MEDDELELSER OM GRØNLAND
UDGIVNE AF
KOMMISSIONEN FOR VIDENSKABELIGE UNDERSØGELSER I GRØNLAND
Bd. 93 · Nr. 3.

ARBEJDER FRA
DEN DANSKE ARKTISKE STATION PAA DISKO Nr. 15

STRAY CONTRIBUTIONS TO THE FLORA OF GREENLAND VI-XII

BY

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WITH 20 FIGURES IN THE TEXT

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BIANCO LUNOS BOGTRYKKERI A/S
1935

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Obs. "Contributions Nos. I—V" were issued as "Arbejder etc. Nr. 13" in Meddelelser om Grönland LXXVII (1930).

VI.

THE GREENLAND SPECIES OF *LYCOPODIUM*, SECT. *COMPLANATA* VICTORIN.

1. Introductory. When, in 1925, my son and former assistant A. E. PORSILD left his home to settle in Canada, I had since his route of travel would take him through Denmark charged him with the task of settling, if possible, a number of accumulated questions of the nomenclature and taxonomy of certain Greenland plants. Among these plants were some curious forms of a *Lycopodium* of the affinity of *L. alpinum*, which did not accord with the descriptions available to me in Greenland. In reporting to me upon this point, he stated that all the specimens of *L. Chamæcyparissus* from Greenland in the Botanical museum of Copenhagen should probably be named *L. complanatum*, with the exception of a few specimens which really were *L. alpinum*. At first I doubted the correctness of this statement, because the identification as *L. Chamæcyparissus* mainly rested on the authority of JOH. LANGE, whose treatment of both species, as far as the Danish flora was concerned, was generally accepted. The Greenland material, moreover, had quite recently been revised by the well-known Swedish pteridologist H. V. ROSENDAHL, who, in a paper in Medd. om Grönl. Vol. 56. 1918, verified all specimens seen by him as subsp. *Chamæcyparissus* A. BR. and only admitted *L. complanatum* for Greenland on the authority of OSTENFELD: Flora Aratica. Shortly afterwards, however, my late friend, professor C. H. OSTENFELD, sent me, for revision of the ranges, the manuscript of his standard list of Greenland Vascular Plants, intended for his treatise "The Flora of Greenland and its Origin" (K. D. V. S. Biol. Medd. VI. 3. 1926, p. 54—69), writing at the same time that he also considered *L. Chamæcyparissus* to be totally absent from Greenland. In accordance with this we find in the paper quoted on p. 54:

"*L. complanatum var.*"

with the distribution: **W:** Disko, 66—60° N.; **E:** Angmagssalik. Of course the syllable "var." means that OSTENFELD did not consider the Green-

land plant typical; and undoubtedly he would, on some suitable occasion, have given his reasons for changing the name. As his untimely death prevented him from doing so I feel it to be almost a duty to revise the specimens at hand in the light of those most recent papers on the subject which were not accessible to me in 1925, namely that by G. SAMUELSSON for Fennoscandia (in Sv. Bot. Tidskr. 13. 245—249. 1919) and by FRÈRE MARIE-VICTORIN for Atlantic America (Les Lycopodinées du Québec. Montréal 1925).

I have to thank the authorities of the Botanical Museum in Copenhagen for their courtesy in placing a large selection of specimens of the plants herein dealt with at my disposal before the typing of the manuscript.

2. The Flora of Greenland contains five species of *Lycopodium* which, ranked according to the area covered, are:

1) *L. Selago L.* from southernmost Greenland to the Northern point of Inglefield Land at 79° N. in West-Greenland and at least to Germania Land in 77° N. in East Greenland. Mostly represented by the dwarfish f. *appressum* Desv. and only bulbilliferous, but from the Southern parts well-sized, nearly typical forms with sporangia and spreading leaves are also met with.

2) *L. "annotinum L."* **W:** 60° at least to 73° N.; **E:** 60° at least to Scoresby Sound about 71° N. The typical form with thin and spreading, finely serrated leaves seems to be totally absent, and probably all Greenland material belongs to the Arctic-American representative *pungens* (LA PYL.) DESV. which by PRITZEL in ENGLER-PRANTL, I. 4. 604 is considered better kept as a separate species.

3) *L. alpinum L.* and 4) *L. complanatum*, see beneath.

5) *L. clavatum L.* only known from a few localities in the most southerly section of the West coast, a form with solitary spikes.

The habitats of all Greenland species of *Lycopodium* are during the winter covered with heavy layers of snow.

3. History of European species of *Complanata*. Before entering upon the history of the group in Greenland we must briefly recall its status in European and American literature, as our knowledge of the plants of Greenland was obtained by comparing them with plants from both continents. I have all my main points from VICTORIN's book supplemented, however, by information from the paper of SAMUELSSON.

LINNÆUS and his nearest successors knew of the group *L. complanatum* and *L. alpinum* only. In 1810 WILLDENOW: Sp. Pl. V. p. 20 described *L. sabinaefolium*, based on a Canadian plant collected by MICHAUX and published in his "Flora" as *L. alpinum*. The name "*sabinaefolium*"

was for a long time in Russia, Germany and Sweden wrongly used for what we now call *L. tristachyum*.

The L. tristachyum of PURSH, published in his Fl. Am. Sept. 1814 was soon forgotten in both continents, whereas its later synonym *L. Chamæcyparissus* A. BR. published 1837 in MUTEL: Fl. Française 4. 192 became better known. The taxonomic value of BRAUN's plant has been much discussed by European botanists, later BRAUN himself made it a subspecies, MILDE and others, following him, a variety. JOH. LANGE considers it a species in the 2. edition of his "Haandbog i den danske Flora" 1856 and in "Flora Danica" pl. 2672, edited by him. LANGE states expressly l. c. that observations in the field of living plants have convinced him about its specific difference from *L. complanatum*. Also M. N. BLYTT: "Norges Flora" I. 1861 keeps it as a species.

The first 5 editions of the famous HARTMAN: "Handbok i Skandinaviens Flora", 1820—1849, recognize *L. complanatum* and *L. alpinum* only, the 6th edition of 1854 has a description of *L. tristachyum*, but under the wrong name "*sabinaefolium* WILLD." which is also used in the important collection "Herbarium Normale" edited by ELIAS FRIES (Fasc. 13. Nr. 100). As late as 1870, in the 10th edition, HARTMAN corrects the name into "subsp. *L. Chamæcyparissus*", and in the subsequent — and last — edition, the 11th, he puts it as a variety. We find the same treatment in the unfinished 12th edition by KROK 1889.

The continuation of this work, the HOLMBERG Flora part 1. 1922 has improved the description and the geographic distribution of the "subsp. *Chamæcyparissus*" in accordance with the revision by SAMUELSSON l. c. The BLYTT-DAHL "Haandbog i Norges Flora" 1906 has it also as a subspecies, whereas RAUNKIÆR: Dansk Exkursionsflora from its first edition had it as a separate species, and in the 4th edition by OSTENFELD & RAUNKIÆR under its valid name *L. tristachyum* PURSH.

4. History of the Greenland species. The first attempt at a complete list of the plants of Greenland was given by HORNEMANN in his "Dansk Oeconomisk Plantelære" of which the Cryptogams were issued in 1837. On p. 352 he has *L. alpinum* as "common on the mountains of Norway, Finmarken, Iceland, Færöes and Greenland". For *L. complanatum* the range, outside of Denmark proper, is given as "on the mountains in Norway, Iceland, Greenland and Færöes" which is a blunder so gross that one may doubt if he had any knowledge of the species at all. In HORNEMANN's days no *L. complanatum* from Greenland was known; and it has never been found either in Iceland or on the Færöes, nor in Great Britain and Ireland, nor in West-Central Continental Europe (see literature quoted by VICTORIN p. 58 and ROUY: Fl. de France XIV, p. 490).

That excellent collector but hypercritical scholar JENS VAHL never

came to publish his numerous and valuable manuscripts on the flora of Greenland. When in 1857 H. RINK needed a list of the plants for the Appendix of his classic work "Grönland statistisk og geographisk beskrevet", JOH. LANGE contributed this list[1]) with the distribution of the individual species as given in the printed duplicate labels of VAHL. Here *L. Chamæcyparissus* is mentioned for the first time as a native plant of Greenland, taken by VAHL in Tasermiut Fiord and by him wrongly identified as *L. alpinum*.

In LANGE's "Conspectus Florae Groenlandicae" of 1880, a much more elaborate work in which several errors of the first list are corrected, only the same collection of *L. Chamæcyparissus* is mentioned. In the Supplement of 1887 there are some more, and in the Second Supplement of 1892 the editor L. KOLDERUP ROSENVINGE, adds *L. complanatum* as "new to Greenland" and states that *L. Chamæcyparissus* can hardly be claimed as a variety but merely as a form.

GELERT, in OSTENFELD: Flora Arctica 1902, having described *L. complanatum* on p. 13 says:

> The typical form is seldom in Arctic regions, more common is the form *L. Chamæcyparissus* A. BR. with more densely bushy branches, which are narrower, and the leaves on the edges and the flats more similar so that the branches are less flat.

This quotation shows that GELERT did not know the essential characters of the plant at all.

All later collectors of Greenland plants labelled their specimens *L. Chamæcyparissus* on the authority of LANGE and GELERT.

The question now arises: why did LANGE name the Greenland plant *L. Chamæcyparissus* instead of *L. complanatum* when he knew both species and described them so well from Denmark? There are several causes. Firstly, LANGE never had an opportunity to visit Greenland himself. Secondly, the Greenland material is in fact habitually different from specimens of *L. complanatum* from the woods of Europe. And the third, and probably the most important, cause is the misleading confusion of the two species in the various editions of the HARTMAN-Flora.

Although not written in a universal language the "Handbok i Skandinaviens Flora" by C. J. HARTMAN and his son CARL HARTMAN has, with its eleven stout editions between 1820 and 1879, acquired an unrivalled standing in scientific literature. Originating in the native country of LINNÆUS, it is supposed to have kept up the unbroken traditions from LINNÆUS, RETZIUS, SWARTZ, WAHLENBERG etc. better than any other

[1]) In spite of the fact that his name was printed as the author of this contribution, LANGE himself never quotes it under his own name, but always attributes it to RINK.

work. Based on an enormous amount of literary information and on immense public and private collections, its descriptions are generally strictly accurate. Therefore, the "HARTMAN" became the standard flora, not only for the Scandinavian Peninsula but also for the surrounding countries as Denmark, Finland, the adjacent part of Russia and the Baltic States, the European Arctic Islands, the Færöes, Iceland and Greenland, as far, in fact, as the Swedish language was understood. No wonder then that a casual obscurity or misunderstanding might become of far reaching significance.

After a fairly good description of the typical form of *L. complanatum* from temperate forests, the 11th edition describes *β Chamæcyparissus* as follows (here translated):

> glaucous; branches more densely aggregated, nearly in bundles and erect, of equal height and narrower, often less flattened; all leaves more appressed, the small ones more free; often with more spikes than in the main form.

By putting the aggregated branches as a leading character and by excluding this from *L. complanatum*, *L. Chamæcyparissus* was generally supposed to be mainly of Northern or even Arctic range, notably by GELERT and KROK, quite in opposition to the facts as we now know them.

5. Revisional work in Northern Europe was begun by H. LINDBERG who, in "Schedae operis quod inscribitur Plantae Finlandiae Exsiccatae fasc. I—VIII, Helsingfors 1906" demonstrated that most of the plants from Finland which had passed as var. *Chamæcyparissus* really were a polystachyous form of *L. complanatum*[1]). The true *L. Chamæcyparissus* was in Finland only known from a very few localities in the Southernmost section. Evidently LINDBERG's paper has escaped the attention of H. V. ROSENDAHL, it might have served as a warning to him before his revision of the Greenland specimens (see above). In 1919 G. SAMUELSSON revised the collections from Sweden and Norway, and some from Denmark and he came to the conclusion that true *L. Chamæcyparissus* occurred only in two localities of South Norway, and in South Sweden to the province of Värmland about Lat. 59°30′ N. All localities known to him are plotted on a map accompanying his paper l. c.

Of plants from Denmark only a few were accessible to SAMUELSSON since all the *Lycopodium* specimens in the Copenhagen museum had been, before the Great War, borrowed by the botanists in Petrograd. After their return it could be stated that *L. tristachyum* was far more scarce in Denmark than L. complanatum, the former occurring in 5, the latter

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[1]) One set of LINDBERG's plant in the said collection is figured on a small scale by LINDQVIST in Bot. Not. 1929, p. 92.

in 17 of the 53 floral districts adopted by the Committee for topographic-botanical investigations in Denmark (see KNUD JESSEN in Bot. Tidsskr. 39, p. 183). Owing to the intensive tilling of the soil in Denmark both species have undoubtedly lost large parts of their natural area.

In Central Europe *L. tristachyum* is more common than *L. complanatum*, reaching from Western Russia to the Pyrenees, whereas *L. complanatum* practically stops at the Rhine valley.

6. In North America F. E. LLOYD in Bull. Torr. Bot. Cl. 26. 1899 (here quoted from VICTORIN) has revived the name *L. tristachyum* of PURSH. About the identity of the American plant with the European *L. Chamæcyparissus* A. BR., there can be no doubt, as LLOYD later had the opportunity to study European plants in the field. Another prominent American student of the genus, L. M. UNDERWOOD, having seen the type specimens of *L. tristachyum*, is also convinced of their identity (see VICTORIN p. 45—46). In North America also *L. tristachyum* has a decidedly more southerly distribution and is confined to the Eastern States from Delaware and North Carolina to Southern Canada, ranging westward to the Great Lakes; whereas *L. complanatum* crosses the continent.

The work of VICTORIN which has been a great help in this study, is an elaborate treatise, giving much more information than promised by its title. The history of the Northern American species is well elucidated by ample quotations from books not easily accessible to everyone. The European writers have also been diligently consulted, of the Scandinavian, however, only the old authors writing in Latin have been read. The Scandinavian botanical literature of this and the previous century seems to have been passed over, probably on account of linguistic difficulties. One of the results is that VICTORIN's map of the distribution of *L. tristachyum* in Europe, p. 45, is quite misleading; this could have been avoided by taking a glance at SAMUELSSON's map l. c. But the author's map of the geographic range of L. complanatum is also objectionable, at least outside the province of Québec. Thus the area is shown to cover the whole of Alaska, with mountains, tundras and all, whereas a comparatively recent paper by TRELEASE gives 4 localities only for *L. complanatum* in Alaska and all confined to the "pan-handle" of South-Alaska. (HARRIMAN Alaska Series V. Washington 1910, p. 392)[1]).

[1]) It is a meritorious task to plot the known distribution of a species of plants or animals on maps and to publish them, for such a map at a glance may give more information about the occurrence of the species and its dependence on climatic or soil conditions, and may give more valuable hints upon the probable age or way of immigration of it than any list of localities can give. But such maps must of course be assumed to be as correct as the sources available permitted. And this, unfortunately

7. Supposed transitional forms and hybrids. The specimens of *L. complanatum* from the Northern sections of Fennoscandia, formerly mistaken for *L. Chamæcyparissus*, have shorter and narrower, more erect and aggregated branches than the lowland forms from the woods. Specimens from Greenland are similar in this respect and a specimen from Labrador matches specimens from southernmost Greenland nearly exactly. As might be expected such alleged "intermediate" or "transitional" forms, or plants with other deviating characters, e. g. short-peduncled spikes, have sometimes made their collectors suggest that they must be results of hybridizations between *L. complanatum* and *L. tristachyum* or, of one of either with *L. alpinum* or, in America, other related American species. VICTORIN has described and named a great number of deviating plants, but prudently as "varieties" or "forms": "à défaut de preuves directes d'hybridation, qu'il serait impossible de fournir en raison des grandes difficultées expérimentales" (p. 50).

Quite recently B. LINDQVIST in Bot. Not. 1929, p. 89 ff. has described and figured a plant named var. *intermedium n. var.* but which the author decidedly claims to be the "heretofore not observed" hybrid between *L. complanatum* and *L. Chamæcyparissus*. Its perfectly developed spores are to the author an indication of the non-specific value of the latter! The diagnosis runs:

> Planta habitu intermedia; rami crebre divisi ut apud *β Chamæcyparissum*. Ramus primarius spicifer. Rami laterales flabellati, steriles. Folia lateralia inferiora et media compressa, superiora et ventralia omnia intermedia. Spicæ bigeminæ. Sporarum forma normalis.

I must confess myself unable to grasp the convincing remarks of this diagnosis. The photograph of a herbarium specimen on p. 93 suggests a specimen of *L. tristachyum*, but a specimen of *L. complanatum* from South Greenland or Labrador, photographed on the same scale, would come out very much the same. The figure on p. 97, which should show the ventral leaves of the hybrid and of its "parents" is unfortunately, by poor reproduction, so blotted that it shows nothing.

LINDQVIST states that he has seen the same hybrid from different places in Germany and found similar forms mentioned in literature from Central, Southern and Eastern Germany, but not from Western Germany or France where *L. complanatum* is scarce. But *L. Zeilleri* ROUY (Fl. de Fr. XIV. 491), claimed by its author to be intermediate and supposed by him to be a hybrid, came from Alsace and the Vosges Mts.

For most of the European species of *Lycopodium* the sexual stage

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is not always the case. Even the new serial publication "Die Pflanzenareale", edited by HANNIG & WINKLER, which is specially designed for the purpose, is not accurate enough.

is known, and it seems that every species has its own type of prothallus. Common to all is symbiosis with a fungus, perhaps a different species of fungus for every species of *Lycopodium*. Of *L. tristachyum* (and *L. alpinum*) the prothallus has not yet been found, but assuming the former to be similar to that of *L. complanatum*, it would be a minute, subterranean, carrot-shaped corpuscle, at most 5 by 9 mm large, monoecious, carrying in the ripe state antheridia and archegonia on its "top". Although we can see its possibility, it seems that under these circumstances almost a miracle must be required for a percolating droplet of moisture to effect a crossing between two different prothalli.

8. Other explanations of "intermediate" forms proposed.

The species of the section *Complanata* VICTORIN are characterized by having more or less dorsiventral aerial shoots with opposite, trimorphous leaves and terete horizontally creeping axes with sparse, uniform and radiar leaves. This dimorphy is independent of gravitation, for in *L. tristachyum* the horizontal stem is so deeply levelled that the secondary branches have to pierce a layer of soil or vegetation before reaching the surface, and the lower parts of these branches, though erect, are also terete with sparse leaves. Thus by observation alone the dependence of the flat branches on light conditions suggests itself. But besides, GOEBEL has demonstrated experimentally that the development of the flat anisophyllous shoots of *L. complanatum* depends totally on light ("Organographie der Pflanzen Jena, 1898—1901, p. 217). GOEBEL (by means of inverted flower-pots) darkened the living stools of the plant during the fall. The next year the branches of the second order, which had been dorsiventral and anisophyllous, had continued their growth, but as terete shoots with sparse, radiar and uniform leaves (fig. 125). Their internal structure, however, was unchanged (fig. 126 on p. 218). The limited vegetative branches of the third order discontinued their growth and no more branching in one plane took place.

The great plasticity of the aërial shoots and their absolute dependence on light, as proved by GOEBEL's experiments, seems to justify our regarding the so-called "intermediate" forms of *L. complanatum* from Northern habitats as a mere response to altered light conditions. When growing in the subdued light of the temperate-boreal woods, the main form (*L. "anceps* Wallr.") develops with its more or less trailing secondary branches and with tertiary shoots at greater intervals; whereas north of the woods, or above the timber-line, the secondary branches also become erect and the tertiary become aggregated in bundles[1]). At its northern limit in West Greenland the vegetative branches

[1]) FERNALD made analogous observations on *L. sabinæfolium* and its variety *sitchense*. Rhodora 25, 1923, p. 167.

of *L. complanatum* are more densely crowded and even shorter (being only 15—20 mm long), than are those of *L. alpinum* from the same locality. But here, in 69°25′ N. Lat., there will be constant polar day-light during nearly its whole growing period.

The length of the peduncles and the number of spikes born on them can also be of slight taxonomic value only. In higher latitudes and altitudes there is a general tendency to develop shorter peduncles and few or single spikes, not only in this section but also, for example in *L. clavatum*. The causes may here be partially light, partially different conditions of nourishment. Even if the arctic soil be often rich and fertile, the light from the low sun and the low temperature may prove unfavourable to metabolism.

It is to be hoped that botanical gardens of the future will establish experimental "farms" for testing the taxonomic units of "wild" plants, or that genecologic institutes, as e.g. G. Turesson's, will take up experiments on the influence of light on morphology and their bearing on taxonomic questions.

9. Some partially neglected characters. In revising the Greenland material it occurred to me that a couple of useful distinctive characters, though by no means new to science, had been neglected by or had escaped the attention of several descriptive works.

A. The sporophylls of *Lycopodium* yield good distinctive characters for species and sometimes for sections as well. Yet, numerous descriptive works do not mention them at all. Generally the sporophyll of *L. complanatum* is quite well described, in a few cases that of *L. tristachyum* also (e.g. in Lange's "Haandbog"), whereas the sporophyll of *L. alpinum* is incorrectly described in most of the floras here available, even in the modern Swedish Holmberg-Flora. The best pictures of sporophylls of *L. alpinum* and *L. complanatum* that I have found are in Hallier: Illustr. Fl. v. Deutschl. 5. Aufl. Vol. I. tab. 73 and 74, except that they appear to be somewhat too massive. The description in the text of this book is, however, not good[1]).

The best description I have found is in Rouy: Fl. de Fr. Vol. XIV. 1913:

> *L. alpinum:* bractées ovales ou lancéolées, atténuées ou subcontractées à la base, acuminées, étalées-dressées, denticulées-erodées, dépassant toujours de plus de $^1/_2$ de leur long. le sporange.
>
> *L. complanatum:* bractées d'un jaune verdâtre, suborbiculaires-réniformes, tronquées ou subcordées à la base, brusquement

[1]) I have no access to "Flora Danica" where pictures of *L. complanatum* and *L. tristachyum* are given on pl. 2671 and 2672, drawn under the supervision of Joh. Lange. They should be excellent.

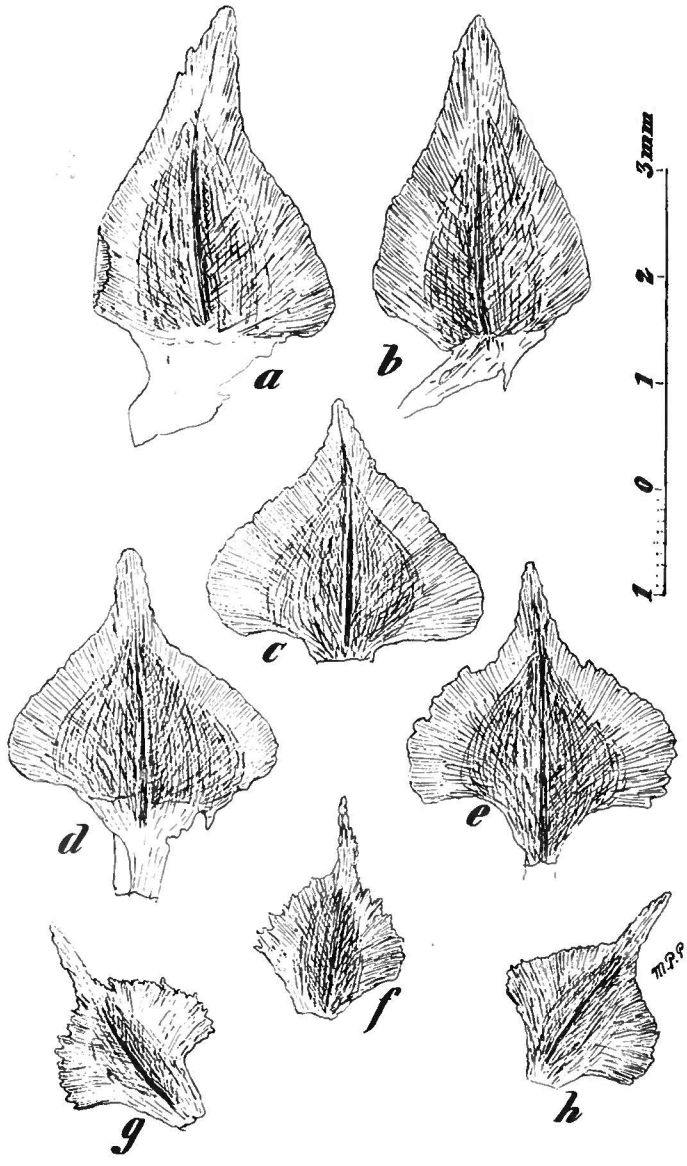


Fig. 1. Showing sporophylls.

a and *b*. *L. alpinum*, from W. Grl., shores of Lake Giesecke, 67°44′ N. 1924 leg. A. E. PORSILD.

c, *d* and *e*. *L. complanatum* f. *canadense* (VICTORIN), from W. Grl. Eqaluit in Amergdla, 64°9′ N. 1931 leg. M. P. PORSILD.

f, *g* and *h*. *L. tristachyum*, Liberty, Me. U. S. A. 1902 leg. CUSHMAN.

cuspidées, à acumen env. une fois plus court que le sporange, ondulées-sinuées à la marge.

and briefer in VICTORIN l. c. p. 106 ff.:

L. alpinum: diodophylles ovales, aigues, érodées.

L. complanatum: diodophylles scarieuses, à contour semicirculaire, brusquement terminées en pointe, diversement dentées.

L. tristachyum: diodophylles presque semi-circulaires, diversement dentées, brusquement contractées en une pointe subulée.

In the following list some of the dimensions will be given. Unfortunately, only a few specimens of the *L. tristachyum* at hand were fit for use. As to form, their sporophylls accord well with descriptions by LANGE and VICTORIN, but at the same time they are positively smaller than those of *L. complanatum.* If this be constant, we must recognize one more character.

The mature sporophylls of all three species are yellowish-greenish with membranous, hyaline margins and points, the cells of which are narrow and provided with thick, multiporous walls. Only in the middle parts are chlorophyll and stomata found. After wintering the sporophylls become dull, opaque, greyish-brownish, and in this state the denticulations and the points are partially worn off. Consequently the measures of withered, one-year-old sporophylls are always smaller than those of fresh ones, from the same individual.

