopenstr.* Rundhaugen (S). *Lomfj.* Lomfjordbotnen (S).

The previous records of *D. Wahlenbergii* Hartm. (Malmgren 1862 p. 239) and *D. lactea* Adams (Summerhayes and Elton 1928 p. 207) belong probably mostly here, the localities are:

(*Murchisonfj.* NE Land 80° (Malmgren)). *Hinlopenstr.* Gyldénøyane (Elton), Von Otterøya (Elton). *Sorgfj.* Heclahamna (Malmgren). (*Lomfj.* (Malmgren)).

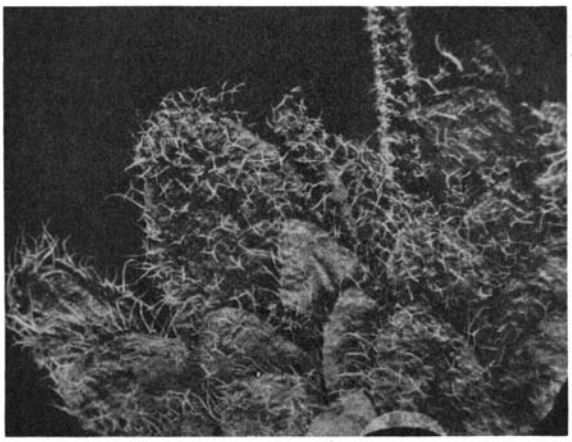


Fig. 12. *Draba oblongata* R. Br. Stem and the typically rounded leaves with minute stellulate hairs and rel. few ciliae. Spec. from Gerardodden, 13/7 1931. Magn. 7,5/1.

Appears to be rather rare in North-East Land, probably partly owing to the fact that it does not seem to be able to grow on the dolomite, occupying large parts of the area investigated. It is rather variable in the density of the tufts, in the width of the leaves, hairiness, and so forth. Single hairs on the stem are sometimes seen, and some few specimens with densely hairy stems (Gerardodden, Triodalen) should perhaps be interpreted as the hybrid *D. lactea* × *subcapitata*; however, they are fertile. A specimen from Lady Franklinfjorden, inner south side is entirely sterile to judge also from the remaining abortive siliques of the previous year. The presence in this specimen of a cauline leaf and a somewhat branched stem might be interpreted as an admixture with *D. fladnizensis*. However the plant looks rather abnormal and is probably infested with a parasite, which may be a sufficient explanation of its sterility.

D. lactea is known farthest north from John Murray Island 82° 45′ (Wulff) on the north coast of Greenland (Ekman 1932 p. 442).

34. *Draba nivalis* Liljebl. Pl. II.

Brennevinsfj. Depotodden (Malmgren). *Lady Franklinfj.* Gerardodden (S). (*Murchisonfj.* North-East Land 80° (Malmgren)).

Malmgren 1862 p. 239.

Apparently very rare in the whole of the investigated area. I did not see more than one little tuft of it on Gerardodden innermost in Lady Franklinfjorden. It is in the field a very characteristic little *Draba* on account of its dusty, greyish colour, caused by the dense covering of minute stellulate hairs.

The northernmost known locality for the pure species seems to be Depotodden of Malmgren, as the record Muskox Bay in Grinnell Land 81° 40′ (Simmons 1910 p. 92) is problematic.

35. *Draba oblongata* R. Br. Fig. 12.

Northern Ids. Kvitøya (Malmberg), Nordkapøya (Elton). *Brennevinsfj.* Depotodden (Malmgren, Fries, S), 2.5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Franklinfjellet, west side (S), Shore plain west of Franklinfjellet (S), Gerardodden (S), Westmanbukta (S). *Murchisonfj.* Floraberget (S), Wargentindalen (S), Sveanor (S), (Stenö (Fries), NE Land 80° (Malmgren)). *Ids. in Murchisonfj.* S. Russøya (S). *Hinlopenstr.* Cape Sparre (S), Rijpdalen (Ahlmann), Gyldénøyane (Elton), Rundhaugen (S), Torellneset (S), Ulvebukta (Elton), Von Otterøya (Elton). (*Sorgfj.* (Fries)). *Lomfj.* Dvergbreen (S).

Malmgren 1862 p. 239, sub nom. *D. micropetala*? Hook.; Fries 1869 p. 130, sub nom. *D. leptopetala* Fries; Summerhayes and Elton 1928 p. 207.

Found here and there in the area investigated, but nowhere in any great quantities. Fruiting specimens are nearly always easy to distinguish by the very shortly beaked siliques equally rounded at both ends, hairy, and of a characteristic brownish to lila green colour. Young specimens without any pods from the foregoing year may cause a great deal of trouble in determination, especially as against the *D. Bellii* forms. Compared with the specimens I have seen of *D. oblongata* in Greenland, those found in North-East Land are generally considerably smaller and never so free from unbranched hairs as to tempt one to name them *D. micropetala* Hook. (cf. Ekman 1931 p. 467).

The northern limit is Cape Salor 82° 54′ (Wulff) on the north coast of Greenland (Ekman 1931 p. 468).

36. *Draba rupestris* R. Br.

Not noted by us, previously recorded (Eaton 1873 p. 42) from: *Sorgfj.* Heclahamna (Eaton). (*Lomfj.* (Eaton)).

To this form series belongs probably also *D. hirta* var. 4 from Heclahamna (Parry) (Hooker 1828 p. 208).

The northernmost locality known for this species is Heclahamna, provided that the determination is in agreement with the present limitation of *D. rupestris*.

37. *Draba subcapitata* Simm. Fig. 13.

Brennevinsfj. Depotodden (S), Kontaktberget (S), 5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Franklinfjellet, west side (S), Gerardodden (S), Persberget (S), Tombolaøya (S), Basisøya (S). *Murchisonfj.* Raudstupet (S), Floraberget (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Krykjeslukta (S), Sveanor (S). *Ids. in Murchisonfj.* Ringertzøya (S), Oskarøya (S), S. Russøya (S). *Hinlopenstr.* Cape Sparre (S), Kalkstranda at Forsiusfjellet (S), Rundhaugen (S), Ismåsefjellet (S). *Lomfj.* Faxedalen (S).

The greater part of the older records (Malmgren 1862 p. 239, sub nom. *D. pauciflora*? R. Br.; Fries 1869 p. 131, sub nom. *D. Martinsiana* J. Gray; Nathorst 1883 p. 20, sub nom. *D. altaica* (Ledeb.) Bunge; Wulff 1902 p. 109, sub nom. *D. Fladnizensis* f. *altaica* (Bunge) Gelert probably belong to this species. They are given from the following localities:

Brennevinsfj. Depotodden (Malmgren). (*Murchisonfj.* NE Land 80° (Malmgren), Stenö (Fries)). *Hinlopenstr.* Augusti Bay (Malmgren), Gyldén-øyane (Elton), (Wahlenberg Bay (Malmgren, Fries)). *Sorgfj.* Heclahamna (Malmgren, Wulff). (*Lomfj.* (Malmgren)).

The only white-flowered *Draba* common and widely distributed in North-East Land. Here it is, as a rule, very densely caespitose and during anthesis generally quite stemless with the little flowers scarcely protruding or often hidden among the rosette leaves. Of the common *Drabae, D. subcapitata* is perhaps the one to give least taxonomical difficulties.

Also in North Greenland *D. subcapitata* and *D. Bellii* forms seem to dominate among the Drabas. Here the northern limit is recorded at Low Point 83° 6′ (Wulff) in Ostenfeld 1923 p. 237.

Fig. 13. *Draba subcapitata* Simm. Leaves with conspicuous dorsal nerve and coarse and long apical ciliae. Pods glabrous. Spec. from Triodalen, 29/7 1931. Magn. 7,5/1.

38. *Eutrema Edwardsii* R. Br.

Not seen by us; previously found (Wulff 1902 p. 102): *Sorgfj.* Heclahamna (Wulff).

The northern limit of *E. Edwardsii* is in Sommerdalen 82° 29′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 237).

39. *Parrya nudicaulis* (L.) Regel.

Not seen by us, previously recorded (Hooker 1828 p. 209) from: *Sorgfj.* Heclahamna (Parry).

This is the only locality hitherto recorded for this plant from Svalbard. Later it has been searched for by many expeditions visiting the fjord, but always without result. Nevertheless it may, of course, very well be thought to grow there, and as long as we cannot directly prove that the record of this big-flowered and conspicuous plant was wrong, there does not seem to be any justification for denying the correctness of the determination given by an authority like W. J. Hooker. This is the northernmost record given for this plant.

Caryophyllaceae.

40. *Cerastium alpinum* L. sens. lat.

Northern Ids. Karl XII Øy (Andersson and Hesselman), Waldenøya (Parry, Eaton), Nordkapøya (Elton). *Brennevinsfj.* Depotodden (Malmgren, S), Kontaktberget (S), 2.5 km SE of Cape Hansteen (S), Cape Hansteen (S). *Lady Franklinfj.* Franklindalen, west side (S), Franklinfjellet, west side (S), Shore plain west of Franklinfjellet (S), Hansøya (S), Gerardodden (S), Inner west side (S), Persberget (S), Westmanbukta (S), Tombolaøya (S), Lågøya (Parry), Basisøya (S). *Murchisonfj.* Raudstupet (S), Floraberget (S), Norvika, north side (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S), Triodalen (S), Krykjeslukta (S), Sveanor (S), (Murchisonfjorden (Wulff)). *Ids. in Murchisonfj.* Oskarøya (S), S. Russøya (S). *Hinlopenstr.* Cape Sparre (S), Augusti Bay (Malmgren), Gyldénøyane (Elton), Rundhaugen (S), Ismåsefjellet (S), Torellneset (S), Ulvebukta (Elton), Von Otterøya (Elton). *Sorgfj.* Heclahamna (Parry, Malmgren, Wulff), Inner west side (S). *Lomfj.* Faxedalen (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Eaton)).

Hooker 1828 p. 209; Malmgren 1862 p. 241, 267; Eaton 1876 p. 42; Andersson and Hesselman 1900 p. 58—61, sub nom. *C. alpinum* et *C. edmonstonii* (Wats.) Murb. & Ostenf.; Wulff 1902 p. 102, 110; Summerhayes and Elton 1928 p. 207, 232.

Since *Cerastium Regelii* (q. v.) has with greater or less difficulty been separated from the *Cerastium* form series in our material from Northern Svalbard, the *Cerastium alpinum* forms remain. Here the taxonomical difficulties are still greater — or I would rather say — here as elsewhere we make ourselves insuperable difficulties by going farther in our division into so called species than does our real power of differentiating warrant. Taxonomy, instead of being a help, becomes unmanageable and thereby loses its justification.

Every one can see that the two types *C. alpinum* L. and *C. arcticum* Lge (*C. Edmondstonii* (Wats.) Murb. et Ostenf., *C. nigrescens* Edm.), and perhaps even *C. hyperboreum* Tolm. are different, but this fact does not entitle us to regard them as species. The question is what value may be attached to the differential diagnoses drawn up, and in this respect opinions may differ. Of fundamental importance, in my opinion is in this respect the practical applicability of the dividing principle, in other words, that the preponderating part of a complete and intact material will freely permit of such a division, also that the principle of classification contains at least one character of qualitative differential diagnostic value and is not merely quantitative. The latter is the case with the whole form series *C. alpinum — arcticum.*

Tolmatchew (1930) has tried to show that the Svalbard *Cerastium C. arcticum* (*Edmondstonii*) of previous authors in reality belongs to another species which he names *C. hyperboreum* Tolm. The differential diagnosis of his new species runs as follows (1. c. p. 7): "Die Ähnlichkeit mit *C. arcticum* wird hauptsächlich durch die verhältnismäßig breite Form der Kelchblätter bei *C. hyperboreum* bedingt. Aber bei *C. arcticum*

sind die Kelchblätter noch breiter und haben keinen oder nahezu keinen membranösen Besatz, der unserer Art eigen ist. *C. arcticum* wird auch durch einzelne Blüten charakterisiert, während die Stengel von *C. hyperboreum* je mehrere Blüten tragen. In Bezug auf die Polsterform ist *C. arcticum* unserer Art auch wenig ähnlich und schließlich besteht dessen Behaarung aus kurzen Haaren, während für *C. hyperboreum* auch längere Haare charakteristisch sind. Also, ..."

I cannot but disapprove from this very relative and inaccurate differential diagnosis, which, as far as I can see, does not even correspond to the facts which may be derived from specimens or literature. Thus, the broad membraneous margin of the sepals is just a character which is pointed out as typical for *C. arcticum* (*C. Edmondstonii*) at least in the Scandinavian material (cf. Lindman 1926 p. 260, 262, and Fig. 160_3), and neither does Lange in his description (1880 p. 31) mention that they are lacking or nearly lacking. *C. arcticum* from the Arctic, it is true, as a rule is somewhat more hairy and tufted than are specimens from more southerly localities, which latter specimens are, however, described as being longhaired, greyish and commonly densely tufted (Lindman 1926 p. 262). From any large material it seems to me to be evident that the pubescence, and width of the membraneous margin in this group of *Cerastium* are so very inconstant and poor characters that they cannot warrant a separation between species. The same is the case with the seed characters (cf. also Asplund 1918 p. 26). Regarding the multiflority of the northern forms, this can hardly be said to represent more than a tendency from a statistical point of view. Uniflority is thus not at all a rule, at least not in Scandinavia, and on the other hand uniflowered specimens are not rare in the Arctic.

From the foregoing it will be apparent that I can not at all agree with Tolmatchew in his conclusion, which immediately follows the differential diagnosis just quoted, viz.: "Also, die Unterschiede zwischen den beiden Arten sind scharf genug, und die öfters vorkommende Zurechnung von *C. hyperboreum* bloß zu *C. arcticum* wird wahrscheinlich nur dadurch erklärt, daß echtes *C. arcticum* auf Spitzbergen nicht vorkommt und die in einiger Hinsicht an dasselbe erinnernde Form als dessen Analogon betrachtet wurde."

As Tolmatchew now operates with *C. alpinum*, *C. arcticum*, (*C. Edmondstonii*), as well as *C. hyperboreum* as separate units, our material of indeterminable intermediate forms will thus be increased three-fold, for in addition to the intermediates *C. alpinum — arcticum*, we get those of *C. alpinum — hyperboreum* and *C. arcticum — hyperboreum*. If, in addition, we point out that from all these, excepting perhaps *C. alpinum*, there are regular transitions to *C. Regelii*, it will be understood that things are getting confused with four species and five or six transition series. It should be mentioned that we have also in our

herbarium a fairly large parcel of *Cerastium*, respecting which Tolmatchew himself has not been willing to take any standpoint.

To encumber the intermediate forms with hybrid nomenclature (Tolmatchew 1930 p. 8) is, in my opinion, most unsatisfactory. The prevalent explanation that pollen has failed and that fruit "never" has developed is not much more than a mere phrase, particularly when applied to arctic material.

If we travel eastward from Spitsbergen we come to one more species of the same group, viz., *C. Bialynickii* Tolm. which, according to the description and the few specimens I have seen, seems to be difficult to work in with all the others; but I dare not, however, take any definite stand on this question. *C. Bialynickii* has previously been determined by Tolmatchew in material from Spitsbergen, but was subsequently again struck off the Spitsbergen flora by him. — The geographical distribution used in support of doubtful morphological "species" is in truth a two-edged sword.

The confusion, lack of uniformity, hybrids, and so forth, which may be seen in the majority of large herbaria from the region under review, appear to demonstrate clearly enough that the splitting up into species is in no harmony with our actual morphological faculty of exact differentiation; and it does not serve any purpose. With just the same right as we define these types in the series as species and thereby create an inaccurate and impossible taxonomy, we may regard *C. alpinum* L. s. lat., in respect of hairiness, tufting, the shape of the sepals, and so forth, as a widely variable species. The variability is particularly clearly shown if arctic and southern forms are compared.

One fact which, among others, may indicate that the so-called *C. hyperboreum* may be only a form of *C. alpinum* conditioned by its environment is that the few occasions on which typical *C. alpinum* was found, it was always in talus or under stones where the plants were in every way more extended (cf. shadow forms) than *C. hyperboreum*, which grew at will in the open and preferably on sandy ground. If we compare the variation of the *C. alpinum* forms on the long east coast of Greenland we find almost exclusively, in the rich vegetation of the southern parts, typical *C. alpinum* with lax tufts and slender leaves and sepals, whereas in Eirik Raudes Rand (abt. 73°) we find, and usually on the sand, all transitions to the dense tuft formation of the northern "*C. hyperboreum*."

In so far as we are not able on a purely morphological basis to delimit these types better, and we do not know whether the transitions are due to hybridization or convergence, I cannot regard the *C. arcticum* Lge as anything but a variety within the formseries of *C. alpinum* L. The high arctic, very densely tufted *C. hyperboreum* type of Tolmatchew is in my opinion, if it should be named at all, at all events not worthy of more than a form name under the *C. alpinum* L. var. *arcticum* (Lge).

C. alpinum s. lat. is very commonly distributed in the area investigated, where it is as a rule densely tufted, particularly in dry, sandy places (*C. arcticum*, *C. hyperboreum*), whereas between large stones in talus and similar conditions it spreads more like the typical *C. alpinum* of southern regions. Such markedly lanate forms as are usual in Scandinavia and, e. g., East Greenland, are rare in Northern Svalbard. Among all *Cerastium* forms in Svalbard there are, as far as I can see, morphological transitions.

C. alpinum has its most northerly known limit at Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 233).

41. *Cerastium Regelii* Ostenf. Fig. 14.

C. alpinum L. var. *caespitosum* Malmgr.; *C. Edmondstonii* (Wats.) Murb. et Ostenf. var. *caespitosum* (Malmgr.) And. et Hesselm.; *C. alpinum* L. f. *pulvinatum* Simmons.

Northern Ids. Waldenøya (Parry). *Brennevinsfj.* Depotodden (Malmgren, S), 5 km SE of Cape Hansteen (S), Cape Hansteen (S). *Lady Franklinfj.* Franklindalen, west end (S), Franklinfjellet, west side (S), Shore plain west of Franklinfjellet (S), Hansøya (S), Gerardodden (S), Westmanbukta (S), Lågøya (Parry). *Murchisonfj.* Detterbukta (S), Raudstupet (S), Floraberget (S), Norvika, north side (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Krykjevatnet (S), Sveanor (S), (Murchisonfjorden (Wulff)). *Ids. in Murchisonfj.* Ringertzøya (S), Kvaløya (S), Flyndra (S), Oskarøya (S), S. Russøya (S). *Hinlopenstr.* Cape Sparre (S), Kalkstranda at Forsiusfjellet (S), Forsiusfjellet (S), Rijpdalen (Ahlmann), Gyldénøyane (Elton), Rundhaugen (S), Ismåsefjellet (S), Von Otterøya (Elton). *Sorgfj.* Heclahamna (Parry), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet 360 m (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Fries)).

Hooker 1828 p. 209, sub nom. *C. alpinum* β; Nathorst 1883 p. 25, sub nom. *C. alpinum* L. γ var. *caespitosa* Malmgren; Andersson and Hesselman 1900 p. 62, sub nom. *C. edmonstonii* var. *caespitosum* (Malmgr.) And. & Hesselm.; Wulff 1902 p. 102, sub nom. *C. Edmondstonii* f. *caespitosa*; Summerhayes and Elton 1928 p. 207.

As regards the systematic value and position of this plant, different views have been advanced. Malmgren (1862 p. 242) regarded it as a variety under *C. alpinum* L.; Andersson and Hesselman (1900 p. 58, 61) considered it to be a variety of *C. Edmondstonii* (Wats.) Murb. et Ostenf. (*C. arcticum* Lge), and corresponding to the smooth form var. *glabrum* Retz. of *C. alpinum*, which is not rare in the mountain tracts of Scandinavia. They regard *C. Regelii* as a vicarious form of *C. Edmondstonii* in the Arctic — an hypothesis which, however, appears difficult to maintain when one has seen both of them thriving side by side in the Arctic, and therefore, in other words, there cannot exist any substitution in that sense. In the same paper the authors point out that no such substitutional form of *C. alpinum* is known from Greenland or Svalbard. Simmons (1906) is sceptical in his remarks respecting Andersson and Hesselman's theory, for he has in his possession material of a smooth pulvinate *Cerastium* which he has not been able to distinguish from

C. Edmondstonii var. *caespitosum* (Malmgr.) And. et Hesselm., but which he cannot, however, refer to a form or variety of *C. Edmondstonii*, as the latter, in accordance with his own and Ostenfeld's opinion, should not belong to the known flora of Greenland (cf. Simm. 1906 p. 121). Simmons further expresses the view that in the Spitsbergen material of *C. Edmondstonii* var. *caespitosum* there are probably concealed forms which are derived from *C. Edmondstonii* as well as from *C. alpinum* (= f. *pulvinatum* Simm.), but which, on account of a convergence, cannot be morphologically separated, at all events not as sterile specimens.

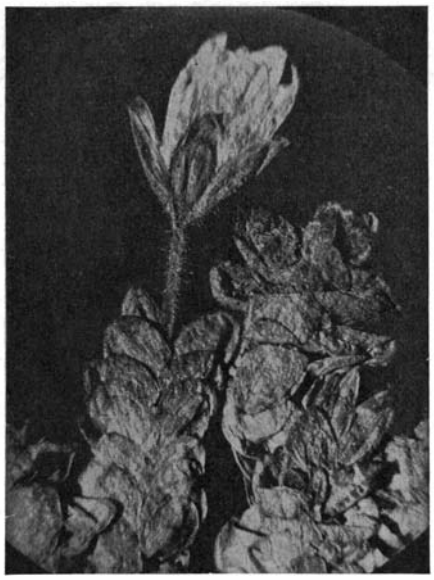


Fig. 14. *Cerastium Regelii* Ostenf. with its typical, very short segments. Spec. from Wargentindalen, 22/7 1931. Magn. 3,8/1.

In 1909 this plant was raised to the status of a species by Ostenfeld under the name of *C. Regelii*, and in so doing he points out its rather distinct characteristics and, further, that he has never seen transitions between it and *C. alpinum* or *C. Edmondstonii* (Ostenfeld 1909 p. 11). Among the synonyms, *C. alpinum* f. *pulvinatum* Simm. is not given. He writes 1920 p. 224 about the synonymy of *C. alpinum* var. *pulvinatum* Simm.: ". . . . . *C. alpinum* var. *caespitosum* auctt., non Malmgren." In dealing with the distribution he points out in his reference to the said paper by Simmons that *C. Regelii* does not exist in Greenland and Ellesmereland — an argument for which there is no explanation unless we assume that Ostenfeld, in common with the other authors, have regarded f. *pulvinatum* Simm. as being derived from *C. alpinum*, and *C. Regelii* as derived from *C. Edmondstonii* (cf. e. g., Ostenfeld and Lundager 1910 p. 20). *C. Regelii* is also not included in "The Flora of Greenland and its Origin" (Ostenfeld 1926).

Simmons is however aware of the fact that his f. *pulvinatum* and var. *caespitosum* (Malmgr.) And. et Hesselm., does not permit of being morphologically separated in a sterile state. On an examination of Simmons' material from Ellesmereland and Vaage's from N. E. Greenland, I have not been able to prove any morphological difference between either sterile or flowering specimens of f. *pulvinatum* and *C. Regelii*. It therefore appears to me to be more natural to throw morphological identities together, whereby *C. Regelii* (including f. *pulvinatum* Simm.) emerges as a well defined extreme arctic and now circumpolar species.

Fig. 15. *Minuartia Rossii* (R. Br.) Graebn. with ripe capsules. Spec. from Sorgfjorden, 15/8 1931. Magn. 9/1.

C. Regelii and *C. alpinum* f. *pulvinatum* presents itself in nature to our eyes as a unit, and therefore we must accept it as such in a morphological system, and desist from keeping it divided merely on so mysterious a basis as philosophizing as to its genetic origin.

Ostenfeld (1909 p. 11) considers that he has not seen any transition forms from *C. Regelii* to the *C. alpinum* complex. Unfortunately, I have not been so successful in my material from northern Svalbard, for I have found a fair number of transition forms which, judged on the basis of the diagnoses now submitted, cannot with certainty be referred to the one or the other. Whether this transition is due to a convergence or to a genetic connection cannot be known; I am inclined to think that the latter is the case. Tolmatchew dismisses these difficulties merely by considering these intermediate forms as hybrids.

C. Regelii is one of the very commonest plants in North-East Land, being widely distributed also within the otherwise so sterile limestone areas. It was almost exclusively found there sterile in the form of the well known, very characteristic, yellowish-green, dense tufts in somewhat wet clayey places. The internodes are extremely short, so that the small and mostly lustrous smooth leaves are arranged like roof-tiles (Fig. 14).

C. Regelii is known farthest north on the north coast of Greenland, Low Point (Wulff) 83° 6′ (Ostenfeld 1923 p. 233, sub nom. *C. alpinum* L. f. *pulvinatum* Simmons).

42. *Melandryum apetalum* (L.) Fenzl. Pl. II.

Hinlopenstr. Gyldénøyane (Elton). *Sorgfj.* Heclahamna (Parry, Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren)).

Hooker 1828 p. 209, sub nom. *Lychnis apetala* L.; Malmgren 1862 p. 241, sub nom. *Wahlbergella apetala* (L.) Fr.; Andersson and Hesselman 1900 p. 55, sub nom. *Wahlbergella apetala* (L.) Fr. f. *arctica* Th. Fr.; Summerhayes and Elton 1928 p. 207.

Not rare in the mentioned places in Lomfjorden and Sorgfjorden. It prefers moist ground, and often grows in fairly big tufts. Not all of the specimens seen correspond to the var. *arcticum* Th. Fries with respect to the petals, as these are not always protruding. But our plants are always strongly pubescent.

Melandryum apetalum has farthest north been collected at Low Point 83° 6′ by Th. Wulff on the north coast of Greenland (Ostenfeld 1923 p. 233).

Fig. 16. *Minuartia biflora* (L.) Schinz. et Thell. Peduncles glandular hairy and leaves 1-veined. Spec. from Lomfjordbotnen, 13/8 1931. Magn. 7,5/1.

43. *Minuartia biflora* (L.) Schinz. et Thell. Fig. 16 and Pl. II.

Sorgfj. Heclahamna (Wulff). *Lomfj.* Dvergbreen (S), Lomfjordbotnen (S).

Wulff 1902 p. 102, sub nom. *Alsine biflora* L.

Was only seen in Lomfjorden where it was fairly common, growing in big flat tufts often up to 2 dm in diameter, and flowering abundantly, Northern limit is Heclahamna.

44. *Minuartia Rossii* (R. Br.) Graebn. Fig. 15 and Pl. II.

Hinlopenstr. Augusti Bay, flowering specimen (Malmgren), Rundhaugen (S). *Sorgfj.* Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet 200 m (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren)).

Malmgren 1862 p. 242, sub nom. *Arenaria Rossii* R. Br.

Not rare on sandy and clayey ground in the localities given above. It grows in the form of flat cakes of a very characteristic dark reddish-green colour and is most often sterile. Fertile specimens with flowers and ripe capsules and seeds were found especially in Sorgfjorden (Fig. 15). Specimens with ripe capsules of this extreme high arctic species have very rarely, if ever before, been brought home. The ripe seeds are dark brown, slightly papillose (0.50—0.52 × 0.61—0.72) mm and most often 3—5 in each capsule.

Minuartia Rossii is recorded from many places on the north coast of Greenland, the northernmost of which is Sommerdalen 82° 29′ (Wulff) (Ostenfeld 1923 p. 234), its northern limit.

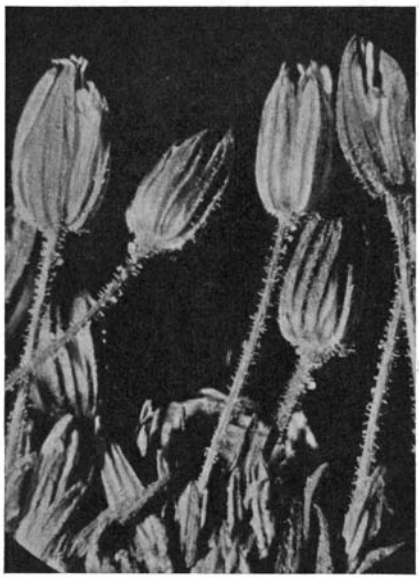


Fig. 17. *Minuartia rubella* (Wahlenb.) Graebn. Peduncles glandular hairy and leaves 3-veined. Spec. from Gerardodden, 13/7 1931. Magn. 7,5/1.

Fig. 18. *Minuartia stricta* (Sw.) Hiern. Peduncles glabrous and leaves without apical tooth. Spec. from Sorgfj., 15/8 1931. Magn. 7,5/1.

45. *Minuartia rubella* (Wahlenb.) Graebn. Fig. 17 and Pl. II.

Northern Ids. Waldenøya (Parry). *Brennevinsfj.* Depotodden (Malmgren). *Lady Franklinfj.* Gerardodden (S), Inner west side (S), Westmanbukta (S), Tombolaøya (S), Basisøya (S). *Murchisonfj.* Raudstupet (S), Floraberget (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Krykjevatnet (S), Sveanor (S), (North-East Land 80° (Malmgren), Murchisonfjorden (Ringertz, Wulff)). *Ids. in Murchisonfj.* Oskarøya (S), S. Russøya (S). *Hinlopenstr.* Augusti Bay (Malmgren), Gyldénøyane (Elton), Rundhaugen (S), (Hinlopenstredet (Malmgren)). *Sorgfj.* Heclahamna (Parry), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet 360 m (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren, Eaton)).

Hooker 1828 p. 210, sub nom. *Arenaria rubella* Sm.; Malmgren 1862 p. 243, sub nom. *Alsine rubella* Wahlenb.; Eaton 1873 p. 42, sub nom. *Alsine rubella* Wahlenb.; Andersson and Hesselman 1900 p. 65, sub nom. *Alsine rubella*; Wulff 1902 p. 102, sub nom. *Alsine hirta* Hartm. *β rubella* (Wahlenb.); Summerhayes and Elton 1928 p. 207, sub nom. *Alsine rubella* Wahlenb.

Common and widely distributed in the area investigated, and also found on dolomite. The peduncles in our material from North-East Land rarely grow out to as much as two cm in length.

Northern Limit is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 234).

46. *Minuartia stricta* (Sw.) Hiern.
Fig. 18 and Pl. II.

Sorgfj. Inner west side (S).

Previously not known with certainty from Svalbard.[1] Our only specimen is quite typical and may be distinguished from *M. biflora* and *M. rubella* by the lack of glands, and from *Sagina intermedia* by its only three valves of the capsule and by the lack of the apical tooth of the leaves so characteristic of *S. intermedia* (cf. Fig. 16, 17, 18 and 19). In looking over the material of *Minuartia* and *Sagina* from Svalbard in the Botanical Museum of Oslo I find that this species has previously been brought home from Spitsbergen by Dr. B. Lynge: Bellsund, Fagerdalen (Recherche Bay) 16/7 1926 (sub nom. *M. rubella*). It seems quite possible that this easily overlooked species will be found on closer examination also in other herbaria, but is nevertheless probably rare in Svalbard. The find might very well be anticipated as it is known from North East Greenland (Scoresby Sound and Eirik Raudes Land), northern Norway and Novaya Zemlya (found by Lynge 1921). Sorgfjorden is by far its northern limit.

Fig. 19. *Sagina intermedia* Fenzl. Glabrous, leaves with apical tooth Spec. from Westmanbukta, 11/7 1931. Magn. 7,5/1.

47. *Sagina intermedia* Fenzl. Fig. 19 and Pl. II.

Northern Ids. Nordkapøya (Elton). *Brennevinsfj.* Zeipelbukta (S), 2.5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Shore plain west of Franklinfjellet (S), Gerardodden (S), Inner west side (S), Westmanbukta (S), *Murchisonfj.* Floraberget (S), Celsiusfjellet (S), Snaddvika, north side (S). Snaddvika, south side (S), Triodalen (S), (NE Land 80° (Malmgren)). *Sorgfj.* Heclahamna (Parry, Malmgren), Inner west side (S). *Lomfj.* Faxedalen (S), Lomfjordbotnen (S).

Hooker 1828 p. 210, sub nom. *Spergula saginoides* Vahl; Malmgren 1862 p. 243, sub nom. *Sagina nivalis* (Lindbl.) Fr.; Summerhayes and Elton 1928 p. 232, sub nom. *Sagina nivalis* (Lindbl.) Fr.

Rather common in clayey and sandy places, especially near the shore, but very rarely seen on the pure dolomite limestone ground.

[1] Sommerfelt (1833 p. 242) gives "Alsinella stricta?, fra Sydcap." As far as I know this specimen has later been lost and it is thus not possible to know whether it was a real *Minuartia stricta* or perhaps rather a *Sagina intermedia*, which latter common species is not mentioned in that paper.

It seems almost to be the rule that the dry capsules from the previous year stand erect on their peduncles just as in a *S. caespitosa* (Vahl) Lge, whereas only the young plants show the characteristic decumbent peduncles and capsules.

The nothernmost locality known for this plant is Sommerdalen 82°29′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 235).

48. *Silene acaulis* L. Pl. III.

Sorgfj. Heclahamna (Parry, Malmgren, Andersson and Hesselman), Inner west side (S). *Lomfj.* Lomfjordbotnen (S).

Hooker 1828 p. 209; Malmgren 1862 p. 240; Andersson and Hesselman 1900 p. 54.

Fairly common in the localities mentioned in these two fjords, but not yet found in North-East Land.[1]

Northern limit is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 235). It was recently found new to Frans Josef Land by Mrs. Boyd's expedition 1928.

49. *Stellaria humifusa* Rottb. Pl. III.

Murchisonfj. Floraberget (S). *Hinlopenstr.* Gyldénøyane (Elton). *Sorgfj.* Heclahamna (Parry).

Hooker 1828 p. 209; Summerhayes and Elton 1928 p. 207.

Previously not found in North-East Land. Some sterile tufts of the characteristic brownish colour were found on the beach in front of Floraberget. Here it was growing in company with *Sagina intermedia*, *Luzula nivalis*, sterile leaves of *Cardamine pratensis* and the rare lichens *Lobaria linita* and *Nephroma expallidum*.

Northern limit is Floraberget.

50. *Stellaria longipes* Goldie.

Northern Ids. Nordkapøya (Elton). *Brennevinsfj.* Depotodden (Malmgren, Torell 1500 f), Zeipelbukta (S), Kontaktberget (S), 2.5 km SE of Cape Hansteen (S), Cape Hansteen (S). *Lady Franklinfj.* Franklindalen, west end (S), Franklinfjellet, west side (S), Hansøya (S), Gerardodden (S), Westmanbukta (S), Lågøya (Parry, Malmgren). *Murchisonfj.* Raudstupet (S), Floraberget (S), Norvika, north side (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, south side (S), Triodalen (S), Krykjevatnet (S), Sveanor (S), (Murchisonfjorden (Wulff)). *Ids. in Murchisonfj.* Ringertzøya (S), Oskarøya (S), S. Russøya (S). *Hinlopenstr.* Cape Sparre (S), Kalkstranda at Forsiusfjellet (S), Rijpdalen (Ahlmann), Gyldénøyane (Elton), Rundhaugen (S), Torellneset (S), Ulvebukta (Elton), Perthesøya (Malmberg), Von Otterøya

[1] The records of Nathorst (1883 p. 46) of *S. acaulis* from Brennevinsfjorden and Lomfjorden are most probably erroneous as it is not mentioned from these fjords anywhere else in literature. According to kindly information by Mr. Johannes Lid no specimens are either present in Scandinavian or foreign collections.

(Elton). *Sorgfj.* Heclahamna (Parry, Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet (S), Dvergbreen (S), Lomfjordbotnen (S).

Hooker 1828 p. 209, sub nom. *S. laeta* Richards; Malmgren 1862 p. 241, sub nom. *S. Edwardsii* R. Br.; Chydenius 1865 p. 231, sub nom. *S. Edwardsii* R. Br.; Andersson and Hesselman 1900 p. 56; Wulff 1902 p. 102, sub nom. *S. Edwardsii* R. Br.; Summerhayes and Elton 1928 p. 207, 232.

One of the most common plants which is frequent also in the limestone areas. Flowering specimens, which were very rarely seen in North-East Land, were fairly common in Sorgfjorden and Lomfjorden.

Most of our specimens are decumbent and especially on the very barren limestone may have acquired a habit quite like that of *Cerastium Regelii*, with very short internodes, short and broad leaves covering each other like roofing-tiles and growing in decumbent and rather compact tufts, var. *humilis* Fenzl. A tendency in the direction of var. *peduncularis* (Bunge) Ledeb. with the long and pubescent internodes and erect stem (cf. Lynge 1923 p. 32) was in North-East Land only seen in Floraberget. Also with respect to pruinosity, *S. longipes* varies a great deal. Thus stands of quite epruinose, shining olive-green specimens are sometimes seen. The habitat seems to be largely responsible for most of these variations.

Stellaria longipes is one of the plants recorded from the northernmost locality on earth viz. Frederic E. Hyde Fjord 83° 15′ (I. P. Koch) in Peary Land on the north coast of Greenland (Ostenfeld and Lundager 1910 p. 19).

Polygonaceae.

51. *Koenigia islandica* L. Pl. III.

Not seen by us, previously found (Wulff 1902 p. 102): *Sorgfj.* Heclahamna (Wulff).

Th. Wulff writes (1902 p. 102) the following about his interesting find: "Besonders bemerkenswert ist das Auftreten von *Koenigia* an der Küste auf beinahe 80° n. lat., da die Pflanze bisjetzt nur im Eisfjorde beobachtet wurde. Dies ist wahrscheinlich die nördlichste Lokalität der Erde, wo eine annuelle Pflanze noch gedeiht." If *Cochlearia* is not to be reckoned a facultative annual plant, this holds good. Since the time of Wulff in 1899 *Koenigia* has been found in many other places in Spitsbergen but no further north than Heclahamna, which is its present northern limit.

52. *Oxyria digyna* (L.) Hill. Pl. III.

(*Northern Ids.* Sjuøyane (Nordenskiöld)). *Brennevinsfj.* Kontaktberget (S), 5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Franklinfjellet, west side (S), Gerardodden (S), Inner west side (S), Westmanbukta (S). *Murchisonfj.* Raudstupet (S), Floraberget (S), Wargentindalen (S), Celsiusfjellet (S),

Snaddvika, north side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Sveanor (S), (Murchisonfjorden (Wulff), NE Land 80° (Malmgren)). *Hinlopenstr.* Augusti Bay (Malmgren), Ismåsefjellet (S). *Sorgfj.* Heclahamna (Parry, Malmgren, Eaton), Inner west side (S). *Lomfj.* Dvergbreen (S), Lomfjordbotnen (S).

Hooker 1828 p. 212, sub nom. *O. reniformis* Hook.; Malmgren 1862 p. 249, 267; Eaton 1876 p. 43, sub nom. *O. reniformis* Hook.; Wulff 1902 p. 102.

Occurs rather sparingly on North-East Land, where it shuns the dolomite ground and is preferably found in the interior parts of the fjords. Most of our specimens from North-East Land, except some few specimens collected in the bird-cliffs, are very dwarfed, often not exceeding 5 cm, and with a miserable little rosette of strongly red-coloured leaves. It was often found in company with *Dryas*, *Potentilla emarginata*, *Polygonum* and *Salix polaris*.

Northern limit is I. P. Koch Fjord 82° 48′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 238).

53. *Polygonum viviparum.* L. Pl. III.

Brennevinsfj. Depotodden (Malmgren, S), 5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Gerardodden (S). *Murchisonfj.* Floraberget (Kulling, S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Triodalen (S), (Murchisonfjorden (Wulff), North-East Land 80° 600 f. (Malmgren)). *Hinlopenstr.* Augusti Bay (Malmgren), Ismåsefjellet (S). *Sorgfj.* Heclahamna (Parry, Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (cf. Nathorst 1883 p. 46)).

Hooker 1828 p. 212; Malmgren 1862 p. 248; Nathorst 1883 p. 46; Andersson and Hesselman 1900 p. 65; Wulff 1902 p. 102.

Occurs sparsely in North-East Land, and most often in company with *Oxyria* and *Salix polaris*, like these usually indicating a "good" botanical locality in this desolate tract. Here it is as a rule only some few centimetres high, except in the bird-cliffs where some specimens attained 15 cm. Some of these from Floraberget had their spikes quite destroyed by smut.

Northern limit is Sommerdalen 82° 29′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 238).

Salicaceae.

54. *Salix polaris* Wahlenb. Fig. 20, 21 and Pl. III.