In the following dimensions the length is always reckoned from the base of the sporangium as it is difficult to remove entirely the narrow basal part of the sporophyll. Each line of figures represents a varying number, 6—10, of sporophylls from the same spike measured. Measurements in millimeters.

L. complanatum

Locality	Breadth	Length	Point
Grl. Tunugdliarfik, 61°10′, Aug. 10. 1925	2.5—**2.7**—2.8	1.8—**2.4**—2.7	1/4 of length
Grl. Ameralik, 64°9′, July 22. 1895	2.0—**2.2**—2.5	2.2—**2.3**—2.5	1/4 —
Grl. same place, Aug. 10. 1931	2.0—**2.4**—2.7	1.8—**2.4**—2.7	1/4 —
Grl. Sinigfik, 69°25′, Aug. 15. 1929, not quite mature	1.9—**2.2**—2.3	**2.4**	1/4 —
same specimen, from previous year.....	**1.9**	**1.7**	
Québec, Gaspe, July 22. 1923.....	2.0—**2.3**—2.5	2.4—**2.6**—2.7	1/4 —
Labrador, Anatolak, 1926, SEWALL.....	**2.8**	**2.8**	1/4 —
Russia, White Sea, 1904, POHLE.....	2.8—**3.9**—3.0	2.4—**2.5**—2.7	1/4 —
Average...	**2.6**	**2.4**	1/4 of length

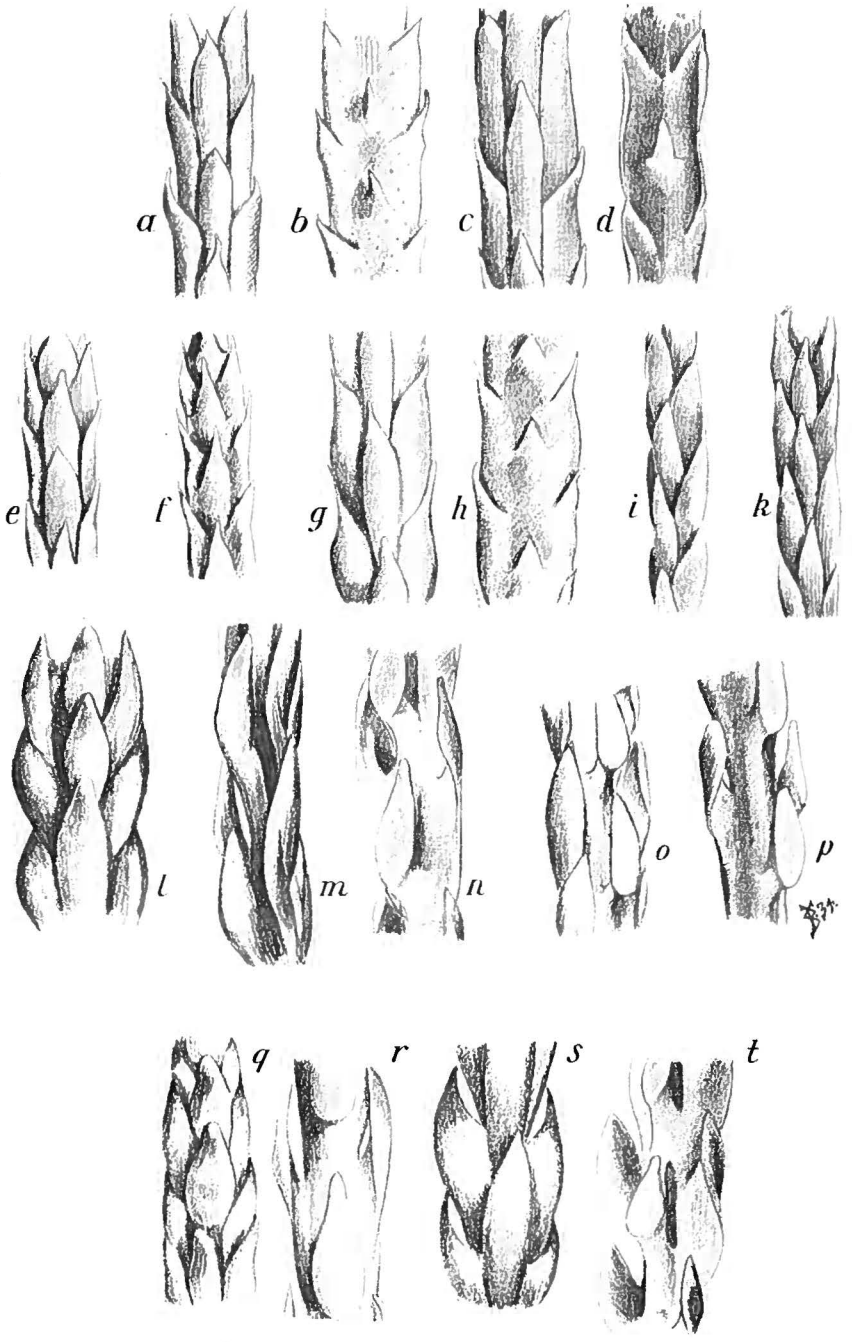


Fig. 2. Showing the shape of the leaves on the ultimate branches.
a *L. complanatum*, dorsal side, from island in the White Sea, 1904, leg. R. POHLE.
b the same, ventral side.
c *L. complanatum*, dorsal side, from W. Grl., Eqaluit in Ameragdla, 64°9′ N., 1895 leg. C. H. OSTENFELD; *d* the same, ventral side. Obs. this specimen is a juvenile state, compare the next, which is from the same locality, 1931 leg. M. P. PORSILD.

L. tristachyum

Locality	Breadth	Length	Point
U. S. A. Maine, July 20. 1912	1.3—**1.6**—1.7	1.5—**1.6**—1.8	$^1/_3$ of length
Pr. Edw. Isl., July 11. 1912	**1.4**	**1.8**	c. $^1/_2$ —
Denmark, Jutland, Hauborg Kro, 1858	1.9—**2.0**—2.2	1.9—**2.0**—2.2	- $^1/_2$ —
Ibd., Aastrup, 1858	1.5—**1.6**—1.6	**1.6**	- $^1/_3$ —
Ibd., Viborg, 1870	1.6—**1.7**—1.9	1.8—**1.8**—1.9	- $^1/_2$ —
Ibd., Viborg (MORVILLE)	1.7—**1.8**—1.9	1.8—**2.0**—2.2	- $^1/_2$ —
Ibd., Himmerland, Fandrup, 1920	1.4—**1.6**—1.9	**2.2**	- $^1/_2$ —
Ibd., Thorsted, 1858	**1.6**	1.6—**1.8**—1.9	- $^1/_2$ —
Average...	**1.7**	**1.9**	c. $^1/_2$ of length

L. alpinum

Locality	Breadth	Length
Grl. Frederiksdal, 60° N., July 25. 1925	1.0—**1.3**—1.7	2.4—**2.7**—3.0
Grl. Kangikitsoq, 68°18′, one year old	1.9—**2.1**—2.3	2.6—**2.8**—3.3
Grl. Kvanefjord, 62°5′, fresh Aug. 18. 1922	1.8—**1.8**—1.9	2.7—**2.9**—3.1
same specimens, one year old	1.6—**1.7**—1.8	1.9—**2.4**—2.8
Grl. Godthaab, 64°11′, Sept. 5. 1926	2.1—**2.2**—2.4	2.3—**2.5**—2.9
Grl. Lake Giesecke, 67°44′, July 31. 1924	1.5—**1.6**—1.7	3.0—**3.2**—3.5
Iceland, Dalsmynni, July 28. 1910	1.1—**1.2**—1.5	2.2—**2.5**—2.9
Norway, Dovre, 1856, Th. Jensen	1.1—**1.3**—1.8	3.0—**3.1**—3.2
Switzerland, Lenzerhaide, Sept. 4. 1921	1.7—**1.7**—1.8	2.6—**2.9**—3.2
Alaska, Iliamna Lake, Gorman 84. 1902	1.8—**1.9**—2.2	2.2—**2.6**—3.0
Average...	**1.7**	**2.8**

g dorsal side. ***h*** ventral side.

i *L. tristachyum*, dorsal side from Pr. Edw. Island, Alberton, dry clearings, 1912 leg. FERNALD & ST. JOHN. ***k*** the same, ventral side.

l *L. alpinum*, from E. Grl. Qingaq near Angmagssivik 65°57′ N., in shade under rocks, 1902, leg. C. KRUUSE, dorsal side.

m *L. alpinum* from S. W. Iceland, Dalsmynni, 1910 leg. HELGI JÓNSSON, dorsal side. ***n*** the same, ventral side.

o *L. alpinum*, ventral side, from Quebec, Matane County, alpine meadows, 1075 m., 1923 leg. FERNALD, GRISCOM & MACKENZIE.

p *L. alpinum*, ventral side, from Switzerland, Stäzerhorn, 2000 m., among *Vaccinium*, 1916 leg. J. BRAUN-BLANQUET.

q *L. alpinum*, dorsal side, from W. Grl., Lake Giesecke region, 67°44′ N., 1924 leg. A. E. PORSILD. ***r*** the same, ventral side.

s *L. alpinum*, dorsal side, from Alaska, Iliamna Lake region, 1902 leg. GORMAN. ***t*** the same, ventral side.

Obs. the figures are drawn from photographs unfit for reproduction; the magnification varies slightly between 5—7 times, reduced by reproduction to $^2/_3$.

B. The ventral leaves of the assimilating flat branches have been eagerly studied and generally well described as far as *L. complanatum* and *L. tristachyum* are concerned, since they have been considered key characters for the distinction. Nearly all authors state correctly that the ventral leaves in the former species are much smaller than the dorsal ones, forming only insignificant, densely appressed points, whilst in the latter the ventral and dorsal leaves are nearly of equal size and free from the stem by half their length.

The relative size of the ventral leaves of *L. complanatum* is smallest in full grown specimens from lower latitudes. In young shoots, and in specimens from higher latitudes the difference in size is not so marked, the shoots of the Northern specimens showing in this respect a juvenile appearance. Yet they are very different from genuine *L. tristachyum*.

Concerning *L. alpinum* all modern European floras at hand content themselves with stating that the leaves of the branches are densely imbricate, placed in four ranks, and about of equal size, and none of them seem to have noticed that the ventral leaves of this species differ much in shape from those of all the other Northern species. The free part of the leaf bends out from the stem at a wide angle and hence upwards so as to obtain the shape of the teeth of certain cultivators (see fig. 2 o and p).

I have found this character mentioned by the following American writers: LLOYD, 1902 (here quoted from VICTORIN p. 57) "en forme de truelle de macon"; RYDBERG: "Rocky Mountain Flora" 1917, "trowel-shaped"; VICTORIN l. c. p. 92, 106 "cochleariformes". It is the more astonishing that this character has escaped the attention of the European writers in that it has been detected and described by WAHLENBERG: Flora Lapponica 1812. Speaking — on p. 291 — about the affinity of *L. alpinum* to *L. complanatum* and of the casual difficulties in discerning extreme forms he adds:

"Facile distingvitur latus inferius ramorum ob folia discreta et qvasi peltata".

This curious leaf-form is easily visible in fresh material but sometimes not so plain in dried and pressed herbarium specimens. However, boiling in water for a couple of minutes, especially with a few drops of chloral hydrate solution added, will immediately make the leaves swell and restore their natural position. I have found the character constant in plants from sunny and shaded positions as well, from Greenland (some 60 collections), Iceland, Færöes, Scotland, Norway, Kola Peninsula, Denmark, the Alps, Québec and Alaska (altogether 130 collections), and I have found it especially valuable in identifying the sterile and habitually highly deviating specimens from shaded habitats.

10. Differential diagnoses of *L. alpinum*, *L. complanatum* and *L. tristachyum*.

	L. alpinum	*L. complanatum*	*L. tristachyum*
Horizontal creeping stems	superficially or nearly so, up to $^1/_2$ m long, 2 mm thick or thinner	under slight cover of moss or foliage, up to 1 m long, about 2 mm thick	deeper levelled than preceding, up to 1 m long, stouter than preceding, up to 4 mm thick
Assimilating and fruiting branches	somewhat yellowish green, erect, 3—8 cm long, forked from base, aggregated in dense bundles, obtusely foursided or (in shaded positions) indistinctly flattened	dark green, rarely subglaucous; 5—20 cm long, 2—4 mm broad, in shaded places fan-like bifurcated, in sunny shorter, in aggregated bundles, distinctly flattened, ±concave on ventral side	distinctly bluish-green, 10—25 cm long, 1.3—1.8 mm broad, bifurcated and aggregated in bundles, flattened or obsoletely foursided, not concave on ventral side
Branch leaves	±densely imbricated, in four ranks, all of nearly equal size with upper halves free from stem, yet trimorphous: the points of the lateral ones downwards bent, the ventral trowel shaped (Fig. 2, l—t)	distinctly trimorphous; the lateral ones keeled, dorsal smaller and free to $^1/_3$ of length, ventral very small, densely appressed (Fig. 2, a—h)	less distinctly trimorphous, lateral leaves with upward or somewhat inward directed points, dorsal and ventral of equal size, free from stem to over $^1/_3$ of length (Fig. 2, i—k)
Spikes	sessile, normally single, rarely in pairs, 5—15 mm long, slightly overtopping the barren branches	1—$2^1/_2$ cm long, 1—several on slender to stoutish peduncles, 1—5 cm long	2—3 cm long, on very slender 15—30 cm long peduncles, these normally at top twice bifurcated, bearing 4 spikes each
Sporophylls	ovate-elliptic or cymbiform, margins and points subentire or indistinctly eroded, 1.7 mm broad, 2.8 long (Fig. 1, a—b)	broadly ovate or subcordate, 2.6 mm broad, 2.4 long, abruptly narrowed into an irregularly denticulate point, $^1/_4$ of length (Fig. 1, d—e)	of the same form as in the preceding, but smaller, 1.7 mm broad, 1.9 long, point relatively longer, $^1/_2$ of length (Fig. 1, f—h)
Occurrence	on dry, sunny slopes, occasionally somewhat shaded under foliage or shrubs, Alpine to Arctic, but not Higharctic	in shaded Temperate-Boreal woods, sometimes on heaths, outposts North of or above timberline	on sunny heaths. Geographical distribution more local and more to the South than preceding.

11. Results of the revision of the Greenland specimens. After a careful examination of all available specimens representing, by the way, practically all plants that have been reported from Greenland, we come to the conclusion that 1) *L. tristachyum* PURSH is totally absent from Greenland. The great majority of specimens which have been listed as this or as *L. Chamæcyparissus* are in fact forms of *L. complanatum*, whereas a few are forms of *L. alpinum*. This conclusion is much more in accordance with our present knowledge of the geographical range of *L. tristachyum*, as more southerly than that of *L. complanatum*.

2) *L. complanatum* has only been found in the southern half of the west coast. This fact is in complete harmony with the absence of *L. complanatum* from Western Europe south of Scandinavia, from Great Britain, Færö Islands and Iceland. We shall, accordingly, have to regard *L. complanatum* as a western, American type in Greenland.

12. Forms and distribution of *L. complanatum* in W. Greenland. None of the Greenland forms of *L. complanatum* exactly match what is considered the typical *L. complanatum* of Europe ("*L. anceps* WALLR."). The nearest are certain forms growing in the birch-woods in southernmost Greenland. Although the remaining specimens show various developments and sizes, according to the nature of their habitats, their technical character is quite uniform, and we may safely conclude that they originated genotypically from one stock.

In his treatise VICTORIN has proposed two new varieties of *L. complanatum*, which he describes as follows:

1) *L. compl.* var *canadense* n. v.

Caule principali generaliter epigæo, in herboratorum speciminibus præsente; aëriis ramis primariis brevibus, densis (5—10 cm longis); spicis robustis, generalissime solitariis cum pedunculis (1—3 cm longis) parum e foliis exsertis.

2) *L. compl.* var. *elongatum* n. v.

Caule principali (rhizoma) hypogæo, generaliter in speciminibus herboratorum absente; aëriis ramis primariis elongatis (15—25 cm longis) plus minusve laxis; spicis 2—4, crassis elongatisque (20—30 mm longis, 3 mm latis); primariis pedunculis elongatis (5—6 cm longis); pedicellis (3—10 mm longis); ultimis sterilibus ramis latis (3 mm circa), valde complanatis; marginalibus foliis latis cum liberis apicibus divaricatis.

Of the var. *elongatum* I have seen one specimen, quoted by VICTORIN (Rivière Ste. Anne des Monts, FERNALD Nr. 25. 414). It is said to occur in Québec, but to be more common in western America. Of var. *canadense* I have a specimen from Labrador (Anatolak, C. S. SEWALL, 1928). Its range is given as Alaska, Yukon, Great Bear Lake, N. and E. Québec and Labrador, and the author remarks: "Le nom de variété *canadense* semble bien convenable à une plante qui est presque exclusivement

confinée a ce pays" (p. 71). Further VICTORIN, having restricted the occurrence of typical *L. complanatum* to such places as escaped the last glaciation, states that var. *canadense* is "un extrême, essentiellement développé dans les régions subarctiques après le retrait du glacier continental" (p. 75), and that var. *canadense* in alpine situations of W. N. America "atteint son expression finale dans une forme rabougrie, à épis pratiquement sessiles et qui, par l'effet convergent des conditions de milieu, mime curieusement le *L. alpinum*. Elle doit porter le nom de *L. complanatum* L. var. *pseudoalpinum* FARWELL Mich. Acad. Sc. 18:94. 1916" (p. 71).

Both of these "varieties" connected by intermediate forms occur in Greenland. This fact is not remarkable as W. Greenland and Canada have so many boreal and subarctic plants in common. But in northern Europe *L. complanatum* is represented, near its northern boundary, by forms which in most characters coincide with the American variations; these have long ago been named. The analogon of "var. *pseudo-alpinum* FARWELL" of 1916 is "var. *fallax* ČELAKOVSKY" "Prodr. Fl. Böhm." I. 14. 1869, which is a stunted plant from alpine situations with sessile or subsessile spikes and with short and densely aggregated branches, resembling *L. alpinum*. And corresponding to "var. canadense Victorin" we have the great host of northern forms of *L. complanatum*, the majority of which have probably been collected in Fennoscandia and Denmark. The aggregated branches of these varieties made HARTMAN and the Scandinavian botanists following him mistake them for *L. tristachyum* PURSH. Probably the most remarkable of these varieties has been described by H. LINDBERG in Schedæ operis quod inscribitur Plantæ Finlandiæ Exsiccatæ. Fasc. I—VIII. Helsingfors, 1906, and named f. polystachyum LINDB. FIL. A small sized photograph of one of LINDBERG's specimens is published in Bot. Not. 1929, p. 92. Having the large collection of *L. complanatum* from Denmark, belonging to the University of Copenhagen, at hand I must admit that most of the specimens show a marked tendency to develop numerous short and thick spikes, whereas the variety canadense of VICTORIN — and the plants from Greenland — tend to develop single, or few, slender and somewhat elongated spikes. This may in fact be taken in favour of regarding the Greenland-Canadian plants as having originated from a different stock than the N. European, and also as a justification of VICTORIN's new name.

On the other hand, the number of the spikes in a Lycopodium is a weak characteristic to found a name upon since the number often varies in the same individual. And as all the remaining characters, to a high degree, seem to be dependent on light conditions, some perhaps on temperature or soil, I shall prefer to keep the names proposed in America for variations of *L. complanatum* to designate forms rather than varieties.

Specimens seen of *L. complanatum* from West Greenland.

S. Disko.

Godhavn, 69°15′ N., 1892, P. H. SØRENSEN, sterile;
Skansen, 69°27′ N., 1908, M. RIKLI, sterile;
— — 1921, A. E. PORSILD, sterile;
Skanseklippen, 69°25′ N., 1929, R. T. PORSILD, f. pseudo-alpinum;
Sinigfik, 69°25′ N., 1929, R. T. PORSILD, a weak f. *canadense*, transitional to f. *pseudo-alpinum*.

Godthaab Fiord-region.

Fiskefjord, Qingua, 64°55′ N., 1885, S. HANSEN, sterile;
Umanaq, 64°29′ N., 1907, GANDRUP, f. *pseudo-alpinum;*
Pisigssarfik, 64°26′ N., 1914, NYGAARD, f. *pseudo-alpinum;*
Eqaluit in Ameragdla, 64°9′ N., 1895, OSTENFELD, two collections, one from the heath, one from thickets, both are f. *canadense;*
the same place, 1931, M. P. PORSILD, the same form.

Julianehaab District.

Tunugdliarfik, S. of Kiagtut, 61°10′ N., 1925, A. E. & M. P. PORSILD, f. *canadense;*
Iganeq at Igaliko, 500', shaded, 1888, ROSENVINGE, near f. *typicum*;
Agdluitsoq, 60°45′ N., 1925, A. E. & M. P. PORSILD, f. *canadense;*
Tasermiutsiaq, 60°27′ N., 1889, N. HARTZ, f. *pseudo-alpinum;*
Kangikitsup Qingua, 60°18′ N., 1925, A. E. & M. P. PORSILD, f. inter f. *canadense* et *pseudo-alpinum* intermedia;
Tasermiut, Taserssup Qingua, 60°16′ N., 1828, VAHL, f. *canadense;*
ibd. 1880, C. PETERSEN, f. *canadense;*
ibd. 1889, N. HARTZ, f. *pseudo-alpinum;*
ibd. — — (in birch woods) near f. *typicum:*
ibd. 1925, A. E. & M. P. PORSILD, partly f. *canadense*, partly, from the woods, a form near the type.

Specimens to be excluded from *L. complanatum*[1]):

1) Kangarsuk, S. of Fiskenæs, 1888, ROSENVINGE;
2) Qingaq, Angmagssivik, East Greenland, KRUUSE;
3) Ikerasaussaq, N. point, East Greenland, KRUUSE.

All belong to *L. alpinum* and will be mentioned below.

[1]) After this was written G. SEIDENFADEN has, in Medd. om Grl. Vol. 106, Nr. 3 (1933) p. 43, recorded two occurrences of a *Lycopodium* in S. E. Greenland which he, trusting to the literature, has labelled *L. complanatum* L. subsp. *chamæcyparissus* A. BR. Though I have not seen them, I should think they are more likely to be referable to the W. Greenland form of *L. complanatum*.

13. *L. alpinum* is in most parts of Greenland and in other Arctic or Alpine localities decidedly a plant of the light, growing on rather dry, sunny slopes and in Greenland normally fertile every year. Because of its horizontal superficial stem, its densely aggregated bundles of obtusely foursided branches with densely imbricate leaves of nearly equal size and owing to its sessile spikes, this normal form cannot be confused with any other species.

But, in the Southern sections of its range, or in lowland stations in temperate climates, forms are met with growing more or less overshadowed by heather, grass, the foliage of herbs or shrubs, or by moss, and their appearance is rather different. Often, too, they are sterile. The vegetative branches may then be two or three times longer and more slender, but it is especially the internodes that are longer so as to make the leaves squarrose rather than imbricate. Even the type of *L. alpinum*, as figured by LINNÆUS in "Flora Lapponica" t. XI. Nr. 6, is not what is here considered the normal form but, rather, a slightly shaded plant. In extreme cases also the branches become rather flat, or even channeled as the tips of the lateral leaves are bent towards the ventral side.

Such deviating forms have sometimes been mistaken for forms of *L. complanatum*, *L. tristachyum* or *L. sabinæfolium* var. *sitchense* or for crossings between *L. alpinum* and any one of the other species enumerated. As stated above, the peculiar form of the ventral leaves should be sufficient for a correct placing, even of sterile forms[1]).

In the herbarium of the Botanical Museum in Copenhagen J. BORODIN of Leningrad has labelled one specimen of *Lycopodium* from West Greenland definitely as

L. alpinum L. var. *planiramulosum* TAKEDA.

A couple of Danish specimens were also labelled by Borodin as *planiramulosum*, however, with a question mark. Following this suggestion A. E. PORSILD has labelled a number of specimens from the southern parts of Greenland with the same name.

TAKEDA's variety has been described and pictured in Tôkyô Bot. Mag. vol. 23. 1909 as follows[2]):

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[1]) Eventually, in doubtful cases, a decision seems to be reached by means of the anatomy of the leaves of sterile branches. In "Kgl. Fysiogr. Sällsk. Handl." B. 3 — also issued as a doctor's thesis, Lund 1892 — JOHAN ERIKSSON has published a study on the leaf-anatomy of a great number of species of *Lycopodium*, amongst which are *L. alpinum* and *L. complanatum*. The results are described at length on p. 42—43 where a somewhat different occurrence of the stomata in the species in question is mentioned. But as the aim of this investigation was not to obtain characters of taxonomic value, the influence of different light on the material treated has not been considered.

[2]) Text and picture have kindly been copied for me by the Museum staff in Copenhagen.

Lycopodium alpinum Linn. Var. *β planiramulosum* Takeda, var. nov.

Lycopodium alpinum MAKINO in Tôkyô Bot. Mag. XII, p. 304; Id. op. XVI, p. 197, excl. syn; MATSUM. Index Plant. Japon. I, p. 357, excl. syn., nec. Linn.

Lycopodium alpinum HANZAWA in Trans. Sapporo Nat. Hist. Soc. I, p. 135, ex parte.

Differt a typo foliis ramulorum sterilium lateralibus adpressis, lanceolatis, convexis, falcatis, apice valde incurvis, quorum iarinæ ad paginam ventralem ramuli versus paulum curvatæ, itaque ramuli subtus non canaliculati videntur. Spicis ad apicem ramorum modice elongatorum sessilibus.

Hab. Yezo. — Prov. Iburi: In summitate montis Makkarinupuri (T. ISHIKAWA! 24. IX. 1893; S. ITÔ! 7. VIII. 1907; K. KONDÔ! 2. VIII. 1908).

Diese neue Abart unterscheidet sich von der typischen Art durch folgende Merkmale: Die Kiele der sichelförmigen, stark aufwärts gekrümmten Blätter des Nebenzweiges biegen wenig nach der Unterseite des Zweiges um, sodass die Zweige sich unten keineswegs zweirinnig zeigen, und deshalb etwas breiter als die der typischen Art sind. Die bald dicht bald etwas locker beblätterten, ährentragenden Äste überragen oft die Laubzweige mässig.

Diese Varietät erinnert an *Lycopodium sabinaefolium* sowie L. *complanatum* wegen seinen nach unten nicht gekrümmten Randblättern, unterscheidet sich jedoch davon durch die sitzenden Ähren, die Form der Sporophyllen und den viel kleineren, schwächeren Habitus.

Ex: The Botanical Magazine, Tôkyô vol. 23, p. 229, 1909.

Authenticated specimens of Takeda's variety are not at hand. In the above-quoted description the passages emphasized (by me) in both texts do not fit the Greenland specimens in question. On the contrary, in our specimens the lateral leaves bend with their upper parts distinctly towards the ventral side so as to make the branches channeled and not plane. The drawing fig. a does not show the peculiar shape of the ventral leaves, whereas this is still more plain in our deviating forms than in the normal ones. I therefore doubt the identity of Takeda's plant with the plants from South Greenland.

Of the true nature of these deviating forms, occurring in S. Greenland, Iceland, etc. there can be no doubt. They are simply shade forms differing principally from the normal lightplants by their longer internodes. The most extreme forms I have seen are from East Greenland and from Alaska but there are numerous intermediate states of intergrading. Though not mentioned in any handbook accessible to me, they have yet in some cases puzzled collectors and museum officials. Besides the cases of Gelert and Kruuse which, having entered the botanical literature, will be mentioned below, there is in Copenhagen a sheet of specimens from Ivigtut, leg. Kornerup, which Joh. Lange first labelled *L. Chamæcyparissus*, later correcting it to *L. alpinum*. On the other hand, another sheet of specimens from S. Isortoq near Sukkertoppen, taken by Rosenvinge and by him labelled *L. alpinum*, exhibits under 1) "specimens from open places" (the typical form) and under 2) "specimens from the

shade" (the form here considered) which shows that the collector in the field plainly understood the significance of the latter form.

Actually, a proper name for these merely ecologic deviations should not be necessary. Since, however, they have already caused confusion and have, in the writer's opinion, been misnamed, it may be practical to call attention to them by a name:

Lycopodium alpinum L.

forma umbrosum n. f. Differt a forma primaria, in apricis crescente, ramulis longioribus superne saepe attenuatis et foliis, propter internodia elongata, minus vel haud imbricatis. Ceterum foliorum forma non diversa.

14. Enumeration of some representative specimens of L. *alpinum* L. f. *umbrosum* n. f.

Alaska: Lake Iliamna region, 1902, GORMAN, Nr. 84. Very stout, sterile branches up to 10 cm. long, spikes 13—15 cm. above horizontal stem.

West Greenland: Kunguk, 65°55′ N., 1885, S. HANSEN, c. fr.;
S. Isortoq near Sukkertoppen, 65°20′ N., ROSENVINGE, p. p. c. fr.;
Björnesund, Eqaluit, 63°, 1878, KORNERUP, sterile;
Kangarsuk, S. of Fiskenæs, 62°58′ N., in a shaded ravine, 1888, ROSENVINGE, c. fr.;
This specimen was correctly identified by the collector as *L. alpinum*, but by GELERT in Fl. Arct. p. 13 transferred to *L. complanatum* f. *fallax* ČELAK. This idenfication was accepted by ROSENDAHL in Medd. om Grl. 56. 218. Finally, in 1913, the specimen was labelled *L. alpinum* var. *planiramulosum* TAKEDA by J. BORODIN.
Julianehaab, 60°43′ N., 330′, 1880, C. PETERSEN, sterile;
Kangikitsup Qingua, 60°18′ N., A. E. & M. P. PORSILD, partly; c. fr.;
Pamiagdluk, 59°55′ N., 1891, LUNDHOLM, sterile;

East Greenland: Kuteq, 60°41′ N., 1883, EBERLIN, c. fr.;
Serqinouk, 60°58′ N., 1829, J. VAHL, sterile;
Qingaq, Angmagssivik, 65°57′ N., in shade under rocks, 1902, and N. point of Ikerasaussaq, 66°5′ N., between rocks, 1899, both sterile. By the collector C. KRUUSE they were published in Medd. om Grl. 30. 283 as *L. complanatum β Chamæcyparissus*, which identification was accepted by ROSENDAHL in Medd. om Grl. 56. 219. The last mentioned is a very stout and coarse form, with branches reaching up to 12 cm above the horizontal stem.

Iceland: S. W. Dalsmynni, 1910, Nr. 632, H. JÓNSSON, c. fr.;
W. Hvammur, 1897, Nr. 1052, H. JÓNSSON, c. fr.;
N. W. Patricksfjörður, 1908, KN. JESSEN, c. fr.;

Scotland: In monte Clova, GRAHAM, c. fr.;

Denmark: Anholt, 1930, J. GRØNTVED, sterile;

Sweden: Jämtland, Snasahögerna, NYMAN, c. fr.;
Russia: Kola Peninsula, Charlowka, 1904, POHLE, sterile.

15. Distribution of *L. alpinum* in Greenland.

Although *Lycopodium alpinum* may justly be termed an Arctic or Alpine plant, it is absent from all higharctic countries, and, accordingly, in Greenland a distinct southern and lowland type. The northernmost occurrence in West Greenland, so far known, is Serfarssuit on the eastern coast of Svartenhuk Peninsula, 71°45′ N., 1929, M. P. & R. T. PORSILD[1]). It is also known from a few places on Nugssuaq Peninsula and on the mainland E. and S. of Disko Bay. On S. and S. W. Disko it is quite common, but not noticed from the other sections. Even farther south it is scarce and only to be met with in sheltered places in the interior. South of the Godthaab region it is common.

In East Greenland it is known from several stations south of Angmagssalik. In the Angmagssalik District, 65—66° N. KRUUSE found it in numerous places, but it was always scarce. North of 66°20′ a few localities have recently been recorded by BØCHER (Medd. om Grl. 104, 3 p. 5. 1933). It has been found on Danmarks Ø in the interior of Scoresby Sound, 70°27′ N., by HARTZ.

March 1932.

Postscript.

This manuscript was completed in the early spring of 1932, but its publication was postponed as I had hopes of obtaining electric light supply, which would have rendered it possible to produce an ample number of objective microphotograms, supporting the opinions set forth in the paper. Unfortunately, these hopes failed, and I had to content myself with a small number of drawn sketches, based on photographs unfit for reproduction.

April 1934.

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[1]) On partly printed labels for duplicates distributed, the geographical latitude of this place is wrongly given as 70°45′ N.

VII.

THE GREENLAND UTRICULARIAS

With some remarks on the aquatic flora in general.

Although JENS VAHL's Greenland herbaria contain a great abundance of aquatic vascular plants, mosses and algae, proving that he paid full attention to the lake and pond vegetation, this persevering collector did not succeed in finding *Utricularia*. This fact alone shows how scarce the occurrences in Greenland are. Also the fact that the present writer, after more than 25 years' herbarisations in various parts of Greenland and after searching for it in suitable places, only met with it seven times, may speak for the same. The first specimen was taken by BERGGREN in 1870, the next by BERLIN in 1883, the next by ROSENVINGE in 1888, another by HARTZ in 1890 and another by VANHØFFEN in 1892. All these were sterile and were identified and published as *U. minor*. By the final working up of VANHØFFEN's plants ABROMEIT pointed out that his specimens really represented *U. ochroleuca*, which caused ROSENVINGE to revise the former collections, with the result that HARTZ' specimens, too, belonged — at least partially — to this species. In 1918 I found a sterile specimen which I identified and distributed as *U. intermedia*, and in 1924 I found the same plant in another place.

For the identification of these last species I had very little help in the older descriptive works, where the winterbuds were mentioned, to be sure, but not satisfactorily described. H. GLÜCK's elaborate work on the morphology and life-history of Utricularia ("Biologische und morphologische Untersuchungen über Wasser- und Sumpfgewächse" II. Jena 1906) was not accessible to me, and Vol. VI, 1 of HEGI: "Illustrierte Flora von Mittel-Europa" (published in 1918), in which Professor GLÜCK gave an abstract of his large work and some of his original drawings, had not reached me. I had thus for help only some few sketches, published by ABROMEIT on pl. II of his "Botanische Ergebnisse B" (Bibliotheca Botanica 42. Stuttgart 1899) and I had no adequate herbarium specimens from other countries for comparison either.

During a visit to Europe and Canada in 1929—30 I saw a good deal of Utricularia specimens in the public herbaria in Copenhagen and Ottawa which, impressive by their much larger size, caused me to doubt my former identifications. For a renewed study I had, for loan, by the courtesy of the authorities of the Botanical Museum in Copenhagen, all specimens preserved from Greenland, some selected and well authenticated specimens of the three species in question from other parts of the world[1]) and

[1]) E. g. two of the earliest distributed specimens of *U. ochroleuca:* 1) Hälsingland, Skog, leg. R. HARTMAN (FRIES: "Herbarium Normale" fasc. XVI. Nr. 23), probably a cotype; 2) Värmland, Carlstad, leg. J. AGARDH.

GLÜCK's book. The result of this investigation was that I had to keep to my former identification, but at the same time it became apparent to what extent the "unnatural" conditions of the habitat had modified these plants.

Before entering upon details hereof I shall give a brief description of the specimens from Greenland.

Utricularia minor L. Sp. Pl. (1753) p. 18. BERGGREN, Øfvers. K. Vet.-Akad. Förh. 1871 p. 875; LANGE: Consp. Fl. Gr. I, p. 72; II, p. 261; BERLIN, Øfv. K. Vet.-Akad. Förh. 1884 p. 57; ROSENVINGE: Consp. Fl. Grl. III, p. 685; ABROMEIT: Botan. Ergebn. B. p. 41, pl. II. fig. 25—27; PORSILD, Medd. om Grl. 58, p. 144.

Floating stems dark green, very weak and slender, 5—15 cm long, often curled up as a small green patch over dark brown growth of aquatic mosses, internodes longer than the leaves. Leaves 3—6 mm long, 2—8 mm broad, 2—3 times forked, divisions terete, tapering to subulate tips, the central vascular bundle barely visible under a lens, (fig. 3, d; 4, h, i) generally each leaf with one or two bladders, size: 1—1.5 × 2—2.5 mm, tips of the ultimate divisions with a short, one-celled mucro, visible under a strong lens, without lateral bristles. Winterbuds in mature state globular, dark greenish, 2—3 mm in diameter, scales closely complicate, bearing 6—8 acuminate divisions with mucronate tips (fig. 5, b; 6, g, h).

In shallow water, generally entangled in algal filaments and overgrown with diatoms. Scarce, probably often overlooked.

West Greenland: Igaliko, 61° N. ROSENVINGE 1888,
Sofia's Harbour, Arfersiorfik fiord, 68°21′ N., BERLIN 1883.
Orpigssôq, Qingua, 68°30′ (HTZ) with *U. ochroleuca*, 68°41′N., 50°55′ W., M. P. PORSILD 1932.
Claushavn, about 69° N., BERGGREN 1870.
Brede Bugt, 69°16′ N., M. P. PORSILD 1915.
Amitsuatsiaq fiord, 70°45′ N., M. P. & R. T. PORSILD 1929.
Qeqertat, 70°59′ N., M. P. & R. T. PORSILD 1929.

General Distribution: Temperate-boreal Europe, Asia and North America, also in northernmost Fennoscandia and Iceland, southwards to Spain and California.

Utricularia ochroleuca R. HARTM. Bot. Not. 1857, p. 30. Handb. Skand. Fl. 11. ed. (1879), p. 123. Exs.: Herb. Norm. fasc. 16, Nr. 23. ABROMEIT: Bibl. Bot. vol. 42, p. 41, tab. II. fig. 20—24 (1899).

Floating stems green or purplish tipped, weak and slender, 5—15 cm long, internodes shorter than in the preceding.

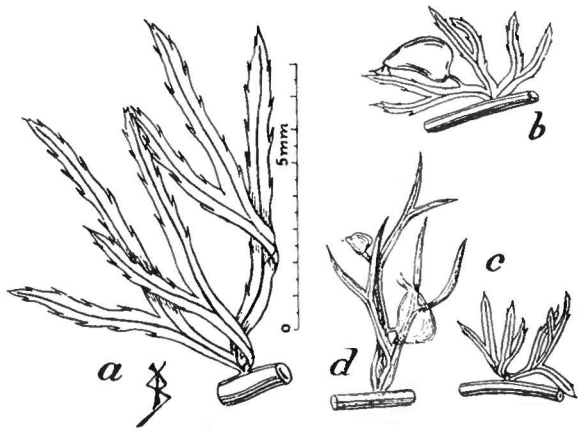


Fig. 3. Leaf-blades of Utricularia.
a U. intermedia, Sofias Havn. *b U. ochroleuca*, Ikerasaq. *c* the same species, Carlstad. *d U. minor*, Amitsuatsiaq.

Leaves 3—6 mm long and broad, 2—3 times forked, divisions flat with plainly visible median vein, ultimate divisions acuminate with terminal long one-celled bristle and with 3—5 similar ones on the edges near the tip (fig. 3, b, c; 4, e—g). Often these bristles are in pairs or in threes, especially on the transitional leaves developed near the winterbud. Several leaves with one, rarely with two bladders each; separate shoots bearing bladders alone without green leaves (as

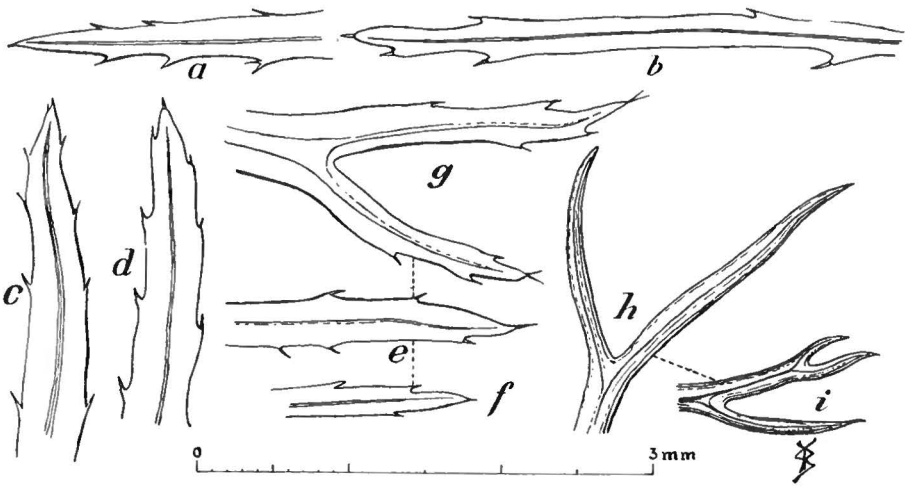


Fig. 4. Utricularia, tips of the ultimate divisions of the leaf-blades.
a U. intermedia, Sofias Havn. *b* do., Newfoundland. *c* do., N. Strömfjord. *d* do., Ireland. *e U. ochroleuca* Ikerasaq. *f* do., Carlstad. *g* do., Skog. *h U. minor*, Amitsuatsiaq. *i* do., Fyen.

in the typical European plant) were seen by ABROMEIT, but are absent from my material and are probably not always developed in Greenland; bladders 1.5 × 2 mm. Winterbuds uncinate, purple, 4—5 mm long and 2—4 mm thick, scales with 6—8 segments, the upper part of which bear, on each edge, a few teeth with 1—3 onecelled bristles each (fig. 5, c; 6, d—f).

In shallow ponds and on inundated marshes; habitually this stunted form is very much like the preceding.

West Grenland:

Orpigssôq, 68°37′ N., HARTZ 1890 (with *U. minor*).
Orpigssôq, 68°41′ N., GRØNTVED 1932.
Ikerasaq, 70°30′ N., VANHØFFEN; P. H. SØRENSEN 1893.

General Distribution: Northern, central and western Europe southwards to France. Nova Scotia (Rhodora 1931, p. 124, first record for America). In Herbarium Hauniense I have seen sterile specimens, collected by FR. JOHANSEN at Teller, Alaska, 65°12′ N., labelled and distributed by the Canadian National Herbarium as U. intermedia No. 98898. The specimens are poorly dressed, but the green leaves as well as the bud-scales show the distinguishing marks of *U. ochroleuca* clearly. In size the plants approach the European. — A remarkable range extension.

Utricularia intermedia HAYNE in SCHRADER's Journal vol. I. 1800, p. 18. tab. 5. — M. P. PORSILD: Flora of Disko and Adjacent Coast. Medd. om Grl. vol. 58. p. 144. 1920.

Floating stems light-green, stouter than those of both preceding species, 8—12 cm long; by their short internodes and long and slender leaf-segments the stems show a brush- or moss-like appearance. Leaves 8—15 mm long and broad, several times forked into linear flat divisions with easily visible median veins. Ultimate segments mostly subobtuse, with a single terminal one-celled bristle and with a long series of similar alternating bristles on either edge (fig. 3, a; 4, a—d). Bladder larger than in the preceding, 4.5 × 3 mm, borne on separate branches; single bladders are rarely found among the green leaves. Winterbuds light-green -greyish, in the mature state globular or subellipsoid, 3.5—4 mm large, with densely crowded scales, simulating a cone. Scales in circumference reniform, cleft into 6—8 obtuse, or rarely somewhat acuminate lobes, bearing at the tip and on each margin 4—6 wart-like teeth, each with a bundle of 2—11 long bristles (fig. 5, a; 6, a—c, i).

Forming extensive patches in shallow ponds with clear water.

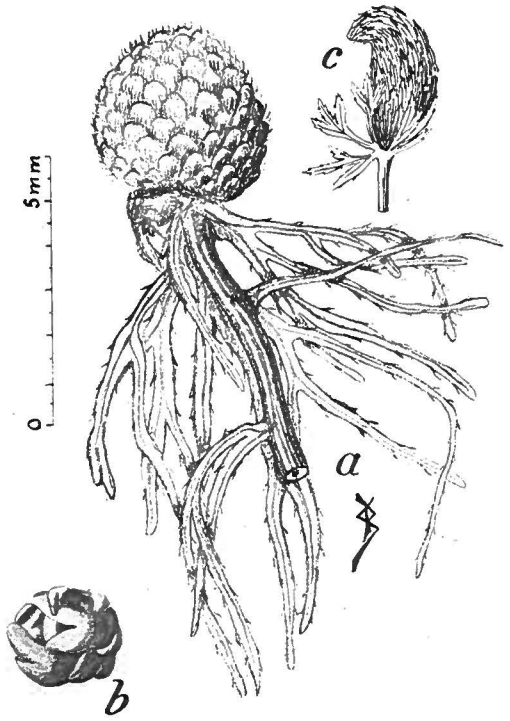


Fig. 5.
Winterbuds of Utricularia.
a U. intermedia, Sofias Havn. *b U. minor*, Orpigssôq. *c U. ochroleuca*, Ikerasaq.

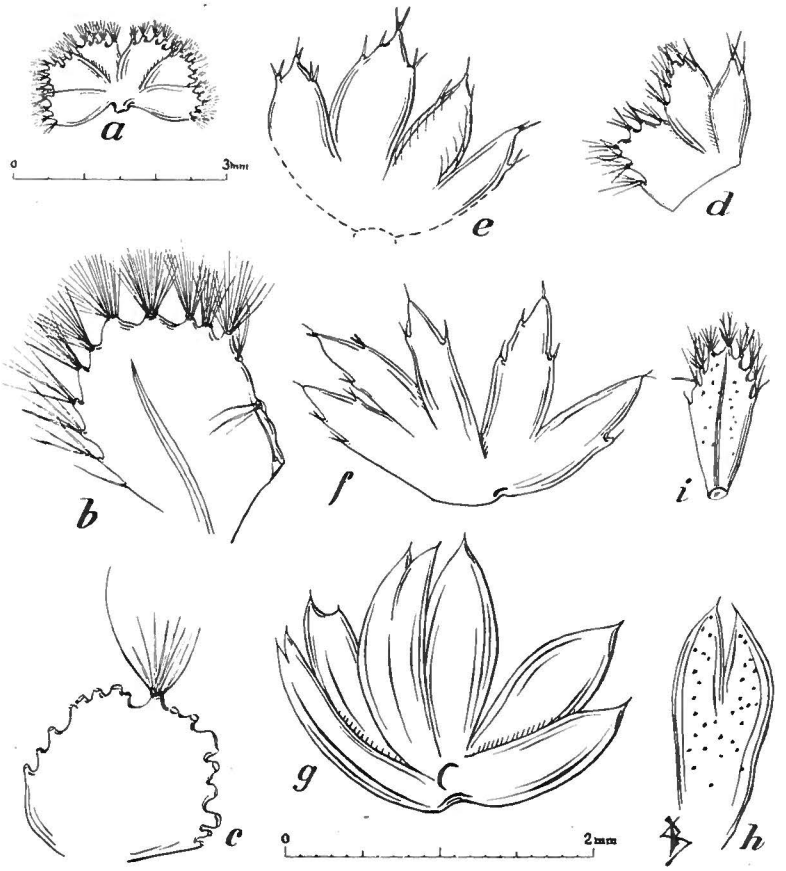


Fig. 6. Scales of the winterbuds of Utricularia. *a* scale of *U. intermedia*, N. Strömfjord. *i* lobe of the same, magnified. *b* lobe of the same species, V. Götland. *c* do., Newfoundland. *d* lobes of *U. ochroleuca*, Carlstad. *e* scale of do., Skog. *f* scale of do., Ikerasaq. *g* scale of *U. minor*, Orpigssôq. *h* lobe of the same.

West Greenland:

N. Strömfjord, N. of Sarfarssuaq, 67°49′ N., A. E. & M. P. PORSILD, 1918.

Sofia's Harbour, Arfersiorfik fiord, 68°20′ near the border of the inland ice, M. P. PORSILD, 1924.

General Distribution: Circumpolar in temperate regions, not known from Iceland. Atlantic N. America northward to Hudson Bay at 58°50′ (Churchill), even flowering, J. M. MACOUN. Map of eastern American range in FERNALD: Persistence of Plants in Unglaciated Areas. Mem. Am. Ac. vol. 15. 1925, p. 319; southwards to Italy, Japan, Quelpart Island S. of Corea and California.

Utricularia		Floating leaf-bearing stems				
		length cm	leaves		bladders	
			size mm	number of ultimate divisions	number on leaf	size mm
U. minor	Eur.	8—29	3—10 l. / 4—10 br.	7—15	1—5	
	Grl.	5—15	3—6 l. / 2—8 br.	2—8	1—2	2×1.5
U. ochroleuca	Eur.	8—15	4—10 l. / 7—15 br.	7—15	1	5×3
	Grl.	5—6	3—5 l. / 3—5 br.	3—8	1	2×1.5
U. intermedia	Eur.	8—27	4—9 l. / 7—14 br.	7—17		5×3
	Grl.	8—12	8—10 l. / 8—15 br.	8—12		4×3

		Winterbuds				
		diameter mm	size of scale mm	number of lobes on scale	number of teeth on lobe	number of bristles on teeth
U. minor	Eur.	0.5—5	2—10 l. / 2—15 br.	8—20		1
	Grl.	2—3	2 l. / 2 br.	6—8		1
U. ochroleuca	Eur.	1—5	2 l. / 5 br.	7—20	2—7	1—3
	Grl.	2—4	2 l. / 3 br.	6—8	1—2	1—3
U. intermedia	Eur.	1—6		10—12	5—10	1—25
	Grl.	3—4	2 l. / 3 br.	6—8	4—6	1—11

In the table above the dimensions of the Greenland specimens are compared with the figures given by GLÜCK for European forms, that is to say, for his "Seichtwasserformen", for are in many respects the deep water forms much larger. From the table it will be seen that the Greenland specimens are in nearly all vegetative parts more stunted and more simple, but as is apparent from the drawings fig. 3—6, their "technical" characters in the green leaves and the winterbuds are so little altered that there can be no doubt about the identity of the species.

All known localities for *Utricularia* in Greenland are far from the outer coast, situated in tracts with more sunshine and less fog and,

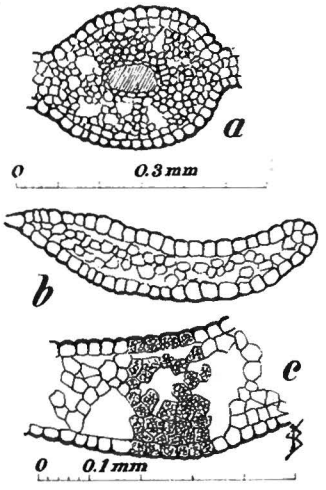


Fig. 7. Winterbud of U. intermedia, N. Strömfjord. *a* and *b* section of axis and upper half of a scale-lobe, note the interstices. *c* part of *b* magnified, showing the contents of starch.

consequently, with a warmer summer. Both stations of *U. intermedia* are practically at the very foot of the inland-ice. The habitats are shallow ponds or quiet and shallow bays of the lakes, provided that their water level is rather constant during the period of vegetation. *U. minor* is mostly found over a dense bottom-growth of *Scorpidium* or other brown aquatic mosses. Being so very inconspicuous this species is probably sometimes overlooked, as it may be confounded with colonies of green algae. *U. intermedia* grew in both places in clear water in which it produced considerable "clouds". During winter these places freeze down to the bottom. — In the HEGI-flora it is stated that the detached winterbuds sink to the bottom and that all leaf- and bladderbearing shoots decay. Probably this also holds good in the arctic habitats, though winterbuds, collected in August, showed large airfilled interstices in their tissues (see fig. 7).

In several papers, but especially in that entitled "Om nogle ejendommelige Temperaturforhold i de baltiske Söers Literalregion og deres Betydning" (Biol. Arb. tilegnede EUG. WARMING, Copenh. 1911) WESENBERG-LUND has called attention to the high temperatures found during early spring on the southerly exposed shores of Baltic lakes, even if the main body of the lake is covered with solid ice. By a great number of examples he illustrates the great importance of the "abnormal" high temperature for animals and plants. Several southern types having their northern limit in Denmark, are at home here. Also the early spawning of frogs and pikes takes place here.