Northern Ids. Nordkapøya (Eaton, Elton), Castrénøyane (Fries) (cf. Summerhayes and Elton p. 232). *North Coast.* Ekstremhuken (Montague). *Brennevinsfj.* Depotodden, (Chydenius, S), Zeipelbukta (S), Kontaktberget (S). 5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Franklinfjellet, west side (S), Shore plain west of Franklinfjellet (S), Gerardodden (S), Inner west side (S), Persberget (S), Westmanbukta (S), Lågøya (Parry). *Murchisonfj.* Raudstupet (S), Floraberget (S), Wargentindalen (S), Celsiusfjellet (S)

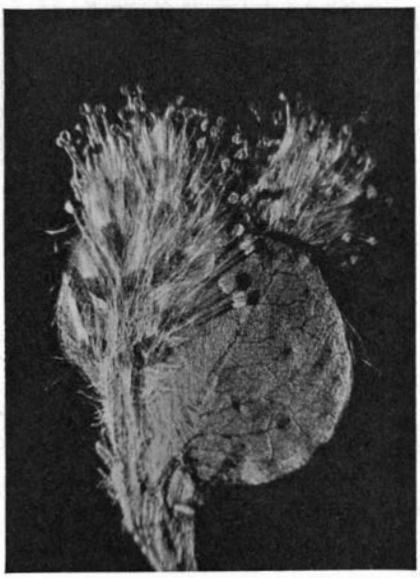


Fig. 20. *Salix polaris* Wahlenb. ♂
Spec. from Sorgfjorden, 16/8 1931.
Magn. 3,8/1.

Fig. 21. *Salix polaris* Wahlenb. ♀
Spec. from Kvalrossodden, 22/7 1931.
Magn. 3,8/1.

Snaddvika, north side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Sveanor (S), (Murchisonfjorden (Wulff)). *Ids. in Murchisonfj.* Oskarøya (S), Teltøya (S), S. Russøya (S). *Hinlopenstr.* Augusti Bay (Malmgren), Gyldénøyane (Elton), Rundhaugen (S), Ismåsefjellet (S), Torellneset (S) *Moffen* (Ringertz). *Sorgfj.* Heclahamna (Parry, Malmgren, Eaton), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet 360 m (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Eaton)).

Hooker 1828 p. 212, sub nom. *S. herbacea* L.; Malmgren 1862 p. 249, 267; Chydenius 1865 p. 231; Eaton 1876 p. 43; Andersson and Hesselman 1900 p. 67; Wulff 1902 p. 102; Summerhayes and Elton 1928 p. 232 and Pl. XXVIII.

Fairly common and in similar places as the foregoing species. In North-East Land it was rarely found to grow in such large tufts as were commonly seen in Lomfjorden and Sorgfjorden.

It has been collected farthest north at Cape Nansen 80° 32′ (Olaf Hanssen) in Frans Josef Land, which locality is only a trifle more northerly than the previous northern limit on Nordkapøya mentioned above.

Ericaceae.

55. *Cassiope tetragona* (L.) Don. Pl. III.

Sorgfj. Heclahamna (Parry, Malmgren), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet 340 m (S). Lomfjordbotnen (S), (Lomfjorden (Malmgren, Eaton, Elton)).

Hooker 1828 p. 211, sub nom. *Andromeda tetragona* L.; Malmgren 1862 p. 248, sub nom. *Andromeda tetragona* L.; Eaton 1876 p. 43, sub nom. *Andromeda tetragona* L., Summerhayes and Elton 1928 p. 211.

Not yet found on North-East Land. Its ± dense stands are rather common in the localities visited in Lomfjorden and Sorgfjorden. At the head of Lomfjorden some specimens were found with yellowish and somewhat deformed tips, caused by a parasitical fungus.

Northern limit is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 234).

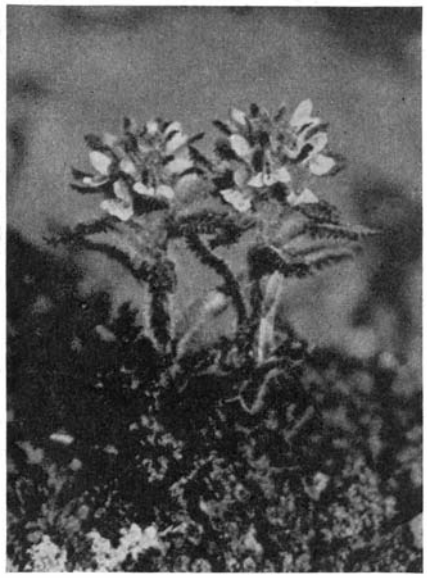


Fig. 22. *Pedicularis hirsuta* L. Snaddvika 27/7 1931.

Scrophulariaceae.

56. *Pedicularis hirsuta* L.

Fig. 22, 53 and Pl. III.

Brennevinsfj. Depotodden (S). *Murchisonfj.* Floraberget (S), Snaddvika, north side (S). *Hinlopenstr.* Augusti Bay (Malmgren). *Sorgfj.* Heclahamna (Parry, Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Lomfjordbotnen (S).

Hooker 1828 p. 211; Malmgren 1862 p. 248; Andersson and Hesselman 1900 p. 17.

Rare in North-East Land, where it was found only in the most favourable localities. In Sorgfjorden it seems to be rather rare but was found in great quantities, especially innermost in Lomfjorden. The first flowering specimen in North-East Land was seen on July 27 in Snaddvika, i. e., three weeks later than in Adventfjorden when it was flowering already on our arrival on June 21.

The northernmost locality known for this species is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 244).

57. *Pedicularis lanata* (Willd.) Cham. et Schlecht. var. *dasyantha* Trautv. Pl. III.

Lomfj. Lomfjordbotnen (S).

Grows in abundance on the west shore innermost in Lomfjorden, in which fjord it seems, however, not to have previously been observed. It seems to prefer somewhat drier places than *P. hirsuta.* The galea in our specimens is rather strongly pubescent and not rarely with ± distinct teeth. It is quite striking how much better the Ellesmere Land and West-Greenland plants retain their pink colour compared with the eastern var. *dasyantha* Trautv., seen from Spitsbergen and Novaya Zemlya.

Northern limit for the species is Discovery Harbour 81° 43′ (Hart) in Grinnell Land, Arctic America (Simmons 1906 p. 31).

Compositae.

58. *Arnica alpina* (L.) Olin. Pl. III.

Lomfj. Lomfjordbotnen (S).

New for the area investigated. Seven specimens were found on a little ice-scoured crag innermost in Lomfjorden on the east side facing the Veteran Glacier, all of them with the heads quite recently torn off probably by ptarmigan or reindeer. This place was also the only one where *Trisetum spicatum* was found; these two plants seem to me often to grow together in the Arctic.

Arnica alpina has been found farthest north in Bellot Island 81° 40′ (Feilden) in Grinnell Land, Arctic America (Simmons 1906 p. 23).

59. *Erigeron uniflorus* L. sens. lat.

Not seen by us, previously found (Eaton 1876 p. 43): *Sorgfj.* Heclahamna (Eaton).

It appears most probable that this record has been founded on *E. unalaschkensis* (DC.) Vierh. as according to information kindly furnished by Johannes Lid, the other *Erigeron* in Spitsbergen viz. *E. eriocephalus* J. Vahl is extremely rare, only known from Wijdefjorden.

Erigeron uniflorus sens. lat. is known farthest north from I. P. Koch Fjord 82° 48′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 242).

60. *Taraxacum arcticum* (Trautv.) Dahlst. Pl. III.

Murchisonfj. Floraberget (Kulling, S), Triodalen (S). *Sorgfj.* Heclahamna (Parry), Inner west side (S). *Lomfj.* Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren)).

Hooker 1828 p. 211, sub nom. *Leontodon palustre* Sm.; Malmgren 1862 p. 247, sub nom. *T. phymatocarpum* Vahl; Eaton 1876 p. 43, sub nom. *T. phymatocarpum* Vahl.

New to North-East Land, where it seems very rare. In Floraberget it was common and abundantly flowering on July 23, attaining here a height of 15 cm. In Triodalen only some few small specimens in bud were found on July 20. When I visited Floraberget for the last time on Aug. 4 the seeds were not yet ripe. About a week later fruiting specimens were commonly seen in Lomfjorden and Sorgfjorden.

Northern limit is Sommerdalen 82° 29′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 242).

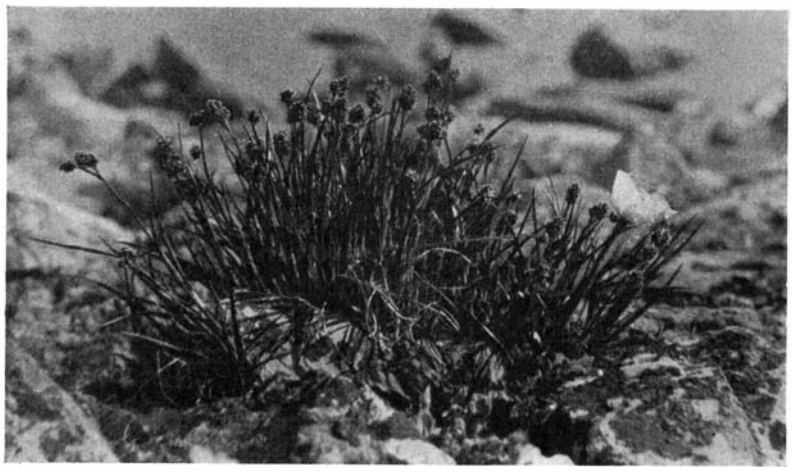


Fig. 23. *Luzula confusa* Lindeb. Celsiusfjellet, 27/7 1931.

Monocotyledones.

Juncaceae.

61. *Juncus biglumis* L. Pl. III.

Brennevinsfj. Depotodden (Malmgren). *Lady Franklinfj.* Inner west side (S), Westmanbukta (S). *Murchisonfj.* Raudstupet (S), Floraberget (S), Snaddvika, north side (S), Snaddvika, south side (S), Triodalen (S), Krykjevatnet (S), Sveanor (S), (Murchisonfjorden (Wulff)). *Ids. in Murchisonfj.* Teltøya (S). *Hinlopenstr.* Augusti Bay (Malmgren), Rundhaugen (S). *Sorgfj.* Heclahamna (Malmgren), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet 340 m (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren. Fries)).

Malmgren 1862 p. 249; Andersson and Hesselman 1900 p. 83; Wulff 1902 p. 102.

Seems on the whole to be rare in North-East Land, where it is usually only some few (2—3) cm high. It grows in wet and clayey localities and is often first detected by the more conspicuous, withered straws from the previous year, as the plants do not seem to attain their full height until late in the summer or autumn. In the *Eriophorum Scheuchzeri* swamps on the west side of Sorgfjorden specimens up to 15 cm in height were found.

The northern limit is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 232).

62. *Luzula confusa* Lindeb. Fig. 23.

Northern Ids. Nordkapøya (Elton), Castrénøyane (Fries) (cf. Summerhayes and Elton 1928 p. 233), (Sjuøyane (Nordenskiöld)). *Brennevinsfj.* Depotodden (1500 f. Torell, S), Zeipelbukta (S), Kontaktberget (S), 5 km SE of Cape Hansteen (S), 2.5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Franklindalen, west end (S), Franklinfjellet, west side (S), Shore plain west of Franklinfjellet (S), Gerardodden (S), Inner west side (S), Persberget (S),

Fig. 24. *Luzula nivalis* (Laest.) Beurl. Floraberget, 24/7 1931.

Westmanbukta (S), Lågøya (Parry). *Murchisonfj.* Raudstupet (S), Floraberget (S), Norvika, north side (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), (Murchisonfjorden (Wulff)). *Hinlopenstr.* Cape Sparre (S), Rundhaugen (S), Ismåsefjellet (S), Torellneset (S), Perthesøya (Malmberg), Von Otterøya (Elton). *Sorgfj.* Heclahamna (Parry, Malmgren, Eaton), Inner west side (S). *Lomfj.* Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (see Nathorst 1883 p. 47)).[1]

Hooker 1828 p. 212, sub nom. *L. hyperborea* R. Br.; Malmgren 1862 p. 250, sub nom. *L. hyperborea* R. Br.; Chydenius 1865 p. 131, sub nom. *L. hyperborea* R. Br.; Eaton 1876 p. 43, sub nom. *L. arcuata* Wahlenb.; Nathorst 1883 p. 47, sub nom. *L. arcuata* (Wg) Sm. var.* *confusa* Lindeb; Wulff 1902 p. 102; Summerhayes and Elton 1928 p. 207, 232, 233.

Common everywhere on granite, gneiss, and slate in North-East Land, but very rare or lacking on the pure dolomite limestone. Like the foregoing species and also *Luzula nivalis*, the straws found from the previous year are generally considerably longer than the living culms, which indicates that their period of growth is not finished until late in the season. The largest specimen in our collection from North-East Land attains 23 cm in height.

Luzula confusa is known farthest north from Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 232).

63. *Luzula nivalis* (Laest.) Beurl. Fig. 24.

Northern Ids. Nordkapøya (Fries), Castrénøyane (Fries). *Brennevinsfj.* Depotodden (Fries), 5 km SE of Cape Hansteen (S), Cape Hansteen (S). *Lady Franklinfj.* Franklindalen, west end (S), Franklinfjellet, west side (S), Shore plain west of Franklinfjellet (S), Gerardodden (S), Inner west side (S),

[1] Summerhayes and Elton (1928 p. 233) give "*Luzula*" from Ekstremhuken (leg. Montague).

Westmanbukta (S). *Murchisonfj.* Raudstupet (S), Floraberget (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, south side (S), Triodalen (S), Sveanor (S). *Hinlopenstr.* Rundhaugen (S), Ismåsefjellet (S), Torellneset (S), *Sorgfj.* Heclahamna (Malmgren), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet, 340 m (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren)).

Malmgren 1862 p. 250, sub nom. *L. arctica* Blytt; Fries 1869 p. 135, sub nom. *L. hyperborea* Br.

About just as common as is *L. confusa* in North-East Land, but prefers wetter localities than the latter, moving soil, moss carpets and the like. It is much more densely tufted than *L. confusa*, this being especially distinct in the small, only some few cm high and often laxiflorous, nana-form, forming compact little mats of dense and confluent tufts (cf. Fries 1869 p. 135), especially to be seen at Torellneset, Rundhaugen, and Westmanbukta. The inflorescence of this little form may sometimes be almost as laxiflorous as in a *L. Wahlenbergii* Rupr.; however, every transition to the main form is seen, but it is so characteristic that it may well deserve a form-name:

L. nivalis (Laest.) Beurl. f. *nana*, nov. forma:

Caespitibus humilioribus pulviniformibusque, $1-2^1/_2$ cm altis, caulibus folia aequalibus vel paullo superantibus et inflorescentia ± dissoluta et laxiflora a typo recedit.

In addition to its dense tuft formation and some other characters, *L. nivalis* is easy to distinguish from *L. confusa* on account of its dull, violet-coloured base, which is shining, reddish-brown in *L. confusa.*

Considerable areas of the shore plain west of Franklinfjellet in Lady Franklinfjorden are covered by a vegetation consisting mainly of tufts of *L. nivalis* and *L. confusa* (Fig. 51 p. 113). Our largest specimens from North-East Land (Floraberget) attain a height of 14 cm.

Northern limit is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 233).

Cyperaceae.

64. *Carex maritima* Gunn. Fig. 25 and Pl. III.

C. maritima Gunn. 1772 in Fl. Norv. II p. 131; (non *C. maritima* O. F. Müll. 1777 in Fl. Dan. IV, Fasc. XII, t. DCCIII); *C. incurva* Lightfoot 1777 in Fl. Scot. II p. 544.

Murchisonfj. Floraberget (S).

New to North-East Land. It seems to be very rare all through the investigated area, where it was only found on the fertile slope under the steep bird-cliff of Floraberget. Here it grows in abundance, forming a dense carpet, with some *Cerastium alpinum*, *Festuca rubra*

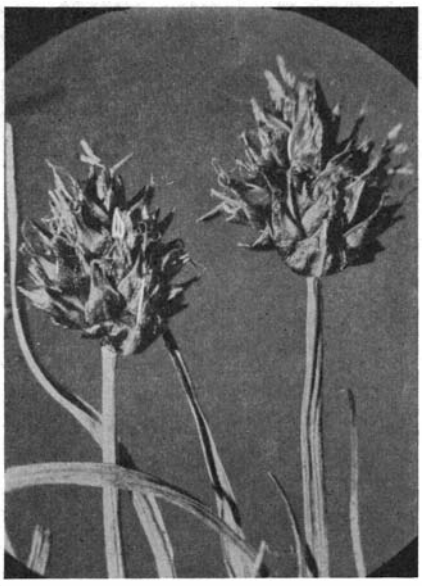


Fig. 25. *Carex maritima* Gunn.
Spec. from Floraberget, 3/8 1931.
Magn. 3,8/1.

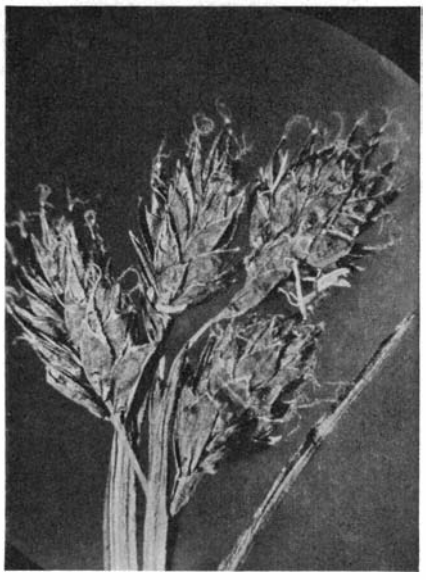


Fig. 26. *Carex misandra* R. Br.
Spec. from Snaddvika, 27/7 1931.
Magn. 3,8/1.

var. *arenaria*, *Luzula confusa*, *Polygonum viviparum* and *Chrysosplenium tetrandrum* intermingled (Fig. 57 p. 126). Our specimens, which were all in flower when the locality was visited for the first time on July 23, attain a maximum height of 7 cm and all belong to the common, low, ascending var. *setina* (Christ.) Fern., preferably growing in dry and sandy places. This is so far the only form of *C. maritima* Gunn. which I have seen from Svalbard.

A detailed account of the synonymy of the two species *C. maritima* Gunn. (syn. *C. incurva* Lightf.) and *C. paleacea* Wahlenb. (syn. *C. maritima* O. F. Müll.) is given by Fernald (Rhodora 1933 p. 395—398)[1].

Northern limit is Discovery Harbour 81° 43′ (Hart) in Grinnell Land, Arctic America (Simmons 1906 p. 146).

65. *Carex misandra* R. Br. Fig. 26 and Pl. III.

Lady Franklinfj. Hansøya (S), Gerardodden (S), Westmanbukta (S). *Murchisonfj.* Raudstupet (S), Snaddvika, north side (S), (Murchisonfjorden (Wulff)). *Hinlopenstr.* Augusti Bay (Malmgren), Ismåsefjellet (S). *Sorgfj.* Heclahamna (Parry, Malmgren, Eaton, Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren)).

Hooker 1828 p. 212, sub nom. *C. fuliginosa* Sternb. et Hoppe; Malmgren 1862 p. 251; Eaton 1876 p. 43; Andersson and Hesselman 1900 p. 79; Wulff 1902 p. 102.

[1] The name of the author of the present species, a Norwegian bishop and botanist, is Gunnerus and not "Gunner" as it is consistently written in the cited paper.

The most common *Carex* in North-East Land, where, however, it appears to be rare in the investigated area. It was, as a rule, found only in the interior parts of the fjords, on dry, sunny slopes in company with *Dryas*, *Potentilla emarginata*, *Salix*, *Oxyria*, *Polygonum*, *Pedicularis hirsuta*, *Carex nardina* and similar relatively xerophilous and rare species in North-East Land. Flowering specimens with the culm and spikelets projecting from the leaf rosette were noted for the first time on July 27 in Snaddvika, where, however, the highest specimen did not measure more than 10 cm. In Sorgfjorden and Lomfjorden *C. misandra* is fairly common. In the latter fjord smut had not uncommonly destroyed the achenes.

Carex misandra has been found farthest north at Cape Benet 83° 1′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 228).

66. *Carex nardina* E. Fries. Fig. 27, 28, 29 and Pl. IV.

Lady Franklinfj. Hansøya (S), Gerardodden (S). *Murchisonfj.* Wargentindalen (S), Snaddvika, north side (S). *Sorgfj.* Heclahamna (Malmgren, Wulff, Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet 360 m (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Fries, Eaton)).

Malmgren 1862 p. 251; Fries 1869 p. 137; Eaton 1876 p. 43; Andersson and Hesselman 1900 p. 81; Tengwall 1916 p. 549.

The typically developed, large straight *C. nardina* ("*C. Hepburnii* Boott"), like the occasionally occurring ± small and curvate forms and all transitions thereto, are rare in the investigated area of North-East Land, from where it has not previously been reported. It was found in sparse quantities in the inner parts of the fjords in company with other more "exacting" plants such as *Dryas*, *Carex misandra*, and others.

In a previous paper (Devold and Scholander 1933 p. 121) I have expressed my view on the relation between *C. nardina* E. Fries and the so-called *C. Hepburnii* Boott, in which I concluded that *C. Hepburnii* is nothing but the optimally developed form of our own little *C. nardina*, and I shall endeavour to elucidate this view at greather length.

C. Hepburnii was introduced into Scandinavian literature in Svensk Botanisk Tidskrift 1916 by T. Å. Tengwall (1916 p. 543). Here he maintains it as a distinct species, contrary to authorities like e. g. Kükenthal who had reduced it to a variety. *Carex Hepburnii* as a separate species has subsequently again been effectually disposed of by Ostenfeld (1923 p. 161).

It is of interest to note that Boott, in his description of *C. Hepburnii* (Hooker 1840 II, p. 209), does not give any differential diagnosis in respect of *C. nardina*, which he probably did not know, for it was not described by E. Fries until the year before (E. Fries 1839 II, p. 55).

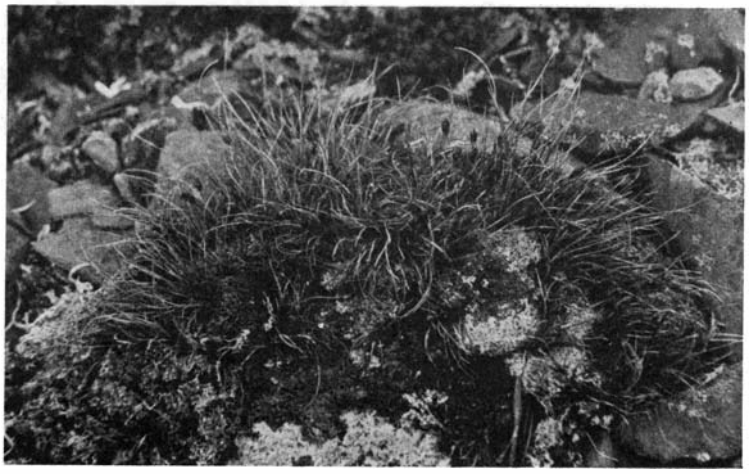
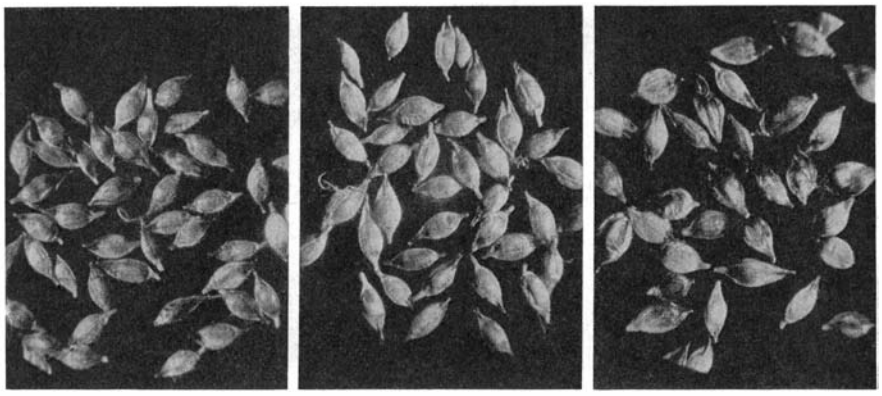


Fig. 27. *Carex nardina* E. Fries. Partially dead tuft with dwarfed and curvated straws and leaves only at the edge. Wargentindalen 22/7 1931.

In the said paper Tengwall founds his conception of *C. Hepburnii* as a separate species on its characteristic habit, and the somewhat larger utricles, which are said to be (3.4—4) × (1.45—1.65) mm, as against *C. nardina* with (3—3.5) × (1.25—1.45) mm; further, the achenes of *C. Hepburnii* are more obovate, broadest above the middle. In *C. nardina* they are more oval and narrower.

In the first place, as regards habit, the small incurvate *C. nardina* is found throughout the whole area of distribution of *C. Hepburnii* — as far as I can see from my own observations in the field and on the basis of herbarium material and literature. Particularly in exposed places such as mountain tops, the large, flat, and wind-worn tufts may be seen, with their centres quite dead and frequently cowered with crustaceous lichens (cf. Fig. 27). Where the edges of these tufts are still alive, these short and crooked *C. nardina* straws are as a rule developed. This is a very common phenomenon I have seen everywhere in those parts of the Arctic I have worked, and it is obvious that every transition is met with, up to the large luxuriantly developed plants (cf. Devold and Scholander 1933 Fig. 31 p. 122). The connection existing between these old, partly dead tufts, and the *nardina* habit of the straws, seen whereever the *C. Hepburnii* type is found, demonstrates that this habit has no taxonomical significance.

The great excess of the *nardina* type occurring in Scandinavia may find its explanation by taking into account the fact that we find ourselves here at the extreme limit of its area of distribution, where we may imagine that it can rarely attain an optimal development, owing, for instance, to conditions of climate or competition.



a *b* *c*

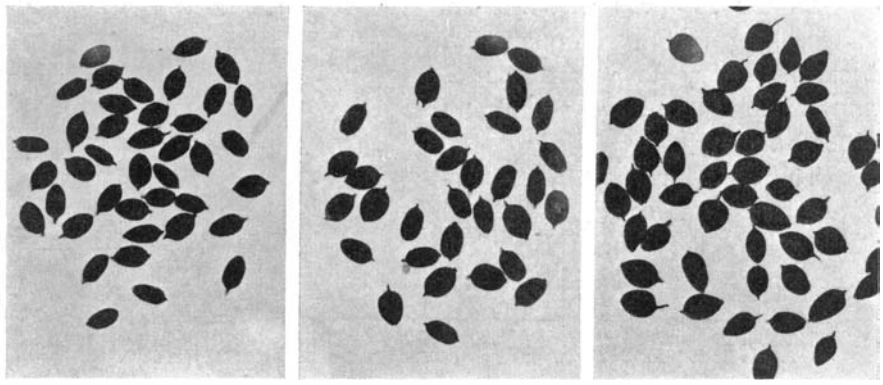
Fig. 28. Ripe utricles in *Carex nardina* E. Fries.

a in *C. nardina* from Scandinavia. *b* in "*C. Hepburnii*" from Scandinavia. *c* in "*C. Hepburnii*" from the Arctic.

Each utricle originates from different specimens, and from different localities, (except in *b*, cf. text). Note the very slight average difference in size between *a*, *b* and *c*, which obviously cannot in single cases serve as distinguishing character between species. Magn. $^{4,45}/_{1}$.

There then remains the biometric difference in the utricles and the slight difference in form of the achenes. The shades of difference in question will be best seen from a few photographs (Fig. 28 and 29). The utricles and seeds reproduced here are in the ripest possible state and are taken from the centre of the spike; they are all from different plants and all the plants are from as widely different places as possible. *C. nardina* (Fig. 28 *a* and 29 *a*) is from Scandinavia and taken from Tengwall's revised specimens. The Scandinavian "*C. Hepburnii*" (Fig. 28 *b* and 29 *b*), in contrast to the others, are all from one place and probably not from so many different tufts; they are also determined and collected by Tengwall. The other "*Hepburnii*" material (Fig. 28 *c* and 29 *c*) originates from typical specimens taken at random here and there within practically the whole of the area of geographical distribution.

It will be seen that there actually seems to exist here a slight difference of a statistical nature, particularly between arctic and Scandinavian material (both forms included), whilst the difference between Tengwall's Scandinavian *nardina* and *Hepburnii* appears to be indistinct, to say the least of it, and it is still more indistinct in arctic material. It seems to me evident that this cannot in itself serve as the basis of a species distinction for individual plants. I shall not deny that there may statistically possibly exist a difference in the form of the achenes which may be found through diligent investigation; but I consider it perfectly evident from Fig. 28 and 29 that this is not applicable in individual cases.



a *b* *c*

Fig. 29. Silhouettes of ripe achenes in *Carex nardina* E. Fries.
a in *C. nardina* from Scandinavia. *b* in "*C. Hepburnii*" from Scandinavia.
c in "*C. Hepburnii*" from the Arctic.

Each achene originates from different specimens, and from different localities (except in *b*, cf. text). No difference can here be traced in form and size between *a* and *b*, whereas statistically those in *c* are somewhat larger but at the same time, unfortunately independent of the habit, very varying from one specimen to the other. Magn. $^{5,3}/_{1}$.

Obviously, there may be concealed biological biometrical breeds under the slight difference that has been proved in the size of the utricles between arctic and Scandinavian, and possibly also between Scandinavian (not arctic) *nardina* and *Hepburnii*. It is however also possible that an explanation may be found in the circumstance already mentioned, namely, that Scandinavia is at the extreme limit of the area of distribution and also that the small half-dead *nardina* tufts may produce somewhat smaller fruits. Whatever explanation may be the right one, the fact cannot have any influence on the taxonomy.

Similar and far wider variations in size will of a certainty be demonstrable through diligent statistical investigations in the case of most plants in the Arctic.

Kenneth Kent Mackenzie (North American Flora, Volume 18, Part 1, p. 21) gives the following differential diagnosis in the key:

"Sheaths tapering into the blades; spikes ovoid-orbicular; scales ovate-orbicular, obtuse, with lighter-coloured midvein; achenes lenticular. 1. *C. nardina.*

Sheaths abruptly contracted into the blades; spikes oblong; scales ovate or obovate, obtusish or acutish, the center lighter-colored, conspicuous; achenes usually triangular. 2. *C. Hepburnii.*"

I cannot but consider also the characteristics here enumerated to be extremely vague and in both instances very variably tendencies which are without any firm inter-coupling.

So far as I can see, there is still lacking that exact qualitative basis necessary to regard the *C. nardina* forms as being specifically different.

The northern limit for *C. nardina* s. lat. is I. P. Koch Fjord (82° 48′) (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 229).

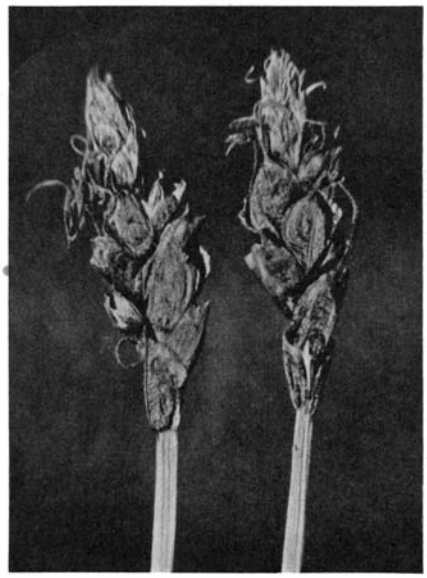


Fig. 30. *Carex rupestris* All. Big specimens from a bird restingplace in Lomfjordbotnen, 13/8 1931. Magn. 3,8/1.

67. *Carex rupestris* All.

Fig. 30 and Pl. IV.

Murchisonfj. Snaddvika, north side (S). *Sorgfj.* Heclahamna (Malmgren). Inner west side (S). *Lomfj.* Lomfjordbotnen (S), (Lomfjorden (Malmgren)).

Malmgren 1862 p. 251.

New to North-East Land, where it seems to be very rare. A small stand of this sedge, covering an area of about 7—8 m² was found on a sunny slope on the north side of Snaddvika, growing here in company with *Carex nardina*, *Lycopodium Selago*, *Pedicularis hirsuta* and some other rare species in North-East Land. Our specimens from this place are flowering, small 6 (—10) cm high. On the manured ground on a *Stercorarius* resting place in Lomfjorden some luxuriant specimens were found (Fig. 30), reaching a height of between 14 and 15 cm.

Northern limit is Discovery Harbour 81° 43′ (? Greely) in Grinnell Land, Arctic America (Simmons 1906 p. 144).

68. *Carex saxatilis* L. Pl. IV.

Sorgfj. Inner west side (S).

New to the investigated area. Some flowering specimens were found in the *Eriophorum Scheuchzeri* swamps on the west side of Sorgfjorden, growing along the border of small ponds and in company with *Dupontia*, *Juncus biglumis*, *Carex subspathacea* and flowering *Cardamine pratensis*. The biggest specimen is not more than 12 cm high.

The locality in Sorgfjorden is the northernmost one known for *Carex saxatilis*.

69. *Carex subspathacea* Wormskj. Pl. IV.

Sorgfj. Inner west side (S).

New to the investigated area. It was found in the locality mentioned under *C. saxatilis* in quite a number in the stands of *Eriophorum*

Fig. 31. *Carex ursina* Dew. Spec. from Myggbukta in N. E. Greenland, leg. S. Aandstad 26/7 1932. Magn. 3,8/1.

Scheuchzeri, and nearly one kilometre away from the shore line. Our specimens are flowering and of the brownish colour so characteristic of this species.

Northern limit is Sorgfjorden.

70. *Carex ursina* Dew. Fig. 31 and Pl. IV.

Sorgfj. Inner west side (S).

New to the investigated area. Some few and rather small tufts with almost ripe seeds were found on the shore plain about 200 m from the beach.

It finds here its most northerly known limit.

71. *Eriophorum Scheuchzeri* Hoppe. Fig. 32 and Pl. IV.

Hinlopenstr. Rundhaugen (S). *Sorgfj.* Heclahamna (Parry), Inner west side (S). *Lomfj.* Lomfjordbotnen (S), (Lomfjorden (Malmgren)).

Hooker 1828 p. 212, sub nom. *E. capitatum* Host; Malmgren 1862 p. 250, sub nom. *E. capitatum* Host.

New to North-East Land, where only two small specimens in bud were found in a small pond on the east side of Rundhaugen. On the west side of Sorgfjorden some large swamps were quite overgrown with its beautifull stands (Fig. 32). These bogs are situated about 1 1/2 km westwards from the lagoon and were detected on account of the *Eriophorum Scheuchzeri* stands, being just visible in the fieldglass from the beach as a fine white line.

Northern limit is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 230).

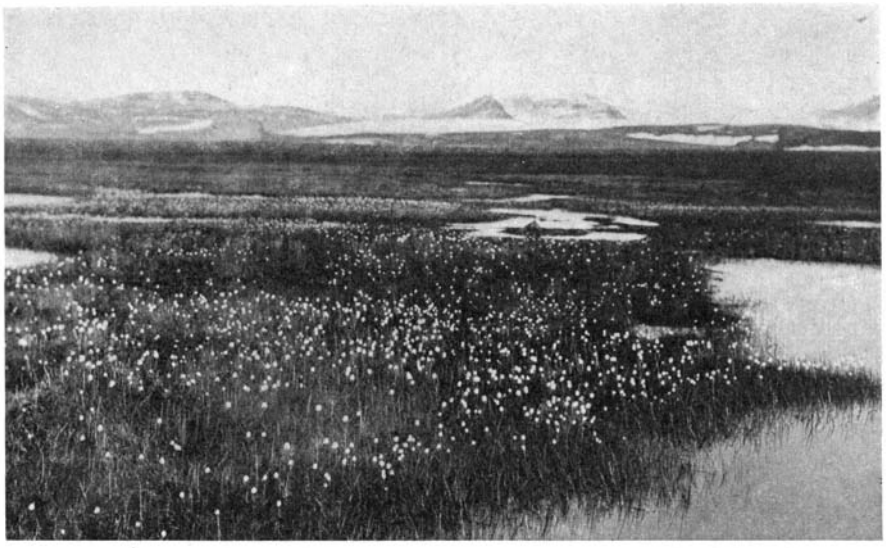


Fig. 32. *Eriophorum Scheuchzeri* Hoppe, in bogs on the west shore of Sorgfjorden. Phot. 15/8 1931.

Gramineae.

On account of the indefinite and often inconsistent terminology frequently encountered with, regarding the flower of the *Gramineae* I here append a general diagram illustrating the terms (Boissier 1884 "Flora Orientalis" Vol. 5, Fasc. II p. 432) used in the following text, in order to avoid misinterpretations. A terminology of this type is in my opinion the most adequate because the terms *gluma* and *glumella* express as such the homology of these organs, and because the *palea*, which anatomically, ontogenetically and by its position (inserted on the peduncle, and with its back turned towards the rachilla, see fig. 33!) belongs in quite another category, in this terminology obtains a separate name, which is highly desirable.

72. *Alopecurus alpinus* Sm. Pl. IV.

Brennevinsfj. Depotodden (Malmgren, S). *Murchisonfj.* Floraberget (S), Triodalen (S), Krykjeslukta (S), Krykjevatnet (S), Sveanor (S). *Hinlopenstr.* Kalkstranda at Forsiusfjellet (S), Augusti Bay (Malmgren), Rundhaugen (S), Ismåsefjellet (S), Torellneset (S). *Sorgfj.* Heclahamna (Malmgren). *Lomfj.* Faxedalen (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren, Eaton)).

Malmgren 1862 p. 251; Eaton 1876 p. 43.

Rather rare in North-East Land where it is preferably found below the bird-cliffs or at bird hummocks but may also be found in

sparse stands on unmanured ground, and even on pure dolomite limestone. The first flowering specimens were found in the bird-cliff Krykjeslukta on July 29, where also the biggest specimens were seen, viz., 22 cm high.

The northern limit is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 230).

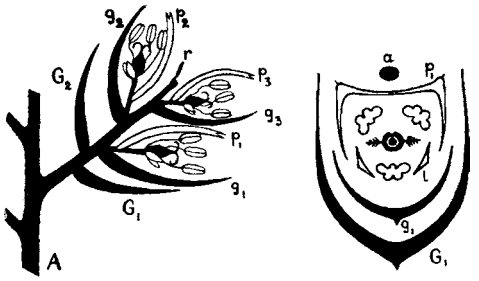


Fig. 33. Diagram of the grassflower. G gluma, g glumella, p palea, l lodicula, A axis of inflorescence (rachis), a axis of spikelet (rachilla), r rudiment.

73. *Deschampsia alpina* Roem. et Schult. Fig. 34, 35, 52 and Pl. IV.

Murchisonfj. Wargentindalen (S). *Sorgfj.* Heclahamna (Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjell 200 m (S), Lomfjordbotnen (S), Cape Fanshawe (Malmgren), (Lomfjorden (Malmgren)).

Malmgren 1862 p. 251, sub nom. *Aira alpina* L.; Nathorst 1883 p. 34; Andersson and Hesselman 1900 p. 77.

New to North-East Land, where it seems to be very rare and was only found in one place, viz., at the south end of Wargentindalen. Here it grew in small and mostly sterile tussocks on the wet and sandy borders of a little rivulet (Fig. 52 p. 114). Even sterile plants are always easy to recognize on account of their characteristic ligule (cf. Fig. 35). In Lomfjorden and Sorgfjorden it is fairly common in wet places, growing in dense and large tussocks and sometimes reaching a height of more than 30 cm.

All our specimens are viviparous. The visible parts of the bulbil are here as always formed by the vegetatively metamorphosed glumellae (Fig. 34 g_1—g_5) especially nos. 2 and 3 from below, which have grown out and partly turned green. The paleae and shrunken stamens (Fig. 34 p_1—p_3, st), being always present in our material, are subject to a gradual and finally total atrophy the higher up on the spikelet they are situated (cf. under *Poa* p. 84 and Fig. 41). No specimens with partly functioning stamens were seen. Leaving the vivipary out of question *D. caespitosa* (L.) PB. is in other respects so different from *D. alpina* that it may be difficult to look upon *D. alpina* as a merely viviparous form of *D. caespitosa* (cf. Devold and Scholander 1933 p. 136, 137).

In *D. alpina* quite an interesting case of homology may be deduced. By the mentioned vegetative metamorphosis of the glumellae we may directly in one and the same viviparous spikelet observe the gradual transformation of the single parts of the glumellae, each into its characteristic part of the fully developed and lasting leaf, and in such a way that the degree of transformation increases with the number of

the glumellae counted from below. Thus, the lower part of the glumellae, viz., below the awn, is successively converted into the normal leaf sheath, the awn itself or sometimes the secondarily outgrowing and hypertrophying dorsal nerve passes into the lasting leaf-blade, whereas the split part of the glumellae above the junction with the awn is transformed directly into, and finds its full homology in, the ligule of the outgrown leaf (Fig. 34 and 35). In this development the ± reduced paleae and sexual parts do not take part, but shrink away, no structures corresponding to them being so far present in the normal young plant. I have without succes searched for them between the basal sheaths of the fullgrown plant. The roots of the bulbil are secondarily developed from the lower part of the main axis. It is interesting to see how the apparently rather specialized spikelet is turned by such simple means into a complete, small young grass-plant.