Moreover WESENBERG-LUND pointed out the bearing of these facts upon questions of quaternary geology. We have numerous deposits in which remains of arctic terrestrial plants and animals are mixed with those of an aquatic biota seemingly belonging to a quite different climate. They have caused much discussion according to the stress laid upon either of the components. In such cases the author's advice is that the aquatic components of the deposits should not count, especially not where the deposits occur in lower latitudes where the considerable altitude of the sun, during the retreat of the glacier also, would be able to sharpen the effect.

The theses of WESENBERG-LUND, supported by the natural conditions of the Baltic lakes, will apply equally in regard to ponds in the Arctic. Whereas the big and deep lakes of the Arctic are practically destitute of plant life and almost so of animal life, the shallow ponds are relatively rich in life, and, as we shall see, the higher flora has a foreign, non-arctic character. Here too the thawing takes place from the sunny shores and the temperatures of the pond and shallow shore-water are higher than those of the air. The weaker effect of the sun's lower altitudes is in some degree compensated by the perpetual sunshine during the summer.

Information about the actual temperature of the pond-water in West Greenland is to be found in H. BACHMANN's "Beiträge zur Algenflora des Süsswassers in Westgrönland" p. 171 (Mitteil. Naturf. Ges. Luzern VIII. 1921). During a summer visit the lowest temperature recorded by this author was 3.75°C. the highest 15.6° C. BACHMANN admits that the temperatures of the water are connected with those of the air, but at the same time he emphasizes the much slower changes of the water-temperatures. He found the morning temperatures surprisingly high. In a pond on S. Disko recording thermometers were placed from July 3d—Aug. 13; the minimum recorded from that period was 7° and the maximum 15° C.

Hereby must be borne in mind that most of the places studied by BACHMANN are situated on the outer coast, whereas the habitats of *Utri-*

cularia and several other aquatic plants are all to be found within the large fiords or even near the inland-ice, i. e. in places which are much more favoured by fair weather and more sunshine, less fog and downpour and less wind. It was for these places the late O. NORDENSKIØLD coined the term "Polarsteppe" (Geograph. Zeitschr. 20, (1914) p. 513, 519, 520, etc.

List of the aquatic vascular plants of Greenland, the commoner ranked approximately according to frequency.

	W.	E.	w. flow.	fr.
Hippuris vulgaris L.	60—73°, ?77°	60—66°, 71—77°	+	+
Ranunc. confervoides (Fr.).	60—76°	60—66°, 71—74°30′	+	+
— *reptans* L.	60—71°	60°, 65°37′	+	+
Sparganium hyperboreum (Læst.)	60—71°	? 63°55′	+	?
Potamogeton filiformis Pers.	60—62°, 66—71°	65°39′	r	r
— *groenlandicus Hagstr.*	60—62°, 67—71°		ster.	
Callitriche verna Kütz.	60—70°	60—71°	+	+
— *hamaluta* Kütz.	60—69°	60, 63, 65°	+	+
Comarum palustre L. grows in its N. range in water, in its S. in Sphagnum	60—67°	65—67°	+	+
Menyanthes trifoliata L.	60—69°		+	r
Potamogeton gramineus L.	60—61, 67°		r	?
— *tenuifolius* Raf.	60—67°		+	+
Callitriche autumnalis L.	69—70°		+	+
— *anceps* Fern.	60—61°	60°	+	+
Myriophyll. exalbescens Fern.	66—71°		+	
— *alterniflorum* DC.	60—62°		r	
Heleochar. acic. submersa	68—72°		ster.	
Juncus subtilis E. Mey.	water form 68—70°		ster.	
Utricularia minor L.	61, 68—71°		ster.	
— *ochroleuca* Hartm.	68—71°		ster.	
Limosella aquatica L.	60—61, 71° annual		+	+
Subularia aquatica L.	60°	65°37′ annual	+	+
Isoëtes echinospora Dur.	60—61, 69°			+
Sparganium affine Schnitzl.	61, 64°	65°37′	+	?
Isoëtes lacustre L.	60, 60°44′			+
Utricularia intermedia Hayne	67°49′	68°20′	ster.	
Potamogeton mucronatus Schr.	69°30′ only once		ster.	
— *obtusifolis* M. & K.	68° only once		ster.	

When the world range of each of the listed plants is plotted on a map the major part of their area, including the "point of gravitation" will be found well down in temperate regions. Consequently none of them

can be justly termed "arctic" [1]). Some of them evidently thrive well and reproduce themselves normally, others are stunted, sterile; they may keep their place by means of vegetative persisting parts but they are unable to gain new territory. Except the two annuals, the two species of *Isoëtes* and the three *Utricularias*, the persistence of all the remaining is secured by creeping rhizomes which are able to stand the frost, even when they are as weak as those of *Callitriche*, *Heleocharis*, *Juncus*, *Ranunculus* and *Potamogeton*. Besides, at least the narrow-leaved *Potamogetons* develop special hibernating shoots. The new hibernacles are formed early in summer; the inflorescence follows, if the season will permit it, as an extra luxury.

The existence of these plants in the arctic and isolated Greenland is a difficult problem. Are they relicts from a former, more genial post-glacial epoch or are they casual immigrants? And if they are, by what means do they arrive? One thing may safely be stated: if there were plants surviving the maximum of glaciation on postulated nunataqs there were certainly none of these among them.

About the dispersal of *Utricularia* nothing is said, either in GLÜCK's work or in the HEGI-flora, which probably means that very little is known. SERNANDER in "Den skandinaviska vegetationens spridningsbiologi", Uppsala 1911, mentions several cases of fragments of *U. vulgaris* and *U. minor* in the spring-, summer- and autumn-drift on Swedish lake-shores, also a few cases of drifted winterbuds, still attached to their mother-stems. Moreover there is on record a case of a winterbud frozen up in solid ice; when chopped out and placed in an aquarium it started growth immediately. Eventually this will enable the plant to move from one place to another in the same body of water or downwards with its draining-system, but not upwards, or from one lake over land to another. And for the Greenland plants even this possibility is excluded, as their occurrences generally have no open draining ditches.

Because of their contents of nutritious substances the winterbuds of *Utricularia* may be alluring to waterfowl, but having no protective tissues, they would undoubtedly be digested, when eaten.

As to the possibility of being brought in as seeds, there seem to be very small chances. HEGI states, that the seed production of European species is very scarce, relatively common only in *U. vulgaris* and *U. minor*. Of *U. ochroleuca* the flowers are well known, but fruiting specimens and seeds have never been found.

How did then the *Utricularias* migrate to Greenland?

[1]) *Ranunculus confervoides* is seemingly an exception. If treated as a proper species it may be called "boreal-subarctic", but by many authors it is considered an "ecologic" form of the polymorphous *R. trichophyllus* Chaix.

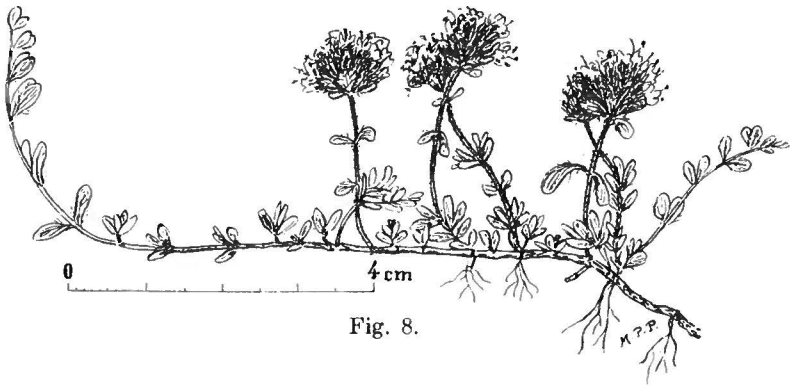


Fig. 8.

VIII.

THE GREENLAND WILD THYME

History. One of the natural products which attracted the attention of the pioneers of the present colonization of Greenland in their new home was the Wild Thyme, probably because of its alleged multifarious medical and culinary properties. Thus in his "New Perlustration or Natural History of the Old Greenland" HANS EGEDE writes (translated):

"Wild Thyme grows everywhere in the fiords near the hills, and it gives off an extremely pleasant odour when the sun has set." (2. edit. 1741, p. 24).

however, in the earliest technical paper on Greenland plants, by ROTTBØLL [1770], *Thymus* is not mentioned, evidently because ROTTBØLL in this paper only treated the Greenland plants of the first 12 classes in the system of LINNÆUS. — In his "Oeconomiske Plantelære" 3. edit. Vol. I. 1821, p. 660 HORNEMANN records *Th. Serpyllum* as a Greenland plant, and he further thinks that var. *hirsutum* SCHUMACHER, described from the vicinity of Copenhagen, also occurs there. This, however, is a mistake, since SCHUMACHER's plant is a *holotrichous* form, whereas the Greenland plant, as we shall see, is *goniotrichous*. — When HORNEMANN, in 1832, prepared a list of plants found on GRAAH's exploratory expedition to southeast Greenland, he coined the well fitting name var. *prostrata* for the Greenland Thyme, but, as no description was given, this name, according to international rules, is unfortunately invalid. Nevertheless the combination *Th. Serpyllum* var. *prostratum* was entered by J. LANGE in his "Conspectus Florae Groenlandicae I". 1880, and has been in general use by writers on the flora of Greenland and Iceland ever since. —

In working up the plants collected in various parts of Greenland by the American explorer E. K. KANE, E. DURAND describes as Nr. 68 Thymus Serpyllum var. arcticum nov. var.

"Foliis pellucido-punctatis, ad basin ciliatis, 5-venosis, venis subtus valde prominentibus. Calycis dentibus corollæque lobis ciliatis."

"This variety is probably the same as that collected by VAHL on the eastern coast of Greenland, and described by Professor HORNEMANN as var. *decumbens* (sic!). The stems are quite prostrate, as almost all the forms of *serpyllum;* the leaves are of a pale green color, with pellucid dots, ciliate at base, and with veins remarkably prominent and symmetrical. Flowers capitate among the upper leaves, which, as well as the calyces, are tinged with bright purple. Calycinal teeth and lobes of the corolla ciliate. Fiske Fiord, 65°".

The type locality given should be the fiord at Fiskenæs, 63°5′ N., visited by KANE, rather than Fiskefiord, 64°45′ N. which was not visited (cfr. p. XII. 5. Indsk.). More important is the erroneous statement "lobes of the corolla ciliate" (see beneath).

A better description was given by LANGE, l. c. p. 81.

"Differt a forma vulgari foliis obovato- v. subrotundo-ovalibus, pagina superiore, margine petioloque longe albopilosis, nervis secundariis utrinque 2 crassis valdeque in pag. inf. prominulis, inflorescentia dense capitata; corolla villosa."

to which L. K. ROSENVINGE (Consp. III. 1892. p. 688) added:

"Variat caule magis minusve piloso; interdum duo latera opposita subglabra, dum alia duo dense pilosa. Folia semper manifeste, nonnumquam satis longe petiolata."

Finally E. WARMING has studied the biology of the flowers of the Greenland Thyme (K. D. Vid. Selsk. Forh. 1886, p. 110—113; Resumé in French p. XXVI), to which paper we shall return later. And quite recently K. RONNIGER, in an additional note to a revision of the races of *Thymus Serpyllum* occurring in Great Britain, has proposed the combination *Thymus arcticus* DURAND, which should be (DURAND) RONNIGER.

Taxonomical status. The genus *Thymus* comprises about 35 primary species and a vast number of subspecies and geographical races, ranging over the whole of Europe, from northern Fennoscandia, Iceland and South Greenland to North Africa (Abyssinia and the Canary Islands) and throughout temperate and boreal Asia to Kamtchatka. Of these only *Thymus Serpyllum* of LINNAEUS concerns us here. By all authors this "species" is considered polymorphic, but as to the valuation of the minor units proposed, whether they may be considered as established species, subspecies, geographical races or hybrids, no agreement has been reached as yet. Endeavours to define the constituents of the collective species have been made in Central Europe, where especially Austrian, Hungarian, Czech and Swiss botanists have exhibited great activity in this task, starting with

1) A. KERNER who, in 1894, proposed that the species of the whole genus should be divided into three sections according to the nervation of the leaves:

1. Hyphodromae. Median nerve strong and keeled, lateral ones degenerate.
2. Camptodromae. Lateral veins upwards arched, not entering the leaf-margin proper.
3. Marginales. Lower pair of lateral veins forming the thickened leaf-margin.

2) V. Borbás, in 1890, proposed several new subdivisions, e. g. in the second section, to which *Th. Serpyllum* belongs:
   1. Goniotrichi, flowering stems sharply quadrangular with alternately hirsute and glabrous sides.
   2. Holotrichi, flowering stems terete, uniformly hirsute.
3) J. Briquet, in his treatment of the Labiatae in Engler-Prantl: Natürl. Pflanzenfam. 1897, made a retrograde movement, in uniting several "Linnean" species under "*Thymus Serpyllum*".
4) J. Velenovský, in 1906, investigated the biological morphology of the stems (already suggested by E. Fries) and divided his section Serpyllum into three groups:
   1. Suberecti, without decumbent or creeping shoots, 13 species.
   2. Pseudorepentes, with sterile, limited shoots from leaf-axils of the one-year-old stems, 19 species.
   3. Repentes, with lateral stolons growing unlimitedly, 31 species.
5) K. Lyka, in 1924, combined all these characters and in addition he took the geographical distribution into consideration, while
6) K. Ronniger 1923 proposed to divide the Central-European species into 5 "Linnean" ones, each subdivided into a number of collective species, subspecies, races, forms and hybrids.
7) H. Gams, in 1927, gave an elaborate treatment of the family in Hegi: Illustr. Flora v. Mitteleuropa Vol. V. 4. The above-mentioned particulars are mainly taken from his work. Gams adopted the Lyka-system for the Linnean *Thymus Serpyllum*, divided into 21 subspecies, each with several varieties and forms, covering the area of the above-mentioned handbook. Of the subspecies No. 8 is called "subsp. *Serpyllum* (L. em. Fries) Briquet em. Lyka" the same name being thus used for the minor and the major unit, which recalls the style of nomenclature in zoology. It is this form — or rather, this aggregate of forms — which alone ranges up to northern Scandinavia, and which, in the key, is designated as holotrichous.

Dr. Gams gives it as his opinion that the European species of *Thymus* very likely may have originated from a crossing and subsequent splitting up of a few ancestral forms. But, as no cytologic investigations or hybridizing experiments have been made so far, it is at present im-

possible to define which were the probable ancestors and which forms are the probable hybrids. To this may be added that only very few of the numerous forms have been observed under cultivation. Therefore ecologic experiments too seem greatly needed, all the more since the principal characters used for classification are derived from vegetative organs. On the other hand, it is known that certain homologous or parallel forms of different European races may occur intermingled on the same spot, but not on the same plant, and may yet keep remarkably constant.

The taxonomic status being as it is, the second best we can do seems to be to study and describe, as exactly as possible, the local races we encounter, and leave to geneticists of the future to find the proper valuation of the units described and named. In the following the Greenland plant is simply called *Thymus arcticus*, but this does not mean that the present writer claims specific rank for it, it is merely his intention to apply the briefest possible designation.

Thymus arcticus (E. DURAND) RONNIGER: Rep. Bot. Exch. Club for 1923, publ. Nov. 1924, p. 237. (Syn.: *Thymus Serpyllum* L. and var. *hirsuta* HORNEMANN: Oecon. Plantel. 3. ed. I. 1821, p. 660. — *Th. Serp.* var. *prostrata* HORNEMANN in GRAAH: Undersögelses-Reise 1832, p. 125. nomen nudum! — J. LANGE: Consp. Fl. Groenl. I. 1880, p. 81 and subsequent authors on the flora of Greenland and Iceland. — *Th. Serpyllum* var. *arcticum* DURAND in KANE: Second Grinnell Expedition Vol. II, p. 459. 1856).

Shoot-structure (fig. 8). A dwarfish shrub with the old roots and stems lignified, the flowering and young vegetative shoots herb-like. The principal axis is decumbent, growing unlimitedly, the older parts are rooting. In the axils of the leaves of the previous years are developed low, erect vegetative shoots, bearing only 2—3 pairs of leaves and erect, floral shoots with 2—3 elongate internodes, terminated by the inflorescence. Further, lateral runners, imitating the top of the main axis, are developed. The horizontal parts of the stem are terete or nearly so, sparingly pubescent or naked; the older parts shed the leaves and the bark becomes brown. The floral shoots (fig. 10 a) are 2—4 cm high, rarely more, decidedly foursided and generally distinctly goniotrichous (with hirsute sides alternating with subglabrous ones). Sometimes the upper internode, under the inflorescence, is indistinctly holotrichous. The hairs are spreading (patentissimi), as long as the diameter of the stem or a little longer.

The leaves (fig. 9) are evergreen, lasting two or three years, leathery, entire, elliptical-obovate with cuneate base, tapering to a distinct petiole, 6—9 mm long, 2—4 mm broad; the blade is in the young state with long, sparse, white hairs on the upper side, glabrous on the lower, bearing

on each side two or three long cilia near the base or on the petiole, sometimes there are more cilia farther up, especially on the leaves of the horizontal shoots and in the inflorescenses. In age the soft white hairs are shed whereas the cilia remain. One median nerve and two pairs of opposite lateral veins are strongly projecting, rib-like on the lower side, hardly visible on the upper. The veins are upwards arched, vanishing before reaching the top and always leaving the margin free. Between the veins are large, semipellucid dots ("Labiatendrüsen").

The inflorescence is capitate — hemispherical, consisting of 3—4 whorls of shortpeduncled flowers. The uppermost leaves, the floral

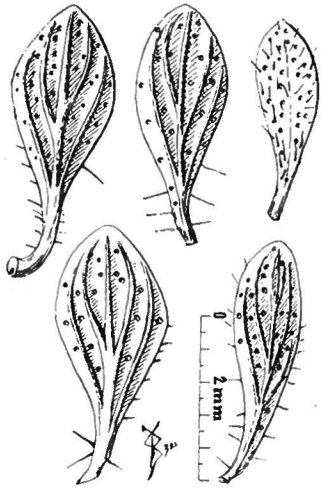


Fig. 9. *Thymus arcticus*, different leaves taken from the same individual.

bractlets, the calyces and corollas are bright purple; after flowering calyces and bractlets are copper-coloured. The bractlets are linear-lanceolate and ciliate (fig. 10 c).

The calyx (fig. 10 b, c) is campanulate, two-lipped, the lower lip with two long, subulate and nearly straight teeth, the upper with three short, spreading teeth, all ciliate. There is a primary strong nerve in each tooth, a somewhat weaker secondary in each sinus between, the latter is ramified above with the branches entering the teeth and joining the primary nerve, thus making the calyx 10-nerved. Briquet states (Engler-Prantl IV. 3. a. p. 194) that the 3 secondary nerves in some genera are divided into two parallel bundles each, thus making the calyx 13-nerved, and in the definition of the genus the calyx is said to have 10—13 nerves. Gray-Manual (7. ed. p. 708) states for *Thymus* "13-nerved", the only species incorporated being *Thymus Serpyllum L.*, whereas Gams in the Hegi-Flora for the same plant states "mit 10 erhabenen Nerven". In the

Greenland plant no traces of a duplicating of the secondary nerves could be found. Externally the calyx is hirsute-ciliate, internally it is copiously white, villous, closing the throat after the shedding of the corolla. Dimensions: tube 2.0—2.4 mm long, short teeth 0.8—1.0 mm, broad, 1.7—2.0 mm long.

The corolla (fig. 10 b) is two-lipped, the upper lip flattish, notched at the top and here provided with some pellucid dots. The lower lip is three-lobed, the lobes obtuse. The corolla-lobes are not ciliate, as stated by DURAND, and the corolla cannot correctly be termed "villous" either, as LANGE did. Within, the corolla tube and the interior sides of the lobes

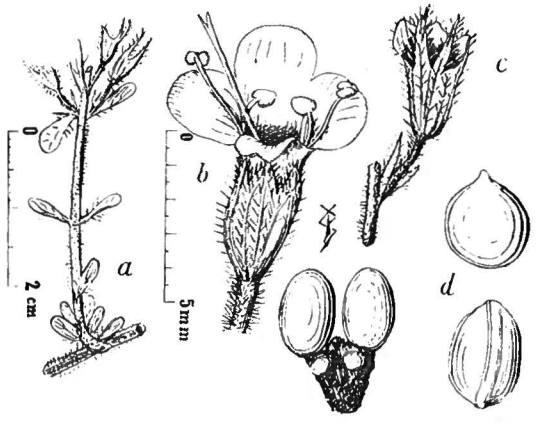


Fig. 10. *Thymus arcticus*. a. part of flowering branch showing hairs on the internodes growing in ranks; b. flower; c. calyx and bractlets; d. nearly mature achenes, to the left a case with two abortive and two fertilized ovules.

are glabrous. Externally the tube is sparingly pubescent, and on the outer side of the upper lip the hairs are coarser. Sometimes the tips of the uppermost hairs may project over the margin of the lip but they do not emerge from the margin itself. Dimensions: tube 3.0—3.5 mm long, diameter of lateral lobes 4—5 mm.

From the time of DARWIN and HILDEBRAND it is well known that *Thymus Serpyllum* L. and the great majority of its Central-European races are gynodioecious, i. e. besides individuals with perfect flowers others are found bearing somewhat smaller flowers, which are pistillate only, or with more or less abortive stamens. WARMING (l. c.), studying the flowers of Greenland Thyme *in vivo*, describes and figures different perfect flowers (fig. 4. A. C. D. F. L.) and says (translated):

> "also this plant has at least two kinds of flowers, female and bisexual, of which the former, as in Europe, are smaller than the latter and bear stamens the anthers of which are nearly sessile and seemingly open, but which never contained pollen".

An example is shown in his fig. 4. B. — As will be seen in the quotation nothing is said about the probable frequency of such flowers.

The present writer must own to not having studied this point in the field, as did WARMING, but I have examined a number of specimens from 22 different collections, covering the whole range of the plant in Greenland, and they all had perfect flowers with pollen in their anthers. Therefore it seems that in Greenland gynodioecy of Thymus must be rare or merely occasional.

WARMING further states that proterandrous flowers are found as well as proterogynous. As far as can be concluded from herbarium specimens proterandry seems to be far more common. However, I have seen single flowers with expanded stigma-lobes and closed anthers, but they were taken from individuals where the other flowers were proterandrous. Also several cases of homogamous flowers were seen, as might be expected in accordance with the well known rapid development of the flowers during the prolonged bright arctic daylight in summer.

On his way home from Greenland, WARMING happened to see the Iceland Thyme in flower around Reykjavik, and it struck him that the flowers of the Icelandic plant, compared to the Greenland race, had longer stamens and styles (fig. 4. E. G. H.). This observation I cannot corroborate from herbarium specimens at hand. I should think that the Greenland cases with short stamens and styles, described and figured by WARMING, were not fullgrown, as these organs at maturity seem to me to be just as long as in the Icelandic plants. In fact, WARMING's flower D (from Greenland) has longer stamens than his Icelandic plant E. and a style equalling the style of the Icelandic E. G. and H.

Fruits (fig. 10 d). At its northern limit in West Greenland I have only once collected the plant, and it was perfectly sterile in August 1914. But from its northern limit in East Greenland, in the district of Angmagssalik, KRUUSE reports it as flowering abundantly, and he also expressly states that ripe fruits are developed. In herbarium specimens with withered or shed corollas I found in almost half the number no fruits at all, the four-parted ovary being seemingly normal but the ovules not fecundated. Of the remaining the great majority had but one fecundated nutlet, and I have seen one case (fig. 10d, left) with two nearly mature nutlets, the other pair being abortive. Near maturity the form and the size of the nutlets were rather uniform, globose-ellipsoid, 0.95 × 0.75 mm. Seen under a microscope the surface is minutely punctulate.

Occurrence. *Thymus arcticus* grows on sandy soil or gravel, often on rocks (Archean) or at the edges of thickets, preferably on sunny slopes, in sheltered parts of the fiords, rarely along the outlying coast. I have seen no specimens from a soil rich in lime.

Distribution in Greenland. West Greenland: Quite common south of 62° N. and in the Godthaab fiord-system, about 64° N. There are several scattered localities known south and north of the Godthaab district, but as these sections are but incompletely investigated, a much larger number of stations may here be anticipated. The northernmost find is Holsteinborg, 66°56′ N. (GIESECKE, WARMING & HOLM, PORSILD), whereas it has not been found by the numerous collectors visiting the fiord-area within that place. East Greenland: There are half a dozen scattered stations known between 60° and 64° N., it is common in the fiords of the Angmagssalik district, the northernmost locality being Cape Wandel, 66°20′ N. (KRUUSE).

General distribution. The Iceland Thyme has generally been identified as *Th. Serpyllum* var. *prostratum* HORNEM. and from a too scanty herbarium material it seems to be identical with the Greenland plant.

The plant from the Færöe Islands was originally named f. *borealis* LANGE (in ROSTRUP, Bot. Tidsskr. 4. p. 49. 1870). Later LANGE gave up this name for var. *prostratum* HORNEMANN. Of this plant a somewhat defective material is at hand, from three collections. They are very small-leaved, but small leaves are eminently characteristic of all Færöese plants. Yet they seem to me to be different from the Greenland-Iceland plant, thus the leaves are mostly 7-veined, which suggests a comparison with the small-leaved *Th. britannicus* RONNIGER l. c. p. 237.

LANGE l. c. also cites Northern Scandinavia as the range of var. *prostratum*. Here I have no suitable material for control. No varieties are mentioned in the leading handbooks of BLYTT, NORMANN, DAHL, HARTMAN or LINDMAN, and the Scandinavian plants are generally described as holotrichous, like the Central-European. However, BLYTT also seems to have seen goniotrichous plants.

Of *Th. arcticus* RONNIGER says (l. c. p. 238) "a circumpolar race of *Th. Serpyllum* standing very near to *Th. britannicus*" (from England and Scotland). Thinking that the word "circumpolar" was a mere slip of the pen, since *Th. Serpyllum* is known to Atlantic North America as an introduced plant only, occurring from N. Sc. to N. Y. and Pa., I applied to Dr. RONNIGER for information, and he kindly wrote (May 31. 1929): "Ein Exemplar aus Labrador haben wir im botanischen Institut in Wien. Dieses Vorkommen ist jedenfalls spontan".

This is quite curious as no Thyme is mentioned in the literature on the flora of Labrador from E. MEYER up to the most recent American investigations. I cannot but think that these specimens may be from early collections of the Moravian missionaries, who in former times were also active in South Greenland. Their collections were disposed of by

their common leaders in Germany, and too often plants from Greenland and Labrador were confounded. Thus *Pedicularis groenlandica* may have come from Labrador, and not from Greenland, where it has not been observed for a hundred years.

In Greenland the Thyme may justly be considered a southern and eastern type of the flora.

Febr. 1933.

Postscript.

After this had been finished for the press I received J. DEVOLD & P. F. SCHOLANDER: Flowering Plants and Ferns of Southeast Greenland (Skrifter om Svalbard etc. Nr. 56. Oslo 1933), in which Dr. SCHOLANDER states that *Th. britannicus* RONN. and *Th. arcticus* (DUR.) RONN. belong to a single species which should bear the latter name. In addition he also records *Th. neglectus* RONN. from S. E. Greenland.

IX.

GENTIANA DETONSA ROTTBØLL

In 1770 CHRISTEN FRIIS ROTTBØLL published his "Afhandling om en Deel enten gandske nye eller vel forhen bekiendte, men dog for os rare Planter, som i Island og Grönland ere fundne, tilligemed en kort Indledning om Urtelærens Tilstand i Dannemark". The first part of this paper is on the history of botany in Denmark, the second is a most important contribution to the taxonomy of Arctic plants. The paper was "read" at the last meetings of the Royal Academy of Sciences in Copenhagen in 1766 and at the first of 1767, and published in 1770 in vol. 10 of its transactions: "Skrifter, som udi det Kongelige Selskab af Lærdoms og Videnskabers Elskere ere fremlagte og oplæste" p. 393—468, with 8 plates. This periodical, the now very rare first series of what to day is called "Det Kgl. Danske Videnskabernes Selskabs Skrifter", is almost universally quoted as "Acta Hafniensia", in spite of the fact that the Academy never used such a title, and, besides, there had existed another periodical for which the quotation "Acta Hafniensia" was official, namely the famous "Acta Medica & Philosophica Hafniensia" edited by Thomas Bartholin 1673—1680.

The historical part of ROTTBØLL's paper and his critical and nomenclatorical remarks on the plants are written in Danish, whereas his diagnoses and descriptions are in Latin. Although his descriptions are remarkly elaborate for the time, and his illustrations quite good, several of ROTTBØLL's names have for a long time been unjustly relegated to synonymy in favour of names later proposed, e. g. G. serrata Gunn. (for

detonsa), G. glacialis Vill. (for tenella), or ROTBØLL's names have been used, but ascribed to other authors, e. g. G. detonsa "FROELICH" or "FRIES", Saxifraga tricuspidata "RETZIUS" etc. As will be shown below this long lasting confusion probably started with WILLDENOW's misleading way of quoting.

As ROTTBØLL's paper seems to be very little known and probably is not accessible in younger libraries, it may be appropriate to reprint his text, the Danish part in translation:

The 4. *Gentiana* so much resembles that species which Mr. LINNÆ names *ciliata* that it can hardly be regarded as more than a variety of it. It has a large and showy flower, of light-blue colour, and is 4-parted; but the corolla-lobes are destitute of the usual hairs around their edges, being instead somewhat erose above and bearing at the middle of each side 2 small teeth. It seens remarkable because such a variation has not before been recorded by botanists, as also because we have found a plant in our countries which heretofore was only known from Canada and the southern mountains of Europe. I have called it *Gentiana dentosa*, by which name it may either be regarded as a variety of *Cil.* or as a new species; it grows on the seashore in Iceland and is shown by me in fig. III on plate I, to which the following description may be added:

Gentiana detonsa, corollis 4fidis, laciniis oblongis apice subcrenatis, margine utroque bidentatis[1]).

Radix parva, teres, subdivisa, descendens.

Caulis unicus, glaber, strictus, tetragonus, pallide fuscus, pollicaris; *ramos* exserens oppositos, patentes, cauli similes; sed breviores, 2 aut 3 lin. spatio remotos.

Fol. opposita, sessilia, erecta, cauli appressa, linearia, obtusiuscula, glabra, striata, carinata, uncialia, aut sesqui-uncialia.

Pedunculi caule ramisque, quos terminant, 2 l. 3 longiores, tetragoni, glaberrimi, uniflori.

Flores magni, campanulati, pallide coerulei, quorum *maximus*, qui caulem ipsum terminat.

Perianth. Monophyll. coloratum, infundibuliforme, 4fidum; *Laciniis* erectis, patentibus; oppositis 2 lanceolato-subulatis, 2 reliquis ovatis ac eis multo brevioribus.

Corolla maxima, campanulata, ultra medium 4fida; *Lobis* oblongis, apice subcrenatis; margine medio utrinque bidentatis.

Stamina filamenta 4, erecta, parum supra tubum eminentia. *Antheræ* oblongæ, lineares, incumbentes.

Pistillum Germen oblongum. *Styli* 2 crassi, 3goni, divaricati. *Stigmata* foliacea, orbiculata, crenata.

[1]) Cfr. Fl. Dan. Fascic. VI. Tab. CCCXVII cum nomine specifico pag. 5.

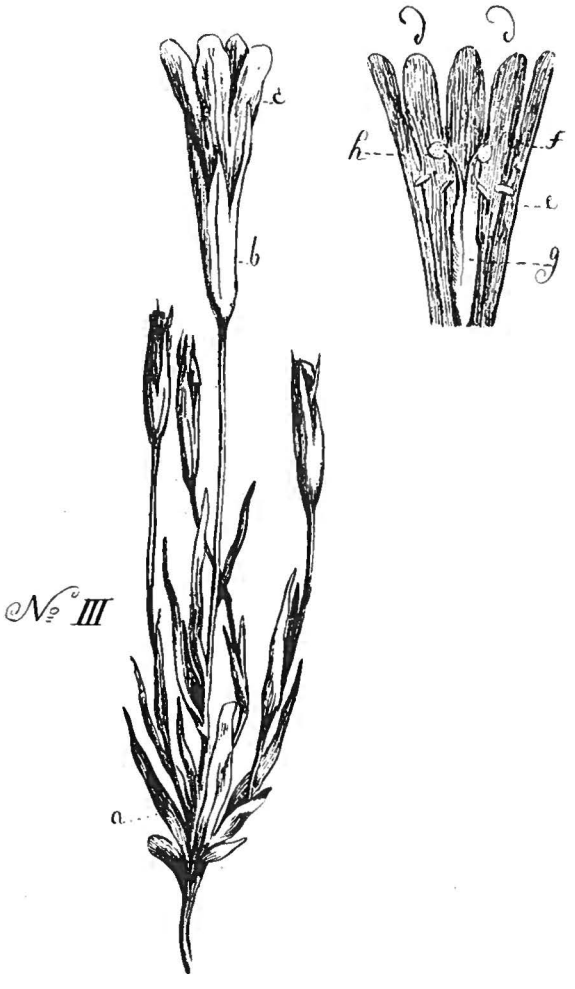


Fig. 11. Explanation of the engravings (translated): Pl. I, fig. III. *Gentiana detonsa;* (a) plant with stem, branches and leaves, (b) calyx, (c) corolla, (d) corolla-lobes, (f) teeth, (e) stamens, (g) ovary, (h) styles with their stigmas.

In the second part of his "Flora Norvegica" J. E. GUNNERUS lists as No. 733 a 4-parted *Gentiana* from Arctic Norway which he identifies as *G. ciliata* L. As No. 819 is decribed a new 5-parted species by the name *G. serrata*, illustrated on GUNNERUS' pl. 2 figs. 3—5. As GUNNERUS was a member of the Copenhagen academy and was moreover staying in Copenhagen while preparing parts of the manuscript, he must have known ROTTBØLL's paper. GUNNERUS' book bears on the title-page the year 1772, but actually it was not published until 1776, after the author's death.

In his edition of LINNÆUS: "Species Plantarum" Tom. I. 2 (probably published 1798) WILLDENOW has as the last section of the genus:

× × × ×*Corollis quadrifidis hypocrateriformibus, fauce nudis*, which corresponds to the section *Crossopetalum* FROEL. Here he lists *G. ciliata*, *crinita*, *barbata*, *detonsa* and *serrata* with no author's name annexed. Directly under the name he then quotes the diagnosis of FROELICH's monograph: "De Gentiana libellus" 1796 and thereafter he gives some other quotations. For *G. ciliata* the nomenclatorically valid quotation of LINNÆUS: "Species Plantarum" is totally omitted. As at the same time the years of issue of the writings are not given, any reader of WILLDENOW's work would be under the impression that FROELICH was the author of all species. Even the latest monographer of the genus, N. KUSNEZOW, writes in ENGLER-PRANTL, IV. 2. p. 86:

"*G. detonsa* FROEL. ×○ Nordeuropa, Nord- und Centralasien, Nordamerika.
G. serrata GUNN. Nordamerika."
(×means widely ranging, ○ variable).

GRISEBACH, in his "Genera et Species Gentianae" 1839 and in his treatment of the family in DE CANDOLLE: "Prodromus" T. IX, persistently puts "FRIES" as author of species described by ROTTBØLL. This may be a confusion with ROTTBØLL's middle name FRIIS, but has more probably originated from some abbreviation of FROELICH's name to "F." or "Fr.", which last form became the official abbreviation of the Swedish botanist E. M. FRIES. This combination is to be met with e. g. in ROTHROCK's "Flora of Alaska".

WAHLENBERG, in his "Flora Lapponica" 1812. p. 71 repeats the differences between *G. detonsa* and *G. serrata* emphasized by GUNNERUS, FROELICH and WILLDENOW, but states that both occur in Arctic Norway. He puts *G. serrata* as the main species, *G. detonsa* as a variety β. HORNEMANN, in his Dansk oeconomisk Plantelære 3. Opl. p. 301. 1821, has a similar opinion.

However, with increased knowledge of the plants, the leading writers on the Scandinavian flora: C. J. HARTMAN, M. N. BLYTT, C. HARTMAN, A. BLYTT, J. LANGE, J. M. NORMAN, O. DAHL etc. were all convinced about the identity of *G. detonsa* and *G. serrata*, but all used the name later proposed. As is well known, the number of the calyx- and corolla-lobes and stamens is four or five and some times varying in the same section or species or even on the same plant (e. g. *G. tenella*). But in the section *Crossopetalum* fourparted flowers seem to be normal in all known species, and fiveparted rare exceptions, also in *G. detonsa* from Norway.

In 1901 TH. HOLM described as new species a number of North American *Gentianae* which had passed as forms or varieties of *G. serrata* GUNN., and from the St. Lawrence River region two more have later

been added, namely *G. Victorinii* FERNALD and *G. gaspensis* VICTORIN. On p. 179 of his paper (Ottawa Naturalist XV. 1901) HOLM summed up the points by which all American species differed from the Norwegian-Icelandic-Greenlandic *G. serrata*, viz.:

1) frequently carinate and scabrous calyx;
2) very veiny and fringed corolla-lobes;
3) constant presence of nectariferous glands at the base of the corolla;
4) conspicuous style;
5) strongly papillose seeds.

The last point shows that HOLM cannot have had mature seeds of *G. detonsa* before him. The only place where the seeds seem to have been mentioned is by HARTMAN: Fl. Skand. 11. uppl. who says: "fröna runda, tätt fintaggiga" (seeds round, densely spinulose). A more detailed description of seeds from a plant taken at Igaliko in South Greenland, Aug. 1828 by J. VAHL would be:

Semina minuta, irregulariter polyëdrica licet fabaeformia, 0.50 — **0.65** — *0.75 mm longa, 0.35* — **0.45** — *0.50 mm lata, testa spadicea, reticulata, pustulis pallidioribus conicis obtusis, 0.05 — 0.06 mm longis undique obsita.*

The present writer has seen seeds of some of HOLM's species, also of some species from the Rocky Mountains, and from a number of still unidentified specimens of the section *Crossopetalum* from Alaska and the Mackenzie River district, and they all agree in having pustule-like, soft emergences from the thickwalled epiderm-cells of the seed-coat. The length, form and density of these "papillae" are varying, and may be of great diagnostic value. In some cases they seem to aggregate at both ends of the seed, leaving the sides bare. But this is often difficult to see. To make sure that the seeds of *G. detonsa* were papillose on all sides, they were sucked into a narrow capillary tube which could be rotated slowly under the microscope. Thus this seems to be a key character for the whole section, for the seeds of *G. simplex* GRAY, which originally were described as "broadly winged" are not so, but of the same type. By this character the Fringed Gentians differ from all species of all sections of *Gentiana* occurring in the Northern Hemisphere.

G. detonsa has short but distinct styles (conf. ROTTBØLL's illustration). — Its corolla-lobes are less fringed than in the majority of the other species. Yet, in this point *G. gaspensis* approaches it, as has already been said by its detector, VICTORIN.

HOLM's statement, that *G. detonsa* should be constantly destitute of nectariferous glands, is a mistake. I have seen normal secreting glands in flowers from Greenland, Iceland and Norway. I have also seen cases where no secretion was distinct, but the course of the vascular bundles showed plainly where the gland should be. In Norway also clandestine

forms have been observed; in such the absence of secreting glands will be only natural.

Distribution. Norway: Along the sea-coast from 66°10′ N. to Varanger Fiord (BLYTT — DAHL "Haandbog" p. 577). NORMAN ("Norges Arktiske Flora") records its occurrence in 25 out of 27 districts and enumerates about 60 localities, but they are not continuous. — Iceland: Common on all sea shores, except on the south coast, where it is rare (STEFÁNSSON: "Fl. Ísl." 2. utg. p. 208). Greenland, only known from two districts of West Greenland: **A**: Eqaluit, Igaliko Fiord, 60°46′ N.; around Igaliko, about 61° N. and Isaromiut in Sermilik Fiord, 61°10′ N. — **B**: At the head of Itivdleq Fiord, 66°32′ N. and at a neighbouring place in Söndre Strömfjord (an unpublished record of Mr. C. ERLANSON).

From the quotation of KUSNEZOW at the beginning it would seem that he considers *G. detonsa* a circumpolar species. East of Norway there are two not verified records from the adjacent Finnish and Russian sea-coast ("Herbarium Musei Fennici", Ed. II. p. 142). From the Ural Mountains ranging widely through Siberia is *G. barbata* FROEL. which PRINTZ: "Vegetation of the Siberian-Mongolian Frontiers" 1921 p. 356 unites with *G. detonsa* ROTTB. but which is kept apart by KORSHINSKY: "Tentamen Florae Rossicae Orientalis", 1898 p. 291 and by SCHEUTZ: "Plantae Vasculares Jenisseenses", 1888 p. 140. It is a much larger plant, of the wooded regions, and not halophilous, and it seems to the writer widely different. From Keewalik, Alaska I have a sheet of plants labelled *G. detonsa* ROTTB. taken by W. B. MILLER July 25. 1928. It contains 8 individuals, varying in size from 9—23 cm, 6 of which are simple, one has a single flowering branch from the rosette, one has two branches 12 cm long from the rosette and three from the nodes above. The flowers are larger than in Greenland specimens, but not larger than the best developed Norwegian, the development of the fringes is the same as in ours, the calyx-lobes are not roughened but faintly keeled, the seeds (not quite mature!) match in size, but the papillae seem to be thinner and shorter. The basal leaves are much broader, oblanceolate and obtuse.

During a stay in Copenhagen in the autumn of 1929 I studied the material af *G. detonsa* kept in the Botanical Museum of the University, with the aim of finding, if possible, some specific or racial difference between Norwegian stock (*G. serrata*) and Icelandic-Greenlandic (*G. detonsa*), or, what seemed more likely at the outset, between West-Greenlandic and European stock. As a hurried inspection of the collections showed a difference in size of the best developed flowers, the total length of the top flower of all specimens was measured.

In the section *Endotricha* FROEL. v. WETTSTEIN had found that

almost every region of Central Europe had sets of nearly related pairs of species of which the summer-form had few and elongate internodes and obtuse stem-leaves, whereas the autumn-form had numerous, but short internodes and acute stem-leaves. Furthermore, the sets often contained a third, Arctic or Alpine unit, intermediate in characters. Having in mind how fruitful this discovery had been for solving taxonomical and phylogenetical questions within the section *Endotricha*, I measured, in the specimens of *G. detonsa*, the ratio between the length of the scape with the flower of the main shoot and the leafbearing basal part.

Having come to the final figures I realized that I had not found what I aimed at. The differences, if any, were too small and casual to warrant any geographical or racial type, considering what enormous variation in size and in the vegetative parts may be found in one single population of almost any hapaxanthic plant. Therefore, I have not kept the details of my measurements but only the average figures, and I should not have mentioned these, if another student of the species had not arrived at a different view by a similar mode of proceeding.

Gentiana detonsa ROTTB. (Copenhagen Herbarium)

a) Total length of top flower:

	Greenland	Iceland	Norway
average of all measurements	3 cm	4 cm	3.5 cm
largest seen	3.5 —	4.5 —	4.0 —

Obs. NORMAN records numerous cases from Norway of flowers 4.5 cm long.

b) Length of scape and flower of the main shoot versus length of the basal part of the same:

	Greenland	Iceland	Norway
Scape and flower	$\frac{3}{1}$	$\frac{2}{2}$ — $\frac{3}{2}$	$\frac{3}{2}$ — $\frac{3}{1}$
Basal part			

(M. P. Porsild).

Quite recently Professor VICTORIN has pronounced the Greenland stock of *G. detonsa* a good geographical variety. He writes (Contrib. Laborat. Univers. Montreal Nr. 20. 1932 p. 16):

La distribution atlantique du *G. detonsa* comprend la Norvège du Nord, le Groenland et l'Islande. Il est intéressant de constater que, tandis que la plante continentale est feuillée à la façon du *G. Victorinii* et du *G. gaspensis*, la plante de l'Islande est subscapiforme à l'instar du *G. nesophila*, et celle du Groenland complètement scapiforme. Chez cette dernière plante, les feuilles sont groupées en rosettes basilaires et les

ramifications, quand il y en a, naissent a l'aisselle des feuilles rosulaires, et restent courtes.

Y a-t-il ici simple convergence traduisant une adaption à des facteurs écologiques extrêmes, ou doit-on considérer ce télescopage des nœuds comme suffisamment fixé génotypiquement pour lui accorder une importance taxonomique?

La plante du Groenland constitue en tout cas un extrême qui mérite d'être distingué au moins comme une bonne variété géographique:

GENTIANA DETONSA Rottb. var. **groenlandica** n. var.

Planta scapiformis, 10—18 cm long., caule simplice generaliter, aliquamdiu, ramificata ad imum; foliis rosulatis lanceolatis, acutis vel acutiusculis.

Plante scapiforme (long. 10—18cm) généralement simple, quelquefois ramifiée dans la rosette; feuilles toutes réunies en rosette basilaire, lancéolées, aiguës ou acutiuscules.

GROENLAND: Groenl. occid. Itivdleq-Fiord, Qingua, nordre Vig, 66°32′ N. 5. Juli 1926. MORTEN P. PORSILD. — Syd Groenl. Igaliko (Gardar), 60°59′ N. 6. Aug. 1925. A. E. PORSILD & M. P. PORSILD.

Les plantes d'Islande appartiennent probablement aussi généralement à cette variété, mais le matériel dont nous disposons est insuffisant pour nous permettre de généraliser.

As VICTORIN's new variety rests on two specimens only, both collected and distributed by myself, I could easily see exactly what he meant. The specimens from Itivdleq Fiord, 1926, kept for my own collection, match those shown in VICTORIN's photograph fig. 12 very well; they are perhaps somewhat more branched from the rosette, as in VICTORIN's specimen to the right. But from the very same place I have specimens, taken in 1914, which, having two pairs of stem-leaves, according to VICTORIN should be the continental, Norwegian type. My specimens from Igaliko, 1925 are short and scapiforme, but the flowers of the branches almost reach the top flower. And from Igaliko I have a large set of specimens, collected by J. VAHL in 1828, which contains all VICTORIN's types: the scapiform — Greenlandic, the subscapiform— Icelandic, and the typical — Norwegian, as it is illustrated by his photograph fig. 11.

Having ascertained these facts I applied to my friend Mr. JOHS. GRØNTVED, at the Botanical Museum in Copenhagen, asking him to look over the collections there once more from Professor VICTORIN's point of view. He most obligingly did so at once and sent me the results to which I have added countings of the specimens preserved here.

In the subsequent tabulation the symbols mean:

0 no stem-leaves above the rosette (VICTORIN's "scapiform");

1 one pair of stem-leaves above the rosette; in many cases the

leaf-pair is near the rosette (VICTORIN's "subscapiform"), but probably in more the pair is well above the rosette.
2, 3, 4 with two, three, four pairs of leaves respectively.

Gentiana detonsa ROTTB. (Copenhagen and Disko Herbaria).

Number of pairs of stem-leaves.	0	1	2	3	4
Greenland, 14 sheets, 58 individuals	11	42	5	—	—
percentage	**19**	**72**	**9**		
Iceland, 28 sheets, 90 individuals	17	61	3	7	2
percentage	**19**	**68**	**3**	**8**	**2**
Norway, 27 sheets, 100 individuals	3	52	27	16	2
percentage	**3**	**52**	**27**	**16**	**2**

(J. Gröntved, supplemented by M. P. P.)

I must now confess that I am still less able to find varietal or racial names for the three stocks of *G. detonsa* justified. In all countings the plants with one pair of stem-leaves come in with the highest figure, thus constituting the type of the species. The smaller flowers of the Greenland stock and the lack of plants with three or four pairs of leaves are hardly a result of its geographical isolation, but rather climatic or ecologic responses. Actually the climates of the three ranges are not identical. All Greenland and Iceland stations are south of the polar circle, whereas the main range in Norway is beyond, up to about 71° N., and thus favoured by the long polar day-light. On the other hand, the average temperature of the air for the warmest month, July, is in the Itivdleq region well over 7° C., but not 8° C., in the Igaliko region it is about 9° C., in the Iceland regions ranging from 8° to 9° C., but in the Norwegian from 10 to 12° C.

In looking over these collections I also noticed that plants with a larger number of leaf-pairs were generally simple, lacking the basal branches and thus imitating species like *G. barbata*, *G. simplex*, *G. procera* etc. Having so far had no occasion to see a *G. detonsa* locality in early spring or late autumn, I can only offer mere suggestions for an explanation. The simple stems may be caused by overshading and suppression of the branches by other vegetation, e. g. by grasses, or, similarly to other hapaxanthic plants, they may depend upon the state of development which the seedling can attain to in the year of germination.

From W. KINZEL's famous germinating experiments, carried on for over twenty years, we know that a thorough freezing is necessary to practically all Arctic and Alpine seeds for activating their germinating power, and that germinating takes place in light only. Especially the species of *Gentiana* have been very difficult to bring to germination and

therefore to cultivate. In all three countries *G. detonsa* sheds its seeds during the autumn and germination cannot take place before next summer. When circumstances are favourable they may attain to flowering the same summer, but they are then simple and slender. Undoubtedly a large number of seedlings winter in the rosette state and will be vigorous enough the next summer to raise a high main shoot and a number of weaker branches from the rosette.

March 1933.

X.

A BOTANICAL EXCURSION TO THE FIORDS OF THE GODTHAAB DISTRICT

In company with an old friend Mr. CHR. LØFTING, M. Sc., formerly adviser to the Government regarding the freshwater fisheries of Denmark, I made, in 1931, a motor-boat trip to the large fiords Ameralik and Godthaab-Fiord, the former seat of the ancient Norse colony of Vestribyggd. Thanks to the efforts of a considerable number of travelling botanists and explorers, and of several interested resident officials[1]), the local flora of this district belongs to the best known in West-Greenland, and not much additional information could be expected. My principal aim was to see that part of the country, where in medieval times domestic animals had been raised and kept, and where now sheep ranging is contemplated.

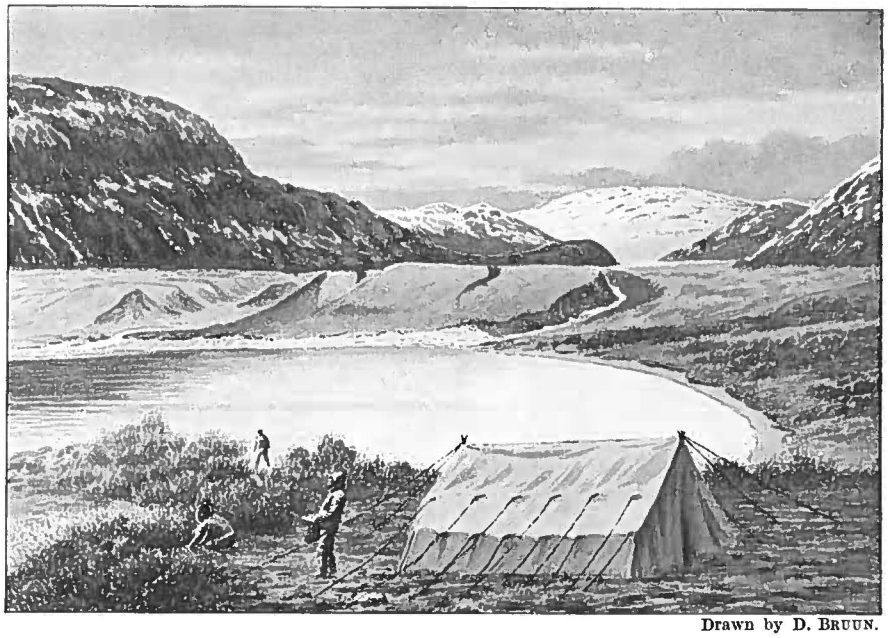
We arrived at Godthaab Aug. 15. and the following day went on to Ameralik fiord, stopping at

1) Qasigiánguit, 64°4′ N., on the southern shore, a little east of the main stream. Along the shore are narrow zones of halophytic plants and near the river are low and barren sandy ridges. We mainly studied a fertile slope, rich in grasses and with willow- and alder-thickets and continued, the same day, to

[1]) Plants from the fiord-area of Godthaab have been collected by:

residents:	travellers:
P. EGEDE, 1734—36.	D. CRANZ, 1761—62.
B. LAERSEN, 1739—57.	K. L. GIESECKE, 1807—10.
C. BRASEN, 1767—68.	M. WORMSKJOLD, 1813.
C. P. HOLBÖLL, 1828—56.	F. C. RABEN, 1823.
H. RINK, 1855—68.	J. VAHL, 1830—32.
J. N. NYGAARD, 1913—15.	A. KORNERUP, 1878.
A. LYNGE, 1927— .	N. O. HOLST, 1880.
	WARMING & HOLM, 1884.
	S. HANSEN & J. A. D. JENSEN, 1885.
	C. H. OSTENFELD, 1895.