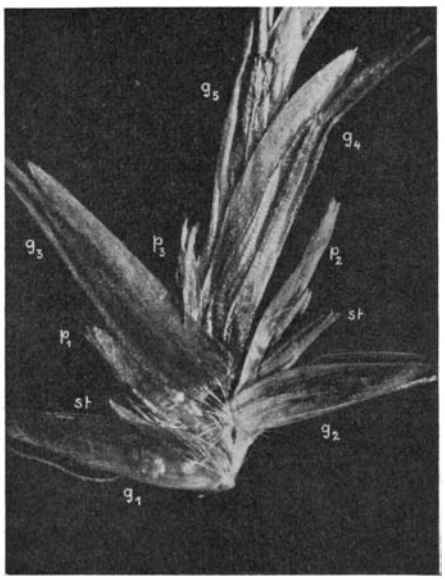


Fig. 34. Viviparous spikelet in *Deschampsia alpina* Roem. et Schult. Glumae removed, the other parts of the spikelet and bulbil have artificially been brought to sprawl. The photo shows the successive transformation of the glumellae into bulbil leaves (g_{1-5}), and in this case also clearly shows how the awn of the glumella and the part above the junction of the awn and the part below it, by and by passes into the resp. blade, ligule and sheath of the bulbil leaf. For explanation of other symbols see Fig. 33. Spec. from Norway. Magn. 7,5/1.

In order to find out if the relationships here described might be applied also to other species I have examined our only herbarium specimen of the very rare viviparous form of *Deschampsia flexuosa* (L.) Trin. recently found by Miss Karen Breien in the province Østfold in southeastern Norway. I have also examined some semi-viviparous forms of *Alopecurus pratensis* L. The direct transformation from awn to leaf-blade is here difficult to trace, which is frequently the case also in individual cases of *Deschampsia alpina*. But on the other hand we find here a thing of the greatest interest, namely the position of the awn. The plants are all semi-viviparous and we find here that also in the non-viviparous, flowering spikelets the awn diverges from the middle of the back of the glumella and not from the base as is the case in the glumella of a normal *D. flexuosa* or *A. pratensis*. In other words, the awn in these grasses and their viviparous parallel forms are related

to each other in just the same way as the awn of *D. alpina* is related to the awn of *D. caespitosa*. This should, in fact, justify the viewpoint that the viviparous forms of *D. flexuosa* and *A. pratensis* are to be regarded as distinct species. However, when I prefer not to do this the reason is partly that the scanty material do not warrant any conclusions as to the constancy of this character and partly that I know nothing of the further geographic distribution of these forms. There is still another reason. If it, namely, in general should be proved that the awn in phenotypically non-viviparous specimens of any awn-bearing species of grass is always distally placed on the glumella as compared with the conditions in the normal parallel forms, then one would be forced to consider the vivipary as the direct cause of the awn-displacement, which again would bring the mentioned viviparous forms of *Alopecurus pratensis* and *Deschampsia flexuosa* in the same category as the viviparous parallel forms of *Poa bulbosa*, *Dactylis glomerata* etc., and like these they were to be considered no more than varieties. If the total disappearance of the awn in *Festuca vivipara* and *Festuca prolifera* (cf. p. 74, 78) should by cultures prove to be the direct result of the vivipary, then the justification for maintaning these as species is also open for discussion. However, as long as we are ignorant of this point, I prefer temporarily to maintain the species distinction in all cases of vivipary in which there in phenotypically non-viviparous flowers yet are constant differences from the normal, fertile parallel form.

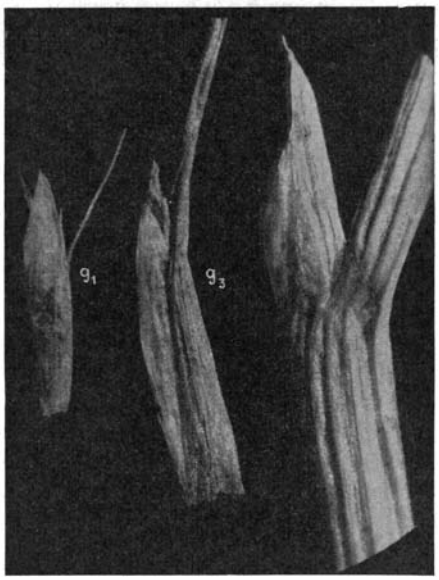


Fig. 35. *Deschampsia alpina* Roem. et Schult., showing the homology of the awn and leaf blade, the part above the awn and the ligule, and the part below the awn and the leaf sheath. g_1 first glumella; g_3 first normal bulbil leaf, formed by the metamorphosed third glumella; to the right leaf of a full-grown plant. Spec. from Norway. Magn. $^{7,5}/_{1}$.

Even if this condition is not present, the vivipary may yet in special cases justify a separation into species viz. when it is combined with a distinct geographical distribution. — The taxonomical difficulties attached to the viviparous parallel forms in vascular plants bring to our mind the quite analogous difficulties attached to the soredious or isidious parallel forms in lichens.

In my opinion it is of great interest to note that the semi-viviparous forms not even here (cf. *Saxifraga comosa* and *Festuca vivipara*, p. 19

and 74) appear to form continuous transitions to the normal non-viviparous forms, as the position of the awn distinctly marks the discontinuity no matter how insignificant the phenotypical manifestation (i. e. glumella prolification) of vivipary may be. If this could be generalized it would indicate that the vivipary innermost was conditioned by such thorough changes that one would have to think of a mutative change of the gene complex. Taxonomical studies will hardly bring anything else but conjectures in these problems. The final word in this case, as in so many other cases, has to be left to experimental genetics.

The northern limit for *Deschampsia alpina* is Wargentindalen in North-East Land.

74. *Dupontia Fisheri* R. Br. Fig. 42 I–II and Pl. IV.

Brennevinsfj. Depotodden (Malmgren, S). *Lady Franklinfj.* Shore plain west of Franklinfjellet (S), Inner west side (S). *Murchisonfj.* Floraberget (S), Snaddvika, north side (S), Krykjevatnet (S). *Ids. in Murchisonfj.* Ringertzøya (S), S. Russøya (S). *Hinlopenstr.* Cape Sparre (S), Augusti Bay (Malmgren), Rundhaugen (S). *Sorgfj.* Heclahamna (Parry), Inner west side (S), (Lomfjorden (Malmgren)).[1]

Hooker 1828 p. 213; Malmgren 1862 p. 252.

Seems to be rather rare in North-East Land, where it was found on moist, clayey or mossy ground. Great and dense stands of this species grow in abundance in the *Eriophorum Scheuchzeri* swamps on the west side of Sorgfjorden.

Dupontia occurs in two habitually very different forms which, however, are connected with intermediates. The only form seen in northern Svalbard corresponds to the main form *D. Fisheri* R. Br. It is characterized by the panicle being most often contracted during and after anthesis, with comparatively short panicle-branches, short and broad, 2- or even 3-flowered spikelets, the obtuse glumellae hairy on the back and being often not overtopped by the glumae (cf. Fig. 42 II p. 90).

The other form *D. psilosantha* Rupr. is as a rule higher, with the long and straight panicle-branches often bent down at acute angles. The spikelets are long and narrow, acuminate, often with only one functioning flower and with the long lanceolate and acuminate glumae overtopping the acute, glabrous glumella. The anthers of this in all parts slender form are as a rule a trifle longer than in the foregoing (cf. Fig. 42 I p. 90). This form was seen in abundance in Adventfjorden.

Seen in a large material, however, the variability of *Dupontia* is great and the intercoupling of the characters here mentioned is hardly so constant as to warrant a separation between species. But Ruprechts

[1] Lågøya as a known locality for *Dupontia* should be regarded as highly improbable, as Hooker (1828 p. 213) states all the specimens from this place to be viviparous, a property otherwise not known in this species.

form deserves in my opinion well the rank of a variety and is here proposed as: *Dupontia Fisheri* R. Br. var. *psilosantha* (Rupr.) nov. comb. (*Dupontia psilosantha* Ruprecht, in Flor. Samojed. Cis. 1845 p. 64).

To judge from Herb. Bot. Mus. Oslo and literature the var. *psilosantha* is very rare in Novaya Zemlya (one locality!), going westwards it is then common in Kolgujew (Ruprecht 1845 p. 64) and is in Svalbard about as common as the main form. In Greenland the main form seems to be very rare as has already been pointed out by Lange (1880 p. 165). In quite a large material of *D. Fisheri* I have here only seen it from two localities both in Eirik Raudes Land, East Greenland. In Arctic America both forms are recorded, however, the hairy main form being the only one present in our collections. Whether the difference in the geographical distribution of these two forms which here seems to be indicated also exists in reality cannot be ascertained without a revision of a great deal more material from Arctic America and Arctic Siberia than have I seen.

Sterile small plants of *Dupontia* may cause some trouble in their determination, as they are easily confounded with specimens of *Poa*, which often grow in similar places. However, *Dupontia* may nearly always be recognized by its nodular, short-segmented subterraneous stem, especially to be seen when the old sheaths are removed, and by the apex of the leaves being straight. In a *Poa* the long-segmented subterraneous stem is very indistinctly nodular, and the leaf-apex is characteristicly bent like a claw (cf. Fig. 41 p. 82, 83).

Dupontia reaches its northern limit at Depotodden in Brennevinsfjorden.

75. *Festuca brachyphylla* Schultes. Fig. 36, 39 *a* and Pl. IV.

F. brevifolia R. Br. (non Muehlenb.). *F. ovina* L. var. *brevifolia* (R. Br.) Hart; *F. ovina* L. var. *supina* (Schur) Hackel; *F. ovina* L. var. *violacea* Gaud.; non *F. ovina* L. var. *vivipara*, auctt. in dealing with material from Novaya Zemlya, Spitsbergen, Bjørnøya, Greenland and Arctic America.

Murchisonfj. Floraberget (S), Snaddvika, north side (S), Triodalen (S), (Stenö (Fries), Hinlopenstredet (Malmgren)). *Sorgfj.* Heclahamna (Parry, Eaton), Inner west side (S). *Lomfj.* Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren)).

Hooker 1828 p. 213; Malmgren 1862 p. 256, sub nomina *F. ovina* L. var. *violacea* Gaud. et *F. brevifolia* R. Br.; Fries 1869 p. 137, sub nom. *F. ovina* L. *β violacea* Gaud.; Eaton 1876 p. 43.

Appears to be rare in North-East Land, where it seldom attains a height of more than 5—8 cm. In favourable localities elsewhere I have not infrequently seen it three times as high.

In a previous paper (Devold and Scholander 1933 p. 139) I have mentioned the result at which I have arrived through the study of quite a comprehensive herbarium material and through personal observation

in the field, namely, that I have never seen *Festuca ovina* in or from the Arctic (Novaya Zemlya, Svalbard, all of Greenland, Ellesmereland s. lat.), but only *F. brachyphylla*. In my opinion the latter is a form series morphologically distinctly separated from that of *F. ovina*. Except in North America, where it is recorded as far south as California, its distribution seems to be chiefly arctic. I shall at this point deal more fully with the main differential diagnostics between this greatly neglected species and its nearest ally.

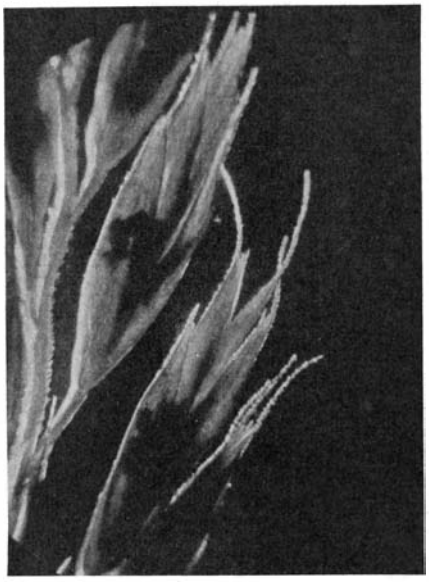


Fig. 36. *Festuca brachyphylla* Schultes. Transmitted light. Note the shades of the very short anthers in the contracted spikelets, and the long awns of the glumellae. Spec. from Sorgfjorden 16/8 1931. Magn. 7,5/1

The principal characteristic of *F. brachyphylla* — which applies to all "*F. ovina*" or "*F. supina*" from the Arctic, excepting the viviparous specimens, I have seen — is the very short, almost cubical, anthers, 0.6—1 (1.4) mm, as against *F. ovina's* anthers which are 2 (1.8—2.5) mm long. The only European form belonging to the *ovina* series with so small anthers is *F. alpina* Suter in the Alps. This obviously belongs, however, in all other characteristics, which I shall shortly enumerate, to the *ovina* series.

During anthesis the anthers of *F. brachyphylla* are exerted on their long filaments beyond the bracts of the unopened, contracted spikelet whereas in *F. ovina* the anthers have very short filaments and remain in place between the palea and the glumella, which are forced apart by reason of the considerable size of the anthers (cf. Fig. 36 and 37). This open, sprawling position between the various paleae and glumellae, which continues after the anthers have fallen away, gives the *ovina* spikelet its so characteristic costal or skeleton-like appearance (very distinct in *F. alpina*), in contrast to the contracted spikelets of *brachyphylla*. The difference is accentuated also by *F. ovina's* frequently far more numerous flowers in the spikelet. Late in the season when past flowering the sprawling spike of *F. brachyphylla*, is however not a rarity. In the case of both these plants the living ones sprawl less than the dried ones.

In *F. ovina* the glumellae are thicker and narrower than in a typical *F. brachyphylla*, which latter characteristic is still further accentuated by the fact that the edge of the glumella in *F. ovina* is so strongly involute

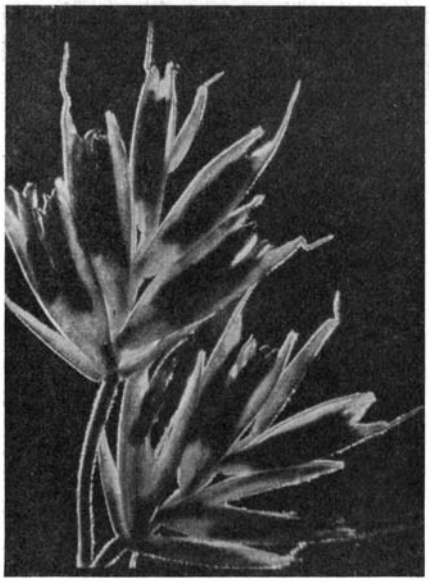


Fig. 37. *Festuca ovina* L. Transmitted light. Note the shades of the large anthers, the last forcing the palea and long-awned glumella apart. Spec. from Norway. Magn. 7,5/1.

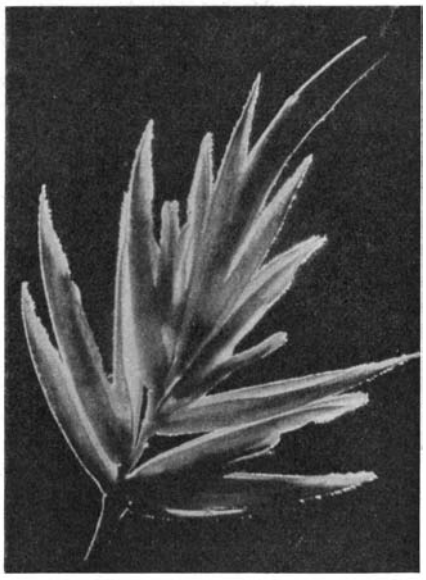


Fig. 38. *Festuca vivipara* (L.) Sm. Transmitted light. Note the large emptied anthers and the entirely awnless glumellae even in the lower non proliferous flowers. Semi-viviparous spec. from Norway. Magn. 7,5/1.

that the glumella has a uniformly narrow appearance. In contrast, we have the broad, bowedged glumellae of *F. brachyphylla*, which in typical cases are thin, almost membraneous shining bluish, and which are not, or only slightly, involute at the edge on flowering specimens. The glumae and glumellae of *F. brachyphylla* and northern representatives of *F. ovina* are always glabrous.

Besides these characteristics of the floral organs, the species varies widely in point of size, colour, flower density, hairiness of the culm (glumae and glumellae are always glabrous), leaf structure, and so forth, without my having been able to prove any discontinuity at any point in the series. I have never in the case of complete specimens had difficulties in distinguisting between *F. ovina* and *F. brachyphylla*.

Forms deviating widely from the low, typical, high arctic *F. brachyphylla* (cf. Ostenfeld 1923 Pl. III Fig. 5), with its characteristic, large, unveined, membranaceous, shining bluish spikelets (6—7 mm l.), and the vagina of the uppermost culm leaf scarcely exceeding the often flattened basal leaves and the basal sheaths brownish membranaceous, and the often hairy culm, were not infrequently seen in S. E. Greenland. They were here in most instances very robust and attained a length of even more than 30 cm already during anthesis, with a usually

very dense-flowered spike of relatively small (4—5 mm l.) and broad spikelets, the glumae, and the comparatively broad, sometimes distinctly three veined glumellae being opaque, pruinous and of a colour varying from green to violet. The vagina of the uppermost culm leaf much exceeds the basal, involute leaves, and the basal sheaths are whitish opaque. This very strange looking and deviating form, which in addition was characterized by its strong cumarin scent, seems to me well to deserve a variety name:

Festuca brachyphylla Schultes var. *groenlandica* nov. var.
(*F. ovina* L. var. *supina* (Schur) Hackel, p. min. parte, auctt.).

Tota planta robustior quam forma typica, altitudine usque ad 30 cm metiens, ceterum ab hac spiculis parvis (longitudine arista exclusa 5—6 mm), glumis glumellisque minoribus, pro portione brevibus latisque (glumellis arista exclusa altitudine 3—4 mm), coriaceis vel cartilaginaceis, interdum ± distincte 3 (5)-nervis, pruinosis, viridi-glaucescentibus—violaceo tinctis, vagina folii caulini summi foliis basalibus multo longior, vaginae basales albescentes recedens.

Particularly typical specimens belonging to this variety, which seems to be connected with the high arctic main form with numerous transitions, were collected in Akorninarmiut in S. E. Greenland, e. g. Dronning Marias Dal (leg. Devold and Scholander July 24 and August 12 1932) and Finnsbu (leg. Devold and Scholander August 14 1932).

In the southernmost regions of the area of distribution of the *F. brachpyhylla* form series the var. *groenlandica* seems to be the most common representantive. The very short anthers on long filaments and the subsequently characteristic way of flowering, and also the arctic distribution well characterize the *F. brachyphylla* series from that of *F. ovina*.

It should be added that I have never in the case of complete specimens had differential diagnostic difficulties in respect of *F. rubra* forms, which, as we know, may be difficult to distinguish from *F. ovina*. In the first place, *F. rubra* is rarely tufted to any great extent, and its anthers are at least quite as large as those of *F. ovina*; besides, it has an awn which does not proceed abruptly, but more gradually, from the glumella point, etc.

The northern limit of *F. brachyphylla* is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 230).

76. *Festuca rubra* L. var. *arenaria* (Osb.) E. Fries. Pl. IV.

Murchisonfj. Raudstupet (S), Floraberget 200 m (S), Sveanor (S). *Hinlopenstr.* Torellneset (S). *Sorgfj.* Heclahamna (Andersson and Hesselman), Inner west side (S). *Lomfj.* Faxedalen (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren)).

Malmgren 1862 p. 256, sub nom. *F. hirsuta* Host; Andersson and Hesselman 1900 p. 70.

New to North-East Land, where it was especially found in the bird-cliffs or at the resting places of *Stercorarius parasiticus*. The glumellae are in all of our specimens strongly pubescent and of a greyish colour, the glumae, on the contrary, being nearly always glabrous and violet-coloured.

Discontinuity in the form series between this hardier and hairy var. *arenaria* and the more southerly and glabrous *F. rubra* sens. str. does not yet seem to have been demonstrated.

Some of our specimens from Floraberget attain a height of 29 cm. The northernmost localities for *F. rubra* (var. *arenaria*) are Raudstupet and Floraberget in Murchisonfjorden.

77. *Festuca vivipara* (L.) Sm. Fig. 38, 39 *c* and Pl. IV.

(*Hinlopenstr.* (Malmgren)). *Sorgfj.* Inner west side (S). *Lomfj.* Faxedalen (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren,Eaton?))

Malmgren 1862 p. 256, sub nom. *F. ovina* L. var. *vivipara* Horn.; ? Eaton 1876 p. 43, sub nom. *F. ovina* L.

Not yet found in North-East Land, but quite common on the other side of Hinlopenstredet in Sorgfjorden and in Lomfjorden. As is usual in extreme arctic regions, only the smooth main form was found; the decidedly more southern, hairy form var. *hirsuta* (Lge) Schol. occurs, although very rarely, in Spitsbergen, from where we have specimens from one locality in Herb. Bot. Mus. Oslo, namely, Dickson Bay: Hugindalen (leg. Ove Høeg 1924). It has also been found in Bjørnøya (Lid 1924).

I have previously (Devold and Scholander 1933 p. 140) referred to the morphological singularities of *F. vivipara* which I consider warrant the conception of this plant as a separate species, distinct from the forms of *F. ovina* as well as *F. brachyphylla*; and I shall now further elucidate my standpoint, also by giving some illustrations (Fig. 36—39).

In order to decide the question as to whether *F. vivipara* is identical with the viviparous parallel form of *F. ovina* (analogous with many viviparous parallel forms in *Poa*, and others), or whether it is a distinct species which is almost exclusively known as being viviparous (analogous, probably, with *Deschampsia alpina*), I find it expedient to choose the semi-viviparous forms as my point of departure. There are all degrees of phenotypical vivipary, and by semi-viviparous forms I mean those forms in which there are in the inflorescence at the same time both fully developed phenotypically non-viviparous ± fertile flowers containing palea and stamens, and viviparous sterile flowers. These semi-viviparous forms are found more particularly in more southern latitudes. If we now consider such a fertile and non-viviparous flower of a semi-viviparous plant, it differs nevertheless considerably from a normal *F. ovina* flower

a *b* *c*

Fig. 39. *a Festuca brachyphylla* Schultes, *b F. ovina* L. *c F. vivipara* (L.) Sm. Note the very short anthers in *a* and the awnless glumellae in *c*. Specimen *a* from Sorgfjorden 16/8 1931, *b* and *c* from Norway. (cf. Fig. 36, 37 and 38). Magn. 5,3/1.

in that the awn is always lacking in *F. vivipara* in the many thousand of individuals I have seen — a fact which, as it later appears, has already previously been known and pointed out by Fernald, the wellknown authority on the North American flora (cf. Rhodora 1926 p. 151). Awnless *F. ovina*, on the other hand, is so extremely rare, at all events in Scandinavia, that we can here leave it entirely out of account. As far as I know, *F. brachyphylla* is not known awnless, and moreover, as *F. vivipara* (also in the Arctic!) has anthers just as large (2—2,5 mm) as those of *F. ovina*, it is out of the question that *F. vivipara* in the Arctic can have anything to do with *F. brachyphylla* (cf. Fig. 36, 37, 38 and 39).

As thus the awn is always lacking in *F. vivipara*, no matter how large or small a degree of vivipary it may posess, it will be apparent that the semi-viviparous forms do not by any means constitute a continuous transition between *F. vivipara* and *F. ovina* — a view held e. g. by Turesson (1926 p. 202), but are only a ± completely viviparous development in *F. vivipara*, which latter may very well be thought to occur as non-viviparous (awnless!), and which is even known to be fructifying (cf. Jenkin 1922 p. 421). I have, however, not personally seen non-viviparous forms of *F. vivipara*; they seem to be very rare.

The quantitative manifestation of the viviparous process (vivipary or semi-vivipary), how interesting it may be in other connections, seems to me to be of little and at all events subordinate importance from a purely taxonomical point of view and seems not to be suitable as a principle of primary sub-division — such as Turesson (1926 p. 193) has done it in his splitting of *F. vivipara* into numerous formae apomictae.

It is a character in many cases even varying with the season (cf. Jenkin 1922 p. 420).

In addition to being awnless *F. vivipara* is distinguished from *F. ovina* in that it very commonly occurs in a hairy parallel form which in our latitudes at least in Scandinavia appears to be lacking in *F. ovina* s. str. Added to this, there are wide divergencies in geographical distribution, particularly in the Arctic, where *F. ovina* is absent also in places where it might very well thrive, e. g., in South-West Greenland.

I have likewise pointed out the singular and noteworthy fact that this species, at all events in the high Arctic, appears practically always to have totally lost the last trace of rudiment of sexual organs, whereas in the bulbil from more southern regions we frequently find a ± rudimentary palea supporting the three mostly sterile stamens.

According to the general conception of rudimentary organs, it is difficult to imagine that their complete disappearance in the high Arctic can have been caused through a recently developed vivipary, but must the more be regarded as a phylogenetically complete reduction throughout the ages — if it is at all permissible, in such a case to apply those laws which are deduced mainly from zoology and palaeo-zoology, i. e. from organisms which in specialization are on a so much higher plane than those we are dealing with here.

The probably very great age of *F. vivipara* or of great parts of *F. vivipara*, is possibly indicated also by its wide distribution despite the inconvenient spreading by bulbils, also at places where *F. ovina* does not exist, e. g., in the Arctic. The high degree of variability within this clone-series may point in the same direction. Turesson (1930 p. 183) has found that the highest degree of polyploidy seems to be combined with the highest degree of vivipary. If this should prove to hold good also in the high arctic completely viviparous, but certainly rather small forms, it fits well in with the conception of the high age of these.

How, it may be asked, are we to understand and construe the circumstance that some *F. vivipara* are totally lacking in sexual rudiments whereas others can produce sexual organs of even full functioning capability?

From the point of view that *F. vivipara* was once explosion-like derived from *F. ovina* — or perhaps from another species — and thus all *F. vivipara* should be about equally old phylogenetically, we must then assume that the arctic climate had acted so as to promote and accelerate the gradual phylogenetic disappearance of these organs whilst in southern latitudes they continued occasionally to arrive at even full development. But how then should we explain the simultaneous occurrence in southern latitudes of both rudimentless and semi-viviparous forms, or e. g., the fact that many *F. vivipara* forms collected on mountain summits in Central Norway in altitudes from 1500—2300 m (Jørgensen 1932), i. e. under very hard climatic conditions, still have palea and sexual organs?

If we on the contrary regard *F. vivipara* as being derived repeatedly ("iteratively") throughout the ages from *F. ovina* as a stem of regeneration (cf. p. 21) it should be easier to understand the difference in the degree of reduction, namely seen in the light of the different phylogenetic age of the recent *F. vivipara* forms. The noteworthy occurrence of nearly only rudimentless (old!) forms just in an area like the Arctic, where *F. ovina* now is lacking and has only long ago or perhaps never lived, is a coincidence of considerable interest which might seem to point in the direction of the last view. Further the following statements by Fernald may deserve attention in this connection. About *F. ovina* he says (1926 p. 151) that it: "is not indigenous in America, merely an introduction from Europe, but both *F. supina* and *F. vivipara* are indigenous in boreal America." Later (1933 p. 134) he states the anthers to be "in *F. vivipara* unknown"; America seems accordingly in contradistinction to Europe practically only to have forms of *F. vivipara* lacking in sexual organs. In other words we here find another example of this noteworthy coincidence of nearly exclusively rudimentless forms of *F. vivipara* as soon as we exceed the limits of the indigenous area of geographical distribution of *F. ovina* s. str. — to carry it to extremes. It should especially be mentioned that when dealing with America, we may leave out of account the already mentioned possible source of error which may be thought to lie in the fact that the arctic climate as such could possibly effect a rapid disappearance of the sexual organs and the palea. On the other hand, however, the presence in North America of a form so closely related to *F. ovina* as is *F. supina* obviously here makes the whole question much more complicated than it is in the Arctic where no form is present from which *F. vivipara* could possibly have originated. Provided that the premisses by a critical revision of large material should prove to hold good and that the facts, here pointed out, and which are valid for the Arctic, may really be generalized it would very strongly support the assumption of a genetic connection between *F. ovina* and *F. vivipara* of a kind as mentioned above, viz. with *F. ovina* as the sexual stem from which the *F. vivipara* clones repeatedly, throughout the ages were split off.

If now this assumption should hold good that *F. vivipara* in one or another way is derived from *F. ovina*, it would then be left to explain the simultaneous disappearance of the awn. Perhaps the total loss of the awn is just one of the earliest manifestations of vivipary? It may possibly be so in this actual case, but any general validity it seems not likely to have, for if we consider another awn-bearing species like e. g. *Alopecurus pratensis* or *Deschampsia alpina* we find that vivipary has only displaced the awn but not like in *F. vivipara* effectuated its total disappearance or assimilation even in non-viviparous flowers. Possibly, however, this difference is only of a quantitative nature.

In his wellknown works (1926, 1930 and 1931) Turesson has proved that the number of chromosomes in the *F. vivipara* clones is a multiple of 7, respectively in the somatic cells 21, 28 and 42 in the cases investigated by him (cf. 1931 p. 13). From the investigations of other authors (cf. Turesson 1930 p. 178) *F. ovina* is known to have the chromosome numbers in somatic cells 14 and 42, and its var. *duriuscula* Hackel to have the numbers 28, 42, and 70. On account of these facts and other agreements Turesson seems to be of no doubt that *Festuca ovina* is the primitive form of *F. vivipara*. However, he does not appear to have been aware of the circumstance of the missing awn in all grades of semi-vivipary in *F. vivipara*, and for this reason it appears to me that his conclusions relative to the systematic appraisement of this grass are somewhat more extreme than his investigations warrant. As far as I can see, the only thing that can prove that *F. ovina* is the direct (recent) primitive form of *F. vivipara* is the direct observation that *F. ovina* immediately as it becomes viviparous, loses its awn, or, conversely, that the fertile non-viviparous forms which have been produced from *F. vivipara* at the same time recover the awn. And this has as far as I have been able to ascertain never been done.

Even though later research may be able to show that *F. vivipara* is a viviparous form occasionally emanating from a typical awn bearing *F. ovina*, it occurs to me that the changes which have thereby taken place in the viviparous offspring were however so great as to warrant a separation of species, especially if we consider its geographical distribution. At all events, so long as this theory has not yet been proved we ought not to include it in our nomenclature, but use a neutral and purely morphological name, and retain *F. vivipara* as a separate species.

The eventual non-viviparous, awnless and fertile primitive form of *F. vivipara* appears then to be practically non-existent (extinct?), as may be the case, for instance, with the rare non-viviparous parallel form of e. g. *Poa bulbosa* or *Deschampsia alpina*. With other grasses, e. g. *Dactylis glomerata*, the condition is the reverse, for in this instance viviparous forms occur very rarely, and may perhaps be regarded, phylogenetically, as a comparatively late occurrence in this grass. Perhaps many grasses end their phylogenetic development as viviparous forms?

Few plants have had so many different names as *F. vivipara*. There is scarcely any form of *F. ovina* (incl. *F. brachyphylla*), and frequently *F. rubra,* of which it has not been described as a form, variety or subspecies. It is in itself very variable, and if we build on the fact that, on account of its practically purely vegetative propagation, it constitutes hereditarily clean lines, clones, then there is ample opportunity to split it up into smaller units (cf. the formae apomictae of Turesson).

The hairy as well as the smooth form of *F. vivipara* is, as a rule, very strongly and typically tufted, and the straws are at the base

surrounded by their typical coriaceous basal sheaths. Judging from our herbarium material, forms are rarely found that do not appear to have been caespitose and where one might think of a proliferous form of *F. rubra*. It may be of interest in this connection to note that Fernald has pointed out (cf. Rhodora 1933 p. 133) that also this form is always awnless, and consequently he creates it under the name of *F. prolifera* Fern. as a separate species, which he supposes to be endemic of North-East America. However, this so-called proliferous form of *F. rubra* is rare, but wellknown from Europe (cf. e. g. Jenkin 1922 p. 418 and Holmberg 1926 p. 236, 237), and we have not few specimens of both the glabrous main form and the hairy var. *lasiolepis* Fern. from the atlantic coastal area of Norway. Many of these specimens are semi-viviparous with partly non-viviparous spikelets and even sometimes with functioning anthers, but always without a distinct awn. However, it should be said that the same arguments which support our conception of *F. vivipara* as a separate species seem in the case of *F. prolifera* not to be fully so strong. Firstly because I have on one occasion seen indication of an awn in a semi-viviparous *F. prolifera* and secondarly because forms occur in *F. rubra* which are ± muticous; strictly awnless forms are, however, exceedingly rare in Scandinavia as I have seen only some few specimens in going through a material of thousands. I have seen no *F. prolifera* from the Arctic.

With our scanty exact knowledge of the causes of vivipary it seems not at all justified to me, to regard *F. vivipara* as a crossbreed between *F. ovina* and *F. rubra* (cf. Seidenfaden 1933 p. 111), on the mere postulate — as does Lindman hold in the case of *Poa* — that viviparity should, as a rule, be produced by hybrid sterility (between different species) and consequently should be an indication of hybridity. This assumption, originally put forward by Ernst (1918 p. 500—512), is, as far as I can see still an open question in genetic research, and consequently the hybrid-nomenclature should, at all events for the present, be avoided; I shall go further in this question under *Poa*.

The northern limit for *F. vivipara* is Sommerdalen 82° 29′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 231 and Pl. II, Fig. 4).

? *Hierochloe pauciflora* R. Br.

Not seen by us, previously recorded (Hooker 1828 p. 213; Eaton 1876 p. 43) from: *Lady Franklinfj.* Lågøya (Parry). *Sorgfj.* Heclahamna (Eaton).

The correctness of these records has greatly been doubted by later scientists Fries, Kjellman, Nathorst and others, who are of the opinion that there has been a confusion with other species, then most probably with *Dupontia*.

78. *Phippsia algida* R. Br.

Fig. 40 and 45.

Fig. 40. Tufts of *Phippsia algida* R. Br. growing under a bird-cliff 2,5 km SE of Cape Hansteen 7/7 1931.

Northern Ids. Kvitøya (Malmberg), Storøya (Malmberg), Karl XII Øy (Andersson and Hesselman, Malmberg), Waldenøya (Parry), Nordkapøya (=North Cape) (Fries, Elton), (Sjuøyane (Nordenskiöld)). *Brennevinsfj.* Depotodden (S), Zeipelbukta (S), Kontaktberget (S), Franklindalen, east end (S), 2,5 km SE of Cape Hansteen (S), Cape Hansteen (S). *Lady Franklinfj.* Franklindalen, west end (S), Franklinfjellet, west side (S), Shore plain west of Franklinfjellet (S), Gerardodden (S), Inner west side (S), Westmanbukta (S), Tombolaøya (S), Lågøya (Parry), Basisøya (S). *Murchisonfj.* Detterbukta (S), Raudstupet (S), Floraberget (S), Wargentinfjellet (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Krykjevatnet (S), Sveanor (S), (Murchisonfjorden (Wulff)). *Ids. in Murchisonfj.* Ringertzøya (S), Depotøya (S), N. Russøya (S), Kvaløya (S), Flyndra (S), Oskarøya (S), S. Russøya (S), Krossøya (S). *Moffen.* South east end (S). *Hinlopenstr.* Cape Sparre (S), Kalkstranda at Forsiusfjellet (S), Gyldénøyane (Elton), Rijpdalen (Ahlmann), Rundhaugen (S), Torellneset (S), Perthesøya (Malmberg), Ulvebukta (Elton), Von Otterøya (Elton). *Sorgfj.* Heclahamna (Parry), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet 200 m (S), Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (Elton)).

Hooker 1828 p. 213; Malmgren 1862 p. 254, sub nom. *Catabrosa algida* (Sol.) Fr.; Andersson and Hesselman 1900 p. 73, sub nom. *Catabrosa algida* (Sol.) Fr.; Wulff 1902 p. 102, sub nom. *Catabrosa algida* (Sol.) Fr.; Summerhayes and Elton 1928 p. 207, 232, 249, sub nom. *Catabrosa algida* (Sol.) Fr.

Common and widely distributed all over the investigated area. It is especially found to develop luxuriantly in the bird islets and bird-cliffs. It is one of the plants in Svalbard to begin to flower earliest in the season, and even fruiting specimens were found on our arrival in North-East Land in the last days of June. Flowering and fruiting specimens were seen all the summer.

Northern limit is Lemming Fjord 82° 53′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 230).

79. *Phippsia concinna* (Th. Fr.) Lindeb. Fig. 46 and Pl. V.

Lady Franklinfj. Hansøya (S), Inner west side (S). *Murchisonfj.* Norvika, north side (S), Celsiusfjellet (S). *Sorgfj.* Heclahamna (Wulff). *Lomfj.* Lomfjordbotnen (S).

Wulff 1902 p. 102, sub nom. *Catabrosa concinna* Fr.

New to North-East Land, where it is rare, and was mostly found on stony and rather moist ground. It seems to develop very late in the season, as nearly all my specimens from here are only the withered, but so much the more characteristic, tufts from the previous year, only two of them having some short flowering panicles hidden amongst the basal leaves. In contradistinction to *P. algida*, *P. concinna* seems not at all to be nitro- or coprophilous. Our withered specimens attain a height of as much as 15 cm.

The northernmost locality known for this species is Hansøya in Lady Franklinfjorden.

80. *Poa abbreviata* R. Br. Pl. V.

Lady Franklinfj. Hansøya (S), Gerardodden (S), Persberget (S), Westmanbukta (S), Lågøya (Parry). *Murchisonfj.* Raudstupet (S), Floraberget 230 m (S), Wargentindalen (S), Celsiusfjellet (S), Snaddvika, north side (S), Snaddvika, south side (S), Kvalrosshalvøya, north point (S), Triodalen (S), Krykjeslukta (S), Sveanor (S). *Ids. in Murchisonfj.* Oskarøya (S), S. Russøya (S). *Hinlopenstr.* Cape Sparre (S), Gyldénøyane f. *pallida* (Elton), Rundhaugen (S), Ismåsefjellet 270 m (S). *Sorgfj.* Heclahamna (Parry), Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet 360 m (S), Lomfjordbotnen (S), Cape Fanshawe (Malmgren), (Lomfjorden (Malmgren)).

Hooker 1828 p. 213; Malmgren 1862 p. 254; Summerhayes and Elton 1928 p. 207.

Its small tufts with the characteristic one-sided short panicle and hyaline base are rather common in North-East Land. It grows in dry places. The f. *pallida* Lindm. occurs now and then together with the main form; it was found in Snaddvika, Triodalen, Krykjeslukta, and Oskarøya. Our specimens from North-East Land are dwarfed, rarely surpassing 10 cm.

At the head of Lomfjorden specimens were found attaining as much as 30 cm in height and somewhat suggesting *Poa Hartzii* Gdgr., which has recently been made clear by Th. Sørensen (1933 p. 145) in dealing with the flora of Eirik Raudes Land in East Greenland. This very remarkable and distinct morphological unit which has so largely escaped the attention of earlier authors and has hitherto only been known from Greenland does not occur in my material from northern Svalbard In looking over our material of arctic *Poa abbreviata*, *Poa glauca* and *Puccinellia Vahliana* in the Botanical Museum of Oslo I have found it abundantly represented in our *Poa abbreviata* material from Eirik Raudes Land (leg. Vaage 1929, 1930, several localities) and in addition

also some specimens from Ellesmereland (leg. Simmons 1899 No. 4243, sub nom. *Poa glauca* Vahl var. *arenaria* Hartz) and Spitsbergen (leg. Lid 1924, sub nom. *Poa abbreviata* R. Br. or *Poa glauca* Vahl). Simmons (1906 p. 162) writes the following about his specimens "In Fram Fjord, I found in loose sand in the river-valley, a form which agrees with var. *arenaria*, Hartz, ... but for the longer and more pointed ligule of the Ellesmereland specimens." From remarks on the labels it appears that also Lid has been aware of the striking long ligule in his specimens from Spitsbergen.

Poa Hartzii Gdgr. emend. Th. Sørensen is an addition to the flora of Svalbard. I have here identified it from the following places:

Wijde Bay: Vestfjorden (three localities, Lid 1924).

Dickson Bay: (one locality, Lid 1924).

The precise localities will be given later in a publication under preparation by Mr. Johannes Lid.

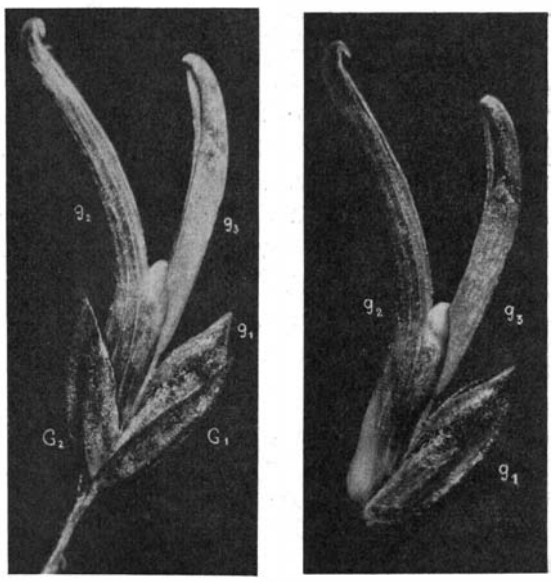
In all the quite extensive material of *Poa Hartzii* which I have seen from its area of known distribution viz. Ellesmere Land (Herb. Oslo), West and East Greenland and Spitsbergen I have only seen specimens with shrunken, unopened, and sterile anthers and only rarely with some, in all probability apomictically formed, seeds. In its always sterile anthers and also somewhat intermediate appearance between *Poa abbreviata* and *Poa glauca* it reminds us of the *Puccinellia vacillans* (cf. p. 95), which is only known sterile and which at the same time is strikingly intermediate between the *Phippsiae* and *Puccinellia Vahliana*; whether these forms, especially the latter, are really hybrids or not must be left to be decided by future genetic research.