2) Eqaluit, in the Ameragdlâ-branch, 64°9′ N., noted for its rich flora. The late archeologist Capt. D. Bruun published an excellent sketch of the scenery in Medd. om Grl. 56, p. 103 — also in 57, p. 221. Along the stream are extensive thickets of *Salix glauca* and of *Alnus repens*, the valley-bottom is covered by a dense heath-vegetation with bogs in the depressions. Coming in with the low tide we saw *Zostera* at the bottom of the harbour, at a depth of 2—3 m, and on the eastern



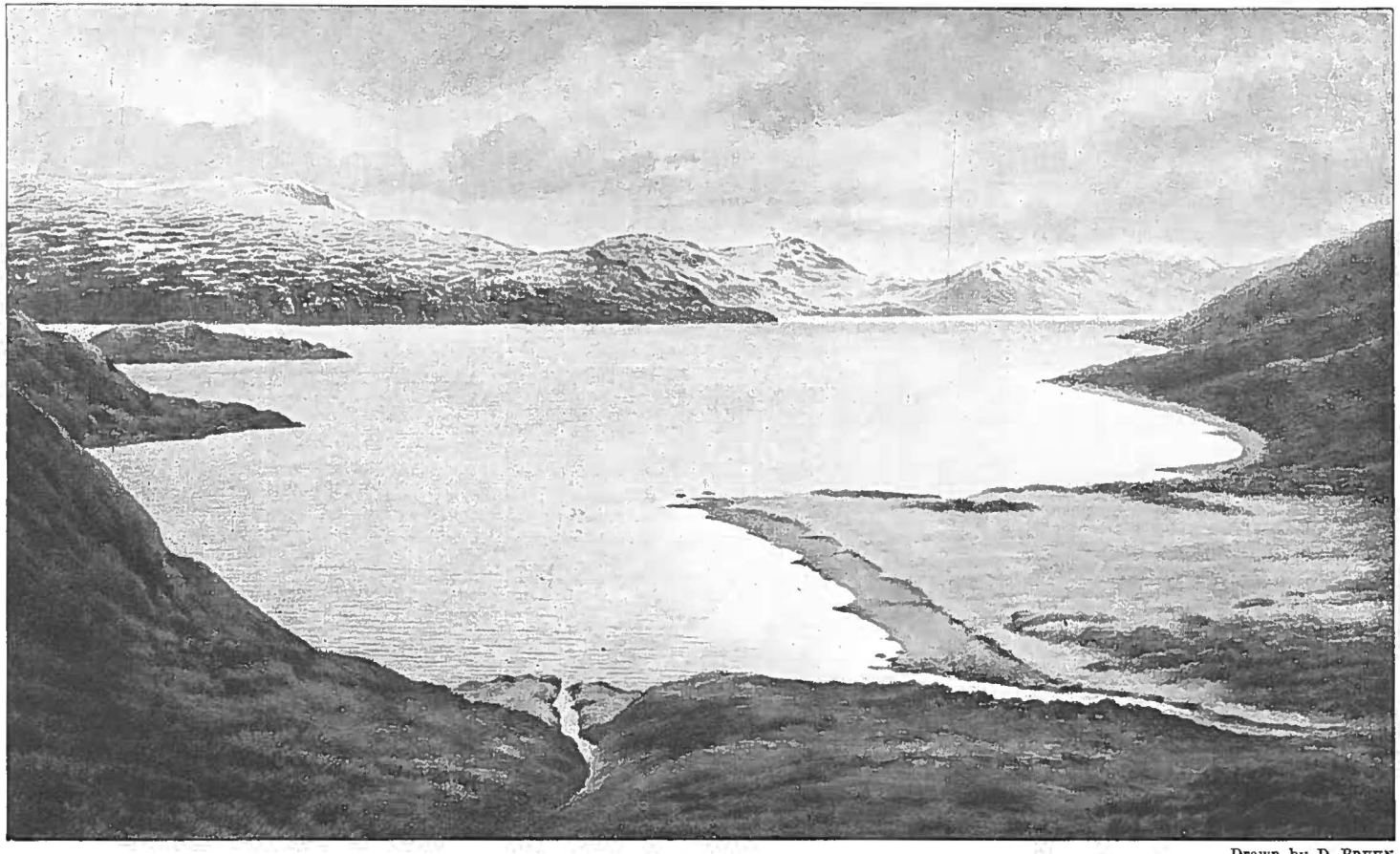
Drawn by D. Bruun.

Fig. 12. Eqaluit, in the Ameragdlâ-branch, the lower end of the valley.

side of the bay, on an alluvial sand- and mud-flat, *Ranunculus Cymbalaria* was found in great abundance. Our next place was:

3) Qilaersarfik, 64°21′ N., at the head of the Ameragdlâ. Here are important Norse ruins which had been excavated by Dr. P. Nørlund the year before. A beautiful picture of the place and its environs was published by Bruun l. c. p. 64 — also in vol. 57. p. 53. The vegetation of the old home-field shown in the picture was an almost pure growth of *Calamagrostis Langsdorffii* and in the tidal zone of the shore *Ranunculus Cymbalaria* was abundant. On the dumping-ground from the excavation a rank vegetation of *Taraxacum*, *Draba incana*, *Cochlearia* etc. was seen. Late in the evening we went to the

4) Head of Itivdleq-branch, 64°21′ N. The place is illustrated by two sketches by Bruun, l. c. p. 89, both showing a remarkable stone-fence over the slope of a pointed hill. The vegetation on the hill-sides



Drawn by D. BRUUN.

Fig. 13. Qilaersarfik. On the point in the foreground are ruins of a Norse church and churchyard. The plain behind is a Norse home-field, now covered with *Calamagrostis Langsdorffii*.



Drawn by D. BRUUN.

Fig. 14. Head of Itivdleq-branch. In the foreground a Norse home-field, on the slope of the pointed hill a stone-fence is barely visible.



Drawn by D. BRUUN.

Fig. 15. The same place, view in the opposite direction, showing the lower end of the fence and a partially sunken enclosure for sheep.

was meagre and open, displaying more rocks than plants. As was known before, *Zostera* grew here. On the evening of the 17. we left for Godthaab, but had to spend our night somewhere on the open northern shore as a dense fog made sailing impossible.

Having refuelled at Godthaab we started early on the 19. and came to:

5) Itivnera, 64°22′ N. in the Pisigssarfik-branch of the Godthaab fiord. As usual the valley-bottom is covered by a poor growth of Ericaceous shrubs, a bog of large extent is found too and, at some elevation, lakes and ponds. It was especially interesting to see a stretch of land which had been burnt some twenty years ago. The ashes and the humus left by the fire had been entirely swept away by the wind, leaving the stony underground bare. Yet, a few plants had started reclaiming the soil. The agricultural possibilities of the place have been discussed by Mr. E. KNUDSEN, director of the Færöese Experiment Station (Beretn. og Kungör. vedr. Kolonierne i Grönland 1927 p. 693). The next day we moved to:

6) Kapisigdlit, 64°30′ N., on the isthmus between the Pisigssarfik- and the Kangersuneq-branches. Here is a dry and stony heath with a number of small lakes and ponds, with bogs in the depressions and small thickets along the watercourses. On very barren, low hilltops *Salix Uva-Ursi* grew abundantly.

7) Ujaragssuit, 64°50′ N. was visited Aug. 21. There was a repetition of the conditions seen in the former place. On following a caribou-hunter's trail a few miles northward I passed a well watered and extremely luxuriant vegetation at the foot of a vertical cliff.

Climate and Soil Conditions. The accompanying graph shows the annual course of the mean temperature of the air and of the precipitation for the colony of Godthaab and for a place in the fiord. The graph confirms the general experience of people living in Greenland that the sheltered places in the fiords have warmer, but drier summers than the less favourable outer points. Very appropriately O. BENDIXEN, in his description of the southern part of West-Greenland[1]), remarks: if, in any latitude of West-Greenland, you move a score of miles eastwards, you will find a larger difference in the climate than in going hundreds of miles northwards or southwards. E. g. comparing the climate of Qôrnoq, 64°30′ to that of Jakobshavn, (p. 75) the principal meteorologic station at Disko Bay, we shall find the summer temperatures of the southern place but very slightly higher, the growing season but a few days longer, whereas the annual amount of precipitation is higher, for Jakobshavn about 28 cm, for Qôrnoq about 36 cm.

[1]) Gronland i Tohundredaaret etc. Medd. om Grl. 61, p. 196.

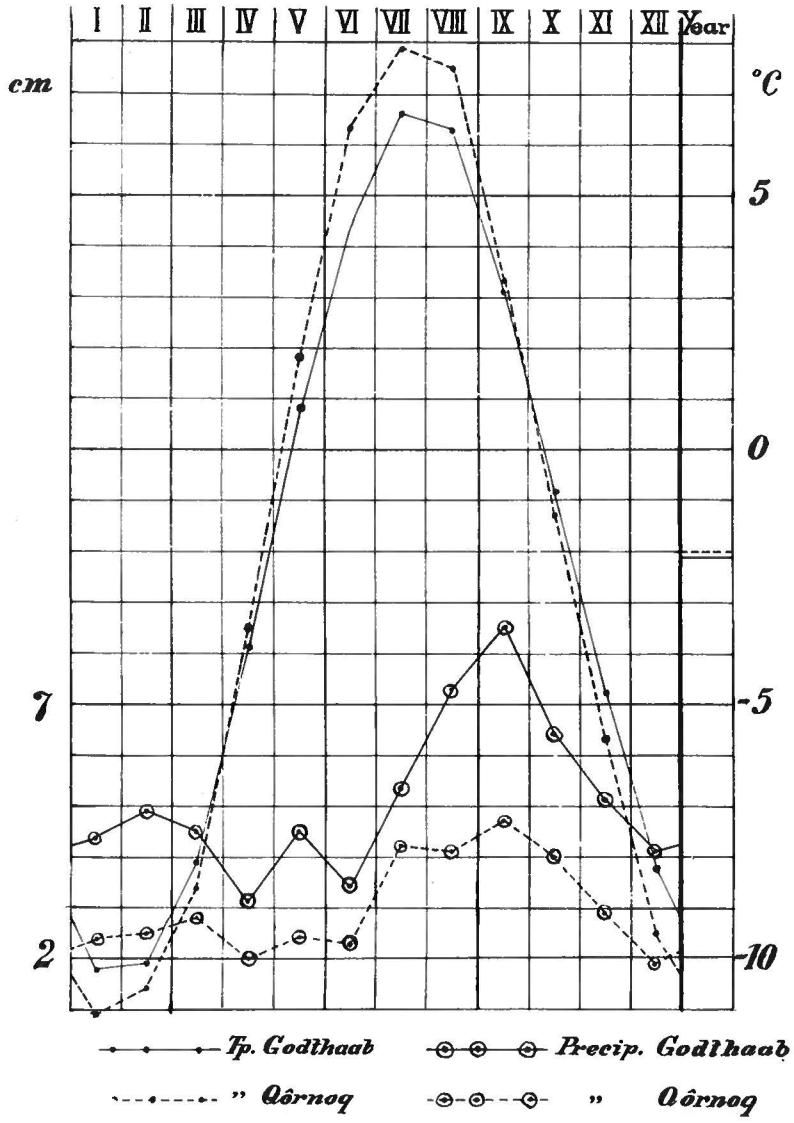


Fig. 16. Average mean temperature and precipitation for Godthaab, 64°10′ N. 51°43′ W. and Qôrnoq, 64°26′ N. 50°58′ W.

The rocks in the fiord-area are gneiss and hornblende-schists, occasionally interrupted by granite or steatite. Often the mountain sides are very steep, bare of vegetation altogether, or with a narrow belt of growth over the talus at their feet. We had to take our anchorages in small bays or protected inlets at the mouths of the valleys. But not even the valley-bottoms were favourable to plant-life. The loose soil was always very thin and, worse than that, it mainly consisted of a

whitish stiff clay seemingly devoid of lime. In this connection it is interesting to learn that KNUDSEN at Itivnera, by digging in the soil of a former experimental plot, noticed that ashes and sheep's manure were almost unconverted fifteen years after.

Compared to the plant covering in the lowland of the basaltic area of Greenland five to eight degrees of latitude farther north, the vegetation in the valleys of the Godthaab district was poor. Even in the lowland gneissarea at Disko Bay between 67° and 70° N. Lat., the vegetation as a whole is generally denser and taller than in the southern section.

According to BENDIXEN (l. c. p. 195) often the lowland in the fiord-area has no covering of snow until about New Year and the always scanty layer will disappear at the beginning of May, if foehn-storms have not swept it away before. This circumstance is certainly a great disadvantage to arctic plant-life.

Having finished a botanical excursion of some duration the present writer generally checks, on printed lists, all plants actually seen, and adds symbols of their frequency when able to do so. The symbols are:

ccc dominant and characterizing the vegetation;
cc everywhere;
c common;
r rare, only seen a few times, or only once, even if the single locality was inhabited by thousands of specimens.
rr very rare, only a few individuals seen;
+ occurrence recorded, but frequency not ascertained.

These check-lists are meant as floristic data, containing the results of the excursion which has generally touched upon several different plant-associations. Hence they should not be mistaken for analytic data of any single plant-community. The following list is a summary of the check-lists.

List of plants observed in the Godthaab Fiord-area.

	Locality number						
	1	2	3	4	5	6	7
Woodsia ilvensis	..	cc	..	c	cc	c	c
— alpina	..	..	..	..	..	..	c
Cystopteris fragilis	cc	cc	..	..	..	..	c
Dryopteris dilatata	r	..	..	..	..	..	+
— Phegopteris	..	..	..	..	..	..	c
— Linnæana	ccc	c	..	..	..	..	c
Botrychium Lunaria	..	..	..	c	c	c	..
— boreale	..	c	..	..	..	..	..
Equisetum arvense	ccc	ccc	ccc	cc	cc	ccc	ccc
— variegatum	..	..	..	..	cc	c	c

	Locality number						
	1	2	3	4	5	6	7
Lycopodium Selago	c	c	..	..	..	..	..
— — f. appressa	cc	cc	..	c	c	c	ccc
— annotinum v. pungens	cc	..	..	..	cc	cc	cc
— alpinum	..	..	..	c	..	..	c
— complanatum	..	c	..	c	..	..	..
Juniperus nana	..	c	cc	c	cc	c	ccc
Sparganium hyperboreum	..	..	..	..	cc	c	c
Zostera marina	..	c	..	cc	cc	c	..
Potamogeton filiformis	..	..	..	..	c	..	..
— groenlandicus	..	..	..	..	?	..	..
— tenuifolius	..	..	..	..	c	..	..
Triglochin palustre	..	..	cc	cc	c	c	..
Hierochloa alpina	cc	cc	cc	c	cc	c	c
Alopecurus æqualis	..	..	..	..	cc	c	..
Agrostis borealis	c	c	..	c	cc	c	c
Calamagrostis Langsdorffii	cc	cc	ccc	..	..	..	c
— hyperborea	..	..	..	cc	ccc	ccc	..
Deschampsia flexuosa	cc	cc	..	cc	c	c	c
Trisetum spicatum	..	..	..	..	c	c	c
Poa alpigena	c	c	cc	c	c	c	c
— glauca	..	c	cc	cc	cc	c	cc
— alpina	..	..	..	..	c	c	c
— rigens	c	c	..	..	..	..	c
Puccinellia retroflexa	..	..	c	c	c	..	..
— phryganodes	..	cc	cc	cc	c	..	..
Festuca ovina	..	..	..	c	c	cc	..
— vivipara	..	..	..	..	..	..	c
— rubra v. arenaria	..	cc	c	cc	c	cc	c
Elymus arenarius v. villosus	cc	cc	ccc	cc	cc	c	cc
Eriophorum Scheuchzeri	..	r	..	..	c	ccc	c
— angustifolium	..	..	..	..	c	cc	..
Heleocharis acicularis	..	..	..	..	..	c	..
Scirpus caespitosus	..	..	..	..	c	c	..
Cobresia caricina	..	..	..	..	c	c	..
Carex scirpoidea	c	c	..	c	cc	c	cc
— Macloviana	..	..	..	r	c	+	c
— Lachenalii	c	c	..	+	c	c	c
— glareosa	..	cc	cc	cc	c	..	..
— canescens	c	c	..	..	c	c	c
— concolor	c	cc	..	cc	c	cc	cc
— alpina	c	c	..	c	c	c	c
— supina	..	r	..	+	c	..	..
— rariflora	..	..	..	c	c	c	c
— capillaris	..	c	..	c	c	c	c
— rotundata	..	..	..	..	c	c	..
Juncus arcticus	..	+	c	?	..	..	c
— nodulosus	..	..	..	..	c	..	..
— subtilis	..	..	..	..	..	c	..

	Locality number						
	1	2	3	4	5	6	7
Juncus castaneus	..	..	..	..	c	c	c
— albescens	..	..	..	..	..	c	c
— trifidus	c	c	..	..	..	c	cc
Luzula parviflora	cc	cc	..	..	..	..	..
— confusa	r	..	c	c	c	cc	c
— multiflora	..	..	..	..	..	..	c
— frigida	..	+	c	c	c	c	c
— spicata	cc	c	c	c	c	c	c
Tofieldia minima	..	cc	..	cc	ccc	ccc	cc
Orchis rotundifolius	..	rr	..	..	..	..	..
Salix herbacea	c	r	..	..	c	c	c
— Uva-Ursi	..	+	..	..	..	c	cc
— glauca	ccc	ccc	ccc	ccc	ccc	ccc	ccc
— arctophila	c	..	..	..	c	cc	c
Betula nana	ccc	cc	ccc	ccc	ccc	ccc	ccc
— glandulosa	r	..	?	?	..	..	..
Alnus repens	c	c	r	c	c	c	+
Rumex Acetosella	cc	cc	ccc	cc	ccc	c	ccc
Oxyria digyna	..	..	..	+	..	..	c
Polygonum viviparum	..	..	cc	c	cc	c	cc
Montia lamprosperma	..	..	c	cc	..	..	..
Stellaria longipes	c	cc	ccc	ccc	cc	cc	cc
— borealis	c	cc	..	..	..	..	..
— humifusa	..	c	cc	cc	cc	..	..
Cerastium trigynum	..	c	..	..	..	..	..
— alpinum	c	+	ccc	c	cc	c	cc
Minuartia rubella	..	..	c	c	..	cc	cc
Honckenya peploides	..	c	cc	cc	c	..	..
Viscaria alpina	..	cc	..	cc	cc	c	cc
Silene acaulis	..	..	..	..	..	..	cc
Coptis groenlandica	cc	c	..	..	..	..	cc
Ranunculus reptans	..	..	..	..	+	c	..
— lapponicus	..	cc	..	+	..	..	..
— hyperboreus	..	..	..	..	c	c	..
— Cymbalaria	..	c	c	..	..	..	..
— acris	..	..	c	..	..	..	..
Cochlearia officinalis	..	c	ccc	ccc	ccc	..	..
Cardamine pratensis	..	..	..	..	..	r	..
Draba incana	..	..	ccc	cc	cc	cc	cc
— daurica	..	..	?	?	..	..	..
Rhodiola rosea	..	..	c	..	..	..	ccc
Saxifraga nivalis	..	..	..	..	..	c	..
— stellaris	c	c	..	..	..	..	..
— rivularis	..	..	..	..	..	..	c
— aizoides	..	..	..	..	ccc	..	..
— Aizoon	..	..	..	..	..	..	cc
Comarum palustre	..	..	..	..	..	c	..
Potentilla tridentata	..	..	..	cc	cc	cc	ccc

	Locality number						
	1	2	3	4	5	6	7
Potentilla pacifica	..	c	ccc	cc	cc	..	..
— maculata	c	cc	ccc	ccc	ccc	cc	cc
Dryas integrifolia	..	..	..	ccc	ccc	ccc	ccc
Alchemilla alpina	r	..	..	..	..	..	..
— filicaulis	c	+	..	..	..	..	..
Callitriche verna	..	..	..	..	..	r	..
— hamulata	..	..	..	..	..	r	..
Chamæner. angustif. v. interm.	cc	c	cc	ccc	cc	cc	c
— latifolium	ccc	ccc	cc	cc	cc	cc	c
Myrioph. alterniflorum	..	..	..	..	..	+	..
Hippuris vulgaris	..	..	..	..	..	cc	..
Archangelica officinalis	r	..	..	..	..	..	c
Cornus suecica	c	..	..	..	..	..	..
Empetrum hermaphroditum	ccc	ccc	ccc	ccc	cc	+	cc
Pirola grandiflora	..	..	..	c	cc	cc	c
— minor	c	+	..	..	..	c	+
Ledum decumbens	..	..	..	..	cc	cc	c
— groenlandicum	ccc	ccc	cc	ccc	cc	ccc	ccc
Rhododendron lapponicum	..	c	c	cc	cc	c	..
Loiseleuria procumbens	..	..	..	..	c	c	c
Phyllodoce coerulea	r	..	..	..	c	c	..
Cassiope tetragona	..	..	..	..	cc	c	..
Vaccinium Vitis-Idæa	..	+	c	cc	cc	c	..
— microphyllum	ccc	ccc	ccc	cc	ccc	ccc	ccc
Diapensia lapponica	..	..	..	..	cc	c	cc
Statice sibirica	..	..	..	..	c	c	..
Gentiana nivalis	..	..	..	c	c	c	cc
Lomatogonium rotatum	..	..	..	..	..	..	c
Menyanthes trifoliata	..	..	..	..	r	cc	..
Thymus arcticus	..	cc	..	cc	c	c	cc
Veronica Wormskjoldii	cc	c	..	+	c	c	..
Euphrasia arctica	..	cc	cc	ccc	ccc	cc	cc
Bartschia alpina	ccc	cc	..	cc	cc	cc	cc
Rhinanthus groenlandicus	..	..	..	..	..	c	..
Pedicularis lapponica	cc	cc	cc	cc	cc	cc	c
— labradorica	..	..	..	..	..	c	..
— flammea	?	..	..	c	cc	c	c
Pinguicula vulgaris	..	c	..	+	c	c	..
Plantago juncoides v. glauca	..	c	cc	c	c	..	..
Galium Brandegeei	..	..	..	..	c	..	..
Campanula rotundifolia	ccc	cc	ccc	ccc	ccc	ccc	ccc
Antennaria groenlandica	c	c	..	r	c	..	..
Gnaphalium norvegicum	c	..	..	..	..	..	..
Artemisia borealis	..	cc	..	..	c	..	c
Taraxacum croceum	cc	cc	..	..	c	..	c
Hieracium hyparcticum	c	c	cc	..	..	..	c

Notes on some of the rarer species observed.

Plants marked with an * are new to the district.

Dryopteris spinulosa (MÜLL.) KUNTZE var. *americana* (FISCH.) WEATHERB., several times found north of Godthaab, was surprisingly rare. We found it only at Qasigiánguit and Ujaragssuit.

**Botrychium boreale* MILDE. On heathland at Eqaluit, stout specimens 12—15 cm high were found. Previously known only from 60—61° N.

Lycopodium complanatum L. Eqaluit, where found before by OSTENFELD; at the head of Itivdleq.

Zostera marina L. f. *stenophylla* ASCH. & GR. In addition to the earlier known localities for growing *Zostera*: in Godthaab fiord and at Itivdleq, we also found it at Eqaluit. At the lowest ebb-tide the depth of the water over the plant was 2—3 m and thus probably beyond the lower limit of the winter-ice. The plants were small, barely 5 dm high. Specimens uprooted by bergs and drifted ashore were very scarce in all places visited.

Potamogeton tenuifolius RAF. Med. Repos. hex. 3. II. 409. 1811. cfr. FERNALD: Rhodora 1931, 209; *P. microstachys* WOLFG. in SCHULTES & SCHULTES: Mant. III. 360. 1827; FERNALD: Rhodora, 1930, 76—82, tab. 197; — *P. rufescens* AUTT. de fl. Groenl. et de fl. Americ., not SCHRADER 1815; — *P. alpinus* AUTT., not BALB. 1804.

At Itivnera specimens with flowers and immature fruits were taken by Mr. LØFTING.

Alopecurus aequalis SOBOL. f. *natans* (WAHL.) SIMM. Itivnera and Kapisigdlit, abundantly flowering.

Calamagrostis hyperborea LANGE. Head of Itivdleq and Itivnera, very abundant.

(*Arctophila effusa* LANGE was not found in the fiords. This plant has been known from the town of Godthaab for more than a century. Here it obviously spreads, being favoured by the proximity of man. From its "natural" stations in ponds, outside the town, it follows drainage ditches and is now also seen in ditches along the roads within the town. It is seemingly not eaten by domestic animals).

Cobresia caricina WILLD. The southernmost record of this plant has, so far, been from Ujaragssuit where I did not see it. At Itivnera and Kapisigdlit large specimens, up to 2.5 dm were seen.

**Heleocharis acicularis* (L.) R. BR. On the border of a small lake at Kapisigdlit, intermingled with *Juncus subtilis* and mosses. Sparingly, but with flowers. In Greenland this species had previously been noticed from places around Disko Bay and North East Bay.