Northern limit for *Poa abbreviata* is Frederic E. Hyde Fjord 83° 15′ (I. P. Koch) in Peary Land, north coast of Greenland (Ostenfeld and Lundager 1910 p. 15).

Some remarks on viviparity in arctic *Poae*.

The classification of arctic *Poae*, and particularly of the viviparous forms, often rank among the greatest taxonomical difficulties presented by arctic flora. Here, as otherwise, the reason is that our so-called natural system is in its essence discontinuous, whereas nature, which we endeavour to press into it, is perhaps in most instances in itself continuous, surely to a much greater extent than we know today, and consequently difficulties of limitation arise.

The well-known Swedish botanist, the late Professor C. A. M. Lindman, deserves great credit for his clear definition of the three fundamental types of *Poae* which we are dealing with here, viz., *Poa alpina* L., *Poa rigens* Hartm. and *Poa alpigena* (E. Fr.) Lindm. I refer to his treatement in Lynge 1923 p. 111: *Poa* by C. A. M. Lindman, Stockholm (p. 111—125).



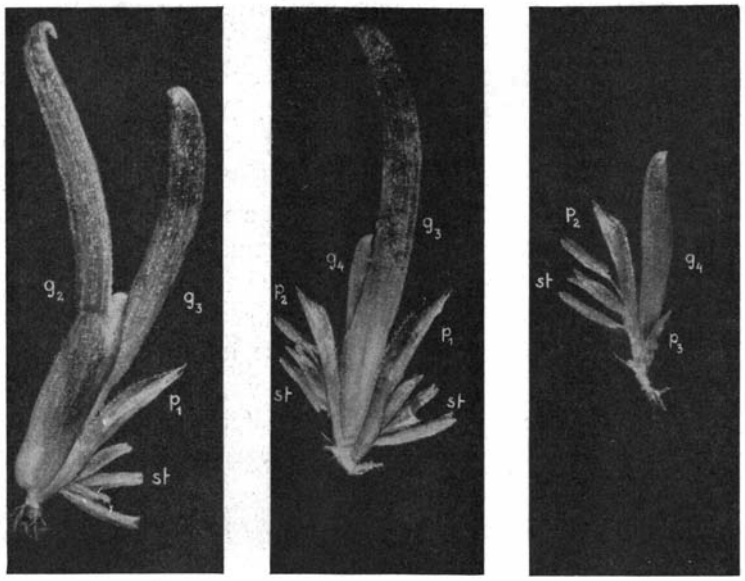
a *b*

Fig. 41. Proliferous spikelet in *Poa alpigena* (Fr.) Lindm. var. *vivipara*, succesively dissected, showing the bulbil leaves to be the result of a direct prolificative metamorphosis of the glumellae; the palea with the sexual organs it supports gradually atrophy.

a spikelet intact; *b* glumae (G_{1-2}) removed; *c* glumella (g_1) removed, exposing the palea (p_1) and three sterile stamens (st); *d* first leaf (g_2) of bulbil removed, exposing a palea (p_2) with three sterile stamens and being thus the transformed second glumella; *e* second leaf (g_3) of bulbil removed together with p_1 and corresponding st, uncovering a minute palea rudiment (p_3) and being thus the transformed third glumella. (Cf. Fig. 33). Spec. from Norway. Magn. $^{7,5}/_{1}$.

As regards his interpretation of the viviparous forms, on the other hand, opinions may differ. We know nearly nothing about general causes of viviparity, and, strangely enough, many botanists appear to have very obscure ideas as to the anatomy of viviparous spikelets. As I shall demonstrate below, this is clearly apparent from the following quotation from Lindman (1923 p. 113), where he says in footnote 2: "The daughter-plant or bulbil is, thus, built up of the top of the rachis, which undergoes a metamorphosis; the bulbil is not a transformation of a flower, nor are the young blades transformed floral organs; all the flowers are lateral or axillary, but the bulbil terminal."

If, however, we dissect under an ordinar good binocular dissecting microscope a viviparous spikelet of, for instance, a *Poa alpigena* var. *vivipara* — after softening it by holding it in vapour — the following will be observed (Fig. 41): (*a*) at the base both glumae of normal appearance are present (G_{1-2}); on removing these (*b*) we come to the lowest normal or ± distinctly changed glumella (g_1); if this be removed (*c*) we find a palea (p_1) of normal appearance with ± rudimentary or sometimes functional anthers (st) and ovary. On the opposite side of this palea we have now, as a rule, the basal parts of the outer first leaf (g_2) in the bulbil (see *b* and *c*). If we remove this leaf carefully, we find inside a ± reduced but otherwise normal looking palea (p_2), as on the other side, but with more distinctly atrophic and small anthers — which, in other words, proves that the inferior large blade of the bulbil is in this case formed by the direct transformation of glumella



c *d* *e*

no. 2 counting from below. If we thereupon (*e*) succeed in removing the next blade (g_8) of the bulbil we shall observe exactly the same thing, viz., that in its axil it has some extremely rudimentary stamens within a shrunken little palea (p_8). Further than this we shall not as a rule succeed in dissection.

In other words, the visible parts of the bulbil are the result of a vegetative metamorphosis of the upper glumellae in particular. There is wide variation as to how far down in the spikelet viviparity is distinct, and also in respect of the degree of atrophy in the anthers and palea. In many forms of *Festuca vivipara,* especially of the smooth arctic form, there is often no trace of sexual organs, but nevertheless it cannot be doubted that the bulbil also in this instance, and presumably quite generally in *Gramineae*, is built on the said principle. There are all transitions from fully functional stamens to none at all.

In the transformation of the glumellae to bulbil blades the venation becomes more prominent, the colour becomes greener, and the whole blade thicker. The complete homology described above in connection with *Deschampsia alpina* (p. 65, 66) is found again here, although not in the same degree, for the glumellae in *Poa* are not so differentiated. The greater part of the glumella here becomes the leaf sheath while the leaf blade and the ligule are differentiated from the extreme upper part.

Yet another very interesting feature is seen during the viviparous transformation of the spikelet to the small grass plant, and that is in the palea. In addition to the wellknown anatomical and ontogenetic

singularities e. g. its complex nature as the result of a coalescence of two floral leaves, which characterize the palea more than the other bracts in the grass flower, it is distinguished also by its position, i. e. with its back placed to the spikelet axis (cf. Fig. 33). A corresponding position is not found in any blade in the young grass plant, and we then find the noteworthy circumstance that the palea does not take part in the vegetative proliferation of the other floral bracts, but remains unchanged by the viviparous process along with the sexual organs it supports, and it also dries away with these organs during the further development.

There are, on the whole, so many distinctive features in the palea that I consider it objectionable not to give it a name of its own (cf. also Hackel 1882 p. 39, 40). The terminology generally used, viz. upper and lower pale, and so forth, is quite unanatomical and therefore very cumbersome; gluma, glumella, and palea (see p. 64, 65) are better, but are unfortunately not commonly used.

In a single instance I have seen the palea growing out and turning green between the equally metamorphosed glumellae. It is conceivable that this might subsequently have been the starting point of an intravaginal shoot. It does not seem very likely, however, that a single and comparatively so specialized blade should be capable of developing into a full shoot.

The roots of the bulbil as well as the lateral shoots are formed from the axis; the roots can sometimes be seen, already before the bulbils have fallen off, to have pierced the basal sheaths. Regarding the interesting microscopical conditions in the viviparous spikelet, e. g. the constant shortening of the rachilla, I may refer to the investigations by Exo (1916) on *Poa alpina* with its var. *vivipara*.

In the matter of the systematization of the viviparous *Poae*, Lindman has tried hard to urge the view that these must generally be regarded as hybrids, i. e. in the sense of species hybrids, seeing that they are frequently morphologically intermediate, particularly in their floral, but also in their vegetative parts, and furthermore are sterile — a theory especially put forward by Ernst 1918 (cf. below). Viviparity should, in other words, be the result of hybrid sterility, or, as Lindman expresses it (1923 p. 112): "I therefore think it inevitable, on meeting with viviparous Arctic *Poae*, to regard them as cross-breeds; the classification, then, must be an attempt to determine their parents, i. e., the components of the hybrid combination." In a footnote he admits the possibility that species such as *Poa alpina*, *Poa laxa*, *Poa arctica*, *Deschampsia alpina*, *Poa bulbosa*, and *Dactylis glomerata* may, however, be believed to occur viviparously without being hybrids. He says: "But an examination may prove such to be sterile from some external damage, e. g., parasitical animals."

In Holmberg's Flora (1926) Lindman has, however, somewhat inconsistently introduced the view that viviparous forms are hybrids.

As far as I can understand, there is no ground for considering viviparity, as a matter of course, as an indicator of hybridity in general. Viviparity is a rather common property in grasses and, to some extent, also in other families, e. g. in *Cyperaceae*. These viviparous forms occur perhaps in most instances as unmistakeably parallel forms of the flowering species, and then frequently in cases where there does not exist any reason for presuming that viviparity is species hybridogenous, e. g., as is the case with most of the above-mentioned species cited by Lindman. His supposition that viviparity in these species may in each individual case be produced by parasitical animals has no foundation whatever. Parasitical animals are not known to be the cause of such small virulent, regular, and uniform formations as bulbils, which furthermore serve as spreading units! In contrast to viviparity the injury done by such parasites is characterized by its local occurrence on the plant.

For the rest, it does not fit in naturally with the conception of viviparity as being species hybridogenous that in the cases which are of interest to us it occurs to the greatest extent just in places where the one "parent" or both of them hardly ever occur otherwise than viviparously and sterile. It would seem more reasonable that the viviparous forms should in such event be more common and abundant, e. g., in the mountain tracts of Scandinavia, where the parents flower side by side. As to the question of the cause of viviparity, we cannot in any way draw general conclusions from the facts available — as to whether it is produced by sterility for some reason or other, whether it is a spontaneous (loss?) mutation or what not; and for these reasons the phenomenon of viviparity must be entirely excluded from the discussion as to whether these arctic *Poae* should be regarded as species hybrids.

Since, in particular, Ernst (1918 p. 500—512) in his great collective work "Bastardierung als Ursache der Apogamie im Pflanzenreich", brought forward this somewhat teleologically coloured question to the effect that the cause of viviparity might lie in a primary sterility brought about by hybridizing, possibly between species — and it is the latter point which interests us here — geneticists have made great efforts to throw light on this question. It will be seen that the problem is in a way of a twofold nature. In the first place we must try to determine the causes of the ± pronounced sterility which always appears to accompany viviparity; and, secondly, if this sterility is in direct causal relation to viviparity. Recent research has, however, not yet been able to give any direct answer to these fundamental questions, but it has collected a series of valuable observations which on other points have increased, and in some instances considerably, our knowledge of the nature of viviparity. So as not to go too far beyond the scope of this paper, I shall here but briefly refer to the most important of the scanty data which in some measure may serve to elucidate the question of

the justification of a hybrid nomenclature ad modum Lindman. Jenkin (1922 p. 418) points out that he has induced viviparity accidentally in *Poa trivialis* and in *Deschampsia caespitosa* by growing them under abnormal (greenhouse) conditions, and states (p. 431) that "viviparity in *Festuca ovina* is to some extent at least hereditary, and that it is inherited not only through the vegetative buds developed in the fully viviparous inflorescences, *but also through such "seeds" as the plant may be able to produce*". Tincker (1925 p. 729) succeeded in inducing viviparity in a *Dactylis glomerata* plant by cultivating it under abnormal light conditions. Turesson (1926 p. 203) summarizes the facts relating to the nature of viviparity in the following way: Viviparity includes phenomena of different kinds and may be:

"A. *modificatorily* induced as in *Phleum pratense*, *Dactylis glomerata* and perhaps in most grasses, or
B. *hereditarily* in nature. The grasses of this group may be further divided according to the ecological significance of the vivipary in
   a. species, where the genotype factors involved in bringing about vivipary are of no significance ecologically. So apparently in *Zea mays*, and
   b. species, where the genotype factors involved in bringing about vivipary have led to the formation of successful habitat races. So in species belonging to the genera *Aira*, *Festuca* and *Poa*."

With regard to the causes of viviparity he concludes by saying that the question will be postponed until more data have been accumulated (l. c., p. 205). Stählin (1929 p. 350) has found the chromosome numbers equal in respect of *Poa alpina* and its viviparous parallel form, and also for *Deschampsia flexuosa* and its viviparous parallel form, and concludes with respect to the causes of viviparity: "Die Möglichkeit, dass die bulbillentragenden Formen trotzdem Bastarde, eben von zwei Eltern mit gleich viel Chromosomen, sind, bleibt, ... immer noch bestehen." Turesson (1930 p. 181, 182) discusses the causes of viviparity, without, however, being able to find that the facts available speak either for or against Ernst's working theory. In 1931 the same writer gives further particulars respecting *Festuca vivipara's* interesting chromosome conditions, but does not take any standpoint on the question that interests us here. Müntzing (1933 p. 131—154) stresses the very remarkable circumstance in this connection that at least three of the Swedish biotypes of the common normal *Poa alpina* L. and four of the common normal *Poa pratensis* bio-types have apomictic seed formation, and with regard to the cause of this he says (l. c., p. 149): "This old problem — the origin of apomixis — must be raised once more on account of the findings reported in the present paper . . . . ." He asks (l. c., p. 150) whether it is not possible that also a similar apomictic seed formation might be prevalent within the non-viviparous common *Festuca ovina*.

It will be clearly evident from the above quotations from the most recent works of the geneticists in this field, that the data which genetics has arrived at does not, at all events, speak for viviparous grasses being species hybrids, or for the frequently or ever accompanying ± pronounced sterility being due to species hybridization; it is even established according to Müntzing's investigations that at all events a large number of our *Poa alpina* and *pratensis* forms, and assuredly several others, have lost their sexuality and are propagated by agamospermy, and consequently do not hybridize at all. Nor can their form of apogamy be caused by species hybridization, for that would lead to the taxonomically untenable consequence that an ordinary good species like *Poa alpina* would be a species hybrid and would have to be designated as such. Furthermore, as it seems to me to lie close to regard just these apomictic plants as the origin of the viviparous parallel forms on account of their more or less pronounced tendency towards sterility, the species hybridization as the general cause of vivipary seems to me to be a weak hypothesis to say the least. It also seems to me that one should avoid species-hybrid terminology as the principle of nomenclature for viviparous grasses. In the first place, such a nomenclature has not yet been supported by genetic research; secondly, it is at all events floristically altogether erroneous in every instance of induced viviparity (cf. above); and thirdly, it offers no advantage whatever over a neutral variety nomenclature, e. g., as suggested in this paper. No terminology can of course ever eliminate the difficulties of drawing lines in continuous material. Finally, we have, by avoiding the use of Lindman's terminology, the satisfaction of not saying more than we positively know.

The non-viviparous *Poa alpina, Poa alpigena* and *Poa rigens* are in themselves widely varying species. *Poa alpina* varies considerably in regard to its otherwise so characteristic base, which by a pronounced tuft formation may be very much split up by intravaginal shoots. As a rule, however, it seems to be a comparatively easy matter to distinguish it from the other two, in the material I have seen. Between *Poa rigens* and *Poa alpigena*, on the other hand, I find that there is every transition and all of them fully fertile. In S. E. Greenland I collected in 1932, in company with may friend, Dr. J. Devold, an abundance of *Poa rigens* and *Poa alpigena* (viviparous forms were not found), which included not a few forms that, as far as I can judge, are entirely intermediate.

Taking this view, we are not surprised that the viviparous parallel forms, of this form series which is already continuous, will, too, be continuous; and they need not therefore be the sterile progeny of a typical *Poa rigens* and a typical *Poa alpigena*.

They may just as well be regarded as viviparous forms analogous with an intermediate non-viviparous form.

If we do not go further than this, we can build on the complete analogy otherwise found in viviparous parallel forms, e. g. in *Dactylis* and others.

It cannot be denied — as Lindman maintains — that the taxonomical difficulties within the viviparous series are often substantially greater than in the non-viviparous one. It is not inconceivable that the loss of sexual organs may cause the type to be less distinct, and that in the same way the whole of the vegetative readjustment which has taken place in the viviparous plant can in itself bring about an obtusion of the characters of the species. Or, what is perhaps more probable and effective, the wide variability (cf. var. *colpodea*, p. 89) has arisen as a result of the clone-property of the viviparous forms, whereby the extent of the variation of the whole form series is, as usual, materially greater than where there is ordinary cross pollination.

As has been pointed out, hybrid nomenclature still lacks in its essential points a firm foundation, and projects a vast distance beyond the limits of that recognition which exact research has so far attained in this field. I shall choose the more cautious standpoint, in all cases where viviparity is the only thing that separates two forms, of designating the viviparous form as var. *vivipara* of the non-viviparous form.

It is on the whole desirable that the nomenclature of viviparous forms should be standardized in some way or other in common taxonomical terms; for now all designations are being used, from species and down to forms for the viviparous parallel forms.

81. *Poa alpigena* (E. Fries) Lindm.

Sorgfj. Heclahamna (Wulff). *Lomfj.* Dvergbreen (S), (Lomfjorden (Malmgren)).

Malmgren 1862 p. 252, sub nom. *Poa pratensis* L. var. *alpigena* Fr.; Wulff 1902 p. 102, sub nom. *Poa pratensis* L.

Non-viviparous *Poa alpigena* seems to be very rare within the investigated area, where so far only specimens with non-flowering spikelets were found. However, no indication of viviparity may be traced in the floral parts. Our specimens were growing in great numbers on the border of a *Stercorarius* restingplace and attain a maximum height of 31 cm.

To judge from literature, *Poa alpigena* does not seem to be known any farther north than the localities given above.

82. *Poa alpigena* (E. Fries) Lindm. var. *vivipara* (Malmgr.), nov. comb.

Fig. 42_{III}.

Poa flexuosa Wahlenb. var. *vivipara* Malmgr., 1862 p. 253, p. p.; *Poa stricta* Lindeb. auctt., p. p.; *Poa herjedalica* Smith, 1920 p. 159, p. p.; *Poa alpigena* × *arctica* Lindm., 1923 p. 122, p. p.; *Poa alpina* × *arctica* Lindm., 1923 p. 123, p. p.

[1] Malmgrens record (1862 p. 254) of *Poa stricta* Lindeb. from Brandywinebay refers most probably to *Poa alpigena* var. *colpodea*.

Murchisonfj. Raudstupet (S). *Hinlopenstr.* Rundhaugen (S). *Lomfj.* Dvergbreen (S), Lomfjordbotnen (S), (Lomfjorden (cf. Nathorst 1883 p. 46)).

Seems to be very rare in North-East Land, where scarsely anything but var. *colpodea* was found. Every intermediate between *Poa alpigena* var. *vivipara* and *Poa rigens* var. *vivipara* is found, just as is the case also between the non-viviparous *Poa alpigena* and *Poa rigens*, and under the heading *Poa alpigena* var. *vivipara* those specimens are classified which, disregarding the vivipary, are closest allied to *Poa alpigena*.

As far as I have been able to ascertain from literature, *Poa alpigena* var. *vivipara* has not been recorded any further north than Raudstupet in Murchisonfjorden.

83. *Poa alpigena* (E. Fries) Lindm. var. *colpodea* (Th. Fries) nov. comb.

Fig. 42_{IV} and Pl. V.

Poa stricta Lindeb. subsp. *colpodea* Th. Fries (Fries 1869 p. 138).

Brennevinsfj. Depotodden (S), Kontaktberget (S), 5 km SE of Cape Hansteen (S), 2,5 km SE of Cape Hansteen (S). *Lady Franklinfj.* Shore plain west of Franklinfjellet (S), Inner west side (S), Persberget (S). *Murchisonfj.* Raudstupet (S), Floraberget (S), Wargentindalen (S), Snaddvika, north side (S), Snaddvika, south side (S), Triodalen (S), Krykjeslukta (S), Sveanor (S), (Murchisonfjorden (Fries)). *Ids. in Murchisonfj.* S. Russøya (S). *Hinlopenstr.* Rundhaugen (S), Ismåsefjellet (S), Torellneset (S), (Hinlopenstredet (Fries)). *Sorgfj.* Inner west side (S). *Lomfj.* Faxedalen (S), Lomfjordbotnen (S), (Lomfjorden (Fries)).

Fries 1869 p. 138, sub nom. *Poa stricta* Lindeb. subsp. *colpodea* Fr.; Nathorst 1883 p. 30, sub nom. *Poa flexuosa* Wg. var. *colpodea* Th. Fr.

This extreme-arctic and morphologically very distinctive form is along with *Poa rigens*, by far the most common *Poa* in North-East Land.

As previously maintained by Th. Fries (1869 p. 138), it is distinguished by its contracted, very dense-flowered, and short-branched panicle. The spikelets are very small and particularly numerous (Fig. 42_{IV}). The greater part of my material has preponderatingly green spikelets, but there are dark ones too. The grass is always sterile and in the autumn is, as a rule, very abundantly viviparous. The reduction of the sexual organs and the palea is complete in typical cases. In the autumn the spike assumes a very bushy appearance, as do also the withered specimens from the previous year, by reason of the very numerous bulbils which frequently remain on the plant.

The culm and the usually comparatively broad blades are usually green. The plant is further characterized by its long subterranean runners. It occurs in wet, clayey places, not infrequently in company with *Dupontia*.

The grass is so different from anything I have seen of Scandinavian and other forms of Lindman's so-called *Poa alpigena* × *rigens* (*Poa herjedalica* Smith) that I was long in doubt in Svalbard as to

Fig. 42.

I. *Dupontia Fisheri* R. Br. var. *psilosantha* (Rupr.) Schol. Specimen from Advent Bay, 23/8 1931.

II. *Dupontia Fisheri* R. Br. Specimen from Sorgfjorden 17/8 1931.

III. *Poa alpigena* (E. Fries) Lindm. var. *vivipara* (Malmgr.). Specimen from Dvergbreen 14/8 1931.

IV. *Poa alpigena* (E. Fries) Lindm. var. *colpodea* (Th. Fries) Schol. Type specimen from Liefde Bay 2/9 1868, det. Th. Fries *Poa colpodea* Th. Fr.

Size 4/5, details 16/5.

what plant it could possibly be. That Lindman has so totally neglected this distinctive form must be primarily due to the fact that he has not personally seen it in nature, and further that the material — judging from earlier locations — has been very limited. At all events, I consider that it well deserves at least a variety name.

The transition between this form and the viviparous form series between *Poa rigens* and *Poa alpigena* is, however, not a sharp one, which fact greatly complicates the question of nomenclature. There exist forms of this var. *colpodea* which, on account of the hairiness of the glumellae, the colour, and so forth, might with nearly just as much justification be classed as a var. *colpodea* of a viviparous *Poa rigens*. In other words, it seems possible that the whole series between *Poa rigens* var. *vivipara* and *Poa alpigena* var. *vivipara* can at every stage produce a var. *colpodea*, all of which may closely resemble one another, probably by reason of a convergence produced by the very extreme environment.

On the basis of its vague morphological limitations and signs of a polyphyletic origin I hesitate in giving it the rank of a species.

In its typical development it seems to approach closest to the viviparous *Poa alpigena*, for which reason I class my specimens as a variety under this — a terminology which, I may add, is not altogether satisfactory in view of what has been said above.

A point which seems to indicate that the *colpodea* may in part be produced by external influence, especially to be mentioned frost, is that it not rarely shows pathological conditions. Thus, the chlorophyll distribution in the blades and spikelets may be uneven and patchy; further, the spikelets may in cases be greatly reduced, so that it is frequently composed only of two small claw-shaped glumae.

In a number of instances, however, it has not these defects, and is able to produce a large quantity of bulbils. It should be noted that similar *colpodea* tendencies, e. g., in *Poa alpina*, are very rare, and do not appear to be combined with the ability to produce bulbils at the same time.

A contributory factor in respect of the frequently abnormal spikelets may be the spreading by stolons, for it is conceivable that the latter may spread the plant to places that do not offer conditions for the development of a normal inflorescence. This impresses itself strongly upon us when we see how very poor is the inflorescence of such plants as have spread, for instance, into wet mosses, whereas the rest of the colony may be quite normal. This is, it may be added, in full agreement with all the distinctly pathological forms of *Carex rigida*, which are so common, for instance in the bogs of S. E. Greenland, and which likewise partly may be explained in the same way (cf. Devold and Scholander 1933 p. 125).

Judging from the arctic material available in Herb. Bot. Mus. Oslo, the var. *colpodea* seems to be very rare elsewhere in the Arctic. We have distinct forms only from Spitsbergen and particularly from the limestone tracts of North-East Land, which it is conceivable will subsequently play a part in the production of this form. Ostenfeld and Lundager (1910 p. 14) mention *Poa pratensis* L. f. *colpodea* (Th. Fries) Gelert from Germanialand in North East Greenland.

84. *Poa alpina* L. var. *vivipara* L. Fig. 43 and Pl. V.

Murchisonfj. Raudstupet (S). *Hinlopenstr.* Ismåsefjellet (S). *Sorgfj.* Inner west side (S). *Lomfj.* Faxedalen (S), Faxefjellet 340 m (S), Lomfjordbotnen (S), Cape Fanshawe (Fries), (Lomfjorden (Fries)).

Fries 1869 p. 138, sub nom. *Poa alpina* L.

This plant has not previously been reported from North-East Land, where it appears to be very rare, and was only found under the bird-cliff Raudstupet. No non-viviparous, flowering *Poa alpina* were seen.

One of the most distinctive marks of *Poa alpina* as well as of *Poa alpina* var. *vivipara* is its characteristic thick, cylindrical, basal parts of withered blade sheaths. As pointed out on many occasions by earlier writers, this basal part may, particularly in bird-cliffs, be ± indistinct on account of its being much split up by a ± strong tuft formation. This splitting up of the basal part in a number of palissades standing closely together but discernible all the way down (Lindman 1923 p. 121), together with the viviparity, is construed by Lindman as being the result of a hybrid interference of *Poa alpigena* or *rigens*.

This marked variability in the basal parts is, however, by no means peculiar to *Poa alpina* var. *vivipara*, but is found also in the flowering non-viviparous main form (for further particulars cf. e. g. Hegi: Illustr. Fl. etc. V_1, p. 310). I therefore find that it is not necessary to assume a hybrid interference as the cause, and especially so because we are not sufficiently acquainted with viviparity to employ it as such in favour of the hybrid hypothesis in a case like this.

In Lynge's material of 1921 from Novaya Zemlya Lindman has determined a number of non-viviparous, but certainly sometimes partially sterile *Poa rigens* as the hybrid with *Poa alpina*, but I find it very difficult to understand how these determinations can be supported. Sterility counts for little in this discussion as far as the Arctic is concerned. If we bear in mind the wide difference there is between exact, experimental genetic research and our herbarium hybrid determinations, it appears to me that we should, where possible, resort to other "explanations" in respect of forms that vary beyond the limits which we have — ourselves — defined as being characteristic of the species in question.

As already pointed out, *Poa alpina* varies greatly in size, tufting, colour, and so forth. But if the basal sheats, wether split or not, and the intravaginal shoots are considered to be the most valuable diagnostic characters, there should be very few complete arctic specimen left where a safe determination is not possible. Between all these *Poa alpina* forms there is, as far as I can see, a continuous morphological series.

Fig. 43. *Poa alpina* L. var. *vivipara* L. Tuft from the foregoing year just uncovered by the melting ice (visible above to the left) and with the numerous hibernated but viable bulbils rooting all around it. Bird-cliff Raudstupet 24/7 1931.

As Asplund (1918, p. 15) has already pointed out, a number of the Spitsbergen forms, as far as our present knowledge goes, are morphologically identical with forms of *Poa jemtlandica* (Almqu.) Richt, which are usually interpreted in Scandinavia as a hybrid with *Poa laxa* Haenke. It is just possible that these viviparous forms in Spitsbergen are viviparous forms of *Poa laxa*, but as this is still an open question and we are also ignorant of the true genetic nature of *Poa jemtlandica* — and further, having regard to the fact that we are dealing with a morphological continuous series from an evident *Poa alpina* var. *vivipara* to these eventual viviparous *Poa laxa* — then I choose as a matter of caution to refer them to the variation series of *Poa alpina* var *vivipara*, and so much the more as *Poa laxa* Haenke has not yet with certainty been collected in the Arctic.

Poa alpina var *vivipara* has its most northerly known limit at Raudstupet in Murchisonfjorden, where it grew in large quantites below the bird-cliff.

85. *Poa rigens* Hartm. Pl. V.

(*Northern Islands*. Sjuøyane (Nordenskiöld)). *Brennevinsfj*. Depotodden (Malmgren, S), Zeipelbukta (S), Kontaktberget (S), 5 km SE of Cape Hansteen (S). *Lady Franklinfj*. Franklinfjellet, west side (S), Shore plain west of Franklinfjellet (S), Gerardodden (S), Inner west side (S), Westmanbukta (S). *Murchisonfj*. Floraberget (S), Celsiusfjellet (S), Snaddvika, north side (S), Triodalen (S), Sveanor (S), (Murchisonfjorden (Wulff)). *Ids. in Murchisonfj*. Oskarøya (S), S. Russøya (S). *Hinlopenstr*. Augusti Bay (Malmgren), Ismåsefjellet (S), Torellneset (S). *Sorgfj* Heclahamna (Parry), Inner west side (S), *Lomfj*. Faxedalen (S), Dvergbreen (S), Lomfjordbotnen (S).

Hooker 1828 p. 213, sub nom. *Poa arctica* R. Br.; Malmgren 1862 p. 253 and 267, sub nom. *Poa cenisea* All.; Wulff 1902 p. 102, sub nom. *Poa cenisea* All.

Fairly common in dry slopes within the whole investigated area. It is a very marked type, being, however, as far as I can see, especially in more southern latitudes, connected with *Poa alpigena* through transitory forms. A rather densely tuft formation is sometimes seen.

Holmberg and Lindman (1926 p. 186—188) have shown that the oldest valid name for this plant is *Poa rigens* Hartm. and not the more commonly used name in arctic literature *Poa arctica* R. Br.

The northern limit is Low Point 83° 6′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 231).

86. *Poa rigens* Hartm. var. *vivipara* (Malmgr.), nov. comb.

Poa flexuosa Wahlenb. var. *vivipara* Malmgr., 1862 p. 253, p. p.; *Poa stricta* Lindeb. auctt., p. p.; *Poa herjedalica* Smith, 1920 p. 159, p. p.; *Poa alpigena* × *arctica* Lindm., 1923 p. 122, p. p.

Murchisonfj. Floraberget 200 m (S). *Sorgfj.* Heclahamna (Parry). *Lomfj.* Dvergbreen (S), Lomfjordbotnen (S).

Hooker 1828 p. 213, sub nom. *Poa arctica* R. Br., viviparous.

Seems to be very rare in North-East Land, where only some few and not quite definite specimens were found. More or less typical specimens standing nearest to *Poa rigens* in the morphologically continuous series of viviparous forms between this one and *Poa alpigena* were not rare in Lomfjorden. Viviparous *Poa rigens* were found in abundance on the shore plain at Longyearbyen, Adventfjorden, many of the forms growing here are of considerable size, which might possibly indicate their being highly polyploidous.

It is not possible from literature to give the exact northern limit for this form. It is probably Floraberget.

87. *Puccinellia angustata* (R. Br.) Rand. et Redf.

Brennevinsfj. Depotodden (Fries). *Lady Franklinfj.* Basisøya (S). *Murchisonfj.* Triodalen (S). *Ids. in Murchisonfj.* Oskarøya (S), S. Russøya (S). *Hinlopenstr.* Gyldénøyane (Elton). *Lomfj.* Faxedalen (S), Cape Fanshawe (Malmgren), (Lomfjorden (Malmgren, Fries)).

Malmgren 1862 p. 254, sub nom. *Glyceria angustata* (R. Br.) Mgr.; Fries 1869 p. 139, sub nom. *Glyceria angustata* (R. Br.) Fr.; Andersson and Hesselman 1900 p. 72, sub nom. *Glyceria angustata* (R. Br.) Fr.; Summerhayes and Elton 1928 p. 207, sub nom. *Glyceria angustata* (R. Br.) Fr.

Apparently rare in North-East Land, where it seems to develop very late, as scarcely any but withered tufts from the foregoing year were found. On the drift-sand fields at Faxedalen it was seen in great quantities together with *Puccinellia Vahliana* and others. The flat tufts were here almost quite buried in the sand, mostly only some few panicles of the strongly radiant geniculate straws being visible. In the flat and large valley of Faxedalen a luxuriant growth of this species bordered a little plateau of earth which was the haunt of geese. The

erect culms attained on this manured ground a height of between 30 and 40 cm. It seems to me that the systematical position of *Puccinellia angustata* is not clear as compared especially with forms of *P. retroflexa* Holmberg, which, for instance, in East Greenland and probably also in northernmost Scandinavia seem to pass inperceptibly into *P. angustata*. *Puccinellia angustata* has its northernmost known limit at Frederic E. Hyde Fjord 83° 15′ (I. P. Koch) in Peary Land on the north coast of Greenland (Ostenfeld and Lundager 1910 p. 14).

88. *Puccinellia phryganodes* (Trin.) Scribn. et Merr. Pl. V.

Brennevinsfj. Depotodden (Malmgren, Fries, S). *Ids. in Murchisonfj.* S. Russøya (S). *Hinlopenstr.* Augusti Bay (Malmgren), (Waygatøyane (Malmgren)). *Sorgfj.* Heclahamna (Wulff), Inner west side (S). *Lomfj.* Lomfjordbotnen (S).

Malmgren 1862 p. 255, sub nom. *Catabrosa vilfoidea* Anders.; Malmgren 1867 p. 259, sub nom. *Catabrosa vilfoidea* Anders.; Fries 1869 p. 139, sub nom. *Glyceria vilfoidea* (Anders.) Th. Fr.; Wulff 1902 p. 102, sub nom. *Glyceria vilfoidea* (Anders.) Th. Fr.

Seems to be very rare within the area investigated in North-East Land. It was in all the mentioned localities found only in sterile condition without any panicle-bearing culms developed.

Northern limit is S. W. Coast of Hendrik Island 82° 3′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 232).

89. *Puccinellia vacillans* (Th. Fries) nov. comb.

Fig. 44, 47, 48, 49 and Pl. V.

Catabrosa concinna subsp. *vacillans* Th. Fries (Fries 1869 p. 142); *Catabrosa concinna* Th. Fries (Figure 89 in Flora Arctica, Ostenfeld 1902 p. 117); *Catabrosa vacillans* (Th. Fries) Aspl. (Asplund 1918 p. 11); *Phippsia algida* × *Puccinellia angustata* (Holmberg 1924 p. 133); *Phippsia concinna* × *Puccinellia angustata* (Holmberg 1924 p. 133).

Lady Franklinfj. Shore plain west of Franklinfjellet (S). *Murchisonfj.* Triodalen (S), (Murchisonfjorden (Malmgren) (Herb. Bot. Mus. Oslo)). *Ids. in Murchisonfj.* S. Russøya (S). *Hinlopenstr.* Wahlenbergfjorden (= Augusti Bay) (Malmgren) (Herb. Bot. Mus. Oslo)). *Lomfj.* Faxedalen (S), Dvergbreen (S), Lomfjordbotnen (S).

Since Th. Fries (1869 p. 142) recognized this plant — which can hardly be rare in Spitsbergen — as a morphological unit, it has either been neglected by later authors or Fries's old determinations have in other instances been transcribed or reduced to a variety under *Catabrosa concinna*. Fries, to judge from erroneous determinations in the herbarium, has not himself been quite certain as to the limitations of his subspecies. He states that he is in doubt (cf. the name *vacillans*) as to the proper significance of this form, and he expresses the supposition that it might

perhaps be thought to be a hybrid between *Catabrosa concinna* or *algida* and *Puccinellia Vahliana*. Nevertheless, he classes it in relation to *Catabrosa concinna* as a subspecies.

Asplund (1918 p. 11), who is the first after Fries to see and recognize this very noteworthy and distinct morphological unit, isolates it, and rightly so, as an independent species on the basis of the morphological distinguishing marks pointed out already by Fries viz. "besonders die vor und nach der Anthese zusammengezogene Rispe, die verhältnismässig grossen Hüllspelzen und die meistens zweiblütigen Ährchen" (Asplund 1918 p. 11). He refers it then (1918) quite naturally to the genus *Catabrosa*, along with *Catabrosa algida* and *concinna*. As, however, since that time the one-flowered *algida* and *concinna* (Holmberg 1924 p. 126—129) have been excluded from the genus *Catabrosa*, which is characterized, amongst other things, by its two-flowered spikelets, the question at once arises as to the correct placing of *vacillans* in the system.[1]

Fig. 44. *Puccinellia vacillans* (Th. Fries) Schol. Typical two flowered spikelets. Spec. from Triodalen, 7/8 1931. Magn. 17,5/1.

Before discussing this I consider, however, that it may be of some interest to deal more closely with the morphology of this good and comparatively little known systematic unit by means of some illustrations and a description of the principal differential diagnoses in relation to the most closely related species.

The *vacillans* is, in the first place, as distinct from *Phippsia algida* and *Phippsia concinna*, distincly two-flowered, or rarely — which is practically the same thing — one-flowered with rudiment. Three-flowered and even four-flowered spikelets are rarely seen. The glumae are large and persisting. The glumellae are large (1,9—2,3) mm (in *Phippsia algida* and *concinna* 1,6—1,9) ± distinctly 3(5) veined, un-

[1] As also observed by Holmberg (1924 p. 134), *vacillans* has incidentally brought in much confusion in the discussion regarding the justification of maintaining *Phippsia* and *Catabrosa* as separate genera and particularly in respect of the placing of *concinna*. In Flora Arctica (Ostenfeld 1902 p. 116) Gelert has namely had a *vacillans* specimen from Spitsbergen (Tempelbay: 22/7 1882 A. G. Nathorst) Herb. Copenhagen, as the basis of his *concinna* diagnosis and illustration (Fig. 89 p. 117 idem), and concludes therefrom that *concinna* is two-flowered and therefore a *Catabrosa* in contrast to the one-flowered *Phippsia algida*.

keeled, and strongly hairy, particularly on the veins below, and further, most often lacerated on the edge approximately like those in a *Puccinellia Vahliana*. The palea is narrow, membranaceous, and dorsi-concave, with the margins sharply incurved ventrally, corresponding to the two veins which are very hairy below (*Festuca* type). The lodiculae are narrow and pointed. The anthers are three in number, 0,75 (0,65—0,95) mm long, sterile. Ovary atrophic. Panicle branches many (abt. 5—8) from each node, and of widely varying length and thickness (as in *Phippsia algida* and *concinna*). During the anthesis the branches are contracted or ± spreading, rarely even bent downward. Anteriorly and posteriorly to the anthesis the panicle is contracted. The tufts with the slightly radiating straws and comparatively narrow and straight leaves are usually easy to split up as a result of the usually long and straight, separate basal parts; by these characteristics and by its frequently pronounced clue of equally thick, undulate roots they resemble those of *Puccinellia Vahliana* (cf. Fig. 50). The leaves are most often of the same characteristic, somewhat yellowish-green colour as in *Phippsia algida* and *concinna* and *Puccinellia Vahliana*, but may also like these not seldom partly have a reddish colour. Ligule 2,0 (1,1—2,7) mm. It grows in clayey and somewhat wet localities, and seems like *Phippsia concinna* and *Puccinellia Vahliana*, and in contrast with *Phippsia algida*, not to be nitro- or coprophilous.

In contrast to the *vacillans*, *Phippsia algida* and *concinna* are decidedly one-flowered. The second rudiment is very rare, and still rarer are two fully developed flowers in the spikelet, but they do occur (Fig. 45, 46). The glumae are small, often deciduous, the lowest one often rudimentary or missing. In either these species both the glumella and palea are dorsi-convex, with a varying degree of hairiness and are often keeled and ending in a distinct point, eventually with one or another lateral tooth. Lodiculae broad, toothed. Anthers (often one in *concinna*, two in *algida*) small, abt. 0,55 (0,45—0,65) mm. Abundantly fructifying; the caryopsis of either varying in size and shape according to the degree of maturity, however, with a tendency (cf. Smith 1914 p. 249, 250) of being more slender and with the greatest width below the midst in *P. concinna* and thicker, with the greatest width above the midst in *P. algida*, as seen in Fig. 45 and 46. Shape and number of panicle branches as in the *vacillans*. Their position is in *Phippsia algida* contracted; in *Phippsia concinna* during and after the anthesis they continue in a protruberant spreading and even bent down position, particularly typical of withered specimens from the foregoing year. The tufts are very dense, and difficult to split up. Leaves often broad, ligule in *P. algida* 1,4 (0,9—1,8) mm, in *P. concinna* 1,8 (1,3—2,5) mm.

Puccinellia Vahliana is distinguished from *vacillans* by its relatively much longer glumae; all parts of the flower in this plant are considerably larger and the spikelets are here (2) 3 to many-flowered and 4—5 times as long as in the foregoing. The usually adduced and uniformly thick panicle branches are very few from each node (2—4). The leaves are apt to be somewhat more rifled than in *vacillans*; otherwise they are very much alike in the vegetative parts. Particularly in respect of vegetative parts *Puccinellia angustata* (R. Br.) Rand. et Redf. is farther removed from *vacillans* than is *Puccinellia Vahliana*.

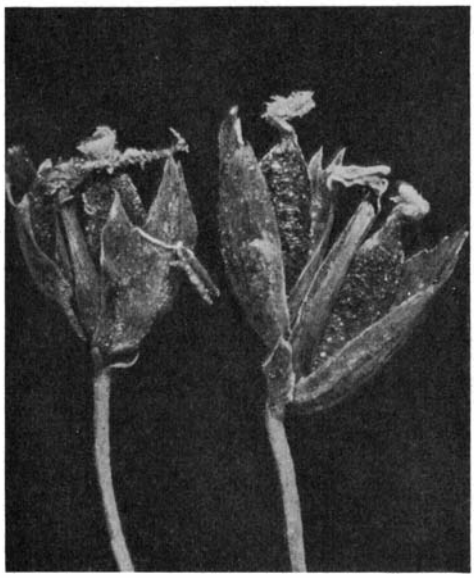


Fig. 45. *Phippsia algida* R. Br. Spikelets, each with one supernumerary flower. Spec. from Snaddvika 7/8 1931. Magn. 17,5/1.

Catabrosa aquatica P. B. on the other hand, is distinguished in both its reproductive and vegetative parts from the whole of the series formed by the preceding plants. The usually brown glumellae with their elevated veins are built up of long and narrow, smooth, nearly linear cells, being thus of quite another celltexture than the scabrous glumae which are formed by more polygonal, violet cells with an elevated margin. This marked difference is not present in any of the preceding species. The palea agrees in form mostly with the ordinary palea type in, e. g. *Festuca* or *Puccinellia*, and thus also with that of *vacillans*. From *Phippsia* (*algida* and *concinna*), *Catabrosa* is likewise distinguished by its round, point-shaped hilum, which in *Phippsia* (and *Puccinellia*) is narrow oblong (Holmberg 1924 p. 128). In addition *Catabrosa* is stoloniferous with a creeping rootstock whereas the other species are caespitose.

Since *vacillans* has been cleared out from *Phippsia concinna* there is obviously no reason to explain why the very closely related and overlapping forms *Phippsia algida* and *Phippsia concinna* should not be regarded as belonging to the same genus. The difficulty of limitation which already exists in this genus between these two species has subsequently been doubled by the introduction of yet a third "subspecies" between them viz., *Catabrosa concinna* algidiformis* H. Smith (1914 p. 250), in which case, as far as I can see, an accurate principle of classification has been left entirely out of account.

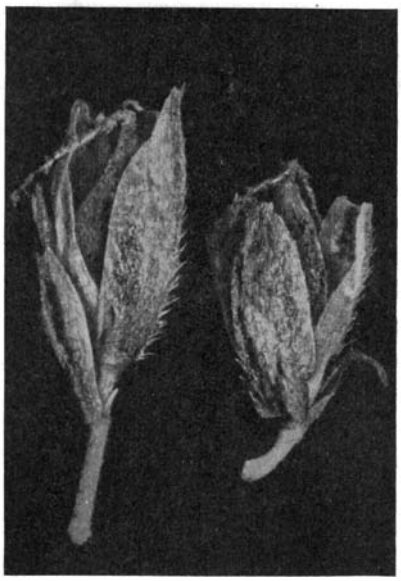


Fig. 46. *Phippsia concinna* (Th. Fries) Lindeb. Spikelets with accidental rudiment of 2nd flower. Spec. from Spitsbergen, Ny Ålesund (Schaefer). Magn. 17,5/1.

To which genus, then, is *vacillans* to be referred? We are here confronted with the difficulty that the question in this case has to be decided without knowing the character which otherwise (cf. Holmberg 1929 p. 128) is regarded as the most important diagnostic character of genetic rank, namely the hilum of the caryopsis; *vacillans* is known in sterile condition only. We shall therefore have to look for other characters, trying to place our plant — in accordance with the principle: the closest relationship by the closest similiarity — in relation to the species of the system where we find the greatest number of identical characters. The choice between the genus *Catabrosa* on one hand, with *C. aquatica* as the only representative, and the genera *Phippsia* and *Puccinellia* on the other hand, appears to me decided, as *vacillans* in all respects naturally fits in as an intermediate link between the two closely related genera *Phippsia* and *Puccinellia*. It should, therefore, be referred to one of these latter genera, *Catabrosa aquatica* being in all respects placed outside. How insignificant the genus distinction in reality is in the series *Phippsia — vacillans — Puccinellia* is clearly shown by looking at the rather common occurrence of supernumerary flowers here and there in the spikelet by *Phippsia* (Fig. 45, 46), and by the fact that single spikelets in *vacillans* on one hand may lack its second flower or it may be present as a rudiment only and in this way approaches *Phippsia*, and on the other hand that it may partly have supernumerary flowers (Fig. 47, 48) and then entirely merging with *Puccinellia*. Furthermore, as long as the possibility can not be refused that *vacillans* may be a hybrid between *Phippsia* and *Puccinellia*, probably *Puccinellia Vahliana,* — which has to be decided by future genetic studies — there is still another reason that the genus of *vacillans* be chosen from these genera. If then *Catabrosa* for these reasons is excluded as the generic name for *vacillans* the alternative left is *Phippsia* or *Puccinellia*. In order to decide this question it might be appropriate to give a synopsis of the most important facts considered in this connection.

The most important characters of *vacillans* that speak for *Phippsia* and against *Puccinellia* are the following: the small size of the flowers,

their colour, and partly their pubescence, and the inflorescence which belongs to the fascicular *Phippsia* type.

For *Puccinellia* and against *Phippsia* speak: the two well developed and relatively large, persistent glumae, the not infrequent occurrence of 5-veined glumellae, the typical *Festuca (Puccinellia)* palea, and the complete number (3) of stamens. — The 2(3—4)-flowered spikelets speak definitely against *Phippsia*, but really neither for nor against *Puccinellia*.

From this it appears that the greater part, and the systematically most important characters of the spikelet of *vacillans* can decidedly not be placed within the limits of *Phippsia* as now accepted (cf. e. g. Bentham and Hooker 1883 p. 1147, 1148; Holmberg 1926 p. 213, 214), but they are more easily placed in the related genus *Puccinellia* (cf. Holmberg 1926 p. 215), even though the macroscopic habit of the plant with its tiny flowers and fascicular inflorescence is closer to *Phippsia*. It is also always this latter genus with which the plant formerly has been confused. Another point of importance by placing *vacillans* is that in placing it in *Phippsia* the limits of this genus would have to be extended in such a way that its most important diagnostic characters (e. g. the one-flowered spikelets, the small glumae of which frequently at least one is lacking, the dorsi-convex palea, the subnumerary (1—2) anthers) would be lost, and thereby leaving the justification for maintaining *Phippsia* as a separate genus open for discussion. Furthermore, it is not a good procedure to take such an important step as changing the diagnosis of a genus as long as there is a warranted suspicion that *vacillans* in reality may be a generic hybrid.

Fig. 47. *Puccinellia vacillans* (Th. Fries) Schol. Left, spikelet with one supernumerary flower. Right, normal two-flowered spikelet. Spec. from Faxedalen, 14/8 1931. Magn. 17,5/1.

Regarding this hybrid question I am quite in agreement with Th. Fries, and particularly with Asplund, in not allowing their nomenclature to express more than just what we know, namely, that *vacillans* is a distinct morphological unit that should have a perfectly neutral name. However, from this, summarily to introduce a hybrid nomenclature, in which we, moreover, mean to be able to say of what parents the plant is the product, is a big jump; and we are departing far from the path of exact research in

introducing it, merely on the basis of our exsiccates. It should be borne in mind that the following hybrid possibilities exist at all events if the hybrid theory be correct, viz.:

Phippsia algida × *Puccinellia Vahliana*
Phippsia algida × *Puccinellia angustata*
Phippsia concinna × *Puccinellia Vahliana*
Phippsia concinna × *Puccinellia angustata*

Fig. 48. *Puccinellia vacillans* (Tn. Fries) Schol. Spikelet with one (left), and two (right) supernumerary flowers. Spec. from Triodalen, 29/7 1931. Magn. 17,5/1.

and I find it obvious that a choice based on exact principles must here be impossible, without experimental genetic research. Besides, the data on which we can support the existence of a hybrid here are no means certain. Sterility is common in the Arctic, both in grasses and other plants, and whether it is hybridogenous or not cannot be determined by a study of pressed specimens.

Judging from our not very intimate knowledge of this good, systematic unit, it is fairly common in Svalbard. In a revision of the whole of the copious arctic and Scandinavian material of *Phippsia* from the herbaries of Oslo and Copenhagen it was found — in addition to earlier locations and particularly those determined as hybrids by Holmberg in 1924 — at several new points here as well as at one place in Novaya Zemlya; but nowhere else. According to this, it would seem to be east arctic, and does not apparently follow the wide distribution of *Puccinellia Vahliana* and *angustata* and *Phippsia algida*, but possibly *Phippsia concinna's* distribution. If this proves to hold good, also after a revision of all other arctic *Phippsia* material, it would suggest, if the hybrid theory were correct, that only *P. concinna* and not the so closely related *algida* entered into the combination, which one should not exactly have expected. It may be of interest to note that *vacillans* was never found by me growing in company with *Phippsia concinna* at the same time as one of the other eventual parents, *Puccinellia Vahliana* or *angustata*. Except in Lomfjorden *vacillans* was not even found in the same locality as these (cf. Pl. V p. 146).

In addition to the list of distribution (p. 95) from North-East Land and Lomfjorden *Puccinellia vacillans* is presently known from the following places in Svalbard:

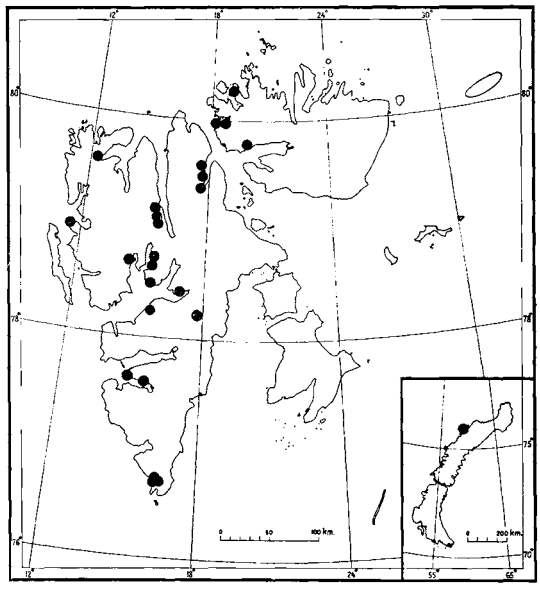


Fig. 49. Map of the known distribution of *Puccinellia vacillans* (Th. Fries) Schol.

Liefde Bay. (2/9 1868, Fries), Herb. Oslo. *Wijde Bay.* Vestfjorddalen under Angelskardet (18/8 1924, Lid); Northern end of Ove Dahlfjellet (19/8 1924, Lid); Landingsdalen (22/8 1924, Lid), Herb. Oslo. *Kings Bay.* Quade Hook (24/7 1907, H. Resvoll-Dieset), Herb. Oslo. *Nordfjorden.* (11/8 1868, Fries) (det. Holmberg 1924, *Phippsia concinna* × *Puccinellia angustata* and *Ph. algida* × *Pucc. angustata*), Herb. Copenh. et Oslo. *Dickson Bay.* Cape Esperanto (8/8 1924, Lid); Oxåsdalen (26/8 1924, Lid), Herb. Oslo. *Cape Thordsen.* (1882, Nathorst) (Holmberg 1924 p. 134, sub nom. *Ph. concinna* × *Pucc. angustata*). *Sassen Bay*, at Rabots Glacier (Asplund) (Asplund 1918 p. 11). *Tempel Bay.* (22/7 1882, Nathorst) (Holmberg 1924 p. 134, sub nom. *Ph. concinna* × *Pucc. angustata*), Herb. Copenh. *Advent Bay.* (Fries 7/8 1868), Herb. Oslo. *Bell Sound.* Van Keulen Bay (Andersson and Hesselman) (Holmberg 1924 p. 134, sub nom. *Ph. concinna* × *Pucc. angustata*); Forsbladhamna (27/7 1926, Lynge), Herb. Oslo; Bell Sound (Vahl) (Fries 1869 p. 142). *Sørkapplandet.* Fisnes (29/7 1920, Lid); Olsokflyane (31/7 1920, Lid); Bjørnbeinflyane (5/8 1920, Lid), Herb. Oslo.

In the arctic collections of Bot. Mus. in Oslo and Copenhagen *Puccinellia vacillans* is as already mentioned not found in the *Phippsia (Catabrosa)* material from Frans Josef Land, Greenland and Arctic America, nor is it present in collections from Scandinavia.

Outside Svalbard I have only found this greatly overlooked and clearly cut species from one place:

Novaya Zemlya, Østre Korsø (= Eastern Krestovii Island) (15/8 1921, Lynge) Herb. Oslo (on a sheet together with *Phippsia algida*).

It was previously only known from Spitsbergen and North-East Land.

Puccinellia vacillans is rare in North-East Land. It grows preferably in somewhat wet, clayey places and seems like *Phippsia concinna* but contrary to *Phippsia algida* not to be nitro- or ornithocoprophilous. Our first flowering specimen of *vacillans* was found on July 29 in the

interior of Murchisonfjorden in Triodalen. Flowering *Phippsia concinna* were earliest found on July 27 at Celsiusberget. Flowering *Phippsia algida* were seen during our whole stay in Svalbard and the first flowering specimen of *Puccinellia Vahliana* and *Puccinellia angustata* were found simultaneously with *Puccinellia vacillans* on July 29 in Triodalen.

The northern limit of *Puccinellia vacillans* is on the shore plain west of Franklinfjellet in Lady Franklinfjorden, north side.

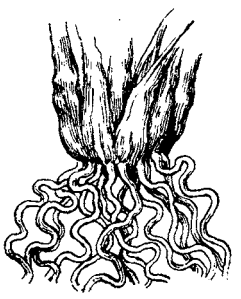


Fig. 50. Basal part of a *Puccinellia Vahliana* (Liebm.) Scribn. et Merz. with the characteristic clue of undulate roots, also found in *Puccinellia vacillans*. Magn. 2/1.

90. *Puccinellia Vahliana* (Liebm.) Scribn. et Merz.
Fig. 50 and Pl. V.

Lady Franklinfj. Hansøya (S). *Murchisonfj.* Wargentindalen (S), Triodalen (S), (Murchisonfjorden (Malmgren)). *Hinlopenstr.* Kalkstranda at Forsiusfjellet (S), Rundhaugen (S), (Hinlopenstredet (Malmgren)). *Sorgfj.* Heclahamna (Malmgren), Inner west side (S). *Lomfj.* Faxedalen (S), Lomfjordbotnen (S), (Lomfjorden (Malmgren, Kjellman ?)).

Malmgren 1862 p. 254, sub nom. *Poa Vahliana* Liebm.; Nathorst 1883 p. 31, sub nom. *Glyceria Vahliana* (Liebm.) Th. Fr.; Andersson and Hesselman 1900 p. 73, sub nom. *Glyceria Vahliana* (Liebm.) Th. Fr.

Rare in North-East Land, where it was found on clayey ground, and where it seems to develop late in the season, as next to nothing but withered tufts from the previous year were found. These dry and defective specimens may, however, easily be recognized from *Puccinellia angustata* and *vacillans* and the *Phippsiae* on account of certain characters in the panicle and the roots.

From *P. angustata* such defective specimens are easily distinguished by their smooth, very small-celled panicle-branches, being scabrous and large-celled in *P. angustata*, by the very characteristic clue of equally thick, undulate roots (Fig. 50) not having this appearance in *P. angustata*; and when present, by the long and lacerate, narrow, at the base densely three-nerved glumes, being in *P. angustata* of the usual short and broad type as in the other *Puccinelliae*. From defective specimens of the *Phippsia* and *Puccinellia vacillans* they are also easily recognized on account of their few panicle-branches from each node, about 2—4, whereas the *Phippsiae* and *Puccinellia vacillans* have many, about 5—8. The pale f. *pallida* Jørgensen seems to be rare within the investigated area, and was only found at Lomfjordbotnen.

Puccinellia Vahliana has its northernmost known limit in Hansøya in Lady Franklinfjorden.

91. *Trisetum spicatum* (L.) Richt. Pl. V.

Lomfj. In the inner parts (Malmgren), Lomfjordbotnen (S).

Malmgren 1862 p. 252, sub nom. *T. subspicatum* P. Beauv.

Seems to be very rare in the investigated area, where it has previously been found only once, perhaps in the same locality as mine, viz. on a dry ice-polished crag innermost in Lomfjorden on the east side in front of the glacier. Here it grew together with the likewise very rare *Arnica alpina*. My specimens are well developed, flowering, and reach a height of 20 cm.

Northern limit is I. P. Koch Fjord 82° 48′ (Wulff) on the north coast of Greenland (Ostenfeld 1923 p. 232).

Short survey of some of the more important finds

with a list of the species reaching their northern limit in the area investigated.

One species, *Minuartia stricta*, has previously not been recorded from Svalbard.

New to North-East Land are:

Lycopodium Selago
Ranunculus nivalis
Chrysosplenium tetrandrum
Potentilla pulchella
Cardamine pratensis
Draba cinerea
Stellaria humifusa
Taraxacum arcticum
Carex maritima (*C. incurva*)
Carex nardina
Carex rupestris
Eriophorum Scheuchzeri
Deschampsia alpina
Festuca rubra var. *arenaria*
Phippsia concinna
Poa alpina var. *vivipara*
Poa rigens var. *vivipara*

New to Sorgfjorden are:

Equisetum arvense
Ranunculus hyperboreus
Saxifraga nivalis var. *tenuis*
Cardamine pratensis
Minuartia Rossii
Minuartia stricta
Carex saxatilis
Carex subspathacea
Carex ursina
Festuca vivipara
Poa alpigena var. *colpodea*
Poa alpina var. *vivipara*

New to Lomfjorden are:

Ranunculus pygmaeus
Saxifraga cernua
Saxifraga comosa
Saxifraga hieraciifolia
Saxifraga nivalis var. *tenuis*
Papaver radicatum
Cochlearia officinalis
Draba oblongata
Minuartia biflora
Sagina intermedia
Silene acaulis
Stellaria longipes

Oxyria digyna
Pedicularis hirsuta
Pedicularis lanata
Arnica alpina
Phippsia concinna
Poa rigens
Poa rigens var. *vivipara*
Puccinellia phryganodes
Puccinellia vacillans

The following species attain in the area investigated by us their presently known northern limit on earth:

Equisetum scirpoides: Sorgfjorden abt. 79° 55′ N. Lat.
Ranunculus pygmaeus: Depotodden in Brennevinsfjorden abt. 80° 25′ N. Lat.
Chrysosplenium tetrandrum: Floraberget in Murchisonfjorden abt. 80° 3′ N. Lat.
Saxifraga aizoides: Heclahamna in Sorgfjorden abt. 79° 55′ N. Lat.
Saxifraga hieraciifolia: Heclahamna in Sorgfjorden abt. 79° 55′ N. Lat.
Saxifraga hirculus: Triodalen in Murchisonfjorden abt. 79° 57′ N. Lat.
Draba alpina: Depotodden in Brennevinsfjorden abt. 80° 25′ N. Lat.
Draba nivalis: Depotodden in Brennevinsfjorden abt. 80° 25′ N. Lat.
Draba rupestris (?): Heclahamna in Sorgfjorden abt. 79° 55′ N. Lat.
Parrya nudicaulis: Heclahamna in Sorgfjorden abt. 79° 55′ N. Lat.
Minuartia biflora: Heclahamna in Sorgfjorden abt. 79° 55′ N. Lat.
Minuartia stricta: Inner west side of Sorgfjorden abt. 79° 53′ N. Lat.
Stellaria humifusa: Floraberget in Murchisonfjorden abt. 79° 58′ N. Lat.
Koenigia islandica: Heclahamna in Sorgfjorden abt. 79° 55′ N. Lat.
Carex saxatilis: Inner west side of Sorgfjorden abt. 79° 53′ N. Lat.
Carex subspathacea: Inner west side of Sorgfjorden abt. 79° 53′ N. Lat.
Carex ursina: Inner west side of Sorgfjorden abt. 79° 53′ N. Lat.
Deschampsia alpina: Wargentindalen in Murchisonfjorden abt. 80° 3′ N. Lat.
Dupontia Fisheri: Depotodden in Brennevinsfjorden abt. 80° 25′ N. Lat.
Festuca rubra var. *arenaria*: Raudstupet in Murchisonfjorden abt. 79° 58′ N. Lat.
Phippsia concinna: Hansøya in Lady Franklinfjorden abt. 80° 9′ N. Lat.
Poa alpigena (?): Heclahamna in Sorgfjorden abt. 79° 55′ N. Lat.
Poa alpina var. *vivipara*: Raudstupet in Murchisonfjorden abt. 79° 58′ N. Lat.
Poa rigens var. *vivipara* (?): Floraberget in Murchisonfjorden abt. 79° 58′ N. Lat.
Puccinellia vacillans: Shore plain west of Franklinfjellet in Lady Franklinfjorden abt. 80° 12′ N. Lat.
Puccinellia Vahliana: Hansøya in Lady Franklinfjorden abt. 80° 9′ N. Lat.

List of some vascular plants collected in West Spitsbergen and Frans Josef Land.

Outside the main area of our investigation, a few plants were collected or noted from the following localities in northern West-Spitsbergen and Frans Josef Land:

Amsterdamøya, north-western point $^{23}/_{6}$ (leg. Schol.):

Cochlearia officinalis *Phippsia algida*

Ytterholmen (directly west of Amsterdamøya $^{23}/_{6}$ (leg. Schol.):

Cochlearia officinalis *Phippsia algida*

Raudfjorden: Alicehamna 19/8 (ground covered by snow; leg. Schol.):

Ranunculus pygmaeus
Saxifraga cernua
Saxifraga groenlandica
Saxifraga nivalis var. *tenuis*
Papaver radicatum
Cardamine bellidifolia
Cerastium alpinum
Cerastium Regelii
Oxyria digyna
Salix polaris
Luzula confusa
Phippsia algida
Poa alpigena var. *vivipara*
Poa alpina var. *vivipara*

Frans Josef Land, Kap Nansen 25/7 1931 (leg. S. Malmberg):

Ranunculus sulphureus
Saxifraga cernua
Saxifraga groenlandica
Saxifraga oppositifolia
Saxifraga nivalis var. *tenuis*
Cerastium alpinum
Papaver radicatum
Cardamine bellidifolia
Cochlearia officinalis
Draba Bellii
Draba oblongata
Alopecurus alpinus
Phippsia algida

According to O. Hanssen and J. Lid (1932) all of these, except *Saxifraga nivalis* var. *tenuis* and *Phippsia algida*, are previously known from this locality or directly to the east of it. All of them have previously been collected in Frans Josef Land.

IV. Remarks on the Vegetation in North-East Land.

A great deal of valuable information has been published on the vegetation of Spitsbergen, particularly by Malmgren (1862), Nathorst (1883), Wulff (1902), Resvoll-Holmsen (1913), and by Summerhayes and Elton (1923, 1928), but these respective authors have dealt very briefly, if at all, with the vegetation of North-East Land. It may therefore be of some interest shortly to consider the phyto-geography of the vascular plants in its flora and to give a brief account of the more common types of vegetation observed in these regions.

In the following list (extracted especially from Hooker 1840, Kjellman 1883, Nathorst 1883, Britton and Brown 1896—98, Gelert and Ostenfeld 1902, Dahlstedt 1905, Simmons 1906, 1913, Ostenfeld 1923, 1926, Lynge 1923, Ekman 1929—32, Hanssen and Lid 1932) the most important data elucidating the polar distribution of the vascular plants of North-East Land is given. The heavy type × indicates that the plant in that region has been found to extend to, or north of, 79° N. lat., which is the latitude roughly corresponding to the southernmost parts of North-East Land.

List showing the polar distribution of the phanerogams of North-East Land (× the plant exceeds 79° N. lat.)	Arctic American Continent	Arctic American Archipelago	Northern Greenland	North-East Land and Spitsbergen	Frans Josef Land	Novaya Zemlya	Arctic Asiatic Continent
Lycopodium Selago	×	×	×	×	-	×	×
Ranunculus hyperboreus	×	×	×	×	-	×	×
— nivalis	×	×	×	×	-	×	×
— pygmaeus	×	×	×	×	-	×	×
— sulphureus	×	×	×	×	×	×	×
Chrysosplenium tetrandrum	×	×	×	×	-	×	×
Saxifraga cernua	×	×	×	×	×	×	×
— comosa	×	×	×	×	-	×	×
— flagellaris	×	×	×	×	×	×	×
— groenlandica	×	×	×	×	×	×	×
— hirculus	×	×	×	×	-	×	×
— nivalis	×	×	×	×	×	×	×
— nivalis v. tenuis	×	×	×	×	×	×	×
— oppositifolia	×	×	×	×	×	×	×
— rivularis	×	×	×	×	×	×	×
Dryas octopetala	×	×	×	×	-	×	×
Potentilla emarginata	×	×	×	×	×	×	×
— pulchella	×	×	×	×	-	×	×
Papaver radicatum	×	×	×	×	×	×	×
Cardamine bellidifolia	×	×	×	×	×	×	×
— pratensis	×	×	×	×	×	×	×
Cochlearia officinalis	×	×	×	×	×	×	×

List showing the polar distribution of the phanerogams of North-East Land (cont.) (× the plant exceeds 79° N. lat.)	Arctic American Continent	Arctic American Archipelago	Northern Greenland	North-East Land and Spitsbergen	Frans Josef Land	Novaya Zemlya	Arctic Asiatic Continent
Draba alpina	×	×	×	×	-	×	×
— Bellii	×	×	×	×	×	×	×
— cinerea	×	×	×	×	-	-	×
— lactea	×	×	×	×	×	×	×
— nivalis	×	×	×	×	-	×	×
— oblongata	×	×	×	×	×	×	×
— subcapitata	×	×	×	×	×	×	×
Cerastium alpinum	×	×	×	×	×	×	×
— Regelii	×	×	×	×	×	×	×
Melandryum apetalum	×	×	×	×	-	×	×
Minuartia Rossii	×	×	×	×	-	-	×
— rubella	×	×	×	×	×	×	×
Sagina intermedia	×	×	×	×	×	×	×
Stellaria humifusa	×	×	×	×	-	×	×
— longipes	×	×	×	×	×	×	×
Oxyria digyna	×	×	×	×	×	×	×
Polygonum viviparum	×	×	×	×	-	×	×
Salix polaris	×	-	-	×	×	×	×
Pedicularis hirsuta	×	×	×	×	-	×	×
Taraxacum arcticum	-	-	×	×	-	×	×
Juncus biglumis	×	×	×	×	×	×	×
Luzula confusa	×	×	×	×	×	×	×
— nivalis	×	×	×	×	×	×	×
Carex maritima (C. incurva)	×	×	×	×	-	×	×
— misandra	×	×	×	×	-	×	×
— *nardina*	×	×	×	×	-	-	-
— rupestris	×	×	×	×	-	×	×
Eriophorum Scheuchzeri	×	×	×	×	-	×	×
Alopecurus alpinus	×	×	×	×	×	×	×
Deschampsia alpina	×	-	×	×	-	×	×
Dupontia Fisheri	×	×	×	×	×	×	×
Festuca brachyphylla	×	×	×	×	-	×	×
— rubra v. arenaria	×	-	×	×	-	×	×
Phippsia algida	×	×	×	×	×	×	×
— *concinna*	-	-	-	×	×	×	×
Poa abbreviata	×	×	×	×	×	×	-
— alpigena v. vivipara s. lat.	×	×	×	×	×	×	×
— alpina v. vivipara	×	-	×	×	×	×	×
— rigens	×	×	×	×	×	×	×
Puccinellia angustata	×	×	×	×	×	×	×
— phryganodes	×	×	×	×	-	×	×
— *vacillans*	-	-	-	×	-	×	-
— Vahliana	×	×	×	×	-	×	×

It appears from this list that of the 64 species in North-East Land 58 species, or about 90 %, are circumpolar, whereas only the remaining 6 species (italics in the list) are, as presently known, not circumpolar. These 6 species are *Dryas octopetala*, *Salix polaris*, *Taraxacum arcticum*, *Carex nardina*, *Phippsia concinna* and *Puccinellia vacillans*.

Of these *Salix polaris* and *Phippsia concinna* are to be regarded as clearly eastern elements in the flora of North-East Land. Less pronounced eastern seems *Taraxacum arcticum* to be, whereas the lack of the main form of *Dryas octopetala* in the Arctic American Archipelago is of little interest for our question.

Clearly western elements in the flora of North-East Land are *Carex nardina* and to a less degree also *Poa abbreviata*, which latter seems not yet to have been found on the Asiatic Arctic coast.

Of special interest is *Puccinellia vacillans*, which has a wide distribution in Spitsbergen and North-East Land but is elsewhere only known from a small island on the north east coast of Novaya Zemlya. As far as presently known it may therefore be said to represent a specific Svalbard element in the flora of North-East Land. Here belongs possibly also *Poa alpigena* var. *colpodea*.

Of the vascular plants of North-East Land 10 species have in other parts of the Arctic, excepting Spitsbergen, not yet been found to reach the northern latitude of 79°, i. e. roughly corresponding to the southernmost parts of North-East Land. These species are, as will be seen in the list: *Ranunculus pygmaeus*, *Chrysosplenium tetrandrum*, *Saxifraga hirculus*, *Draba nivalis*, *Stellaria humifusa*, *Deschampsia alpina*, *Festuca rubra* v., *Poa alpina* v., *Puccinellia vacillans*, *Puccinellia Vahliana* and probably also *Phippsia concinna* (cf. Hanssen and Lid 1932 p. 34, 35). In addition to these, yet 15 plants reach in North-East Land their northern limit presently known (cf. list p. 105). Probably most of these northern limits are only apparent and will fall as soon as the extensive high arctic regions in the North American Archipelago and North Greenland have been as thoroughly explored as the much smaller and more surveyable Svalbard. The mean temperature of July 1931 was at Sveanor in North-East Land + 2.9° C and in the first 10 days of August + 4.1° C (cf. Eriksson 1933 p. 121). According to kind information by professor Ahlmann there is a reason to assume that the summer temperature in North-East Land may be not inconsiderably higher than in other arctic regions in the same latitude, and that the gulf-stream most probably is responsible for this condition. This somewhat warmer climate may be the cause of the more northern limits of some of the species mentioned above. However, it should not be forgotten that our region is floristically much better known than other regions in the same latitude.

As a principle of classification of the vegetation types most commonly observed in North-East Land I have chosen the purely edaphic conditions, for the vegetation in the very preponderating part of the areas of North-East Land attains so incredibly great a degree of openness that in most instances we have great difficulty in believing that biotic factors can have played any part whatever in the modelling

of the vegetation to be found here. In the investigated tracts of North-East Land patches of close phanerogamous vegetation occur almost exclusively in connection with bird-cliffs or other places with manured soil. In this respect the vegetation of North-East Land is clearly distinct from that found even in the nearest adjacent tracts of Spitsbergen such as, e. g., Sorgfjorden and Lomfjorden, where close plant communities are common and attain a fairly extensive distribution.

The vegetation in North-East Land which is richest in respect of both species and individuals is found in the vicinity of the bird-cliffs, even though these localities lie exposed to the sea. Next, as is usual in the Arctic, it is found in the inner fjord districts (cf. Fig. 59 p. 131), where glaciers from the inland ice do not appear to have any restrictive effect on it. Judging from my brief visit to the undulating granite mountains of Brennevinsfjorden, I should not be surprised if it were in this area and in the unexplored, deep granit-bordered fjords of the north coast that the richest flora of North-East Land is to be found. The very poorest flora occurs in the incredibly sterile dolomite regions on the east coast of Hinlopenstredet. The last-named regions will be treated separately in the following account.

The types of vegetation which are most easily characterized and most commonly occurring in the poor, high arctic plant cover of North-East Land may in their main features be grouped as follows:

A. Vegetation of the non-dolomitic areas.

Unmanured ground.

1. Shore vegetation.
2. Tundra vegetation.
3. Vegetation on moving soil.
4. Bog vegetation,
5. Aquatic vegetation.
6. Hillside vegetation.
7. Talus vegetation.
8. Vegetation of steep cliffs and cliff-ledges.
9. Mountain vegetation.

Manured ground.

10. Bird-cliff vegetation.
11. Vegetation of bird stones.
12. Vegetation of bird hummocks.
13. Bird islet vegetation.

B. Vegetation of the dolomitic areas.

Unmanured ground.

Manured ground.

A. Vegetation of the non-dolomitic areas.

Unmanured ground.

In the following description I shall stress only those plant groups (phanerogams and larger lichens) of which I had personal knowledge before my visit to Svalbard in 1931 and for which I therefore have comparatively accurate notes, and in respect of which I trust that the description may be fairly complete. The taxonomy and detailed distribution of the lichens will be given in a later work.

1. Shore vegetation.

A shore vegetation proper, consisting of real halophytes, appears to be quite a rarity along the hitherto known coasts of North-East Land, and at the few points where it has been observed it attains in point of both quality and quantity so low a stage of development that it cannot well be characterized as a formation. The only halophytes found were a few tufts of *Stellaria humifusa*, known only from Floraberget and Gyldénøyane, also small sterile stocks of *Puccinellia phryganodes*, known from Depotodden, S. Russøya and Idunfjellet.

In addition to these rare, genuine shore plants there are a number which are not confined strictly to this habitat but which nevertheless appear to have a certain affinity to the shore vicinity. This applies particularly to *Cochlearia officinalis* and *Phippsia algida*. Both these plants are at the same time clearly nitrophilous or ornitho-coprophilous, and are good examples of the ± clear combination not so very rare in the Arctic, of halophily and nitrophily, which we know in other arctic and sub-arctic plants such as *Puccinellia retroflexa* and partly also *Puccinellia angustata*, *Festuca rubra* and *Elymus arenarius*.

The neighbourhood of the shore frequently appears to be preferred also by such plants as *Sagina intermedia* and *Saxifraga flagellaris*.

2. Tundra vegetation.

The large, and in some instances extensive, tundras formed by the strand flats, particularly on the west side of North-East Land may in respect of their edaphic factors be suitably divided into "rocky flats" (cf. Ostenfeld 1923 p. 263) and the comparatively rarer and smaller, dry and sand-rich tundras which might be called "sandy flats". Both these forms not infrequently occur mixed together like a mosaic and also overlap each other.

Apart from the dolomitic areas, these rocky flats consisting of large or small stones were observed especially in Franklindalen with the bordering parts of the east coast of Lady Franklinfjorden and the west side of that fjord, also at Rundhaugen and Torellneset. The phanerogamic vegetation in such locations is extremely poor in point of quantity and particularly in quality, and mainly consists of the following species which are also common everywhere else:

Saxifraga cernua
Saxifraga groenlandica
Saxifraga oppositifolia
Papaver radicatum
Cochlearia officinalis
Draba Bellii
Draba oblongata
Draba subcapitata
Cerastium alpinum
Stellaria longipes
Phippsia algida

In addition to these there were occasionally found in favourable locations *Minuartia rubella*, *Minuartia Rossii* and *Sagina intermedia*.

The vegetation of foliaceous and fruticose lichens on these rocky flats may frequently be fairly well developed. On the stones themselves the following species are found:

Cetraria hepatizon
Gyrophora cylindrica
Gyrophora erosa
Gyrophora hyperborea
Gyrophora proboscidea
Parmelia alpicola
Parmelia austerodes r.
Parmelia centrifuga rr.
Parmelia incurva r.
Parmelia minuscula
Parmelia pubescens
Stereocaulon fastigiatum

In places much exposed to the wind and mostly with a constant wind direction, and particularly where the ground is composed of smooth round stones in old shorelines, this black lichen flora is not infrequently found to cover only the lee side of the stones, so that the ground as seen from the windward side is of the naked grey stone colour, whilst it is quite lichen-clad and black as viewed from the other side.

On the earth between the stones, most abundant in the cracks, specimens — in some instances very shrunken — of the following larger lichens are found:

Alectoria nigricans
Alectoria ochroleuca r.
Cetraria crispa
Cetraria Delisei
Cetraria nivalis
Cladonia elongata
Cladonia pocillum
Cornicularia aculeata r.
Parmelia omphalodes
Physcia muscigena
Solorina bispora
Sphaerophorus fragilis
Stereocaulon denudatum
Stereocaulon rivulorum
Thamnolia vermicularis

Where the tundra has the character of ± pronounced sandy flats the phanerogamous vegetation often attains a growth incomparably richer than that on the stony lichen deserts just mentioned. Tundras

Fig. 51. *Luzula* tundra on the sandy flats of the shore plain west of Franklinfjellet. Lady Franklinfjorden 13/7 1931.

of this type were observed especially in Lady Franklinfjorden, where great stretches of the strand flat below Franklinfjellet and the inner parts of the southern shore were composed.

The same phanerogams as were mentioned under the rocky flats, with the addition of *Cardamine bellidifolia* and *Salix polaris*, occur also here, yet far more abundantly; they do not, however, succeed in forming any close community s. str. The lichen flora here has diminished greatly in quantity as compared with that which covers the rocky flats. The most conspicuous feature at these places was the marked predominance of both of the *Luzula* species, and to such an extent as to warrant the designation *Luzula* tundra (cf. Fig. 51). The very regular distance between the tufts at many points suggested the existence of a stationary condition being possibly brought about by biotic factors, viz., a root competition. On the said sandy flats below Franklinfjellet there grew in the shelter of these tufts a number of lichens which were otherwise unknown or very rare on the rocky flats, viz., *Lobaria linita*, *Nephroma expallidum*, *Cladonia bellidiflora*, *Stereocaulon dissolutum*, *Solorina crocea* in quantities, *Peltigera rufescens,* and on small stones even *Gyrophora deusta*. In mossy places *Peltigera aphtosa* and *scabrosa*.

On the inner west side of Lady Franklinfjorden there was a similar *Luzula* tundra, which was, however, less exposed than the one already mentioned. Of the plants growing among the *Luzula* tufts I noted, in addition to those enumerated on page 112, *Oxyria digyna*, *Draba lactea*, *Sagina intermedia*, *Saxifraga flagellaris*, also in moss-grown places some few tufts of *Dactylina ramulosa*, *Cladonia chlorophaea*, *coccifera*,

Fig. 52. Sterile tufts of *Deschampsia alpina* growing along a rivulet in the tundra of Wargentindalen, 22/7 1931.

uncialis, and between some of the stones, mirabile dictu, even *Cladonia cornuta*.

In dealing with the tundras of North-East Land it is natural that reference should at the same time be made to the extremely sparse vegetation found in the very common swampy parts of the tundra and in its ponds.

3. Vegetation on moving soil.

Almost in every instance where water from the melted snow flows over the flat tundra, below patches of snow, on the banks of small streams and the edges of ponds, also on river banks, we usually find in North-East Land that very clayey and in extreme instances mushy or pulpy earth, the constituents of which are not infrequently sorted in a singular manner in the well-known, so-called polygon ground. In this ground, which during the greater part of the summer is swampy, and always cold through evaporation, only few plants thrive; these are nearly all plebeians of North-East Land.

The most common phanerogams on this practically moss-free ground are:

Saxifraga cernua	*Cerastium Regelii*
Saxifraga oppositifolia	*Stellaria longipes*
Cochlearia officinalis	*Phippsia algida*

In somewhat drier places we find in clayey ground also *Papaver radicatum*, *Draba Bellii*, *D. lactea* and *D. subcapitata*, often in predominating quantities; and further, *Minuartia rubella*, and occasionally

Saxifraga nivalis v. *tenuis*, *Juncus biglumis*, also *Minuartia Rossii*. Of larger lichens we note on the moving soil *Cetraria Delisei*, which favours moist fissures. Of rarer occurrence in these places are *Cladonia pocillum*, *Stereocaulon rivulorum* and *denudatum*, *Solorina bispora* and *crocea*, of which the last-named in particular, appears in these latitudes to prefer places with a richer phanerogamic vegetation. *Gyrophora cylindrica* is not infrequently found in company with *Juncus biglumis*, when there is a fair degree of circulation in the water in the moving soil, e. g., at the edge of small streams of melted snow. Supplementary to this sparse vegetation near running water I may mention an occurrence of *Deschampsia alpina* along the borders of a rivulet in Wargentindalen (Fig. 52).

4. Bog vegetation.

Except in connection with bird-cliffs the development of bogs in North-East Land appears to be a very rare occurrence. This is in contrast to the conditions in places as little removed as on the south side of Hinlopenstredet, where similar places are often quite overgrown with vegetation (cf. Fig. 32 p. 64). Some indication of bog vegetation was occasionally found along the bank of small streams (Torellneset, Triodalen), and on the edges of small ponds (Rundhaugen, north side of Snaddvika, west of Franklinfjellet). They attained a far higher degree of development under the bird-cliffs, e. g., Floraberget and Depotodden, to which reference will later be made.