**Juncus subtilis* E. MEYER. Recently Professor M. L. FERNALD has shown (Rhodora 1934, p. 92) that the small Greenland *Juncus* which

hitherto has passed as *J. supinus* MOENCH really belongs to the Atlantic American species *J. subtilis* of a more northern range. The sterile waterform was found intermingled with the preceding. Before, it had been noticed several times around Disko Bay, once in the Julianehaab district and at Angmagssalik, East Greenland.

**Juncus nodulosus* WAHL. Fl. Upsal. p. 114. 1820 (Syn. *J. alpinus* AUTT. de fl. Grl., VILL. in part. In N. America, according to HULTÉN: Fl. of Kamtchatka I. p. 222, reported as *J. alpinus* var. *insignis* FR. or as *J. Richardsonianus* SCHULT.). This plant, which in Greenland heretofore was only known from a few localities around Igaliko, about 61° N., I also found at Itivnera. As usual it varied much in size here, from 7 to 26 cm high. The specimens were in full maturity, shedding seeds profusely.

**Luzula multiflora* (EHRH.) LEJ. According to a revision of the Greenland *Luzulas* in the Botanical Museum of Copenhagen by Professor G. SAMUELSSON, Stockholm, the range of the genuine *L. multiflora* in West Greenland should only slightly exceed the 61st parallel, whereas the same authority has acknowledged a specimen from Tasiussaq, 65°35′ N. in East Greenland, as correctly identified. The remaining large number of herbarium sheets of plants, ranging up to about 71° N. on both coasts, which formerly passed as *L. multiflora*, SAMUELSSON referred to *L. frigida* (BUCH.) SAM., or mostly to its marked variety *contracta* SAM.

As might be expected, this latter plant was very common in the fiords, but, in addition there were plants recalling the habit of *L. multiflora*, especially by the long peduncled partial inflorescences. Remembering, however, the importance of the seed character, none of these still immature specimens were collected until, at Ujaragssuit, plants in the act of shedding their seeds were found. A good harvest of seeds of this and, for comparison, of *L. frigida*, from the fiord, was obtained. Both samples were very uniform and, in spite of the minuteness, the difference in size was plainly visible to the naked eye, when a large number were compared. After measuring a large material at home the length of the seed of *L. multiflora* averaged 1.5 mm, that of *L. frigida* var. *contracta* 1.1 mm.

**Orchis rotundifolia* BANKS, which from 1876 to 1925 has only been observed three times in two localities at about 61° N., was found at Eqaluit, on peaty soil among heather, but only one individual with almost ripe capsules. A prolonged search yielded no more specimens. When not in full flower, the plant is very inconspicuous and may easily be overlooked.

A very remarkable extension of its Greenland range was obtained by the American botanist Mr. C. O. ERLANSSON, who found it "on wet meadows near stream, on east side of south arm of Söndre Strömfjord. 66°50′ N. Aug. 2. 1927", according to the label of a duplicate specimen preserved at the Danish Arctic Station.

Salix Uva-Ursi PURSH has been found several times in the Godthaab fiord-district, where its northern limit in Greenland seems to be. In his elaborate monograph of the Greenland *Salices* (Medd. om Grönl. 63) FLODERUS has copied out, from the original labels of the former collectors, all available information about the nature of the habitat of the Skeleton Willow. Of these the oldest, by J. VAHL, running: "in locis lapidosis irrigatis" and "in locis saxosis irrigatis" were taken over in LANGE's Conspectus. They are, however, misleading, whereas the later, by BERLIN, from Ivigtut, (translated): "about 300 m above the sea, on gravelly flats of diabase" or "on weathered syenite" are better. And ROSENVINGE's remarks are (translated) quite to the point: "on loose gravel (of diabase or morainic) and wind swept rocks" and "It is not, as might be anticipated, at home in the heath, nor in the willow copses either; it is always closely prostrate, very flexuous, and it prefers gravelly ground and does not shun wind swept spots." In fact, the occurrences in the Godthaab fiord area are so characteristic that, when once realized, one may easily go straight up to them. The plant is found on denuded hilltops, elevated crests or open wind swept notches, when the rocks consist of a postarchean granite (or perhaps syenite) which by weathering leaves a coarse gravel, mainly consisting of felsspar. These places are extremely dry and on account of the topographical conditions there will be very little covering of snow during the winter, if any at all. Generally the willow grew alone here, rarely associated with single specimens of *Loiseleuria procumbens* or *Festuca ovina* and a few mosses and lichens. In more sheltered and irrigated places it could not stand the competition with the common heath shrubs with their copiously growing mosses.

The nature of the Greenland habitat is thus in good accordance with that of Atlantic N. America, described as "wind swept barrens of a medium acidity".

All plants seen had empty capsules at the end of August.

**Betula glandulosa* MICHX. is generally supposed to have its northern limit on both coasts of Greenland at 63° N. where it meets *B. nana* and intermingles with this. (Cfr. ROSENVINGE, Consp. III. p. 706). However, specimens of *B. nana* with some of the characteristic glands of *B. glandulosa* have been noticed farther north in West Greenland a long time ago. And in a large number of specimens, labelled by the present writer "*B. nana*", the well known Swedish authority on *Betula* Mr. J. G. GUNNARSSON found "wefts" ("inslag") of *B. glandulosa*. Of these some specimens were from the Godthaab district, but even a sheet from the head of Lakse fiord, 72°30′ N., was thus designated.

At Qasigiánguit, I noticed, in a luxuriant growth of *B. nana*,

some deviating shrubs which on closer examination proved to be typical *B. glandulosa* with abundant nearly mature catkins. They were more erect, had slightly smaller leaves and the young twigs were densely covered with glands. Some sterile specimens were also seen which had more depressed branches and the young twigs glandular and at the same time pubescent, evidently hybrids.

I searched for more specimens in the places visited later, but in vain.

Ranunculus Cymbalaria PURSH. J. VAHL detected this plant in Ameralik fiord in 1830[1]) and it has not been observed since in Greenland, neither in this fiord nor in any other part of Greenland.

In the Botanical Museum of Copenhagen two sheets are preserved, labelled in J. VAHL's handwriting:

1) *Ranunculus (hyperboreus?) Cymbalaria* PURSH
ad littus passim a mare inundatum.
Sinus Amaralik 1830. *Aug.*

2) *Ran. Cymbalaria*
ad littus passim a mare (inundatum) in interiore sinus Amaralik, distr. colon. Godthaab.
floret Juli, Aug. et Sept.

Contrary to his custom no special localities are mentioned; this and the word "*passim*" suggests that VAHL found the plant in several places.

When we came to Eqaluit, we anchored in the right part of the bay which is, so to say, the "natural" anchorage. The shore here had very few possibilities for maritime plants and *Ranunculus Cymbalaria* was not found here. But on the left side of the bay I had noticed some alluvial sand- and mudflats. As a crossing of the main stream by foot was impracticable I went over by means of the jollyboat before leaving the place. On the flat, within the shore, were a series of small brackish lagoons and around them, at a certain level, *R. Cymbalaria* grew in great abundance. The individuals were cushion-like, flowering and fruiting, and the threadlike runners were radiating in all directions.

In the next place, Qilaersarfik, conditions were not so favourable. Yet, the plant grew here too, in the narrow zone occupied by other halophytes and intermingled with common terrestrial plants. Most likely the plant will be found in still greater abundance near the heads of the arms of the fiord, where according to the maps, extensive alluvial deposits

[1]) FRISENDAHL l. c. quotes a label in the Swedish State Museum according to which VAHL took the plant in 1847. But this is an error, VAHL visited Ameralik fiord Aug. 25.—Sept. 15. in 1830 and June 28.—July 9. in 1831 and he left Greenland in 1836.

exist. VAHL, travelling in a skin-boat could easily go there, for our motor-boat the water was too shallow. VAHL's term "*passim*", "here and there" is thus quite fitting.

The specimens are stunted, as is generally the case when occurring in Arctic climates; it is the f. *alpina* HOOKER.

In 1916 *Ranunculus Cymbalaria* was very unexpectedly discovered on the coast of Europe, on a small island at the mouth of Oslo fiord, near the Norwegian-Swedish boundary. And in 1917 and 1918 two more localities were found, on the Swedish side, in Bohuslän. Reports on these finds have been published by 1) R. NORDHAGEN: *Ranunculus Cymbalaria* PURSH fundet i Norge. (With a summary in English), Nyt Magaz. f. Naturv. 55. 1917 p. 119—146, illustrated, and 2) A. FRISENDAHL: *Ranunculus Cymbalaria* PURSH och fynd av densamma i Sverige. Act. Fl. Suec. I. 1921 p. 305—328, 24 text-illustr., 1 map, 1 coloured plate. In these papers very much valuable information about the geographical distribution, the morphology and the biology of the plant is brought together. Especially FRISENDAHL has been able to follow the development from tiny seedlings, found in the open, to fullgrown plants, however with immature fruits. Since fully matured achenes are not mentioned by either author nor, curiously enough, in any descriptive work here, I may insert that the ripe achenes are white, flattened above, obliquely pointed by the persistent style. The dimensions of Greenland specimens are (1.13 —) *1.35* (—1.51) mm long (style included), (0.54 —) *0.65* (—0.76) mm broad. Achenes from Alaskan stations are slightly shorter and broader. The outline will appear from fig. 17. On the pericarp are seen some irregular ridges.

NORDHAGEN discusses at length the phytogeographical problem of *R.Cymbalaria* in Europe, comparing its occurrence with the other, often mentioned, American types of plants in western Europe: *Eriocaulon septangulare*, *Spiranthes Romanzowiana* and *Sisyrinchium angustifolium* in Ireland, *Carex scirpoidea*, *Habenaria obtusata*, and *Draba crassifolia* (to which may be added *Braya glabella*) in northern Norway. When in 1904 N. HARTZ found the American plants *Dulichium spathaceum* and somewhat later *Brasenia purpurea* in Danish interglacial deposits, HARTZ suggested that the plants mentioned above were relics from interglacial epochs. NORDHAGEN, however, finds the two groups rather incomparable. The American plants of Norway are arctic and were perhaps able to survive a glaciation, if icefree spots were available, whereas the Irish contingency are plants from a more genial climate. As far as our plant is concerned, NORDHAGEN cannot consider it a relic, not even from post-glacial epochs, but he thinks its occurrence in Scandinavia must be explained as an occasional colonization "*à grande distance*".

NORDHAGEN leaves out of account the possibility of the immigration of *R. Cymbalaria* by wind action. He thinks its arrival by man's activities improbable, as the remote place where it was found is out of the way of the great traffic. Immigration by means of birds being also improbable, there thus remains as the only possibility that it was brought over by oceanic currents. In this connection he justly calls attention to the fact that the large North-American sea-weed *Laminaria longicruris* (also occuring in Greenland) has been found drifting in the Kattegat, and stranded on the coast of Jutland, Bohuslän and northern Norway near Alten. In this case, however, the low coast of Denmark, N. W. Germany and Holland would seem more inviting to our *Ranunculus* and we might expect immigrants from America to turn up on the West coast of Norway, where so many seeds from West India have been found, rather than in Bohuslän.

FRISENDAHL subscribes to the explanation of NORDHAGEN, stating that, according to his observations, the achenes are able to float.

About the floating power some further observations may be appropriate. The pericarp of *R. Cymbalaria* contains no stereome, whereby the plant probably differs from all other species of *Ranunculus*[1]). The cells are empty and the tissue has a spongy aspect, recalling pith. The lenticular seed does not fill out the cavity of the achene, see fig. 17. The specific gravity of the seed is larger than one, but it is enabled to float by means of the spongy tissue of the much larger pericarp and its airfilled cavity.

To obtain an idea of how long the achenes would be floating, I put samples from both localities in Ameralik in glass-tubes with fresh tap-water and also, for comparison, two samples from Alaska, collected by R. T. and A. E. PORSILD in 1926, namely:

No. 1082 from St Michaels, 63°30′ N. July 27.
— 1435 — Port Clarence, 65°15′ N. Aug. 24. The tubes were, at the beginning of September 1932, placed near the window in my laboratory.

At first all samples floated, but after a few days some of the Alaskan samples had sunk, whereas the remaining and all the Greenland achenes were still floating. After one week the tubes were violently shaken, which made a few more Alaskan achenes sink. After another two weeks I tried, by means of a small brush, to bring each individual achene under the water, with the result that nearly all remaining Alaskan and also

[1]) It was on this ground that PRANTL removed *R. Cymbalaria* from *Ranunculus* and put it under *Oxygraphis*, and that E. L. GREENE founded a new genus *Halerpestes*.

some of the Greenland achenes sank. I was then interrupted by other work for a week or more, and when I again examined the tubes the majority of the Alaskan seeds had germinated at the bottom of the tubes. Also some of the Greenland samples had germinated and were

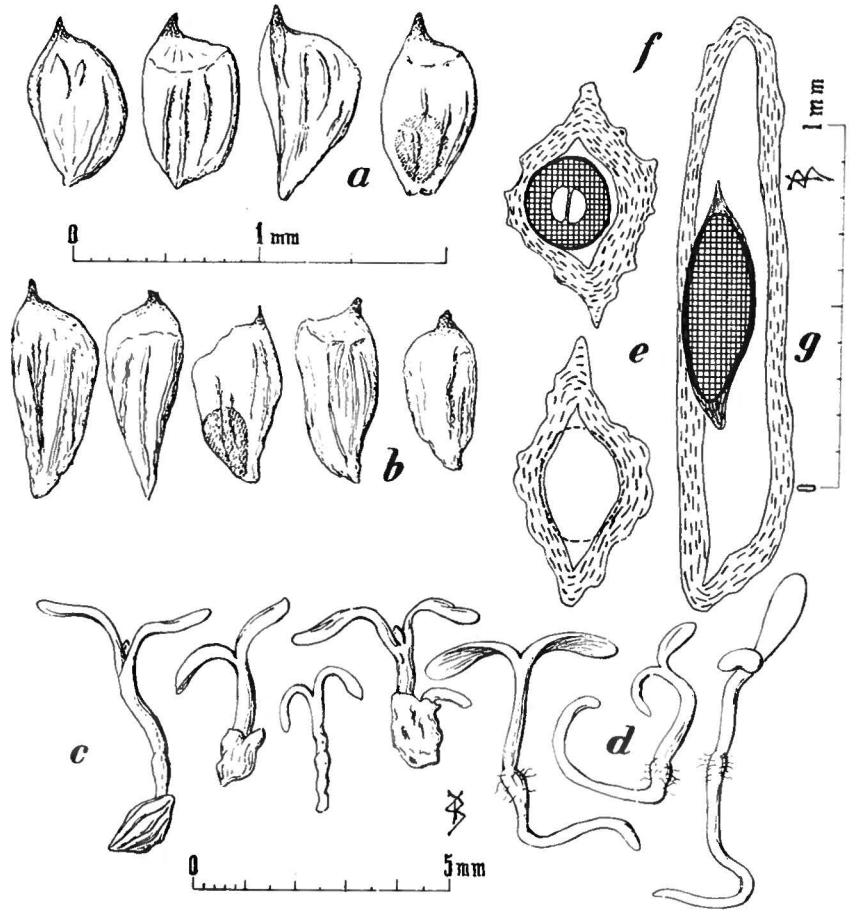


Fig. 17. *Ranunculus Cymbalaria* PURSH. a. achenes from St. Michaels, Alaska; b. from Ameralik Fiord, Greenland; c. seedlings grown from Alaska material; d. from Greenlandic; e. cross-section of achene, somewhat above the middle, the contour of the seed is visible; f. section in lower part showing fruit-wall, seed, endosperm and embryo; g. longitudinal section, somewhat oblique, showing air-chamber of the fruit.

lying at the bottom, and the floating ones were in the act of germinating. On watching these last mentioned closer during the subsequent days it appeared that as soon as some part of the seedling pierced the pericarp the whole would sink.

The achenes from Ameralik had been carried home with their mother

plants wrapped up in ordinary drying blotters, whereas the Alaskan, before reaching me, had experienced the vicissitudes of all primitive ways of transportation over great distances. Moreover, they had evidently been picked up from the ground, as the paper bags contained more sand than achenes. I could see no damage to their pericarps, yet, by gently beating achenes from Greenland with a clothes-brush, I also made them sink in a short time. Therefore, I do not doubt that the cause of the rapid sinking of the Alaskan achenes is that their pericarps have been damaged.

We learn from this experiment that undamaged achenes of *Ranunculus Cymbalaria* may float a long time, but only until they start germination; also that they may keep their power of germination for over 6 years, even under not too good conditions.

FRISENDAHL has l. c. published a map of the geographical distribution of *R. Cymbalaria* and compiled the data for it out of an extensive literature. Unfortunately, however, this map became out of date as soon as it was published, when in the same year H. PRINTZ showed that the whole Asiatic occurrence really belonged to another, related, inland species: *R. subsimilis* PRINTZ (Veget. Sibir. Mongol. Front. p. 236. 1921). This fact again makes it most plausible that the deviating inland forms, from the Rocky Mountains, Mexico and the South American Andes, may also be specifically distinct. They are discussed by FERNALD in Rhodora 1914 p. 160, which paper has escaped the attention of FRISENDAHL. The distribution of the coast plant *Ranunculus Cymbalaria* PURSH is thus Northern North America with a transgression into West Greenland and South Scandinavia.

Ranunculus lapponicus L. is supposed to have its southern limit in West Greenland in the fiord-district of Godthaab; (it is absent from East Greenland). I found it rather scarce at Itivdleq, but very abundant at Eqaluit.

Ranunculus acris L., which has been recorded from several places in the fiords, I only noticed at Qilaersarfik where it was very abundant on and near the Norse house ruins and in their homefields.

Chamaenerium angustifolium (L.) Spach is reported as common in West Greenland to 64° N. North of this latitude it is scattered on the mainland, more common on the southern half of Disko Island, absent from the northern. In East Greenland it ranges to about 67° N. In the fiords of the Godthaab district it was also common.

The Greenland form is var. *intermedium* WORMSKJ. which likewise occurs in Atlantic N. America (see FERNALD: Rhodora 1918, p. 1). This form is generally lower than the type from temperate regions, being only 1—5 dm high and having short and few-flowered inflorescences. But on exceptionally favoured habitats, even at its northern limit, the

specimens may be much larger. I have specimens from S. Disko measuring 1.25 m in height with inflorescences 6.5 dm long. They grew on rock débris at the foot of a vertical wall of basaltic tufa facing south and their roots were permanently watered by "warm" springs from the cliff.

After more than 100 years of collecting and observing the Greenland plant, no fruits or seeds have been found. The plant flowers late, several weeks later than the well fruiting *Ch. latifolium* in the same locality. It was in the flowers of *Ch. angustifolium* that SPRENGEL in 1790 detected the dichogamy. In Europe lowland specimens are always proterandric, at higher altitudes they may be homogamic or even proterogynic. Pollination takes place in early morning hours, by means of bees (*Apis mellifica*, absent from Greenland!), *Bombus* sp. and other *Hymenoptera* (RUBNER & BEGER in HEGI: Illustr. Fl. Mitteleur. V, 2 p. 817).

WARMING has investigated flowers of the Greenland plant, grown in the Copenhagen Botanical Garden, and found them proterandric there, with numerous germinating pollen-grains on the stigma. And in Greenland he found the f. *lejostyla* BERLIN to be nearly homogamic, and he found one case with a germinating pollen-grain (Om Bygningen etc. af nogle grönlandske Blomster. Overs. K. D. Vidensk. Selsk. Forh. p. 133 fig. 8). According to manuscript notes, left by Mr. A. E. PORSILD, pollen is abundantly produced in plants from the whole West Greenland range, and he has seen pollinized stigmas in specimens taken by himself on South Disko Aug. 8. 1923, and in others taken by MELDORF Aug. 17. 1900 at Narssaq, 60°55′ N.

On Disko, the ovary of fully expanded flowers is normally 20 mm long, and after the withering of the flower it still grows to about 25 mm. Within, the ovules and their coma are seemingly normal. But then growth stops and the ovaries dry up, without opening themselves. Thinking that conditions might perhaps be different farther south I asked Mr. A. LYNGE, teacher of natural history at the high-school of Godthaab, to look out for fruiting specimens in his environs and in 1927 Mr. LYNGE sent me some, taken by him at Pisigsarfik in the Godthaab fiord Sept. 12. 1926, in which the "capsules" were in the opening stage. In some of them the valves had split nearly down to the base, and the coma was welling out. When in 1931 I was in the fiord myself I looked for fruiting specimens everywhere and found, on Aug. 16. near Eqaluit, a group of plants on a dry hill slope where nearly all individuals were in the act of opening their capsules. They were, with Mr. LYNGE's specimens, laid in a cover, marked "c. fr." for a future report.

Mature seeds of *Ch. angustifolium*, grown in the Botanical Garden of Stockholm are somewhat clubshaped, on an average 1.27 mm long,

0.48 mm at the broadest. The seed coat is smooth, with an oily lustre, thin, and is closely filled out by the embryo. The "seeds" from opened capsules of the Greenland plants mentioned above are narrowly cylindric, only 0.65 mm long, 0.16—0.20 mm thick, the coat subtranslucent. Sections shewed that they contained no embryo, the nucellar tissue had shrunk and left an air chamber in its place.

**Myriophyllum alterniflorum* DC. When Mr. LØFTING, who was provided with fishermen's long boots, was investigating the animal life of the ponds, he would also snatch some samples of aquatic plants for me. From a small shallow lake at Kapisigdlit he brought me a handful of tops of a sterile *Myriophyllum*. They were too defective for a definite identification, but at least they were not *M. exalbescens* which is known from the region. I can find nothing to prevent them being *M. alterniflorum*, the other species known in Greenland. But this had so far not been found north of 61°35′ N. (ROSENVINGE: Consp. III. p. 657).

Cassiope tetragona (L.) DON. From JENS VAHL's herbaria and diaries the southern limit of this heather has been said to be Igdlorssuit in Ameralik Fiord, 64°10′ N. with the additional statement that it only occurs in the interior parts at altitudes between 1000′ and 2500′ (Consp. Fl. Grl. III, 691). However, we found it on the portage from Ameralik to Kapisigdlit Fiord, and at the head of the last mentioned fiord as well, in both places in lowland situations and displaying the customary abundance met with much farther north.

Recently T. W. BØCHER has published a map showing "the distribution of *Cassiope tetragona* within Greenland" (Medd. om Grl. 104, 3, p. 49). On a small-scaled map, 12 by 18 cm, the author has, as he says, plotted the finding places of the specimens actually present in the Botanical Museum of Copenhagen, seemingly totally neglecting literary records. The paper, entitled "Phytogeographical Studies of the Greenland Flora" discusses, in a theoretical way, the factors controlling the distribution of plants, such as climate, age and origin of the flora etc. and the several maps published are meant as examples illustrating the theories set forth.

An exact plotting of herbarium specimens actually seen is a commendable procedure, when the map is to illustrate the range of a critical species which probably not everybody is able to label correctly, or of rare plants with scattered occurrences, but in a case like this (and in some degree also in the other of BØCHER's maps), it is misleading rather than instructive. Thus on the large basaltic peninsula of Svartenhuk there are no dots, no occurrence is shown in the whole district of Umánaq, mainland and islands, except one locality on the north coast of Nûgssuaq Peninsula, two in the south-eastern gneiss-area. On Disko only four localities are shown, none on Hare Island, none on both

coasts of Waygat Strait, none in the northern parts of Egedesminde district nor in the vast area between 66°—68°, except a few stations on the outer coast.

Having looked over my collection of check-lists from West Greenland I am positively sure that the only true representation of the range of *Cassiope tetragona*, on a map of the scale used by BØCHER, would be to show all ice-free land between 68° and 75° in continuous black, and I believe that the same would fit for the fiord-area north of Cape York and for Inglefield Land as well.

I frankly admit that I have not, nor has any museum, a collection of specimens able to verify these lists, because, if the correctness of every record were to be provable by a specimen, no museum would be able to house them. And I do not think it necessary either. Being one of the most important yielders of fuel in this country, *Cassiope tetragona*, the only species of its genus in Greenland, is known to everybody, nay to every child, as every child in Denmark will know *Anemone memorosa*, *Asperula odorata*, *Trifolium pratense*, *Bellis perennis* etc. etc. It cannot be mistaken for anything else.

This uninterrupted distribution of *Cassiope* is no secret, as a few quotations from the literature will show:

1) TAYLOR, 1862, on the coast and the islands between 69°15′ and 74°18′ says: "occurs everywhere like *Calluna* of Scotland."
2) LANGE, 1880: 64°10′—79° "common, to altitudes about 2500′".
3) ROSENVINGE, 1892: "very common between Upernivik and 74°18′".
4) SIMMONS, 1909, in N.W. Greenland: "seems to take as prominent a place in the vegetation on the Greenland side as it does on the western side of Smith' Sound".
5) PORSILD, 1912, in 71°—73° "very common".
6) — 1920, in 70°41′—66°29′ "very common throughout the whole area; in heath and bogs and up to the borders of the snow fields".

Whereas my check-lists normally carry the symbols cc or even ccc as the mark of frequency of *Cassiope* there are to be found places from which the plant is absent. This fact is not uninteresting, since it reveals some factors controlling the distribution of *Cassiope* not considered in BØCHER's studies.

1) In 1931 Mr. FR. JOHANSEN brought home collections of plants from 12 small islands between 72°47′ and 74°36′ N. His aim was, to the best of his ability, to obtain a complete inventory of the higher plants of each island. *Cassiope* was absent only from Smedeöen (the "black-

smith's island") at the colony of Upernivik, as it will be absent from every Eskimo village site of some age.