The phanerogams found in the dense moss vegetation, which appears to form the first foundation of bog development here, often shape themselves differently according as the water is in motion or stagnant. In these wet mosses at the edge of small streams the following phanerogams are usually found:

Ranunculus sulphureus	*Saxifraga nivalis* v. *tenuis*
Saxifraga comosa	*Saxifraga rivularis*
Saxifraga groenlandica	*Alopecurus alpinus*
Saxifraga nivalis	*Poa alpigena* v. *colpodea*

and in immediate connection with these, but as a rule not in the mosses proper:

Saxifraga cernua	*Sagina intermedia*
Saxifraga hirculus r.	*Juncus biglumis*
Saxifraga oppositifolia	*Luzula nivalis*

Of lichens I noted here a relatively rare occurrence of *Peltigera aphtosa* and *P. canina*.

In the dense moss communities which sometimes border bodies of stagnant water there is a vegetation resembling that just mentioned, but which differs from the latter in certain points. The following phanerogams occur here:

Saxifraga comosa
Saxifraga rivularis
Cardamine pratensis (sterile leaves)
Cerastium Regelii
Sagina intermedia
Stellaria longipes
Eriophorum Scheuchzeri r.
Juncus biglumis
Luzula nivalis
Alopecurus alpinus
Dupontia Fisheri
Phippsia algida
Poa alpigena v. *colpodea*
Puccinellia vacillans
Puccinellia Vahliana

Of lichens the following are sometimes seen: *Peltigera aphtosa*, *canina* and *rufescens*, and *Solorina crocea*.

5. Aquatic vegetation.

Of vascular plants which with any justification may be designated aquatic plants proper, only one is so far known in North-East Land, viz., *Ranunculus hyperboreus*, the sterile leaves of which are, however, only very rarely seen here floating at the edge of the small ponds. The "wettest" of the plants enumerated in the foregoing group are otherwise *Eriophorum Scheuchzeri* and *Dupontia Fisheri*, both of which are not infrequently found growing in deeper water, the latter then not rarely with long floating leaves developed, just like a *Pleuropogon Sabinei*.

6. Hillside vegetation.

This heading comprises the comparatively rich vegetation found especially on southfacing and relatively dry slopes, either below the talus formations of the larger mountains or in patches on the slopes of the low valleys and knolls which are so common, especially in the inner parts of the fjords. At such places, which, ranking after the talus formations, are the richest localities in North-East Land, the following phanerogams are found and most of them quite commonly:

Saxifraga cernua
Saxifraga groenlandica
Saxifraga nivalis
Saxifraga nivalis v. *tenuis*
Saxifraga oppositifolia
Dryas octopetala
Potentilla emarginata
Papaver radicatum
Cochlearia officinalis
Draba alpina
Draba Bellii
Draba lactea
Draba oblongata
Draba subcapitata
Cerastium alpinum
Minuartia rubella
Stellaria longipes
Oxyria digyna
Polygonum viviparum
Salix polaris
Luzula confusa
Luzula nivalis
Festuca brachyphylla r.
Phippsia concinna r.
Poa abbreviata
Poa rigens
Puccinellia angustata r.
Puccinellia vacillans r.
Puccinellia Vahliana r.

Fig. 53. Small patch of close vegetation consisting of *Pedicularis hirsuta*, *Polygonum viviparum*, *Salix polaris* and *Luzula confusa*. North side of Snaddvika 27/7 1931.

Of these the *Draba* species and *Poa abbreviata*, *Phippsia concinna*, *Puccinellia angustata*, *P. vacillans* and *P. Vahliana* favour clayey places. In particularly favourable and sheltered places, most often in the inner fjord districts, the following are a rare supplement to those mentioned above:

Lycopodium Selago rr.
Draba nivalis rr.
Pedicularis hirsuta r.
Taraxacum arcticum r.
Carex maritima (*C. incurva*) rr.
Carex misandra r.
Carex rupestris rr.

Excepting below the bird-cliffs, it is very seldom that the phanerogams themselves succeed in this hillside vegetation in forming a really close cover of vegetation in such a way that the tufts or individual plants of the various species stand side by side and may really be said to be associated. The only place exclusive of the bird-cliffs and other places with manured soil where this was observed in North-East Land was the "rich" locality on the north side of Snaddvika, where a small patch of some few square metres was covered with a loose mat consisting mainly of *Carex rupestris* and mixed with *Papaver radicatum*, *Potentilla emarginata*, *Cerastium alpinum*, *Oxyria*, *Polygonum*, *Salix*, *Poa rigens*, and in between some tufts of *Carex misandra* and *C. nardina*. Here and there in the vicinity minute associations were growing, consisting mainly of *Salix polaris*, *Polygonum viviparum* and *Luzula confusa*, also sometimes *Pedicularis hirsuta*, as is shown in Fig. 53.

The larger lichens met with among the phanerogamous and moss vegetation of the sunny slopes are as follows:

Alectoria nigricans
Alectoria ochroleuca r.
Cetraria crispa
Cetraria Delisei
Cetraria nivalis
Cladonia cervicornis
Cladonia chlorophaea
Cladonia coccifera
Cladonia elongata
Cladonia lepidota
Cladonia mitis r.
Cladonia pocillum
Cladonia uncialis
Cornicularia aculeata
Dactylina ramulosa
Lobaria linita r.
Parmelia omphalodes
Peltigera aphtosa
Peltigera erumpens
Peltigera lepidophora r.
Peltigera malacea r.
Peltigera polydactyla r.
Peltigera rufescens
Peltigera venosa r.
Physcia muscigena
Solorina bispora
Solorina crocea
Solorina octospora r.
Solorina saccata r.
Solorina spongiosa r.
Sphaerophorus fragilis
Stereocaulon alpinum
Stereocaulon rivulorum
Thamnolia vermicularis

Of larger stone lichens the following are found mixed with the other open vegetation:

Cetraria hepatizon
Gyrophora cylindrica
Gyrophora erosa
Gyrophora hyperborea
Gyrophora proboscidea
Parmelia austerodes r.
Parmelia intestiniformis
Parmelia alpicola
Parmelia minuscula
Parmelia pubescens
Parmelia stygia
Physcia sciastra
Stereocaulon denudatum

The whole of this stock of larger lichens, which comprises a fair number of species, attains, however, in respect of both quantity and quality comparatively poor development among the scattered and low phanerogamic vegetation, which offers little shelter.

7. Talus vegetation.

The most luxuriant vegetation of phanerogams and lichens in the Arctic is, as a rule, met with here and there under precipitous cliffs, and particularly if these are bird-cliffs. On the southern slopes there is the most favourable insolation conditions for the low arctic sun, the ground is also heated more easily here because the cooling effect of evaporation from a superficial ground-water (cf. moving soil) is usually small here. The large stones afford shelter, with the result that the heated ground is not so quickly cooled by draught and they are moreover of great importance in that the snow between them remains until the arctic summer has set in. If, in addition, the ground is manured from an overhanging bird-cliff, the favourable conditions of vegetation thus created in such places are not equalled in any other localities of the Arctic.

The comparatively more southern character which the vegetation of such places in the high Arctic often may possess is not merely due to the occurrence of southern species, but also to the fact that the plants there can occur in close communities and can thereby through mutual biotic influence form the associations which they otherwise succeed in forming only in more southern latitudes — in this instance it occurs in no small extent immediately south of Hinlopenstredet.

Excluding the bird-cliffs, the most luxuriant vegetation is, as a rule, associated with the transition zone between the foot of the talus and the strand flat, between the large blocks usually found here. The most dominant vegetation here consists of mosses and then the lichens which they shelter, whereas the phanerogams in similar places in North-East Land succeed only under the bird-cliffs in attaining such close growth as to oust the other vegetation. As examples of such localities of large blocks of stone from screes, without any connection with bird-cliffs, I may mention those below a basalt cliff at Torellneset (Fig. 2), Persberg on the Wargentin tundra, west of Franklinfjellet, Cape Hansteen, and Zeipelbukta in Brennevinsfjorden. The phanerogams here are partly the same as those just enumerated under the hillside vegetation, viz.:

Ranunculus sulphureus
Saxifraga cernua
Saxifraga groenlandica
Saxifraga nivalis
Saxifraga nivalis v. *tenuis*
Saxifraga oppositifolia
Saxifraga rivularis
Potentilla emarginata
Papaver radicatum
Cardamine bellidifolia
Cochlearia officinalis
Cerastium alpinum
Minuartia rubella
Stellaria longipes
Oxyria digyna
Polygonum viviparum
Salix polaris
Luzula confusa
Luzula nivalis
Phippsia algida
Poa alpigena v. *colpodea*
Poa rigens

Of greater interest is the often very luxuriant growth of lichens which may occur here growing among the deep mosses and on blocks of stone. Among the mosses or on the ground between the stones the following larger lichens were noted:

Alectoria nigricans
Alectoria ochroleuca r.
Cetraria crispa
Cetraria cucullata
Cetraria Delisei
Cetraria nivalis
Cladonia alpicola
Cladonia bellidiflora
Cladonia cenotea r.
Cladonia cervicornis r.
Cladonia chlorophaea
Cladonia coccifera
Cladonia cornutoradiata r.
Cladonia deformis r.
Cladonia elongata
Cladonia fimbriata f. *major* r.
Cladonia lepidota
Cladonia mitis
Cladonia pocillum
Cladonia rangiferina rr.
Cladonia uncialis
Cornicularia aculeata
Cornicularia divergens
Dactylina ramulosa

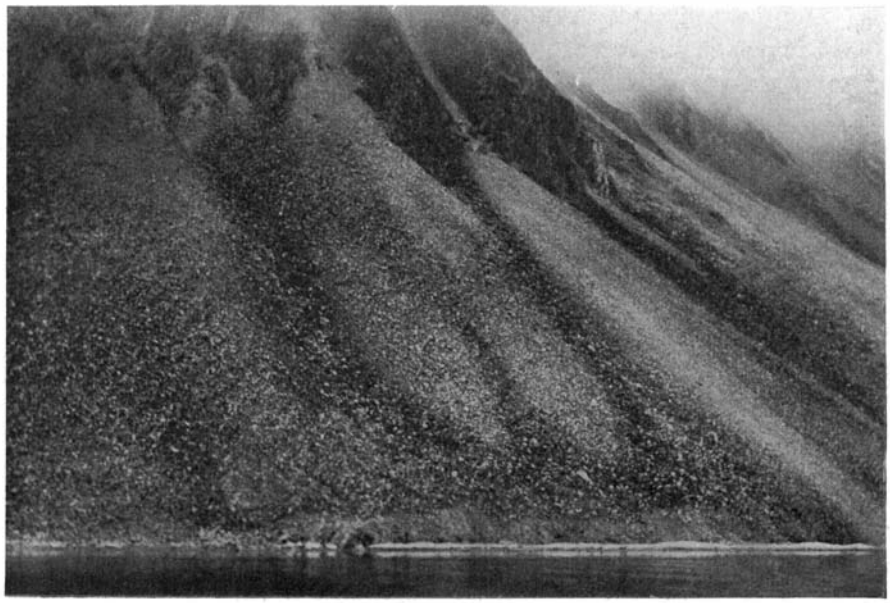


Fig. 54. Lichen vegetation on talus east of Floraberget, visible as dark stripes running down from the cliffs above and uniting at the base of the talus. 23/7 1931.

Lobaria linita r.
Nephroma expallidum r.
Parmelia omphalodes
Peltigera aphtosa
Peltigera canina
Peltigera erumpens
Peltigera polydactyla
Peltigera rufescens
Peltigera scabrosa r.
Peltigera venosa
Physcia muscigena
Solorina bispora
Solorina crocea
Sphaerophorus globosus
Sphaerophorus fragilis
Stereocaulon alpinum
Stereocaulon denudatum
Stereocaulon fastigiatum
Stereocaulon dissolutum
Thamnolia vermicularis

On stone blocks the following were found:

Alectoria jubata v. *calybeiformis*
Cetraria hepatizon
Gyrophora arctica
Gyrophora cylindrica
Gyrophora decussata
Gyrophora erosa
Gyrophora hyperborea
Gyrophora proboscidea
Gyrophora virginis r.
Parmelia intestiniformis
Parmelia alpicola
Parmelia minuscula
Parmelia pubescens
Parmelia saxatilis
Parmelia incurva r.
Physcia sciastra r.
Sphaerophorus globosus

Among the lichens enumerated here it is most surprising to find so far north the occurrence of the *Cladonia* species *cenotea*, *cornutoradiata*, *deformis*, *fimbriata*, and *rangiferina*, a list which may be somewhat increased when we turn to the screes of the bird-cliffs.

A study of the talus vegetation above this lowest zone of large blocks shows that the smaller stones here accommodate a fairly rich rock-lichen flora, mainly comprising the following larger species:

Gyrophora cylindrica
Gyrophora decussata
Gyrophora erosa
Gyrophora hyperborea
Gyrophora proboscidea
Gyrophora virginis
Parmelia alpicola
Parmelia minuscula
Parmelia pubescens

which usually give the talus a characteristic, dark colouring in vertical stripes which run downward from the ridge between two erosion striae in the cliff above and often uniting at the foot (Fig. 54). Corresponding with the erosion striae and the light parts below these the lichen vegetation can be only fragmentary, so long as the disintegration products are constantly sliding down there. As a rule, the phanerogamic vegetation on this less coarse upper part of the scree is poor, as on the cliffs above, consisting only of single tufts of the most common species: *Cerastium alpinum*, *Papaver radicatum*, *Saxifraga cernua*, and *Luzula confusa*. As we shall see, conditions are altogether different at the bird-cliffs.

8. Vegetation of steep cliffs and cliff-ledges.

Vegetation at such places, barring the bird-cliffs, is usually very poor, or is totally absent in respect of phanerogams and larger lichens. The following phanerogams are occasionally found:

Saxifraga cernua
Saxifraga oppositifolia
Cardamine bellidifolia
Cerastium alpinum
Luzula confusa

and the common larger lichens:

Gyrophora decussata
Gyrophora erosa
Gyrophora hyperborea
Gyrophora proboscidea
Parmelia alpicola
Parmelia minuscula
Parmelia pubescens

Where water flows over the cliff, *Gyrophora arctica*, *cylindrica* and *virginis* are sometimes found, and rarely *Gyrophora vellea* usually in fissures.

9. Mountain vegetation.

In connection with the vegetation of talus and cliffs it may be convenient to make brief mention of the vegetation on the mountains of North-East Land. These mountains are all very low. The highest ones are in the Nordkap area, where several peaks are 300—500 metres above sea level, the highest snow-bare peak being 530 metres. Otherwise the mountains are rarely above 200—300 metres in height. The

maximum height records for plants in North-East Land are found in accounts of earlier investigations and are due to Torell, who brought home three phanerogams from the height of 500 metres on the mountain above Depotodden (cf. Chydenius 1865 p. 231).

The subjoined tables will show at a glance the very sparse vegetation of phanerogams and larger lichens of the mountains or mountain peaks examined in North-East Land:

Altitudes recorded for phanerogams in North-East Land	Saxifraga cernua	Saxifraga nivalis	Saxifraga oppositifolia	Papaver radicatum	Cardamine bellidifolia	Draba Bellii	Cerastium alpinum	Cerastium Regelii	Stellaria longipes	Luzula confusa	Luzula nivalis	Phippsia algida	Poa abbreviata
500 m Depotodden				×					×	×			
270 m Ismåsefjellet			×	×						×	×		×
230 m Floraberget	×	×		×		×	×						×
230 m Wargentinfjellet				×	×								
230 m Celsiusfjellet			×			×		×				×	
230 m Forsiusfjellet													
170 m Camp at Inland ice	×		×			×		×					×
170 m Celsiusfjellet													

Altitudes recorded for the larger lichens in North-East Land	Alectoria jubata v.	Alectoria nigricans	Alectoria ochroleuca	Cetraria crispa	Cetraria Delisei	Cetraria hepatizon	Cetraria nivalis	Cladonia coccifera	Cladonia pocillum	Gyrophora cylindrica	Gyrophora erosa	Gyrophora hyperborea	Gyrophora proboscidea	Parmelia alpicola	Parmelia minuscula	Parmelia pubescens	Physcia muscigena	Sphaerophorus fragilis	Stereocaulon denudatum	Stereocaulon rivulorum	Thamnolia vermicularis	Usnea sulphurea
350 m Celsiusfjellet			×				×						×	×								
270 m Ismåsefjellet		×			×		×		×						×		×	×		×	×	×
270 m Wargentinfjellet			×											×	×	×						
270 m Moraine on Inl. ice																						
230 m Floraberget	×	×	×			×	×	×		×	×	×	×	×	×		×	×	×		×	×

It is probable that most of these maximum values for the whole of North-East Land will be increased when the granite mountains of the Laponian Peninsula and the north coast are properly examined.

Fig. 55. Tufts of *Papaver radicatum* and *Cerastium alpinum* growing on slate ground on talus near Floraberget, $^{23}/_{7}$ 1931.

Of the plants mentioned here as occurring on the mountains and mountain peaks of North-East Land, the following may be said to be the commonest and most constant: *Parmelia alpicola* — not infrequently serpiginous at these heights —, *Parmelia minuscula*, also often strongly rhizinous forms of *Gyrophora proboscidea*. Like e. g. in North East Greenland, *Usnea sulphurea* has also here its principal home in high cliff ground, more especially on the edge of precipices, where its rich small colonies are often found growing scattered on the blocks.

The phanerogamic vegetation at these heights of more than 200 metres is in North-East Land as a rule very sparse or non-existent, excepting on the edges of the south facing precipices which during sunshine are heated by the warm rising air, and by the aid of which they must be presumed occasionally to be furnished with seed carried up from the lowland. Immediately above the rich locality Floraberget I found, for instance, the richest vegetation observed anywhere above the 200 metres line in North-East Land; and the air here was also considerably warmer than down by the sea. A vegetation comparatively rich in individuals was likevise found between the large stones on the edge of the basalt plateau near Ismåsefjellet in Wahlenbergfjorden, at the height of approximately 270 metres.

Fig. 56. The bird-cliff Floraberget in Murchisonfjorden, possessing the richest flora yet known in N. E. Land. The dark patches below the cliff (not to the right) are vegetation. 24/7 1931.

Manured ground.

Belonging to this group I observed in North-East Land bird-cliffs, bird-stones, bird hummocks, the vegetation near old skeleton remains, and bird islets.

10. Bird-cliff vegetation.

The following bird-cliff localities were found and examined in North-East Land; Depotodden (*Fulmarus glacialis*), Kontaktberget (*Uria grylle*) and 2.5 kilometres SE of C. Hansteen (*Uria grylle*) in Brennevinsfjorden; Raudstupet (*Rissa tridactyla, Larus glaucus*, *Uria grylle*), Krykjeslukta (*Rissa tridactyla*, *Larus glaucus*) in Murchisonfjorden; and Ismåsefjellet (*Pagophila eburnea*) in Wahlenbergfjorden. In the term bird-cliff I do not include only the cliff with all the nests, but also the talus beneath it and any strandflat there may be.

As already pointed out, the distinguishing feature of bird-cliff vegetation in North-East Land is the close plant-cover, which even at a distance can be seen as green patches in the landscape; this is otherwise very rare in North-East Land. In addition to this strong quantitative increase of the number and frequently also the size of the plants, the list of species, too, is often considerably lengthened.

The bogs which not infrequently occur on the flat under the bird cliffs, e. g., at Ismåsefjellet, Floraberget and Depotodden display, an exceptionally vigorous vegetation with deep mosses (not *Sphagnum*) not only in patches but in continuous stretches of perhaps 50—100 metres

in extent. Here we observe rich deposits of *Dupontia Fisheri*, *Alopecurus alpinus*, *Juncus biglumis*, *Saxifraga rivularis*, and others — a composition which in respect of phanerogams and lichens (not mosses) is the same as is found also in the bogs away from the bird-cliffs (cf. p. 115—116), but with a luxuriance which was not seen elsewhere in North-East Land, although it is to be found immediately to the south, e. g., in the great *Eriophorum Scheuchzeri* bogs on the west side of Sorgfjorden (cf. Fig. 32 p. 64).

Also on the slopes under the bird-cliffs the vegetation attains richer growth than at any other corresponding place in North-East Land away from such cliffs. Particular mention may be made of the entirely overgrown talus under Floraberget. The rich carpet-like cover of vegetation often found in such localities is composed chiefly of phanerogams of which the following grasses are predominant:

Alopecurus alpinus
Festuca rubra v. *arenaria*
Poa alpigena v. *colpodea*
Poa alpina v. *vivipara*
Poa rigens

In this comparatively dense grass vegetation the following additional phanerogams thrive and are usually found:

Ranunculus nivalis rr.
Ranunculus pygmaeus r.
Ranunculus sulphureus
Saxifraga cernua
Saxifraga groenlandica
Saxifraga nivalis
Saxifraga oppositifolia
Saxifraga rivularis
Potentilla emarginata
Potentilla pulchella rr.
Papaver radicatum
Draba nivalis
Draba oblongata
Draba lactea
Cerastium alpinum
Minuartia rubella
Stellaria longipes
Oxyria digyna
Polygonum viviparum
Salix polaris
Pedicularis hirsuta r.
Taraxacum arcticum r.

Under Floraberget great parts of the slope are covered by dense mats of *Carex maritima* Gunn., partly in nearly pure stands cf. Fig. 57, and here and there with *Chrysosplenium tetrandrum* intermingled.

On the small mound usually found right at the top of the slope in the angle between the precipitous face of the cliff and the talus, the grass vegetation in particular, is exceptionally rich and, as a rule, holds the ground alone. Here we find, in the first place, dense growths, occasionally 1/4 metre high, of viviparous *Poa alpigena* and *Poa alpina* forms, and not infrequently also with an addition of *Festuca rubra* var. *arenaria*, *Alopecurus alpinus* and *Phippsia algida*; in other words, just those grasses which are most commonly met with near bird hummocks, and which are the most nitrophilous.

In the dense green phanerogamic carpets below the bird-cliffs the lichens are gradually crowded out with the exception of those which

Fig. 57. Mat of *Carex maritima* (*C. incurva*) intermingled with *Cerastium alpinum* and *Luzula confusa*. Floraberget 23/7 1931.

are able to compete with the phanerogams by spreading themselves over them. This applies particularly to the *Peltigera* species. Even in latitude 80° N. the *Peltigera aphtosa*, *rufescens* and *canina* colonies may attain considerable dimensions in steep places with rich vegetation of phanerogams and mosses, especially where there is running water; *P. aphtosa* may thus attain a growth of close upon 1/2 metre in diameter. A less important part is played in the vegetation by the other larger lichens occurring here, the most important of which are: *Peltigera erumpens*, *scabrosa*, *lepidophora*, *malacea*, *venosa*, *Nephroma expallidum*, *Solorina saccata* and *spongiosa*.

The luxuriant lichen vegetation often found in mossy large-stoned screes may in connection with bird-cliffs attain a still richer development, but without the list of species being changed in any very great measure. As a noteworthy addition to the list of species (p. 119, 120) we may record the occurrence of a plant of so southern a character as *Cladonia carneola* in no less than three bird-cliff localities in North-East Land, viz., Depotodden in Brennevinsfjorden, 2.5 km S. E. of C. Hansteen, and Floraberget in Murchisonfjorden.

The vegetation on the frequently narrow ledges in the bird-cliffs or in the fissures varies somewhat in appearance, according to whether it grows directly under the bird-shelves or along the sides of them. The plants which thrive particularly well and often attain luxuriant development amid all these bird excrements are first of all *Cochlearia* forms and *Phippsia algida*, and, in Floraberget, in addition a rich

occurrence of large fertile *Draba cinerea*, which is not known elsewhere in North-East Land. The lichen flora found on these excrement ledges in the cliff consists of *Physcia muscigena*, and is of exceptional interest owing to the occurrence in the same place of dense tufts of the rare *Physcia constipata* (Floraberget), which elsewhere was found only below a bird-stone in Sorgfjorden. The only other part of the Arctic where this lichen is known to exist is N. E. Greenland, where it is also nitrophilous, and was found below bird-stones and on bird islets (cf. Lynge and Scholander 1932 p. 94).

Fig. 58. Luxuriant vegetation on a cliff-ledge in Floraberget, mainly consisting of *Ranunculus sulphureus*, *Potentilla emarginata*, *Cerastium alpinum*, *Saxifragae Taraxacum*, *Festuca rubra* v., and *Poa rigens*. 23/7 1931.

To the sides of this direct "bird-rain" zone the cliff-ledge vegetation assumes the same character as that of the slope below the bird-cliff, but is often still more luxuriant (Fig. 58) with *Ranunculus sulphureus* a foot high and big tufts of *Potentilla emarginata* var. *elatior*, *Cerastium alpinum*, *Taraxacum arcticum*, *Saxifragae*, *Festuca rubra* var. *arenaria*, *Poa rigens*, and the same dense manured tufts of *Cetraria nivalis*, *crispa* and sometimes *cucullata*, which we know also from the bird islets; and further *Cornicularia aculeata*, also occasionally the thick and dense f. *taurica* of *Thamnolia vermicularis*. — On some such low sunny ledges in Floraberget even such lichens as *Gyrophora deusta*, *Parmelia sorediata*, *Parmelia sulcata*, and *Parmeliopsis ambigua* thrive here in latitude 80° N.

On the vertical face of the bird-cliff is regularly found under all the nests an abundant growth of the orange-coloured *Caloplaca elegans*, which along with the white excrement stripes give the nesting places that characteristic colouring which is visible at a great distance.

At the foot of the vertical cliff, where it is covered and protected by snow in winter, and especially where it is somewhat shady and the dripping water constantly keeps the cliff wet, one frequently finds an exceptionally luxuriant growth of a number of *Physcia* species, viz., large confluent patches of *Physcia caesia* with its large, pretty blue soral balls, as well as dense beds up to a thickness of 1 cm of *Ph. lithothodes*, and in somewhat drier places *Ph. tribacea* and *sciastra*.

In more prominent parts of the cliff face or on large loose blocks below we find the well-known rich occurrence of *Gyrophora* species. Predominant here is usually *G. arctica*, which not infrequently grows to decimetre size. In addition, there are large and often fertile *G. decussata,* also *G. erosa* and *hyperborea*, and on the shady side or in deep fissures we not infrequently find large specimens of *G. vellea*; on the other hand, *G. virginis* and especially *G. polaris* appear to be rare in North-East Land. In company with these *Gyrophoraceae* in the bird-cliffs or on the stones below there are *Parmelia infumata*, *granulosa*, *Xanthoria candellaria*, *Physcia caesia*, *tribacea*, also occasionally *Alectoria jubata* var. *calybeiformis* and *Parmelia saxatilis*. Of crustaceous lichens *Lecanora melanophthalma* and *Caloplaca elegans* are particularly conspicuous.

11. Vegetation of bird stones.

Stones showing up above the flat ground, whether it be a tundra or elsewhere, often serve as perches for birds, and in North-East Land perhaps most frequently for *Stercorarius parasiticus*. The manuring which the stone and its immediate neighbourhood thus receives conditions a special vegetation, particularly in respect of lichens. The most typical bird stones are those found under bird-cliffs, and which have just been described. Away from these cliffs they attain only poor development. The following larger lichens are more or less abundantly represented on the bird stones:

Gyrophora arctica r.
Gyrophora decussata
Gyrophora erosa
Gyrophora hyperborea
Parmelia alpicola
Parmelia granulosa
Parmelia minuscula
Physcia caesia
Physcia sciastra r.
Physcia tribacea
Xanthoria candellaria

In the moss bed often found below the stone we find particularly *Physcia muscigena* and a more or less incidental accumulation of the most common phanerogams of the locality, very often *Saxifraga cernua.*

12. Vegetation of bird hummocks.

A bright spot in the monotonous vegetation of North-East Land is furnished by the nesting places of those birds which breed here in the same place year after year, giving the ground the necessary manuring. In North-East Land only the nests of *Stercorarius parasiticus* were observed, but in Lomfjorden there was also found a small colony of Brent-goose nests. These nesting places are often visible at a considerable distance on account of the small green patch surrounding them. Three such nests were observed and examined in North-East Land.

Sveanor Stercorarius parasiticus hummock	Cape Sparre Stercorarius parasiticus hummock	Rundhaugen Stercorarius parasiticus hummock, at the edge of a pool
Saxifraga cernua *Papaver radicatum* *Cochlearia officinalis* *Juncus biglumis* *Alopecurus alpinus* *Festuca rubra* v. *arenaria* *Poa alpigena* v. *colpodea* *Peltigera rufescens* *Physcia muscigena* (Poor in mosses)	*Saxifraga cernua* *Cochlearia officinalis* *Cerastium Regelii* *Phippsia algida* *Physcia muscigena* (Rich in mosses)	*Cochlearia officinalis* *Juncus biglumis* *Alopecurus alpinus* *Dupontia Fisheri* *Poa alpigena* v. *colpodea* *Physcia muscigena* (Rich in mosses)

Lomfjordbotnen Stercorarius parasiticus hummock 1.	Lomfjordbotnen Stercorarius parasiticus hummock 2	Faxedalen Branta bernicla hummock (nest colony)
Cerastium alpinum *Stellaria longipes* *Polygonum viviparum* *Salix polaris* *Alopecurus alpinus* *Poa alpigena* v. *vivipara* *Poa rigens* *Cladonia pocillum* *Physcia muscigena* (Poor in mosses)	*Cerastium alpinum* *Stellaria longipes* *Taraxacum arcticum* *Carex rupestris* *Festuca rubra* v. *arenaria* *Physcia muscigena* (Poor in mosses)	*Saxifraga oppositifolia* *Cochlearia officinalis* *Potentilla emarginata* *Potentilla pulchella* *Cerastium alpinum* *Dryas octopetala* *Puccinellia angustata* *Physcia muscigena* (Poor in mosses)

The most characteristic feature of this nitrophilous vegetation is the rich growth of grasses, particularly of *Festuca rubra* var. *arenaria*, *Poa alpigena* var. *colpodea, Alopecurus alpinus*, which often border the nesting places in the form of a decimetre-high mound. Of the larger lichens *Physcia muscigena* is practically always found.

13. Bird islet vegetation.

Excepting the dolomitic islands in Murchisonfjorden only one bird islet was investigated, viz., Tombolaøya in Lady Franklinfjorden. This islet is low and in the middle is occupied by a *Sterna macrura* colony. The vegetation on this manured ground is, as usual in the Arctic, a great deal richer in respect of species and individuals than are similar unmanured places, and comprises the following species of phanerogams:

Saxifraga cernua
Saxifraga groenlandica
Saxifraga nivalis
Saxifraga oppositifolia
Papaver radicatum
Cochlearia officinalis
Draba Bellii
Draba subcapitata
Cerastium alpinum
Minuartia rubella
Phippsia algida

Of larger lichens the following were observed:

Alectoria nigricans	*Gyrophora hyperborea*
Cetraria crispa	*Parmelia alpicola*
Cetraria Delisei	*Parmelia minuscula*
Cetraria nivalis	*Physcia muscigena*
Cladonia pocillum	*Thamnolia vermicularis*
Cornicularia aculeata	

Of these especially luxuriant tufts of the *Cetraria* species predominated, which are also common in similar places in other parts of the Arctic. In addition we find *Physcia muscigena* and an abundance of *Cladonia pocillum*. In North-East Land the last-named species was nowhere found to attain a more luxuriant development than on the bird islets.

B. Vegetation of the dolomitic areas.

Unmanured ground.

The whole of the landscape within the dolomitic tracts (cf. Fig. 60) is so characteristic in respect of its geological nature and its incredible sterility, and so distinct from everything which has been described in the foregoing, that it is but natural it should receive special mention. The ground consists of those light-coloured, hard, sharp-edged stationary products of disintegration resulting from dolomitic limestone (cf. Fig. 9 p. 26). This disintegrated rock is often found over great areas, the pieces lying loosely on one another approximately like a thick layer of macadam, without there being any surface soil between the stones; there is consequently a complete absence of those conditions of growth required even by the most frugal of plants such as *Papaver* and *Saxifraga oppositifolia* and a few others which otherwise might thrive here. The distribution of the dolomitic limestone will be best seen from the map, Fig. 59. The shaded parts denote the observed pure dolomite occurrences being large enough to be visible on the map, and are adapted after a geological sketch map which my friend, Dr. O. Kulling, has kindly placed at my disposal, and which is based on his own investigations. According to his kind information one must assume that most of the other rocks within the middle to western Murchisonfjord and the continuances north- and southwards are somewhat dolomite containing, a fact which is clearly reflected by the very low number of species within this region, cf. Fig. 59. The diametres of the black circles or points on this map are directly proportional to the number of species known from that locality. It should be noted that the areas over which these numbers of species are distributed are as a rule in a high potency inversely proportional with the diametres of the circles.

The vegetation on the pure dolomite where there is any soil and moisture between the stones is very scanty or are in many instances

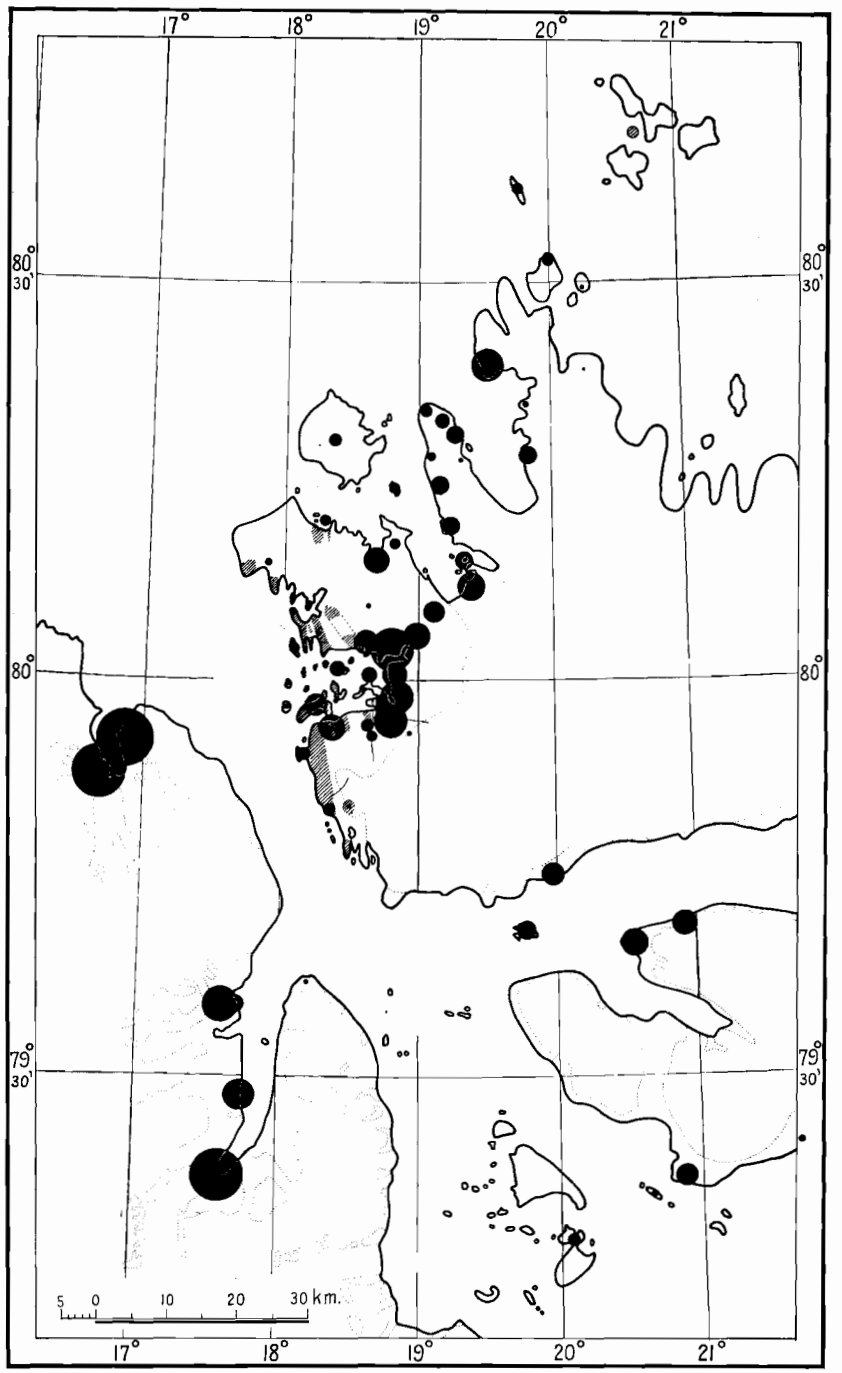


Fig. 59. Sketch map of the main area of the botanical investigation in 1931. The shaded parts denote the observed areas of pure dolomite (adapted after O. Kulling), almost avoid of vegetation. The diametres of the black circles and points are directly proportional to the number of species of phanerogams known from that locality (max. 65). Note the increasing or comparatively great number of species towards the inner parts of the best known fjords, L. Franklinfjorden (80° 15′), Murchisonfjorden (80°), Sorgfjorden (79° 55′) and Lomfjorden (79° 30′), a common phenomenon in the Arctic.

Fig. 60. Typical dolomitelimestone landscape, on the eastern shore of Kinnvika in Murchisonfjorden, 24/7 1931.

altogether absent, and hardly comprises more than the following species, which all occur in extremely sparse growth:

Saxifraga cernua	*Draba Bellii*
Saxifraga oppositifolia	*Cerastium Regelii*
Papaver radicatum	*Stellaria longipes*
Cochlearia officinalis	*Phippsia algida*

A feature still more striking than the great scarcity of phanerogams is the almost total absence of lichens. In addition to some few crustaceous lichens, e. g., *Caloplaca elegans* and *sorediata*, the following larger lichens are found on rare occasions:

Cetraria Delisei	*Parmelia minuscula* r.
Cetraria crispa r.	*Physcia muscigena* r.
Cetraria nivalis r.	

Mosses, too, are rare on this barren ground.

Just as there are gradual transitions from dolomitic ground to the other rockground in Nort-East Land, so are there gradual transitions in the vegetation in these areas, viz. from an almost complete sterility on the pure dolomite to the occasionally comparatively rich vegetation found on other substrata, as already described. Quite exceptionally we find within the purely, or in this case nearly purely, dolomitic areas so relatively rich a vegetation as will be seen in Fig. 61, where the strand flat at Kinnvika was covered within quite a large area by a large number of flat tufts of *Saxifraga oppositifolia*, but which was other-

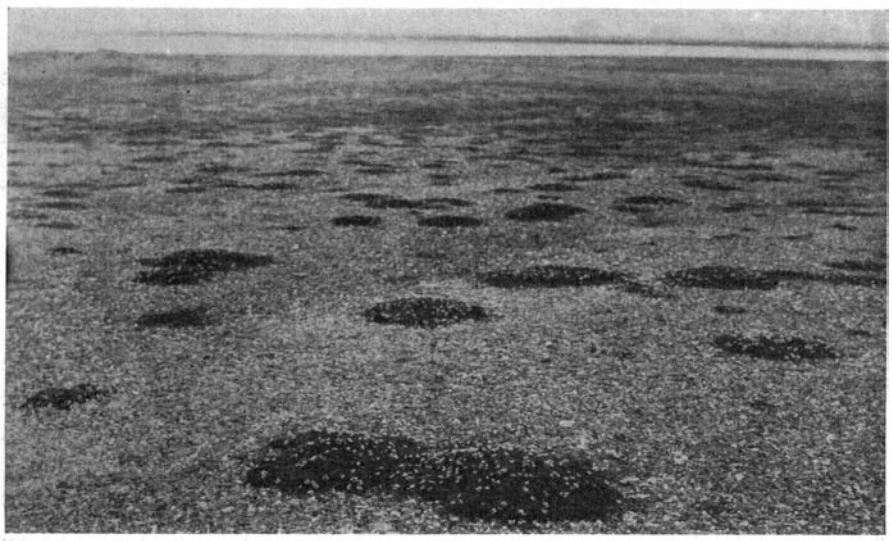


Fig. 61. Dolomitic strand flat in the inner parts of Kinnvika covered by scattered tufts of *Saxifraga oppositifolia*, but otherwise practically sterile. 24/7 1931.

wise altogether sterile, with the exception of individual crustaceous lichens and some few mosses.

Malmgren (1862 p. 266, footnote) has already pointed out that the cause of the great sterility of the dolomite areas must lie in the nature of the substratum, for, almost everywhere where rocks of any other kind show up such as quartzite, slate and basalt, we find a vegetation which is abruptly richer in individuals and number of species than that found on the dolomite substratum.

Manured ground.

The only bright spots in the distressingly poor vegetation of the dolomite limestone are furnished by the patches of manured soil near bird-stones, bird hummocks, old skeleton remains and on the bird islets.

The bird stone vegetation here is extremely scanty, with small and often miserable specimens of the following larger lichens:

Gyrophora decussata
Gyrophora erosa
Gyrophora hyperborea
Parmelia minuscula
Physcia caesia
Physcia tribacea
Xanthoria candellaria

Of crustaceous lichens *Caloplaca elegans* should especially be mentioned as typical for the bird stones.

Below the stone we not infrequently find mosses with *Physcia muscigena* and *Caloplaca sorediata*, also occasionally *Cladonia pocillum*; and of phanerogams *Papaver*, *Saxifraga cernua* or *oppositifolia*.

The bird hummocks observed on the dolomitic ground have already been mentioned (cf. p. 128, 129).

Another type of vegetation on manured ground, and which was observed only in North-East Land on the dolomite ground, is that frequently found near the old skeleton remains of whales and other animals. In addition to the small patch of mosses to be found here, the following phanerogams are observed:

Saxifraga cernua — *Cerastium Regelii*
Saxifraga oppositifolia — *Phippsia algida*
Cochlearia officinalis

and of lichens *Physcia muscigena* and often *Cetraria Delisei*. On the exposed bones, we regularly find *Physcia tribacea* and *caesia*, in addition to crustaceous lichens and mosses. Not in frequently, similar small, but apparently quite motiveless, patches of vegetation are found in these otherwise so sterile areas. If we dig down a little under these patches we very often find, however, the cause to be old bone remains which have become buried here in the course of time.

Also the vegetation on the purely dolomitic bird islets fails to compare with that which is to be found on similar islets composed of other rock. The largest and to a great extent purely dolomitic bird islet in Murchisonfjorden is Depotøya. Here great numbers of eiders, geese, loons and terns breed. Close up to the nests, and particularly on the edges of the small shallow ponds, there is a fairly rich vegetation of deep beds of mosses, and in this were very charateristically found large, continuous patches of *Cladonia pocillum* and large rosettes of up to one decimetre of sterile *Collema pulposum*. Both of these lichens occur in abundance among the mosses also on other bird islets in Murchisonfjorden e. g. Krossøya. Of other larger lichens we often find in their company *Physcia muscigena* and occasionally *Cetraria Delisei*. On the stones there is an extremely poor vegetation consisting of *Physcia caesia* and *tribacea*, often in company with *Caloplaca elegans*, and, in addition, some few crustaceous lichens. Of phanerogams only *Cochlearia* and *Phippsia algida* are common, whereas *Saxifraga rivularis* and *oppositifolia* are comparatively rarer.

Excepting the mats of mosses on the edge of the small ponds and near the nests, the ground on these dolomitic bird islets is practically just as grey and sterile as on the dolomitic islets without any bird life.

V. Lists showing the known Distribution of Vascular Plants within the Area investigated in 1931.

List of Distribution I

Northern Islands, Islands in Murchisonfjorden and Moffen

		Northern Islands								Islands in Murchisonfjorden										Moffen
		Kvitøya	Storøya	Foynøya	Karl XII Øy	Waldenøya	Nordkapøya	Castrénøya	(Sjuøyane)	Ringertzøya	Depotøya	Nordre Russøya	Kvaløya	Flyndra	Oskarøya	Teltøya	Gråøya	Søre Russøya	Krossøya	Moffen
8	Ranunculus sulphureus	.	.	.	.	×	.	.	×	.	.	.	.	.	.	.	.	.	.	.
11	Saxifraga cernua	×				×			×					×	×			×	×	
13	— flagellaris																	×		
14	— groenlandica					×			×	×		×			×			×		×
17	— nivalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	.	.
18	— nivalis var. tenuis																			×
19	— oppositifolia	×				×			×	×		×	×	×	×			×	×	
20	— rivularis				×	×	×		×	×	×	×		×						×
22	Potentilla emarginata	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.
25	Papaver radicatum					×			×	×				×	×	×		×		
27	Cardamine bellidifolia					×			×									×		
29	Cochlearia officinalis				×	×	×				×	×	×	×	×			×	×	×
31	Draba Bellii	×	.	.	.	.	.	.	.	×	.	.	.	.	×	.	×	×	.	.
35	— oblongata	×					×											×		
37	— subcapitata									×					×			×		
40	Cerastium alpinum				×	×	×								×			×		
41	— Regelii	.	.	.	.	×	.	.	.	×	.	.	×	×	×	.	.	×	.	.
45	Minuartia rubella					×									×			×		
47	Sagina intermedia						×													
50	Stellaria longipes						×			×					×			×		
52	Oxyria digyna	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.
54	Salix polaris						×	×							×	×		×		×
61	Juncus biglumis															×				
62	Luzula confusa						×	×	×											
63	— nivalis	.	.	.	.	.	×	×	.	.	.	.	.	.	.	.	.	.	.	.
74	Dupontia Fisheri									×								×		
78	Phippsia algida	×	×		×	×	×		×	×	×	×	×	×	×			×	×	×
80	Poa abbreviata														×			×		
83	— alpigena var. colpodea	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	×	.	.
85	— rigens								×						×			×		
87	Puccinellia angustata														×			×		
88	— phryganodes																	×		
89	— vacillans	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	.	.
	Numbers of species known from each island	5	1	0	4	12	10	3	12	10	3	5	4	7	16	3	1	24	4	6
	Numbers of species known from each island-group	22								26										6

List of Distribution II

North-East Land

		N. coast	Brennevins-fjorden							Lady Franklinfjorden							
		Extremhuken	Depotodden	Zeipelbukta	Kontaktberget	Franklindalen, east end	5 km SE Cape Hansteen	2.5 km SE Cape Hansteen	Cape Hansteen	Franklindalen, west end	Franklinfjellet, west side	Shore pl. w. of Franklinfjellet	Hansøya	Gerardodden	Inner west side	Persberget	Westmanbukta	Tombolaøya	Lågøya	Basisøya
1	Lycopodium Selago	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	Ranunculus hyperboreus		×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6	— nivalis		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	— pygmaeus		×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8	— sulphureus	.	×	.	×	.	.	.	×	×	×	×	×	×	×	×	×	.	.	×
9	Chrysosplenium tetrandrum																			
11	Saxifraga cernua		×	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
12	— comosa		×	.	×	.	×	.	×	×	×	×	×	×	×	×	×	×	×	×
13	— flagellaris	.	×	.	×	.	.	.	×	×	×	×	×	×	×	×	×	×	×	×
14	— groenlandica		×	.	×	.	×	.	×	×	×	×	×	×	×	×	×	×	×	×
16	— hirculus																			
17	— nivalis		×	.	×	.	×	.	×	×	×	×	×	×	×	×	×	×	×	×
18	— nivalis var. tenuis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19	— oppositifolia		×	.	×	.	×	.	×	×	×	×	×	×	×	×	×	×	×	×
20	— rivularis		×	.	×	.	×	.	×	×	×	×	×	×	×	×	×	×	×	×
21	Dryas octopetala		×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
22	Potentilla emarginata	.	×	.	×	.	×	.	×	.	×	×	×	×	×	×	×	×	×	×
24	— pulchella		×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
25	Papaver radicatum		×	.	×	.	×	.	×	.	×	×	×	×	×	×	×	×	×	×
27	Cardamine bellidifolia		×	.	×	.	×	.	×	.	×	×	×	×	×	×	×	×	×	×
28	— pratensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29	Cochlearia officinalis		×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
30	Draba alpina		×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
31	— Bellii		×	.	×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.
32	— cinerea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33	— lactea		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34	— nivalis		×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
35	— oblongata		×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
37	— subcapitata	.	×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
40	Cerastium alpinum		×	.	×	.	×	.	×	.	×	×	×	×	×	×	×	×	×	×
41	— Regelii		×	.	×	.	×	.	×	.	×	×	×	×	×	×	×	×	×	×
42	Melandryum apetalum																			
44	Minuartia Rossii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
45	— rubella		×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
47	Sagina intermedia		×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
49	Stellaria humifusa																			
50	— longipes	.	×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
52	Oxyria digyna		×	.	×	.	×	.	×	.	×	×	×	×	×	×	×	×	×	×
53	Polygonum viviparum		×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
54	Salix polaris	×	×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
56	Pedicularis hirsuta	.	×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
60	Taraxacum arcticum																			
61	Juncus biglumis		×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
62	Luzula confusa		×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
63	— nivalis	.	×	.	×	.	×	.	×	.	.	.	.	.	.	.	.	.	.	.
64	Carex maritima (C. incurva)																			

Murchisonfjorden																		Hinlopenstredet													
Detterbukta	Claravågsundet	Kinnvika	Raudstupet	Floraberget	Wargentinfjellet	Norvika, north side	Wargentindalen	Celsiusfjellet	Snaddvika, north side	Snaddvika, south side	Kvalrosshalvøya, north point	Triodalen	Camp at the inland ice	Krykjeslukta	Krykjevatnet	Sveanor	(Murchisonfjorden)	Cape Sparre	Kalkstranda at Forsiusfjellet	Forsiusfjellet	Augusti Bay (= Idunfjellet)	Oxfordhalvøya	Rijpdalen	Gyldénøyane	Rundhaugen	Ismåsefjellet	Torellneset	Ulvebukta	Perthesøya	Von Otterøya	(Wahlenberg Bay)
.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
				×					×																						
				×																											
				×																							×				
.	.	.	×	×	.	.	×	.	×	.	.	×	.	.	.	×	×	.	.	.	×	.	.	.	×	×	×	.	.	.	.
				×																											
×			×	×		×	×	×	×	×	×	×	×	×	×	×	×	×	×				×	×	×	×	×	×		×	
								×	×	×																×	×				
.	.	.	.	×	.	.	×	.	×	×	×	×	.	.	×	×	×	.	.	.	×	.	.	.	×	.	.	.	.	.	.
×	×		×	×		×	×	×	×	×	×	×		×	×	×	×				×			×	×	×	×	×			
												×									×					×					
			×	×			×	×	×	×		×				×	×				×			×		×	×			×	
.	.	.	.	×	.	.	.	×	×	×	.	×	.	.	.	×	.	.	.	.	×	.	.	.	.	×	×	.	.	.	.
×	×	×	×	×		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×			×	×	×	×	×		×	×	
×				×					×	×							×				×					×	×		×	×	
			×	×		×	×	×	×		×	×			×	×	×					×				×					
.	.	.	.	×	.	×	×	×	×	.	.	×	.	.	.	.	×	.	.	.	.	.	.	×	.	.	.	.	.	.	.
×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×				×	×	×	×	×	×	×	×	
				×			×		×		×	×				×	×	×						×	×	×	×			×	
.	.	.	.	×	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
×			×	×		×	×	×	×	×	×	×		×		×	×	×			×			×	×	×	×	×	×	×	
				×				×	×	×				×			×								×						
		×	×	×			×			×	×	×	×			×	×	×	×	×	×		×		×		×				×
.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
				×			×		×			×			×		×							×	×					×	
																	×														
				×			×									×	×	×					×	×	×		×	×		×	
.	.	.	×	×	.	.	×	×	.	×	×	×	.	×	.	×	×	×	×	.	×	.	.	×	×	×	.	.	.	.	×
			×	×		×	×	×	×	×		×		×		×	×	×			×			×	×	×	×	×		×	
×			×	×		×	×	×		×	×	×			×	×	×	×	×	×			×	×	×	×				×	
																								×							
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	.	.	.	×	.	.	.	.	.	.
			×	×			×	×	×	×	×	×			×	×	×				×			×	×						
				×				×	×	×		×					×														
				×																				×							
.	.	.	×	×	.	×	×	×	.	×	.	×	.	.	×	×	×	×	×	.	.	.	×	×	×	.	×	×	×	×	.
			×	×			×	×	×		×	×				×	×				×					×					
				×			×	×	×			×					×				×					×					
			×	×			×	×	×		×	×				×	×				×			×	×	×	×				
.	.	.	.	×	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.
				×								×																			
			×	×					×	×		×			×	×	×				×				×						
			×	×		×	×	×	×	×	×	×					×	×							×	×	×		×	×	
.	.	.	×	×	.	.	×	×	.	×	.	×	.	.	.	×	.	.	.	.	.	.	.	.	×	×	×	.	.	.	.
				×																											

List of Distribution II (cont.)

North-East Land

		N. coast	Brennevins-fjorden							Lady Franklinfjorden									
		Extremhuken	Depotodden	Zeipelbukta	Kontaktberget	Franklindalen, east end	5 km SE Cape Hansteen	2.5 km SE Cape Hansteen	Cape Hansteen	Franklindalen, west end	Franklinfjellet, west side	Shore pl. w. of Franklinfjellet	Hansøya	Gerardodden	Inner west side	Persberget	Westmanbukta	Tombolaøya	Lågøya	Basisøya
65	Carex misandra	.	.	.	.	.	.	.	.	.	.	.	×	×	.	.	×	.	.	.
66	— nardina												×	×						
67	— rupestris																			
71	Eriophorum Scheuchzeri																			
72	Alopecurus alpinus	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
73	Deschampsia alpina																			
74	Dupontia Fisheri		×									×			×					
75	Festuca brachyphylla																			
76	— rubra var. arenaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
78	Phippsia algida		×	×	×	×		×	×	×	×	×	.	×	×	.	×	×	×	×
79	— concinna												×		×					
80	Poa abbreviata												×		×	×	×		×	
82	— alpigena var. vivipara	.	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
83	— alpigena var. colpodea		×		×		×	×				×			×	×				
84	— alpina var. vivipara																			
85	— rigens		×	×	×		×				×	×		×	×		×			
86	— rigens var. vivipara	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
87	Puccinellia angustata		×																	×
88	— phryganodes		×																	
89	— vacillans											×								
90	— Vahliana	.	.	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.
Numbers of species known from each locality		1	37	7	19	2	19	16	14	8	20	19	18	31	23	10	26	11	13	11
Numbers of species known from each district		1	42							42										

Murchisonfjorden																		Hinlopenstredet													
Detterbukta	Claravågsundet	Kinnvika	Raudstupet	Floraberget	Wargentinfjellet	Norvika, north side	Wargentindalen	Celsiusfjellet	Snaddvika, north side	Snaddvika, south side	Kvalrosshalvøya, north point	Triodalen	Camp at the inland ice	Krykjeslukta	Krykjevatnet	Sveanor	(Murchisonfjorden)	Cape Sparre	Kalkstranda at Forsiusfjellet	Forsiusfjellet	Augusti Bay (= Idunfjellet)	Oxfordhalvøya	Rijpdalen	Gyldénøyane	Rundhaugen	Ismåsefjellet	Torellneset	Ulvebukta	Perthesøya	Von Otterøya	(Wahlenberg Bay)
·	·	·	×	·	·	·	·	·	×	·	·	·	·	·	·	·	×	·	·	·	×	·	·	·	·	×	·	·	·	·	·
							×		×																						
									×																						
																									×						
·	·	·	·	×	·	·	·	·	·	·	·	×	·	×	×	×	·	·	×	·	×	·	·	·	×	×	×	·	·	·	·
							×																								
				×					×						×			×			×				×						
				×					×			×					×														
·	·	·	×	×	·	·	·	·	·	·	·	·	·	·	·	×	·	·	·	·	·	·	·	·	·	·	×	·	·	·	·
×			×	×	×		×	×	×	×	×	×			×	×	×	×	×				×	×	×		×	×	×	×	
						×		×																							
			×	×			×	×	×	×	×	×		×		×		×						×	×	×					
·	·	·	×	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	×	·	·	·	·	·	·
			×	×			×		×	×		×		×		×	×								×	×	×				
			×																							×					
				×				×	×			×				×	×				×					×	×				
·	·	·	·	×	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
												×												×							
																					×										
												×					×				×										×
·	·	·	·	·	·	·	×	·	·	·	·	×	·	·	·	·	×	·	×	·	·	·	·	·	×		·	·	·	·	·
8	3	3	26	48	2	12	30	26	37	24	17	37	4	11	14	28	35	15	10	3	24	1	8	21	30	27	24	8	7	14	3
62																		49													

List of Distribution III
Sorgfjorden and Lomfjorden

		Sorgfjorden			Lomfjorden					
		Heclahamna	Inner west side	(Sorgfjorden)	Faxedalen	Faxefjell	Dvergbreen	Lomfjordbotnen	Cape Fanshawe	(Lomfjorden)
1	Lycopodium Selago	×								
2	Equisetum arvense		×							×
3	— scirpoides	?	×							×
4	— variegatum	×	×		×			×		×
5	Ranunculus hyperboreus		×							
6	— nivalis	×								
7	— pygmaeus	×	×				×			
8	— sulphureus	×	×		×	×	×	×		×
10	Saxifraga aizoides	×	×		×			×		×
11	— cernua	×	×		×	×	×	×		
12	— comosa	×	×					×		
13	— flagellaris	×	×				×	×		×
14	— groenlandica	×	×					×		
15	— hieraciifolia	×	×			×				
16	— hirculus	×								×
17	— nivalis	×	×		×	×	×	×		×
18	— nivalis var. tenuis		×					×		
19	— oppositifolia	×	×		×	×	×	×		×
20	— rivularis	×	×				×	×		×
21	Dryas octopetala	×	×		×	×	×	×		×
22	Potentilla emarginata	×	×		×		×	×		×
23	— nivea	×								
24	— pulchella	×	×		×			×		×
25	Papaver radicatum	×	×		×	×	×	×		
26	Braya purpurascens	×	×		×			×		×
27	Cardamine bellidifolia	×								
28	— pratensis		×							
29	Cochlearia officinalis	×	×	×	×	×		×		
30	Draba alpina	×	×				×	×		×
31	— Bellii			×			×	×		×
33	— lactea	×						×		×
35	— oblongata			×			×			
36	— rupestris	×								×
37	— subcapitata	×			×					×
38	Eutrema Edwardsii	×								
39	Parrya nudicaulis	×								
40	Cerastium alpinum	×	×		×		×	×		×
41	— Regelii	×	×		×	×	×	×		×
42	Melandryum apetalum	×	×		×			×		×
43	Minuartia biflora	×					×	×		
44	— Rossii		×		×	×		×		×
45	— rubella	×	×		×	×		×		×
46	— stricta		×							
47	Sagina intermedia	×	×		×			×		
48	Silene acaulis	×	×					×		
49	Stellaria humifusa	×								
50	— longipes	×	×		×	×	×	×		

List of Distribution III (cont.)

Sorgfjorden and Lomfjorden

		Sorgfjorden			Lomfjorden					
		Heclahamna	Inner west side	(Sorgfjorden)	Faxedalen	Faxefjell	Dvergbreen	Lomfjordbotnen	Cape Fanshawe	(Lomfjorden)
51	Koenigia islandica	×								
52	Oxyria digyna	×	×				×	×		
53	Polygonum viviparum	×	×		×		×	×		×
54	Salix polaris	×	×		×	×	×	×		×
55	Cassiope tetragona	×	×		×	×		×		×
56	Pedicularis hirsuta	×	×		×			×		
57	— lanata var. dasyantha							×		
58	Arnica alpina							×		
59	Erigeron uniflorus s. l.	×								
60	Taraxacum arcticum	×	×				×	×		×
61	Juncus biglumis	×	×		×	×		×		×
62	Luzula confusa	×	×				×	×		×
63	— nivalis	×	×		×	×	×	×		×
65	Carex misandra	×	×		×		×	×		×
66	— nardina	×	×		×	×	×	×		×
67	— rupestris	×	×					×		×
68	— saxatilis		×							
69	— subspathacea		×							
70	— ursina		×							
71	Eriophorum Scheuchzeri	×	×					×		×
72	Alopecurus alpinus	×			×		×	×		×
73	Deschampsia alpina	×	×		×	×		×	×	×
74	Dupontia Fisheri	×	×							×
75	Festuca brachyphylla	×	×				×	×		×
76	— rubra var. arenaria	×	×		×		×	×		×
77	— vivipara		×		×		×	×		×
78	Phippsia algida	×	×		×	×	×	×		×
79	— concinna	×						×		
80	Poa abbreviata	×	×		×	×		×	×	×
81	— alpigena	?					×			?
82	— alpigena var. vivipara						×	×		×
83	— alpigena var. colpodea		×		×			×		×
84	— alpina var. vivipara		×		×	×		×	×	×
85	— rigens	×	×		×		×	×		
86	— rigens var. vivipara	×					×	×		
87	Puccinellia angustata				×				×	×
88	— phryganodes	×	×					×		
89	— vacillans				×		×	×		
90	— Vahliana	×	×		×			×		×
91	Trisetum spicatum							×		
Numbers of species known from each locality		65	61	3	41	21	35	61	4	48
Numbers of species known from each fjord		80			72					

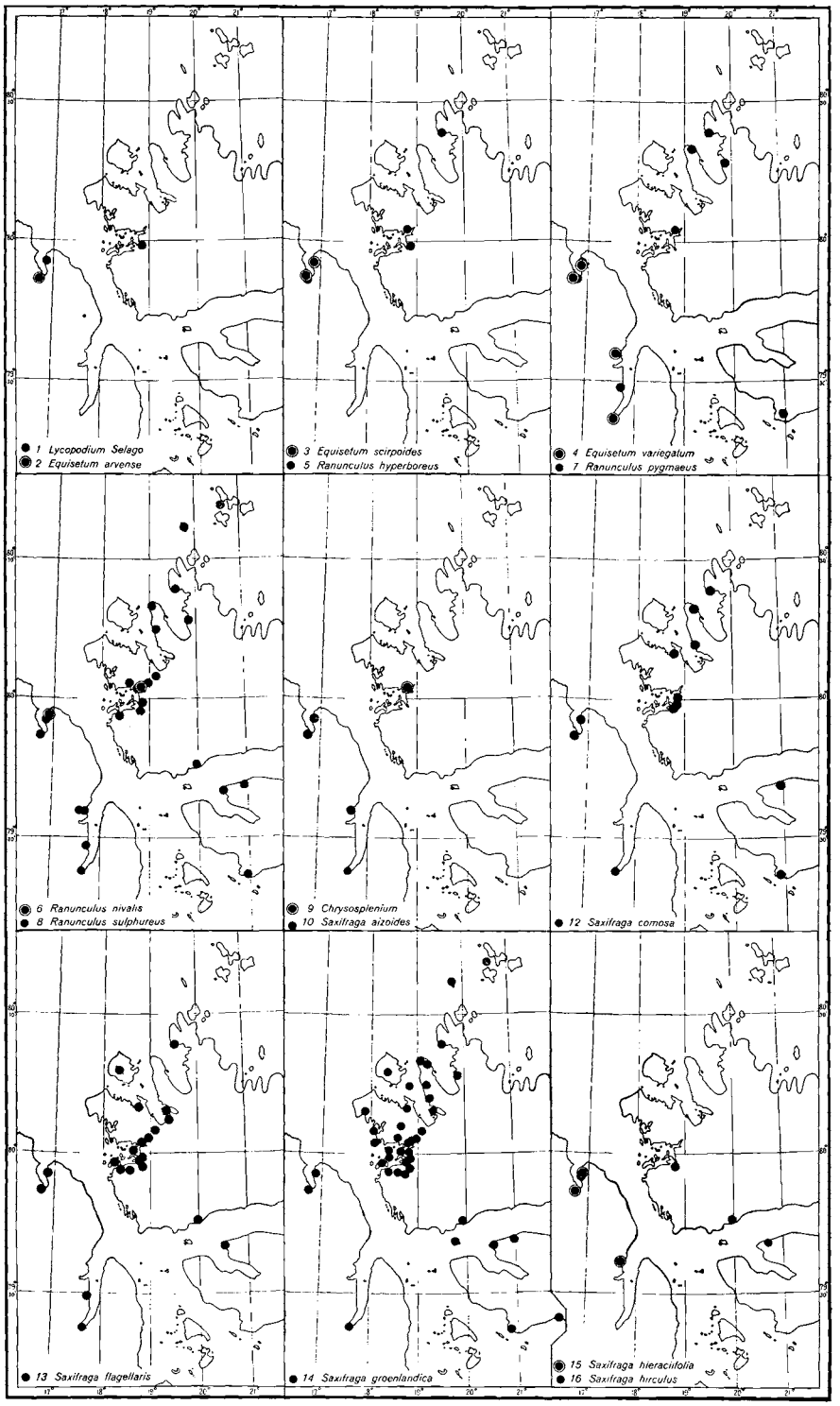

1 Lycopodium Selago
2 Equisetum arvense
3 Equisetum scirpoides
5 Ranunculus hyperboreus
4 Equisetum variegatum
7 Ranunculus pygmaeus
6 Ranunculus nivalis
8 Ranunculus sulphureus
9 Chrysosplenium
10 Saxifraga aizoides
12 Saxifraga cernua
13 Saxifraga flagellaris
14 Saxifraga groenlandica
15 Saxifraga hieraciifolia
16 Saxifraga hirculus

Plate I.

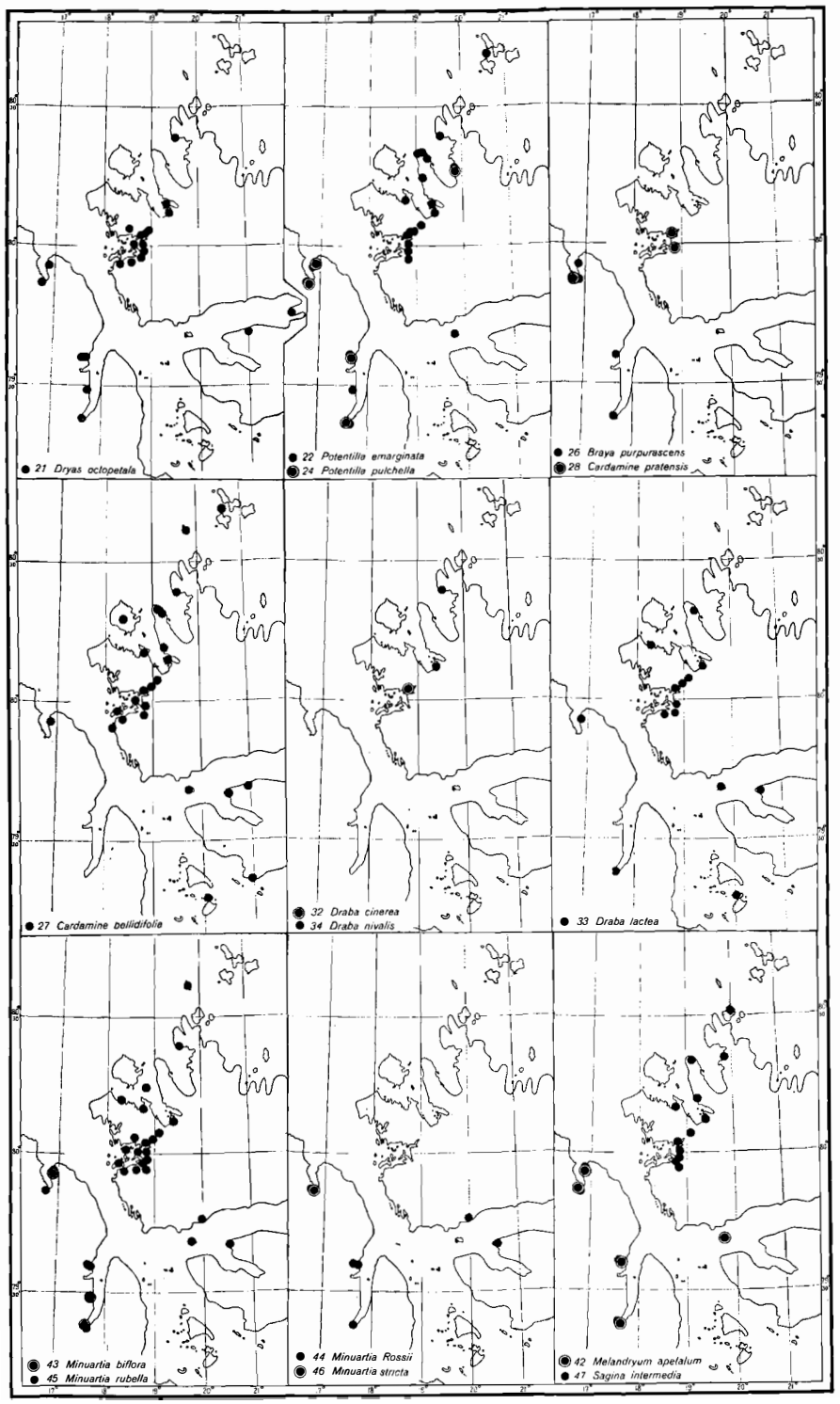

21 Dryas octopetala
22 Potentilla emarginata
24 Potentilla pulchella
26 Braya purpurascens
28 Cardamine pratensis
27 Cardamine bellidifolia
32 Draba cinerea
34 Draba nivalis
33 Draba lactea
43 Minuartia biflora
45 Minuartia rubella
44 Minuartia Rossii
46 Minuartia stricta
42 Melandryum apetalum
47 Sagina intermedia

Plate II.

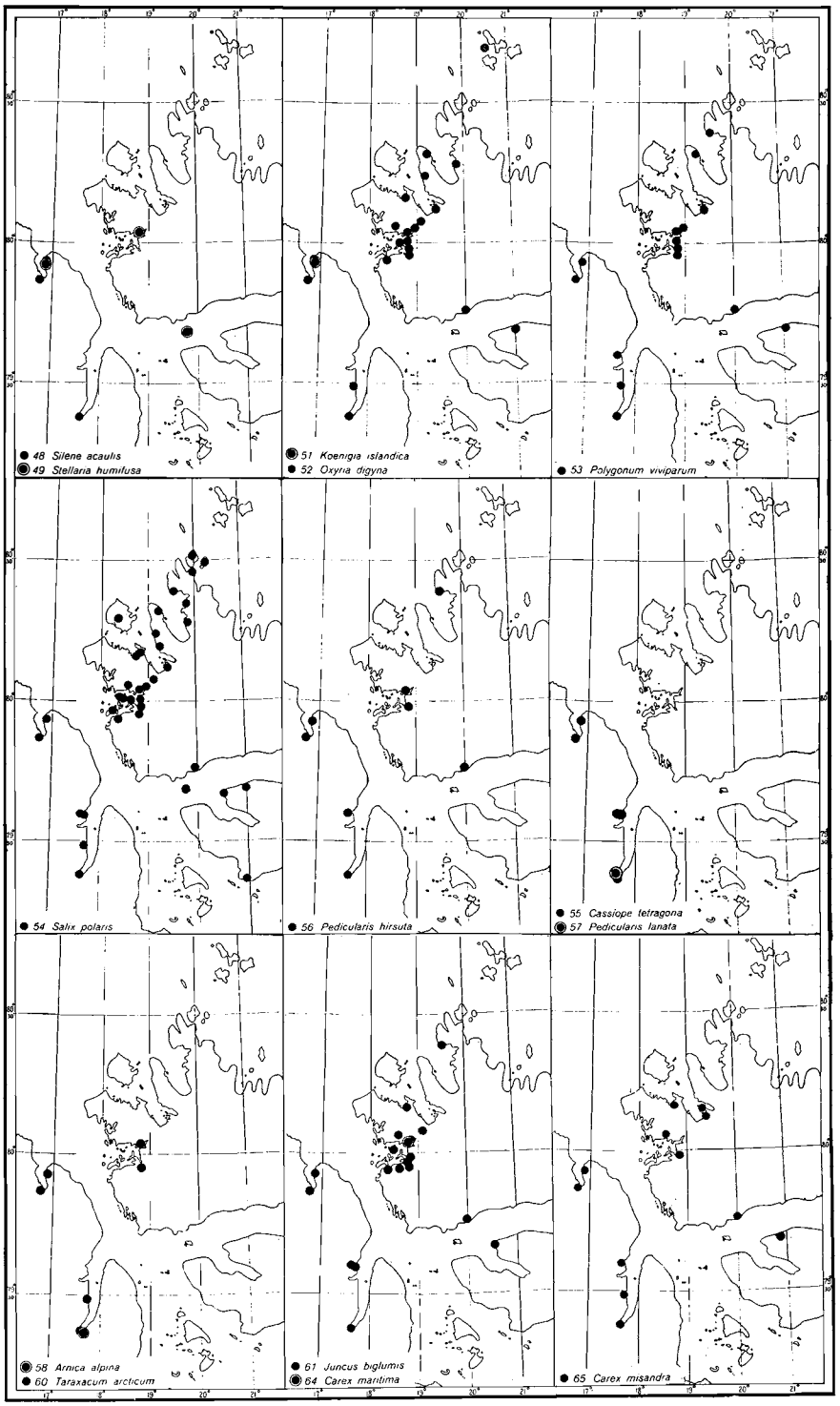

48 Silene acaulis
49 Stellaria humifusa
51 Koenigia islandica
52 Oxyria digyna
53 Polygonum viviparum
54 Salix polaris
56 Pedicularis hirsuta
55 Cassiope tetragona
57 Pedicularis lanata
58 Arnica alpina
60 Taraxacum arcticum
61 Juncus biglumis
64 Carex maritima
65 Carex misandra

Plate III.

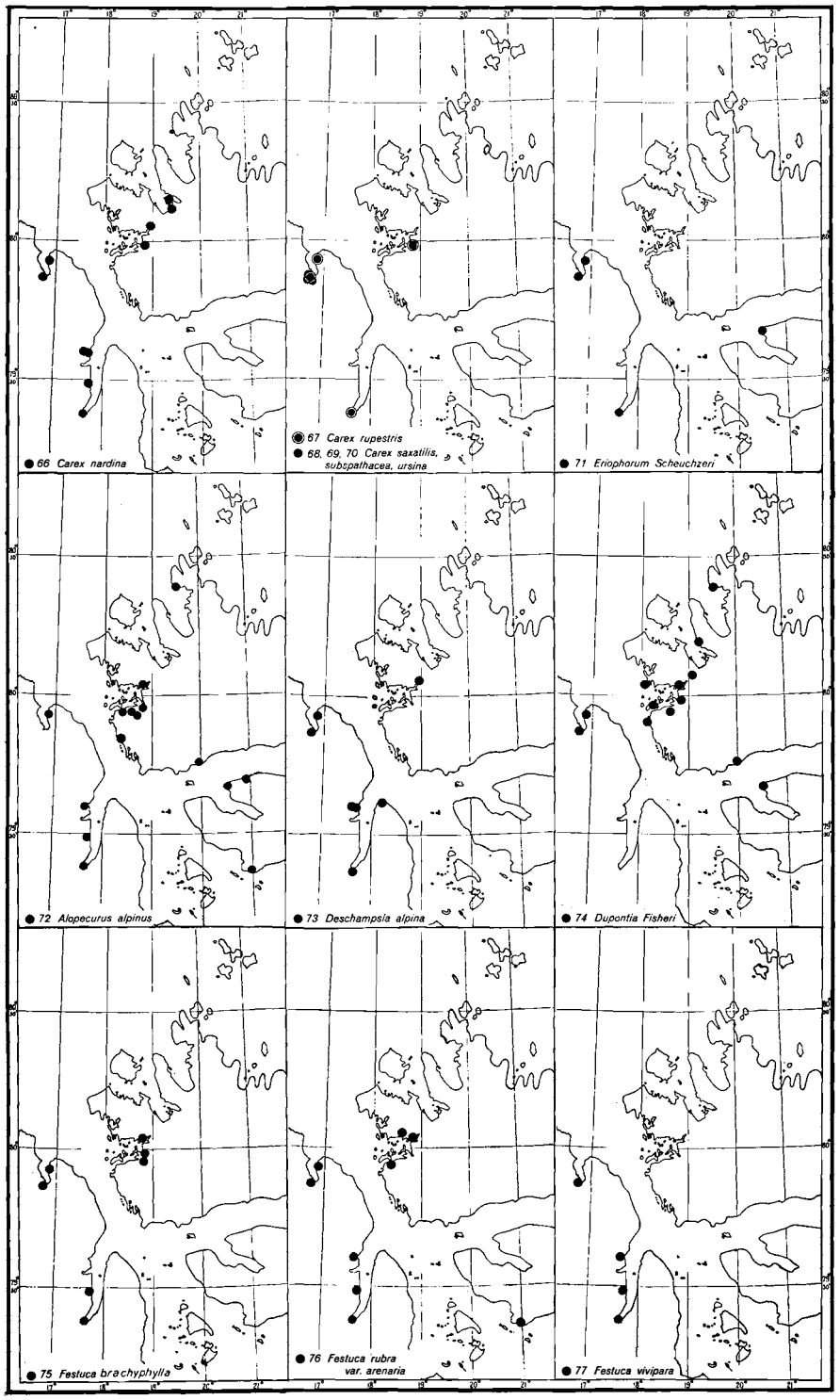

66 Carex nardina
67 Carex rupestris
68, 69, 70 Carex saxatilis, subspathacea, ursina
71 Eriophorum Scheuchzeri
72 Alopecurus alpinus
73 Deschampsia alpina
74 Dupontia Fisheri
75 Festuca brachyphylla
76 Festuca rubra var. arenaria
77 Festuca vivipara

Plate IV.

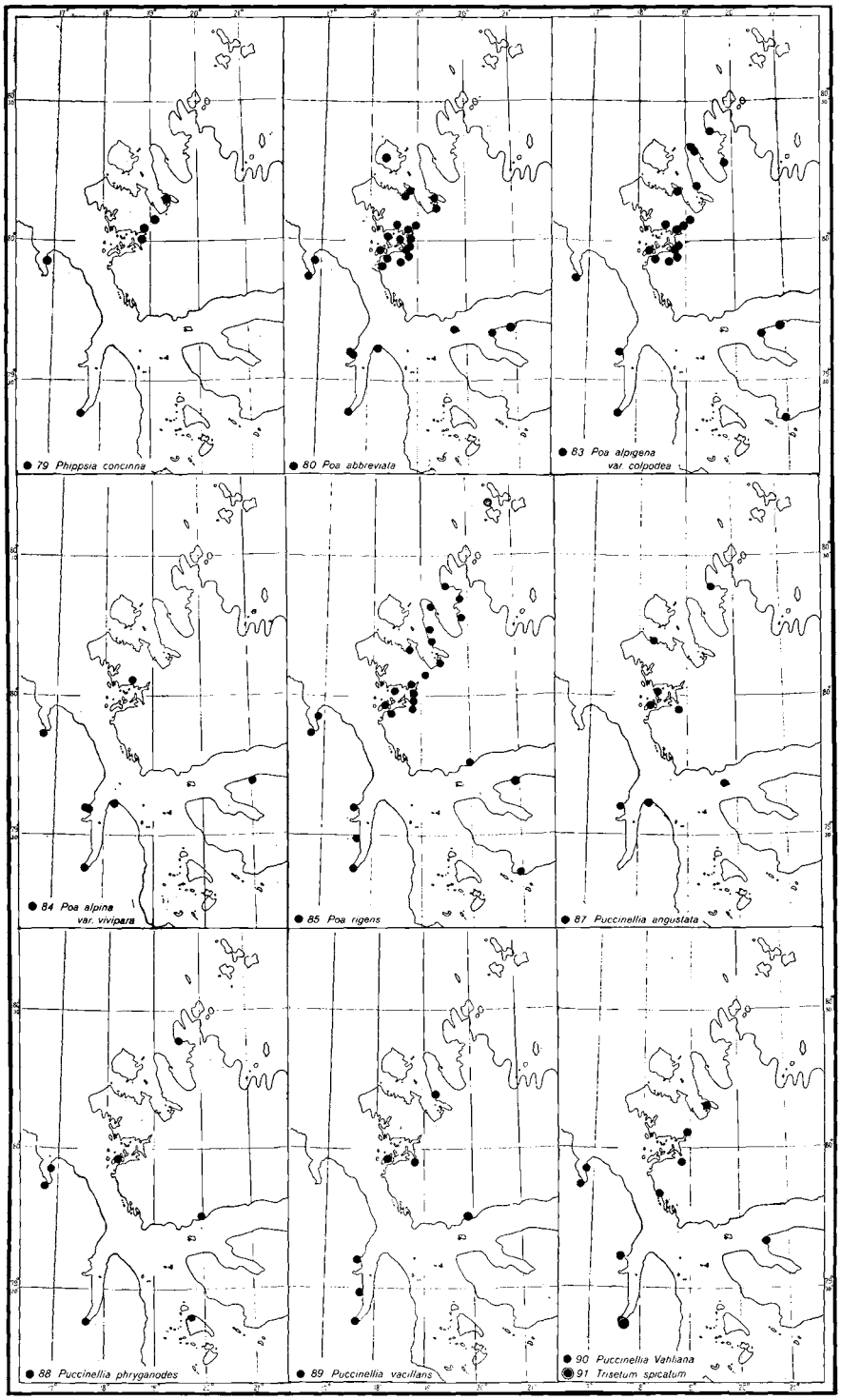

● 79 Phippsia concinna
● 80 Poa abbreviata
● 83 Poa alpigena var. colpodea
● 84 Poa alpina var. vivipara
● 85 Poa rigens
● 87 Puccinellia angustata
● 88 Puccinellia phryganodes
● 89 Puccinellia vacillans
● 90 Puccinellia Vahliana
◉ 91 Trisetum spicatum

Plate V.

Bibliography.

Ahlmann, H. W. and Malmberg, S. Sommar vid Polhavet. Stockholm 1931.

— Den Svensk-Norska Expeditionen till Nord-Ostlandet och Farvattnen däromkring Sommaren 1931. (Ymer 1932. H. 1.) Stockholm 1932.

— Scientific Results of the Swedish-Norwegian Arctic Expedition in the Summer of 1931. Part V: Geomorphology. (Geografiska Annaler, 1933 h. 2—3.) Stockholm 1933.

Andersson, G. and Hesselman, H. Bidrag till Kännedomen om Spetsbergens och Beeren Eilands Kärlväxtflora. (Bihang till Kongl. Svenska Vet. Akad. Handl. Bd. 26. Afd. III. No. 1.) Stockholm 1900.

Asplund, E. Beiträge zur Kenntnis der Flora des Eisfjordgebietes. (Arkiv för Botanik Bd. 15. No. 14.) Stockholm 1918.

Bentham, G. and Hooker, J. D. Genera Plantarum, ad Exemplaria imprimis in Herbariis Kewensibus servata definita. Vol. III. Pars II. Londini 1883.

Berlin, A. Kärlväxter, insamlade under Den Svenska Expeditionen till Grönland 1833. (Öfversigt af Kungl. Vet. Akad. Förhandl. No. 7.) Stockholm 1884.

Blytt, A. Haandbog i Norges Flora. Kristiania 1906.

Boissier, E. Flora Orientalis sive Enumeratio Plantarum in Oriente a Græcia et Ægypto ad Indiæ fines hucusque observatarum. Vol. V, Fasc. II. Genevæ et Basileæ 1884.

Britton, N. L. and Brown, H. A. Illustrated Flora of the Northern United States, Canada and the British Possessions. New York 1896—98.

Brown, R. Chloris Melvilliana. A List of Plants collected in Mellville Island, (latitude 74°—75° N., longitude 110°—112° W.) in the Year 1820; by the Officers of the Voyage of Discovery under the Orders of Captain Parry. With Characters and Descriptions of the new Genera and Species. London 1823. (Reprinted in: The Miscellaneous Botanical Works of Robert Brown, Esqw., D. C. L., F. R. S., etc. Vol. I. London 1866.)

Buchenau, F. Juncaceae (Engler, A. Das Pflanzenreich IV 36.) Leipzig 1906.

Bøcher, T. W. Phytogeographical Studies of the Greenland Flora based upon Investigations of the Coast between Scoresby Sound and Angmagssalik. (Medd. om Grønland Bd. 104. No. 3.) København 1933.

— Studies on the Vegetation of the East Coast of Greenland between Scoresby Sound and Angmagssalik (Christian IX.s Land). (Medd. om Grønland Bd. 104. No. 4.) København 1933.

Chydenius, K. Svenska Expeditionen till Spetsbergen 1861. Stockholm 1865.

Dahlstedt, H. Studier öfver Arktiska Taraxaca. (Arkiv för Botanik Vol. II. No. 8.) Stockholm 1905.

Devold, J. and Scholander, P. F. Flowering Plants and Ferns of Southeast Greenland. (Skrifter om Svalbard og Ishavet Nr. 56.) Oslo 1933.

Dunér, N. and Nordenskiöld, A. E. Anteckningar till Spetsbergens Geografi. (Kungl. Svenska Vet. Akad. Handl. Bil. 6, No. 5.) Stockholm 1863.

Dusén, P. Zur Kenntnis der Gefäßpflanzen Ostgrönlands. (Bihang till Kungl. Svenska Vet. Akad. Handl. Bd. 27. Afd. III. No. 3.) Stockholm 1901.

Eaton, M. A. A List of Plants collected in Spitzbergen in the Summer of 1873 with their Localities. (The Journal of Botany 1876, Vol. 14.) London 1876.

Ekman, E. Nomenclature of some North-european Drabae. (Arkiv för Botanik. Bd. 12. No. 7.) Stockholm 1912.

— Zur Kenntnis der Nordischen Hochgebirgs-Drabae. (Kungl. Svenska Vet. Akad. Handl. Bd. 27. No. 3.) Stockholm 1912.

— Studies in the Genus Draba. (Svensk Botanisk Tidskrift Bd. 23. H. 4.) Stockholm 1929.

— Contribution to the Draba Flora of Greenland. III. Some Notes on the Arctic, especially the Greenland Drabas of the Sections *Aizopsis* and *Chrysodraba* DC. (Svensk Botanisk Tidskrift Bd. 25. H. 4.) Stockholm 1931.

— Contribution to the Draba Flora of Greenland. IV. (Svensk Botanisk Tidskrift Bd. 26. H. 3—4.) Stockholm 1932.

Ekstam, O. Beiträge zur Kenntnis der Gefäßpflanzen Spitzbergen's. (Tromsø Museums Aarshefter 20.) Upsala 1898.

— Einige Blütenbiologische Beobachtungen auf Spitzbergen. (Tromsø Museums Aarshefter 20, 1897.) Tromsø 1899.

Elton, C. S. The Oxford University Arctic Expedition, 1924: The Biology in Relation to the Geography. (The Geographical Journal, August 1925.) London 1925.

— see also Summerhayes, V. S. and Elton, C. S.

Engler, A. and Irmscher, E. Saxifragaceae—Saxifraga. (Engler, A. Das Pflanzenreich IV 117.) Leipzig 1919.

Eriksson, B. E. Scientific Results of The Swedish-Norwegian Arctic Expedition in the Summer of 1931, Part VI: Climatology and Meteorology. (Geografiska Annaler, 1933 h. 2—3.) Stockholm 1933.

Ernst, A. Bastardierung als Ursache der Apogamie im Pflanzenreich. Eine Hypothese zur experimentellen Vererbungs- und Abstammungslehre. Jena 1918.

Exo, A. Poa alpina und die Erscheinung der Viviparie bei ihr. Bonn 1916.

Fernald, M. L. Botanizing in Newfoundland (continued). (Rhodora Vol. 28, No. 332—333.) Boston 1926.

— Recent Discoveries in the Newfoundland Flora (continued). (Rhodora Vol. 35, No. 412.) Boston 1933.

— Recent Discoveries in the Newfoundland Flora. (Rhodora Vol. 35, No. 414.) Boston 1933.

— Recent Discoveries in the Newfoundland Flora. (Rhodora Vol. 35, No. 420.) Boston 1933.

Fernald, M. L. and Weatherby, C. A. The Genus Puccinellia in Eastern North America. (Rhodora Vol. 18, No. 205.) Boston 1916.

Franchet, A. Monographie du Genre Chrysosplenium Tourn. (Nouv. Archives du Museum 3e. Serie.) Paris 1891.

Fries, E. Novitiarum Florae Suecicae Mantissa I—III. Lund and Upsala 1832—42.

Fries, Th. M. Iakttagelser rörande några Arktiska Växter. (Botaniska Notiser 1858.) Lund 1858.

— Lichenes Spitsbergenses. (Kongl. Svenska Vet. Akad. Handl. Bd. 7. No. 2.) Stockholm 1867.

— Om Beeren Islands Fanerogam-vegetation. (Öfvers. af Kongl. Vet. Akad. Förhandl. 1869. No. 2.) Stockholm 1869.

— Tillägg till Spetsbergens Fanerogamflora. (Öfvers. af Kongl. Vet. Akad. Förhandl. 1869. No. 2.) Stockholm 1869.

— Plantae vasculares insularum Spetsbergensium hactenus lectae. Upsaliae 1871.

Fries, Th. M. and Nyström, C. Svenska Polarexpeditionen 1868. Stockholm 1869.

Gunnerus, J. E. Flora Norvegica, Observationibus praesertim oeconomicis panosque norvegici locupletata. Pars prior. Nidarosae et Hafniae 1766. Ibid. Pars posterior. Hafniae 1772.

Hackel, E. Monographia Festucarum europaearum. Kassel und Berlin 1882.

Hanssen, O. and Holmboe, J. The Vascular Plants of Bear Island. (Nyt Magazin for Naturvidenskaberne Bd. 62.) Oslo 1925.

Hanssen, O. and Lid, J. Flowering Plants of Franz Josef Land. (Skrifter om Svalbard og Ishavet Nr. 39.) Oslo 1932.

Hartz, N. Fanerogamer og Karkryptogamer fra Nordøst-Grønland, c. 75° 70′ N. Br., og Angmagssalik, c. 65° 40′ N. Br. (Medd. om Grønland XVIII.) Kjøbenhavn 1896.

— Østgrønlands Vegetationsforhold. (Medd. om Grønland XVIII.) Kjøbenhavn 1896.

Hegi, G. Illustrierte Flora von Mittel-Europa. München.

Hesselman, H. see Andersson, G. and Hesselman, H.

Holmberg. O. R. Die Gattung Phippsia und Ihre Arten. (Botaniska Notiser 1924. H. 2). Lund 1924.

— Handbok i Skandinaviens Flora. Heft 1 och 2. Stockholm 1922 och 1926.

Holmberg, O. R. and Lindman, C. A. M. Über Poa rigens Hartm. (Botaniska Notiser 1926. H. 2.) Lund 1926.

Holmboe, J., see Hanssen, O. and Holmboe, J.

Holmsen, G. Spitsbergens Natur og Historie. Kristiania 1911.

Hooker, J. D. see Bentham, G. and Hooker, J. D.

Hooker, W. J. Botanical Appendix. (Parry, W. E. Narrative of an Attempt to reach the North Pole.) London 1828.

— Flora Boreali Americana; or the Botany of the Northern Parts of British America. Vol. I et II. London 1840.

Hultén, E. Flora of Kamtchatka and the adjacent Islands. I—IV. (Kungl. Svenska Vet. Akad. Handl. Bd. 5. Nr. 1—2. Bd. 8. Nr. 1—2.) Stockholm 1927—30.

Høeg, O. A. and Lid, J. Adventive Plants in Spitsbergen. (Det Kongel. Norske Vidensk. Selsk. Forhandl. Bd. I. Nr. 59.) Trondhjem 1929.

Høeg, O. A. Blütenbiologische Beobachtungen aus Spitzbergen. (Norges Svalbard- og Ishavs-Undersøkelser. Meddelelse Nr. 16.) Oslo 1932.

Irmscher, E. see Engler, A. and Irmscher, E.

Jenkin, T. J. Notes on Vivipary in *Festuca ovina*. (The Botanical Society and Exchange Club of the British Isles. Report for 1921. Vol. VI, Part III.) Arbroath 1922.

Jørgensen, R. Karplantenes Høidegrenser i Jotunheimen. (Nyt Magazin for Naturvidenskaberne. Bd. 72.) Oslo 1932.

Kjellman, F. R. Några Tillägg till Kännedomen om Spetsbergens *Plantae vasculares*. (Öfvers. af Kongl. Vet. Akad. Förhandl. 1874. No. 3.) Stockholm 1874.

— Über den Pflanzenwuchs an der Nordküste Sibiriens. (Nordenskiöld, A. E. Die Wissenschaftlichen Ergebnisse der Vega-Expedition. Erster Band, VI.) Leipzig 1883.

— Die Phanerogamenflora der Sibirischen Nordküste. (Nordenskiöld, A. E. Die Wissenschaftlichen Ergebnisse der Vega-Expedition. Erster Band, VII.) Leipzig 1883.

— Die Phanerogamen-Flora an der Asiatischen Küste der Berings-Strasse. (Nordenskiöld, A. E. Die Wissenschaftlichen Ergebnisse der Vega-Expedition. Erster Band, XIV.) Leipzig 1883.

— Ur Polarväxternas Lif. (Nordenskiöld, A. E. Studier och Forskningar.) Stockholm 1883.

Kolderup Rosenvinge, L. Andet Tillæg til Grønlands Fanerogamer og Karsporeplanter. (Medd. om Grønland III.) Kjøbenhavn 1892.

Kruuse, C. List of the Phanerogams and Vascular Cryptogams found on the Coast 75°—66° 20′ lat. N. of East Greenland. (Medd. om Grønland XXX.) Kjøbenhavn 1911.

Kükenthal, G. Cyperaceae-Caricoideae. (Engler, A. Das Pflanzenreich IV 20.) Leipzig 1909.

Lange, J. Conspectus Florae Groenlandicae, Pars prima. (Medd. om Grønland III.) Kjøbenhavn 1880.

— Bemærkninger om de i 1883—85 indsamlede Planter paa Østkysten af Grønland. (Medd. om Grønland IX.) Kjøbenhavn 1886.

— Conspectus Florae Groenlandicae. Pars secunda. (Medd. om Grønland III.) Kjøbenhavn 1887.

Lid, J. Four New Phanerogams from Svalbard (Spitzbergen). (Nyt Magazin for Naturvidenskaberne. Bd. 63.) Oslo 1925.

— Vascular Plants from South East Greenland, collected on the "Signalhorn" Expedition in 1931. (Skrifter om Svalbard og Ishavet Nr. 44.) Oslo 1932.

— see also Hanssen, O. and Lid, J.

Lightfoot, J. Flora Scotica. London 1777.

Lindman, C. A. M. *Poa.* (Lynge, B. Vascular Plants from Novaya Zemlya. Rep. of the Scient. Res. of the Norw. Exp. to Novaya Zemlya 1921. No. 13.) Kristiania 1923.

— Svensk Fanerogamflora, Ed. II. Stockholm 1926.

Lundager, A. Some Notes concerning the Vegetation of Germania Land, North-East Greenland. (Medd. om Grønland XLIII. Nr. 8.) Kjøbenhavn 1912.

— see also Ostenfeld, C. H. and Lundager, A.

Lynge, B. Vascular Plants from Novaya-Zemlya. (Report of the Scientific Results of the Norwegian Expedition to Novaya Zemlya 1921. No. 13.) Kristiania 1923.

— Vascular Plants and Lichens. (The Norwegian North Polar Expedition with the "Maud" 1918—1925, Scientific Results, Vol. V. No. 1.) Bergen 1929.

— Om Utbredelsen av endel Arktiske Laver. (Svensk Botanisk Tidskrift. Bd. 26. H. 3—4.) Uppsala 1932.

— On Dufourea and Dactylina, three Arctic Lichens. (Skrifter om Svalbard og Ishavet No. 59.) Oslo 1933.

— Om relikte Planter. (Norsk Geografisk Tidskrift Bd. IV, h. 8, Nr. 4). Oslo 1933.

Mackenzie, K. K. Cyperaceae. (North American Flora. Part I. Vol 18.) New York 1931.

Malmgren, A. J. Öfversigt af Spetsbergens Fanerogamflora. (Öfvers. af Kongl. Vet. Akad. Förhandl. 1862. No. 3.) Stockholm 1862.

— Vetenskapligt Bihang till Svenska Spetsbergs-Expeditionen 1864. (Svenska Expeditioner til Spetsbergen och Jan Mayen, utförda under åren 1863 och 1864 af N. Dunér, A. J. Malmgren, A. E. Nordenskiöld och A. Qvennerstedt.) Stockholm 1867.

Murbeck, S. Studier öfver kritiska Kärlväxtformer. III. De Nordeuropeiska Formerna af Slägtet *Cerastium.* (Botaniska Notiser 1898.) Lund 1898.

(Müller, O. F.) Flora Danica IV, fasc. XII, t. DCCIII. Kiøbenhavn 1777.

Müntzing, A. Apomictic and Sexual Seed Formation in Poa. (Hereditas Bd. XVII.) Lund 1933.

Nathorst, A. G. Om Vegetationen på Spetsbergens Vestkust. (Botaniska Notiser 1871.) Lund 1871.

— Nya Bidrag till Kännedomen om Spetsbergens Kärlväxter och dess växtgeografiska Förhållanden. (Kongl. Svenska Vet. Akad. Handl. Bd. 20. No. 6.) Stockholm 1883.

— Studien über die Flora Spitzbergens. Engler's Jahrb. 4. 1883.

— Historical sketch. Swedish Explorations in Spitzbergen 1758—1908. (Ymer 1909. H. 1.) Stockholm 1909.

Nordhagen, R. Studien über die skandinavischen Rassen des *Papaver radicatum* Rottb. sowie einige mit denselben verwechselte neue Arten. Vorläufige

Mitteilung. (Bergens Museums Årbok. Naturvidenskapelig rekke Nr. 2.) Bergen 1931.

Ostenfeld, C. H. Flora Arctica. Part. I. Pteridophyta, Gymnospermae and Monocotyledones. Copenhagen 1902.

— Vascular Plants collected in Arctic North America (King William Land, King Point and Herschell Isl.) by the Gjöa Expedition under Captain Roald Amundsen 1904—1906. (Videnskabs-Selskabets Skrifter. I. Mathem.-Naturv. Klasse 1909. No. 8.) Christiania 1910.

— Plants collected during the First Thule Expedition to the Northernmost Greenland. (Medd. om Grønland LI. Nr. 10.) København 1915.

— A List of Arctic Caryophyllaceae with some Synonyms. (Medd. om Grønland XXXVII.) København 1920.

— Critical Notes on the Taxomony and Nomenclature of some Flowering Plants from Northern Greenland. (Medd. om Grønland LXIV. Nr. 5.) København 1923.

— The Vegetation of the North-Coast of Greenland based upon the Late Dr. Th. Wulff's Collections and Observations. (Medd. om Grønland LXIV. Nr. 9.) København 1923.

— Flowering Plants and Ferns from North-Western Greenland, collected during the Jubilee-Expedition 1920—22 and some Remarks on the Phytogeography of North-Greenland. (Medd. om Grønland LXVIII.) København 1925.

— The Flora of Greenland and its Origin. (Det Kgl. Danske Videnskabernes Selskab. Biologiske Meddelelser. VI. 3.)

Ostenfeld, C. H. and Lundager, A. List of Vascular Plants from North-East Greenland (N. of 76° N. Lat.) (Medd. om Grønland XLIII. Nr. 1.) København 1910.

Parry, W. E. Narrative of an Attempt to reach the North Pole. London 1828.

Pax, F. Über die Flora und die Vegetation Spitzbergens. (Cremer, L. Ein Ausflug nach Spitzbergen.) Berlin 1892.

Penzig, O. Pflanzen-Teratologie. Bd. I—III. Berlin 1919—1921.

Piper, C. V. North American Species of Festuca. (Contributions from the United States National Herbarium, Vol. X, Part 1.) Washington 1906.

Porsild, M. P. The Flora of Disco Island and the Adjacent Coast of West Greenland. From 66°—71° N. Lat. With Remarks on Phytogeography, Ecology, Flowering, Fructification and Hibernation. First Part. (Medd. om Grønland LVIII.) København 1920.

Resvoll-Holmsen, H. Exploration du Nord-Ouest du Spitsberg enterprise sous les auspices de S. A. S. le Prince de Monaco par la Mission Isachsen. Cinquième partie. (Resultats des Campagnes Scientifiques accomplies sur son Yacht par Albert Ier prince souveraine de Monaco, publiés suos sa direction avec le concours de M. Jules Richard. Fasc. XLIV.) Monaco 1913.

— Svalbards Flora, med endel om dens plantevekst i nutid og fortid. Oslo 1927.

Rosenberg, O. Apogamie und Parthenogenesis bei Pflanzen. (Handbuch der Vererbungswissenschaft. Lief. 12 (II, L). Band II.) Berlin 1930.

Ruprecht, F. J. Flores Samojedorum Cisuralensium. (Beiträge zur Pflanzenkunde des Russischen Reiches, Zweite Lieferung.) St. Petersburg 1845.

Seidenfaden, G. Moving Soil and Vegetation in East Greenland. A preliminary Report. (Medd. om Grønland, Bd. 87. No. 2.) København 1931.

— The Vascular Plants of South-East Greenland 60° 04′ to 64° 30′ N. Lat. (Medd. om Grønland Bd. 106. No. 3.) København 1933.

Scholander, P. F., see Devold, J. and Scholander, P. F.

Simmons, H. G. The Vascular Plants in the Flora of Ellesmereland. (Report of the Second Norwegian Arctic Expedition in the "Fram" 1898—1902. No. 2). Kristiania 1906.

Simmons, H. G. A Survey of the Phytogeography of the Arctic American Archipelago with some Notes about its Exploration. (Lunds Universitets Årsskrift. N. F. Afd. 2. Bd. 9. Nr. 19.) (Kongl. Fysiografiska Sällskapets Handlingar. N. F. Bd. 24. Nr. 19). Lund 1913.

Smith, H. *Catabrosa concinna* Th. Fr.* *algidiformis* nov. subsp. und ihre Nächstverwandten. (Svensk Botanisk Tidskrift Bd. 8. H. 2.) Stockholm 1914.

— Vegetationen och dess Utvecklingshistoria i det Centralsvenska Högfjällsområdet. (Norrländskt Handbibliotek. IX.) Uppsala 1920.

Smith, J. E. Flora Britannica. Londoni, White 1800–4.

Sommerfelt, C. Bidrag til Spitsbergens og Beeren-Eilands Flora, efter Herbarier, medbragte af M. Keilhau. (Magazin for Naturvidenskaberne. Anden Rækkes 1ste Binds 2det Hefte.) Christiania 1833.

Stählin, A. Morphologische und zytologische Untersuchungen an Gramineen. (Wissenschaftliches Archiv für Landwirtschaft Band I.) Berlin 1929.

Summerhayes, V. S. and Elton, C. S. Contributions to the Ecology of Spitsbergen and Bear Island. (Journal of Ecology. Vol. XI. No. 2. September 1923.) London 1923.

— Further Contributions to the Ecology of Spitsbergen. (Journal of Ecology. Vol. XVI. No. 2. August 1928.) London 1928.

Sørensen, T. The Vascular Plants of East Greenland from 71° 00′ to 73° 30′ N. Lat. (Medd. om Grønland Bd. 101. Nr. 3.) København 1933.

Tengwall, T. Å. *Carex Hepburnii* Boott, en för Skandinavien ny art. (Svensk Botanisk Tidskrift Bd. 10. H. 3.) Stockholm 1916.

Tincker, M. A. H. The Effect of Length of Day upon the Growth and Reproduction of some Economic Plants. (Annals of Botany. Vol. XXXIX. No. CLVI.) London 1925.

Tolmatchew, A. Die Gattung Cerastium in der Flora von Spitzbergen. (Skrifter om Svalbard og Ishavet Nr. 34.)

Turesson, G. Studien über Festuca ovina L. I. Normalgeschlechtliche, Halb- und Ganzvivipare Typen Nordisher Herkunft. (Hereditas Bd. VIII.) Lund 1926.

— Studien über Festuca ovina L. II. Chromosomenzahl und Viviparie. (Hereditas Bd. XIII.) Lund 1930.

— Studien über Festuca ovina L. III. Weitere Beiträge zur Kenntnis der Chromosomenzahlen Viviparer Formen. (Hereditas Bd. XV.) Lund 1931.

Vaage, J. Vascular Plants from Eirik Raude's Land (East Greenland 71° 30′—75° 40′ Lat. N.). (Skrifter om Svalbard og Ishavet Nr. 48.) Oslo 1932.

Vierhapper, F. Monographie der alpinen Erigeron-Arten Europas und Vorderasiens. (Beihefte zum Botanischen Centralblatt. Bd. XIX. Abt. II. Heft 3.) Leipzig 1906.

Warming, E. Om Grønlands Vegetation. (Medd. om Grønland XII.) Kjøbenhavn 1888.

— Saxifragaceae. I. Morphology and Biology. (The Structure and Biology of Arctic Flowering Plants. 4.) (Medd. om Grønland XXXVI.) Kjøbenhavn 1909.

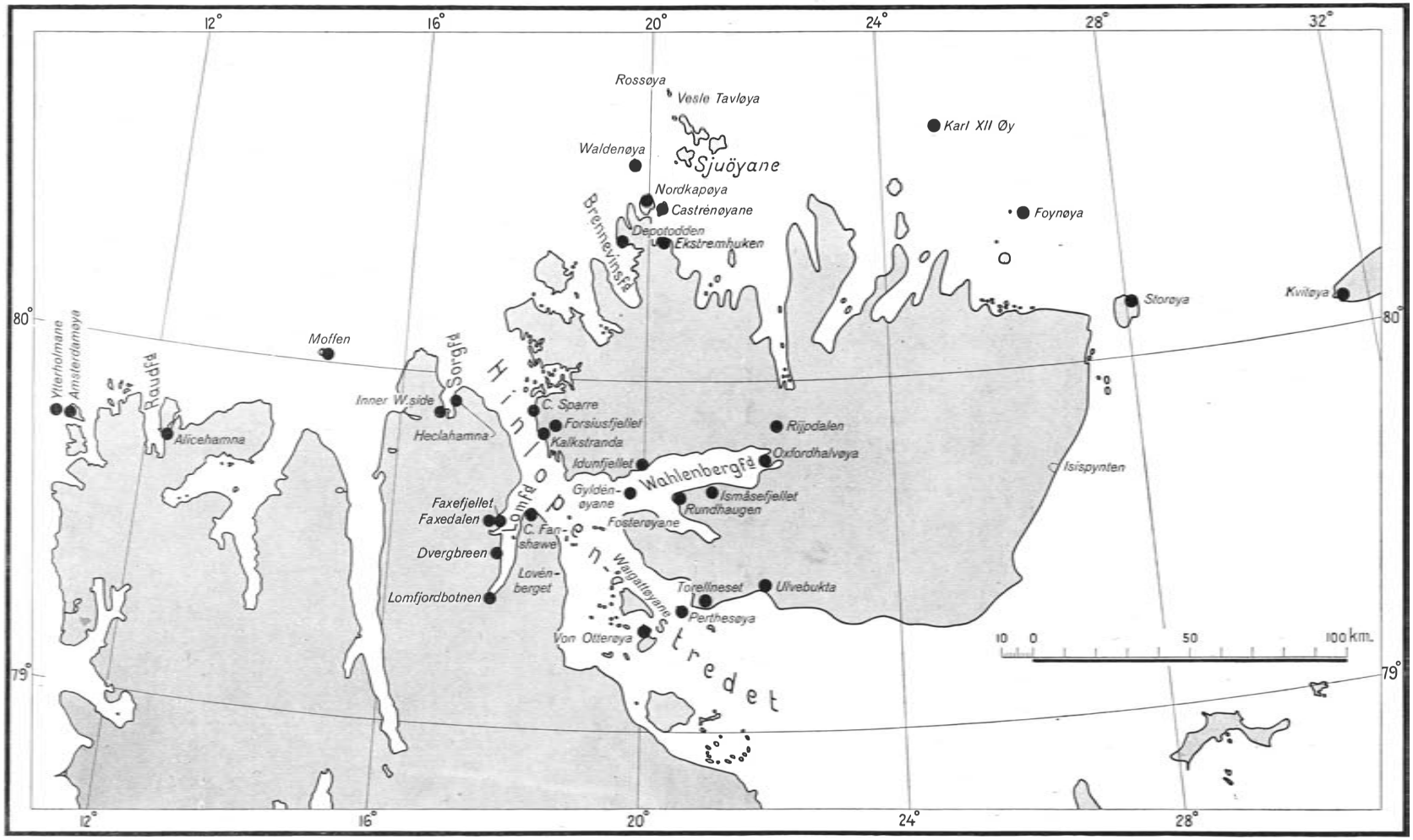
Weatherby, C. A., see Fernald, M. L. and Weatherby, C. A.

Wolf, T. Monographie der Gattung Potentilla. (Bibliotheca Botanica, Band XVI.) Stuttgart 1908.

Wulff, T. Botanische Beobachtungen aus Spitzbergen. Lund 1902.

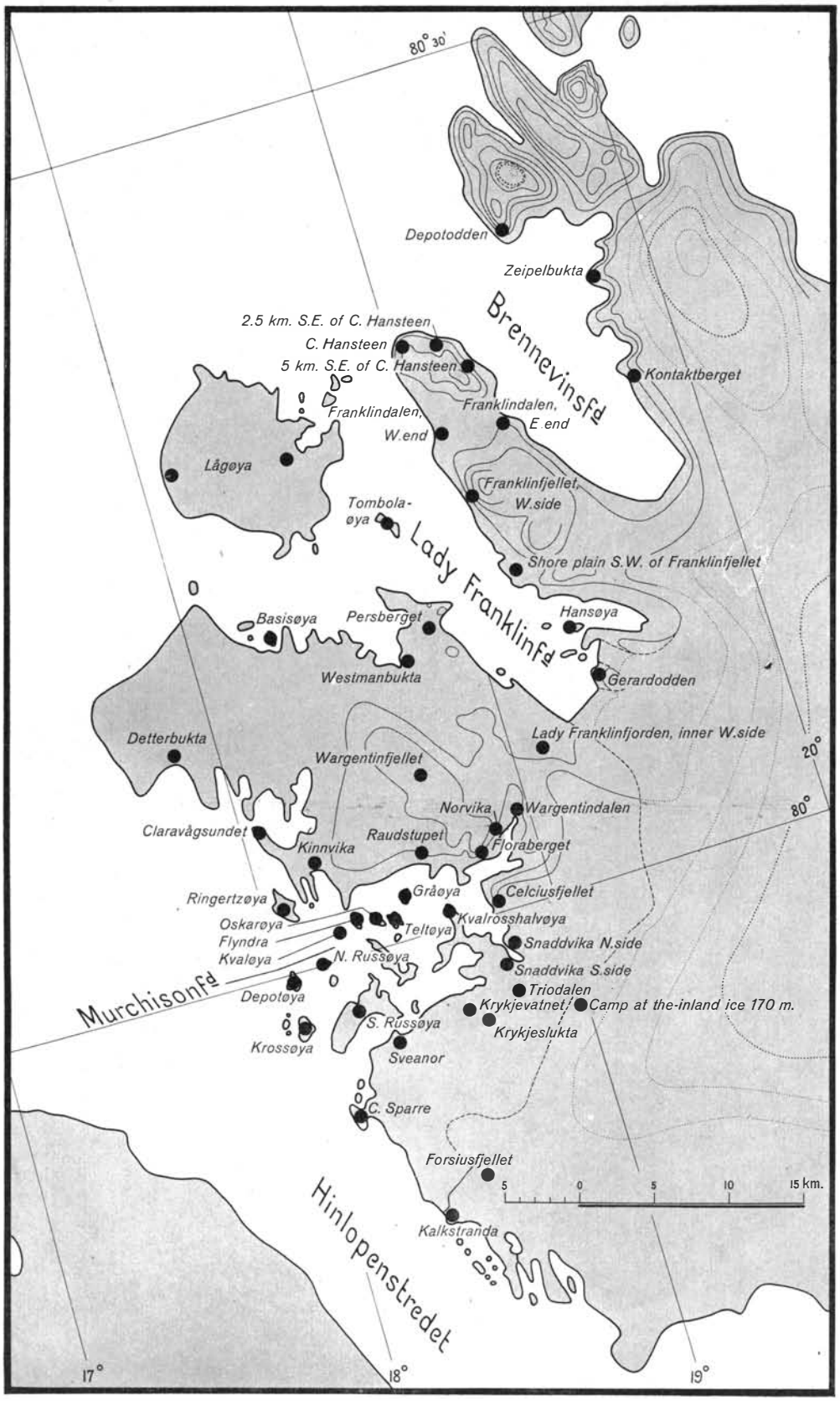
Index of the Genera of Vascular Plants.

(In the text the Species are arranged alphabetically under the Genus.)



Map of Botanical Localities in Northern Svalbard.

The localities in North-East Land between Depotodden and Cape Sparre is seen in the detail map. In West Spitsbergen only those localities are given which were investigated in 1931.



Detail Map of Botanical Localities in Western North-East Land.

Printed April 21st, 1934.

SKRIFTER
OM SVALBARD OG ISHAVET

Nr. 1. HOEL, ADOLF, *The Norwegian Svalbard Expeditions 1906—1926.* 1929. Kr. 10,00.
„ 2. RAVN, J. P. J., *On the Mollusca of the Tertiary of Spitsbergen.* 1922. Kr. 1,60.
„ 3. WERENSKIOLD. W. and IVAR OFTEDAL, *A burning Coal Seam at Mt. Pyramide, Spitsbergen.* 1922. Kr. 1,20.
„ 4. WOLLEBÆK, ALF, *The Spitsbergen Reindeer.* 1926. Kr. 10,00.
„ 5. LYNGE, BERNT, *Lichens from Spitsbergen.* 1924. Kr. 2,50.
„ 6. HOEL, ADOLF, *The Coal Deposits and Coal Mining of Svalbard (Spitsbergen and Bear Island).* 1925. Kr. 10,00.
„ 7. DAHL, KNUT, *Contributions to the Biology of the Spitsbergen Char.* 1926. Kr. 1,00.
„ 8. HOLTEDAHL, OLAF, *Notes on the Geology of Northwestern Spitsbergen.* 1926. Kr. 5,50.
„ 9. LYNGE, BERNT, *Lichens from Bear Island (Bjørnøya).* 1926. Kr. 5,80.
„ 10. IVERSEN, THOR, *Hopen (Hope Island), Svalbard.* 1926. Kr. 7,50.
„ 11. QUENSTEDT, WERNER, *Mollusken aus den Redbay- und Greyhookschichten Spitzbergens.* 1926. Kr. 8,50.

Nos. 1—11: Vol. I.

From Nr. 12 the papers will not be collected into volumes, but only numbered consecutively

Nr. 12. STENSIÖ, ERIK A:SON, *The Downtonian and Devonian Vertebrates of Spitsbergen.* Part I. *Cephalaspidae.* A. Text, and B. Plates. 1927. Kr. 60,00.
„ 13. LIND, J., *The Micromycetes of Svalbard.* 1928. Kr. 6,00.
„ 14. KJÆR, ROLF and J. E. FJELDSTAD, *Tidal Observations in the Arctic.* (In the press.)
„ 15. HORN, GUNNAR and ANDERS K. ORVIN, *Geology of Bear Island.* 1928. Kr. 15,00.
„ 16. JELSTRUP, HANS S., *Déterminations astronomiques.* 1928. Kr. 2,00.
„ 17. HORN, GUNNAR, *Beiträge zur Kenntnis der Kohle von Svalbard (Spitzbergen und der Bäreninsel).* 1928. Kr. 5,50.
„ 18. HOEL, ADOLF, *Das Festungsprofil auf Spitzbergen. Jura und Kreide.* I. Vermessungsresultate. (In preparation.)
„ 19. FREBOLD, HANS, *Das Festungsprofil auf Spitzbergen. Jura und Kreide.* II. Die Stratigraphie. 1928. Kr. 3,00.
„ 20. FREBOLD, HANS, *Oberer Lias und unteres Callovien in Spitzbergen.* 1929. Kr. 2,50.
„ 21. FREBOLD, HANS, *Ammoniten aus dem Valanginien von Spitzbergen.* 1929. Kr. 4,00.
„ 22. HEINTZ, ANATOL, *Die Downtonischen und Devonischen Vertebraten von Spitzbergen.* II. *Acanthaspida.* 1929. Kr. 15,00.
„ 23. HEINTZ, ANATOL, *Die Downtonischen und Devonischen Vertebraten von Spitzbergen.* III. *Acanthaspida. — Nachtrag.* 1929. Kr. 3,00.
„ 24. HERITSCH, FRANZ, *Eine Caninia aus dem Karbon des De Geer-Berges im Eisfjordgebiet auf Spitzbergen.* 1929. Kr. 3,50.
„ 25. ABS, OTTO, *Untersuchungen über die Ernährung der Bewohner von Barentsburg, Svalbard.* 1929. Kr. 5,00.
„ 26. FREBOLD, HANS, *Untersuchungen über die Fauna, die Stratigraphie und Palãogeographie der Trias Spitzbergens.* 1929. Kr. 6,00.
„ 27. THOR, SIG, *Beiträge zur Kenntnis der invertebraten Fauna von Svalbard.* 1930. Kr. 18,00.
„ 28. FREBOLD, HANS, *Die Altersstellung des Fischhorizontes, des Grippianiveaus und des unteren Saurierhorizontes in Spitzbergen.* 1930. kr. 4,00.
„ 29. HORN, GUNNAR, *Franz Josef Land. Natural History, Discovery, Exploration and Hunting.* 1930. Kr. 5,00.
„ 30. ORVIN, ANDERS K., *Beiträge zur Kenntnis des Oberdevons Ost-Grönlands.* HEINTZ, ANATOL, *Oberdevonische Fischreste aus Ost-Grönland.* 1930. Kr. 4,00.

SKRIFTER OM SVALBARD OG ISHAVET

Nr. 31. FREBOLD, HANS, *Verbreitung und Ausbildung des Mesozoikums in Spitzbergen* 1930. Kr. 17,00.

„ 32. ABS, OTTO, *Über Epidemien von unspezifischen Katarrhen der Luftwege auf Svalbard.* 1930. Kr. 2,00.

„ 33. KIÆR, JOHAN, *Ctenaspis, a new Genus of Cyathaspidian Fishes.* 1930. Kr. 1,00.

„ 34. TOLMATCHEW, A., *Die Gattung Cerastium in der Flora von Spitzbergen.* 1930. Kr. 1,00.

„ 35. SOKOLOV, D. und W. BODYLEVSKY, *Jura- und Kreidefaunen von Spitzbergen.* 1931. Kr. 15,00.

„ 36. SMEDAL, GUSTAV, *Acquisition of Sovereignty over Polar Areas.* 1931. Kr. 10,00.

„ 37. FREBOLD, HANS, *Fazielle Verhältnisse des Mesozoikums im Eisfjordgebiet Spitzbergens.* 1931. Kr. 8,75.

„ 38. LYNGE, B., *Lichens from Franz Josef Land.* 1931. Kr. 3,00.

„ 39. HANSSEN, OLAF and JOHANNES LID, *Flowering Plants of Franz Josef Land collected on the Norwegian Scientific Expedition 1930.* 1932. Kr. 3.50.

„ 40. KIÆR, JOHAN. (In preparation.)

„ 41. LYNGE, B. and P. F. SCHOLANDER, *Lichens from North East Greenland.* 1931. Kr. 9,50.

„ 42. HEINTZ, ANATOL, *Beitrag zur Kenntnis der devonischen Fischfauna Ost-Grönlands.* 1931. Kr. 4,00.

„ 43—46. BJØRLYKKE, BJØRN, *Some vascular Plants from South East Greenland. Collected on the "Heimen" Expedition in 1931. Preliminary Report.* LID, JOHANNES, *Vascular Plants from South East Greenland. Collected on the "Signalhorn" Expedition in 1931.* LYNGE, B., *Lichens from South East Greenland. Collected in 1931 on Norwegian Expeditions.* OMANG, S. O. F., *Beiträge zur Hieraciumflora Ost-Grönlands.* 1932. Kr. 4,00.

„ 47. LYNGE, B., *A Revision of the Genus Rhizocarpon (Ram.) Th. Fr. in Greenland* 1932. Kr. 2,00.

„ 48. VAAGE, JAKOB, *Vascular Plants from Eirik Raude's Land.* (East Greenland 71° 30'—75° 40' lat. N), 1932 Kr. 7,00.

„ 49. SCHAANNING, H. THO. L., 1. *A Contribution to the Bird Fauna of East-Greenland.* 2. *A Contribution to the Bird Fauna of Jan Mayen. — Zool. Res. Norw. Sc. Exp. to East-Greenland. I.* 1933. Kr. 3,00.

„ 50. JELSTRUP, HANS S., *Détermination astronomique de Mygg-Bukta au Groenland Oriental,* 1932. Kr. 3,75.

„ 51. BIRKELAND, B. J. et GEORG SCHOU, *Le climat de l'Eirik-Raudes-Land.* 1932. Kr. 2,00.

„ 52. KIÆR, JOHAN †, *The Downtonian and Devonian Vertebrates of Spitsbergen.* IV. Suborder *Cyathaspida.* Preliminary Report. 1932. Kr. 5,50.

„ 53. 1. MALAISE, R., *Eine neue Blattwespe aus Ost-Grönland.* 2. A. ROMAN, *Schlupfwespen aus Ost-Grönland.* 3. O. RINGDAHL, *Tachiniden und Musciden aus Nordost-Grönland.* 4. M. GOETGHEBUER, *Chironomides du Groenland oriental, du Svalbard et de la Terre de François Joseph. — Zool. Res. Norw. Sc. Exp. to East-Greenland. II.* 1933. Kr. 4,00.

„ 55. OMANG, S. O. F., *Übersicht über die Hieraciumflora Ost-Grönlands und Bemerkungen betreffend zwei Monstrositäten des Hieracium Alpinum (L)* Backh. 1933. Kr. 2,50.

„ 56. DEVOLD, J. and P. F. SCHOLANDER, *Flowering Plants and Ferns of Southeast Greenland.* 1933. Kr. 20,00.

„ 57. ORVIN, ANDERS K., *Geology of The Kings Bay Region, Spitsbergen.* 1934. Kr. 20,00.

„ 58. JELSTRUP, HANS S., *Détermination Astronomique à Sabine-Øya au Groenland Oriental.* 1933. Kr. 2,50.

„ 59. LYNGE, B., *On Dufourea and Dactylina. Three Arctic Lichens.* 1933. Kr. 5,00.

„ 60. VOGT, THOROLF, *Late-Quaternary Oscillations of Level in Southeast-Greenland.* 1933. Kr. 5,00.

„ 61. 1. MAURICE BURTON, M. Sc., *Report on the Sponges of the Norwegian Expeditions to East-Greenland* (1930, 1931, and 1932). 2. C. ZIMMER, *Die Cumaceen der norwegischen Expeditionen nach Ost-Grönland 1929, 1930, 1931 und 1932.* — Zool. Res. Norw. Sc. Exp. to East-Greenland. III. 1934. Kr. 2,50.

„ 62. P. F. SCHOLANDER, *Vascular Plants from Northern Svalbard.* 1934. Kr. 15,00.

Norges Svalbard- og Ishavs-undersøkelser, Bygdø Allé 34, Oslo

A. W. BRØGGERS BOKTRYKKERI A/S, OSLO