2) Magdláq, 71°7′, *Cassiope* **r** (*Diapensia*, *Loiseleuria*, *Phyllodoce*, *Ledum* absent); (the rocks were limestone and dolomite).
3) On the "peduncle" of the peninsula Sarpiussat, 68°34′ absent (raised marine beds), on the neighbouring hill-slopes **cc.**
4) Absent on the lateral moraine of the glacier discharging into Arfersiorfik Fiord, 68°21′; (pure mineral soil without humus, covered by non-mycotrophic plants only).
5) A small island in the same fiord, *Cassiope* absent; (breeding place for the Arctic Tern).
6) Flat top of a gneiss-hill near the inland ice, 68° N., elevation about 1000′, *Cassiope* absent; (no snow covering during the winter).
7) N. of Manik, on the Waygat shore of Nûgssuaq Peninsula, there is along the shore a terrace of sandstone, having on its top a very scanty vegetation, mostly of crustaceous lichens. Brooks from the mountain-slopes within have cut V-shaped ravines, perpendicular to the coast-line, in the terrace. One side of the ravines is covered by a dense growth of *Empetrum* with absence of *Cassiope*, the other side, and always the corresponding one, is as densely inhabited by *Cassiope*. (The cause is the difference in the snow covering. Both plants need cover, but *Cassiope* seems to prefer — or to be able to stand? — thicker layers than does *Empetrum*. The ravine-sides occupied by *Cassiope* were the lee-sides of the prevailing wind).

Ledum. The dominant species in the fiord area is *L. groenlandicum* Oed., but *L. decumbens* (Ait.) Lodd. was also quite common. When the ranges of both species overlap, specimens may be found which are somewhat intermediate and which may be hybrids. At Itivnera I saw a stretch of land where the former plant cover had been burnt to the total disappearance of humus some 15 years ago. A recovering of the area had begun by all kinds of plants from the environs. Among the successful pioneers were both *Ledum* species, growing side by side in perfect typical specimens.

Vaccinium Vitis-Idaea L. var *minus* Lodd. was seen in most of the places visited, but the quantity of it was surprisingly small, compared with the areas south of Disko Bay. South of the district of Godthaab only two occurrences are known.

Menyanthes trifoliata L. was seen in great abundance in ponds and on lake shores at Itivnera and Kapisigdlit. Heretofore no mature seeds had been reported from Greenland (cfr. Porsild: Flora of Disko etc. Medd. om Grl. 58. p. 139), but here the plants had withered flowers and perfectly ripe seeds on Aug. 20.

Gentiana nivalis L. seemed to be common, but was only seen in the withered state.

Rhinanthus groenlandicus CHABERT was only seen at Kapisigdlit.

Pedicularis labradorica HOUTT. 1782 (Syn.: *P. euphrasioides* STEPH. 1801. Cfr. E. MEYER: De plant. Labr. p. 44. FERNALD: Rhodora 1931, p. 193). This plant had been only once reported from the fiord area; we found it at Kapisigdlit.

Galium Brandegeei GRAY (Cfr. PORSILD: Stray Contrib. etc. Medd. om Grl. 77. p. 24) was found again at Kapisigdlit, where it was discovered by J. VAHL a hundred years ago. This is its northernmost place known in West Greenland.

Antennaria groenlandica PORSILD was quite common in the district. Other species were not seen.

In my check-lists I have for most of the places visited noted the total absence of *Erigeron*- and *Hieracium*-species. Also *Taraxacum croceum* DAHLST. which I had expected to be common, was surprisingly scarce. At Qilaersarfik I saw a luxuriant growth of *Taraxacum* of the *Ceratophora*-group, unknown to me, on the dumpings from the excavated ruins as well as in undisturbed places. Unfortunately, my collections of this were so badly damaged by moulds during our somewhat stormy homeward trip that I had to discard them. I recommend it to the attention of future visitors.

April 1934.

XI.

A BOTANICAL EXCURSION TO THE SOUTHEASTERN PARTS OF DISKO BAY

In 1932 Mr. JOHS. GRØNTVED, curator of the Botanical Museum in Copenhagen, assisted by the bryologist Mr. L. HARMSEN made researches in plant ecology in the basaltic area of South Disko and Nûgssuaq Peninsula, they having the Danish Arctic Station as their base. To give them an opportunity to see the plant-life on Archean soil of the mainland of Greenland I made, in their company, a motorboat trip to some localities around the S. E. Bay. The flora of this section is well known, thanks to the efforts of a great number of scientific travellers and interested residents, namely P. EGEDE, 1736—40; J. VAHL, 1833 and 1835; RINK; R. BROWN (of Campster), 1867; Mrs. THYGESEN, 1869; S. BERGGREN, 1870; A. BERLIN, 1883; SYLOW, 1883; WARMING & HOLM, 1884; HOLM & ROSENVINGE, 1886; N. HARTZ, 1890; M. C. ENGELL, 1902; M. P. PORSILD, 1917 and 1924.

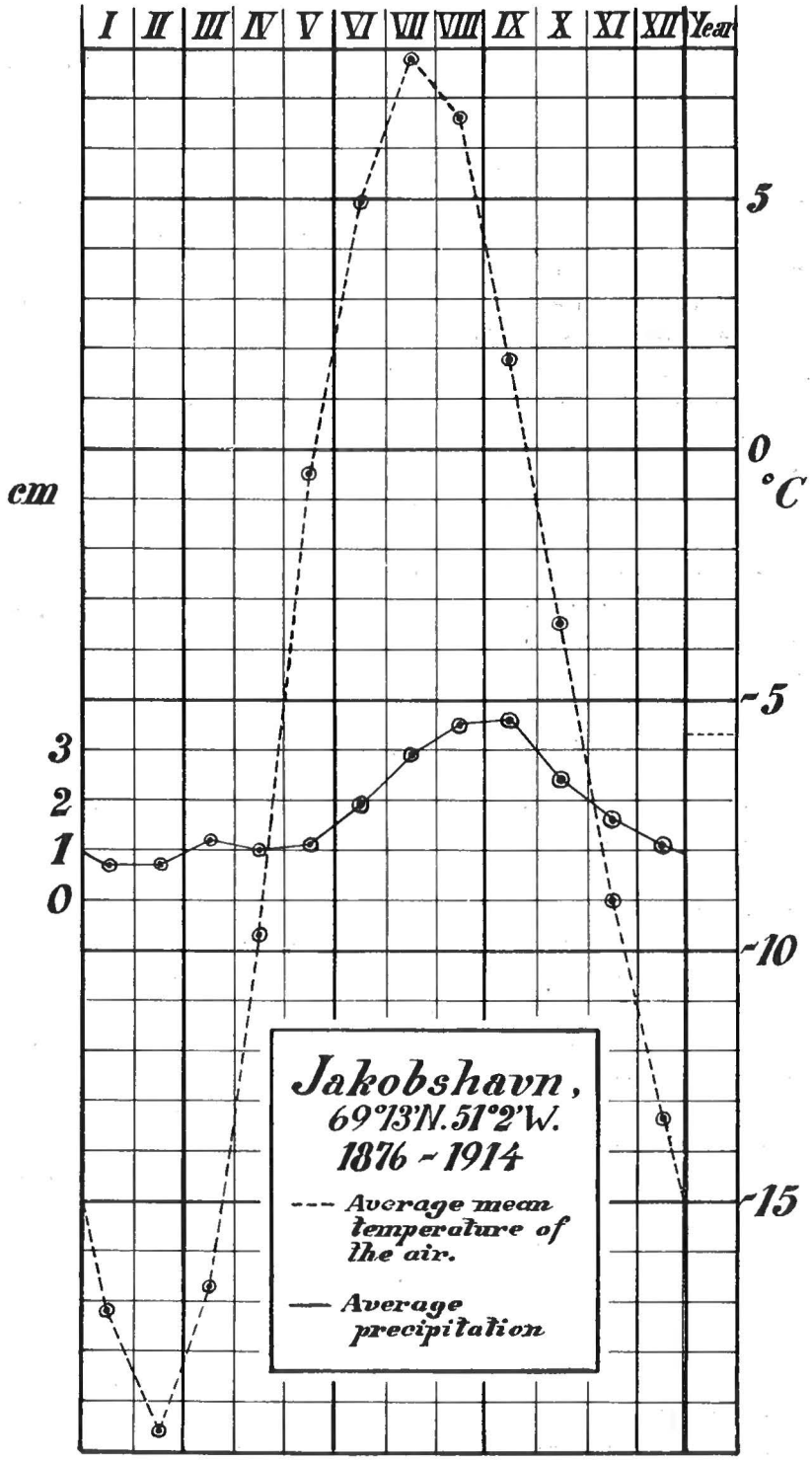

I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
Year
cm
3
2
1
0
5
0
°C
-5
-10
-15
Jakobshavn,
69°13'N. 51°2'W.
1876 - 1914
--- Average mean temperature of the air.
— Average precipitation

Fig. 18.

Remarks on the climate and the soil. From this district we have but occasional climatic records, but from the colony of Jakobshavn, about 40 miles farther north, records have been kept for nearly a century. The accompanying graph shows the average mean temperatures of the air and the amounts of precipitation for this place.

According to the general experience of the population around S. E. Bay the summers are warmer than those of Jakobshavn, with a higher number of sunny days and with less precipitation. At Christianshaab, the main trading post, are to be found the best gardening possibilities north of the polar circle in West Greenland. At the same time the district is ill-reputed for numerous S. E. gales of foehn-like character which may occur at any time of the year involving rapid and considerable rises of the temperature and drought.

The border of the inland ice lies at a level of 300—400 m and the ice-free hills before, of Archean age, are ice-worn and low, the highest barely exceeding 500 m. In the lowland are extensive plains of sand or clay which are raised marine beds, famous for their content of post-glacial fossils (see A. S. JENSEN & P. HARDER in "Postglaziale Klimaveränderungen" Stockholm, 1910). The vegetation of these plains is very open, almost desert-like, containing, however, several interesting species of higharctic types venturing out of their continuous range. On the other hand, in accordance with the favourable summer temperatures of the region, it accomodates a number of southern types, not occurring on the plains but on rocks with a covering of humus or on pond-shores near by. As our trip resulted in a few additions of both types, complete lists will be given below.

A special feature of the district is the abundance of the mountain Cranberry (*Vaccinium Vitis-Idæa* var. *pumilum*) which is here more widely distributed than in any other section of West Greenland. Also the shrub is, at least in fairly good summers, so fertile that the European households at all stations around Disko Bay can get their supply; the natives do not eat the berries of this plant.

Having spent a rainy night in the harbour of Christianshaab, we entered the turpid waters of the fiord Orpigssôq on Aug. 12. Just after passing its eastern arm the boat grounded on the sticky mud and we had some difficulty in getting off again. We then went for the eastern branch and, taking no more chances, stopped on the south coast of a peninsula with the promising name Seqineqarajugtoq ("the land of sunshine"), 68°37′ N. Here were narrow strips of the ordinary shore vegetation, within heath and bogs and finally some small lakes and ponds, yielding a more interesting harvest. In addition to the trivial aquatic plants *Hippuris vulgaris*, *Sparganium hyperboreum*, *Ranunculus confervoides* and *reptans*

we found *Callitriche hamulata*, *Utricularia minor* and *ochroleuca*, *Menyanthes trifoliata* and *Juncus subtilis*. Of southern types, at or near their northern limit we noticed *Calamagrostis hyperborea* in a moist meadow, *Pedicularis labradorica* on bogs and *Rhodiola rosea* on rocks. Our greatest surprise, however, was a colony of *Oxycoccus quadripetalus* v. *microphyllus*, amply flowering and with unripe fruits, four degrees of latitude north of its previous northern limit in the Godthaab fiord-area. It was nearly as astonishing to ascertain the absence of the following which we had expected to be quite common: *Poa alpina*, *Viscaria*, *Silene acaulis*,

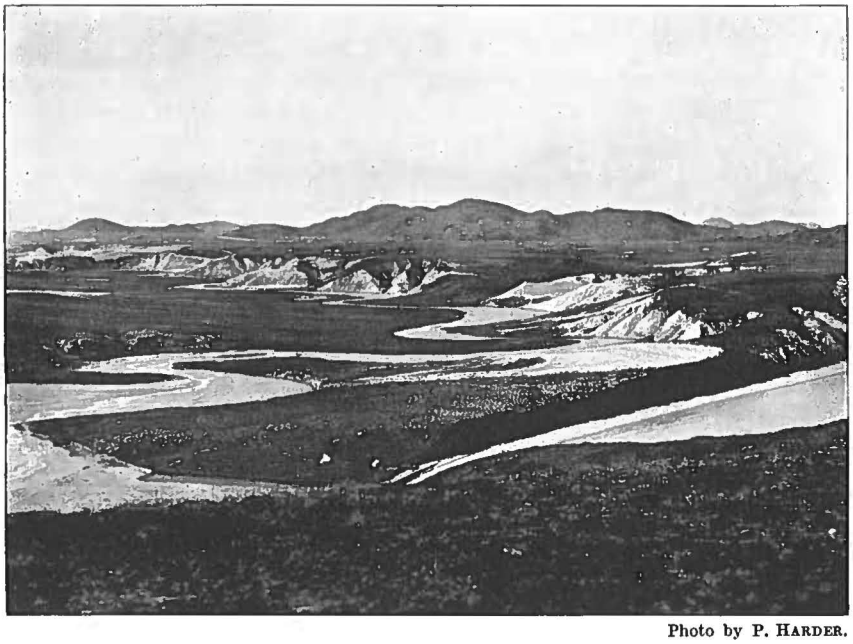


Photo by P. HARDER.

Fig. 19. View of the raised marine beds south of S. E. Bay. In the background hills of gneiss project like islands over the plain.

Sagina and *Minuartia* spp., *Melandrium*, *Honckenya*, *Cerastium trigynum*, *Arabis alpina*, *Cochlearia*, *Harrimanella*, *Loiseleuria*, *Phyllodoce*, *Bartschia*, *Gnaphalium*, *Antennaria*, *Erigeron*, *Taraxacum* etc.

A broken bolt in the engine did not disable our boat at once, but fearing that it would eventually do so, we went on Aug. 13. straight to Egedesminde for repairs, returning immediately through Lange Sund, along the north shore of the island Sarqardlît and stopped at 68°42′ N. and 52°30′ W. An excursion on this island yielded but uninteresting results. Before leaving the next day I made a complete inventory of the higher plants of one of the small islets here, ab. 700 m long, 200 m wide, consisting of gneiss and with an outcrop of diabase at one end:

Equisetum arvense r
Hierochloa alpina c
Puccinellia phryganodes cc
Festuca rubra v. *arenaria* c
Carex glareosa ccc
Carex rariflora r
Luzula confusa cc
Salix glauca cc
Betula nana cc
Polygonum viviparum cc
Melandrium affine r
Stellaria humifusa c
Stellaria longipes c
Cerastium alpinum cc
Ranunculus pygmæus rr
Cochlearia off. v. *grl.*
Saxifraga tricuspidata cc
Empetrum ccc
Pirola grandiflora r
Ledum decumbens cc
Vaccinium microphyllum c

On Aug. 14. we entered the S. E. Bay again and anchored at the head of a small indentation south of the peninsula Angnertussôq. Here were luxuriant heath and bogs, lakes and a peculiar vertical wall of gneiss rock with willow thickets at its foot. Ledges of this wall yielded the northern types *Dryopteris fragrans*, *Calamagrostis purpurascens* and *Luzula nivalis* and on the sea shore we found *Carex ursina* and *subspathacea*. In the lakes were *Potamogeton filiformis*, *Callitriche hamulata* and *autumnalis*, *Hippuris* and *Ranunculus confervoides*, in the bogs *Carex gynocrates* and *Bartschia*. Also *Euphrasia arctica* represented the southern types.

On Aug. 15. we moved to the south coast of the bay at 68°33′ N. and 51°30′ W. Because of shallow water we could not approach the shores of the clay-plains directly, but had to climb over a steep rocky knoll lying before. Our climb alarmed a Bald Eagle (*Haliaëtus albicilla*). By its behaviour it became evident that it had chosen the knoll as a breeding place, which, by the way, is the northernmost I have noticed.

While Messrs GRØNTVED and HARMSEN registered sample-squares of the open vegetation of the plain, I went to a small lake a couple of miles from the shore. In the water were extensive floating masses of abundantly fruiting *Potamogeton filiformis*. *Hippuris* and *Potamogeton groenlandicus* grew there also, the latter sterile as always. The water was not perceptibly brackish to the taste, yet the shore exhibited a remarkable number of more or less halophytic plants, as *Triglochin palustre*, *Puccinellia phryganodes*, *Carex ursina*, *Carex glareosa*, *Juncus arcticus*, *Juncus subtilis*, *Stellaria humifusa*, *Ranunculus hyperboreus*, *Cochlearia*, *Potentilla pulchella*, *Potentilla nivea*, *Plantago juncoides* v. *glauca*. Along the shore was a dense zone of *Carex rotundata* and another *Carex sp.* still unidentified, not Carex stans and seemingly also different from European as well as American races of *C. aquatilis*, which, so far, has not been observed in Greenland.

Returning I followed the small outlet from the lake and found in a swamp, where the tiny brook nearly lost itself, a wide patch of *Dupontia*

Fisheri, about one and a half degrees south of its former southern limit. This find made me request of my companions to look out for *Arctagrostis latifolia*, but as a searching ground we had only the knoll left. In climbing it again I noticed a small depression with a dense cover of grass and there, to my great satisfaction, *Arctagrostis* grew, a range extension southwards of over one degree of latitude.

The next day brought us to anchor east of the narrow "peduncle" of the peninsula Sarpiussat ("resembling a whale's tail"). The soil consisted of alluvial sand and clay, rippled by polygonal fissures, with a more advanced state of development of the plant "cover" than on the plains within. I made here an inventory of the higher plants as complete as possible:

Equisetum arvense cc
— *variegatum* +
Lycopodium Selago c
Elymus arenarius +
Alopecurus alpinus +
Hierochloa alpina c
Calamagrostis neglecta +
Puccinellia phryganodes +
— *retroflexa* c
Poa alpigena c
— *rigens* c
— *glauca* cc
Festuca brevifolia c
— *rubra* v. *arenaria* cc
Eriophorum Scheuchzeri c
— *angustifolium* c
Cobresia Bellardi +
Carex rupestris c
— *scirpoidea* c
— *glareosa* +
— *rariflora* c
— *concolor* c
— *stans* c
— *capillaris* +
— *alpina* +
— *misandra* +
Juncus arcticus cc
— *castaneus* cc
— *albescens* +
— *biglumis* +
Luzula confusa cc
Tofieldia minima cc
Salix herbacea +
— *glauca* cc
— *arctophila* cc
Betula nana ccc
Polygonum viviparaum cc
Honckenya peploides +
Melandrium affine rr
Minuartia rubella r
— *biflora* r
Stellaria humifusa +
— *longipes* cc
Cerastium alpinum ccc
Ranunculus lapponicus +
— *hyperboreus* +
Papaver radicatum +
Cochlearia officinalis +
Draba nivalis rr
— *rupestris* +
Saxifraga oppositifolia +
— *foliolosa* +
— *cernua* +
— *tricuspidata* ccc
Dryas integrifolia cc
Potentilla nivea +
Empetrum ccc
Chamæner. latifolium c
Pirola grandiflora cc
Rhododendron cc

Ledum decumbens ccc
Vaccin. Vitis-Idæa cc
— *microphyllum* ccc
Statice sibirica +
Diapensia lapponica c
Pedicularis lapponica +
— *flammea* +
— *hirsuta* c
Campanula rotundif. c

Having finished our work at Sarpiussat we moved to a similar place farther east. But now our weather luck was gone too, a drizzling rain with gusts of wind made it wiser to leave the unprotected coast and seek shelter in the snug little harbour of the trading place of Akugdlît, 68°40′ N.

The island of Akugdlît consists of two rocky parts, 170 and 200 m high respectively, united by a low boggy isthmus. The total area is but 20 km² and it houses a thrifty native population of about one hundred souls. Because of its good possibilities for hunting seals and especially for fishing sharks (*Somniosus microcephalus*) the place has been inhabited, with a few interruptions, from precolonial days. In the afternoon the rain subsided and we took a stroll over most of the island, following the century-old foothpath connecting the various hunting and fishing points. The vegetation was relatively taller and denser than in the places we had seen before, evidently there was no lack of moisture during the growing season. We noticed about 90 species of higher plants, all common types around Disko Bay, except *Polygonum boreale* Lange and *Rhodiola rosea*.

Having obtained the old and experienced trader's assurance that the wind would be no more than an innocent summer southwester, we started for home in the early morning of the 17th.

The colonial district of Christianshaab — one of the smallest of Greenland — is bordered on the north by the Jakobshavn ice-fiord, on the south by the glacier discharging in Tasiussarssuaq, the northern branch of Arfersiorfik fiord. The isthmus separating the last mentioned body of water from the South East Bay is 10—12 km wide, forming a plain of raised marine beds overtopped by low ice-worn rocky hills of gneiss. The ice-free country of the trading district covers an area of 3000 km² and the total number of species of vascular plants actually observed within the area is 182, a few of which, however, have only been found at the southern limit of the district.

In connection with NORDENSKIØLD's inland-ice marches in 1870 and 1883, the flora of the environs of Tasiussarssuaq, especially of "Sofia"'s Harbour, were studied by BERGGREN and BERLIN respectively. The present writer made a visit to this section in 1924.

Rare Plants. Southern and Northern Types. In good accordance with the favourable summer-temperatures the relative number of southern types is quite considerable. Firstly under this category we shall have to mention the aquatic vascular plants.

	Occurrence within the district	Occurrence on the main-land of Grl. north of the distr.
Hippuris vulgaris	common	to 77°
Ranunculus confervoides	common	- 76°40′
— *reptans*	scarce	- 70°30′
Sparganium hyperboreum	scarce	- 70°
Potamogeton filiformis	scarce	- 71°3′
— *groenlandicus*	scarce	- 70°
Heleocharis acicularis f. *submersa*	rare and local	- 71°42′
Callitriche verna	rare	- 70°59′
— *autumnalis*	rare	- 69°13
Myriophyllum exalbescens	very rare	- 70°30′
Utricularia minor	very rare	- 71°
— *ochroleuca*	very rare	- 70°30′
— *intermedia*	very rare	
Menyanthes trifoliata	very rare	N. Limit.
Callitriche hamulata	very rare	
Isoëtes echinospora	very rare	

Here it may be called to mind that the only find of a Characeous plant in Greenland, namely *Nitella translucens* (Pers.) Ag., was made by HARTZ in a lake near Christianshaab.

Southern types of terrestrial plants.

	Occurrence within the district	Occurrence in the main-land of Grl. north of the distr.
Potentilla tridentata	several places	to 69°54′
Calamagrostis hyperborea	scarce	- 70°40′
Carex gynocrates	scarce	- **71°33′**
— *bicolor*	rare	- 71°45′
— *subspathacea*	rare	- 71°7′
Polygonum boreale	rare	- 70°
Arabis Holboelli	rare	- 71°15′
Draba aurea	rare	- 71°15′
— *stylaris*	rare	- 71°3′
Sedum villosum	rare	- 70°40′
Pedicularis labradorica	several places	
Rhodiola rosea	rare	N. Limit
Lomatogonium rotatum	rare	
Oxycoccus quadripetalus v. *michroph.*	very rare	

Though the relative number of southern types is larger in the district of Christianshaab than in the adjacent parts on the main-land of Greenland, it is far surpassed by the number of southern types occurring on the southern half of Disko Island. The climate of South Disko is decidedly less favourable than that of Christianshaab, but, on the other hand, the soil in the basaltic sections is more fertile than in the gneissic. Another considerable advantage is the numerous springs which, though generally not warmer than 6—8° C., never freeze. On the banks of their outlets the season for active plant-life is thus prolonged, and the subterranean parts of plants, watered by the springs, will be exposed to slight frosts only, or to no frost at all.

Of the 31 species enumerated in the two lists from Christianshaab district the following are seemingly absent from Disko: *Isoëtes echinospora*, *Juncus subtilis*, *Polygonum boreale*, *Rhodiola rosea*, *Callitriche hamulata*, *Myriophyllum exalbescens*, *Oxycoccus quadripetalus* v. *microphyllus*, *Menyanthes trifoliata*, *Lomatogonium rotatum*, *Pedicularis labradorica*, *Utricularia minor*, *U. ochroleuca*, *U. intermedia*. But to make up for it there are 46 species on South Disko which are unknown from the district of Christianshaab.

In the subsequent list the species generally confined to "hot" springs are marked with an asterisk.

Southern types of plants occurring on South Disko, absent from the district of Christianshaab.

**Dryopteris Linnæana*, rare
**Polystichum Lonchitis*, very rare
Botrychium Lunaria, rare
— *lanceolatum*, very rare
Equisetum scirpoides, rare
Lycopodium alpinum, common
— *complanatum*, very rare
Carex Macloviana, common
— *canescens*, very rare
— *rufina*, rare
**Habenaria hyperborea*, scarce
* — *straminea*, numerous places
**Listera cordata*, very rare
**Coralliorrhiza trifida*, very rare
Sagina Linnæi, scarce
**Stellaria borealis*, rare
Thalictrum alpinum, common
Draba incana, rare
— *crassifolia*, rare
Sibbaldia procumbens, very common
Alchemilla glomerulans, common
**Epilobium anagallidifolium*, scarce
* — *lactiflorum*, scarce
* — *Hornemanni*, scarce
* — *palustre*, rare
Chamænerium angustifolium, scarce
**Archangelica officinalis*, scarce
Pirola minor, scarce
— *secunda* v. *obtusata*, rare
**Primula stricta*, very rare
**Gentiana nivalis*, very rare
* — *aurea*, very rare
Veronica alpina, very common

Veronica fruticans, scarce
Bartschia alpina, very common
Euphrasia arctica, common
**Linnæa borealis* v. *americana*, very rare
Erigeron unalaschkensis, very common
Antennaria groenlandica, very rare
Antennaria intermedia, scarce
— *glabrata*, several places
— *affinis*, very rare
— *brevistyla*, very rare
Gnaphalium norvegicum, scarce
— *supinum*, scarce
Hieracium groenlandicum, very rare.

The high-arctic types found in the district of Christianshaab amount to a much smaller number:

	Occurrence within the area	Occurrence south of the area
Woodsia glabella	several places	to 67°
Calamagrostis purpurascens	several places	- 64°
Carex ursina	several places	- 67°
Potentilla pulchella	several places	- 67°
Luzula nivalis	rare	- 64°
Arctagrostis latifolia	rare	S. Limit
Dupontia Fisheri	rare	
Minuartia stricta	rare	
Lesquerella arctica	very rare	
Taraxacum arctogenum, the only find south of 76° N.		
Gentiana tenella, which is fairly abundant in N. E. Grl. was only found in two places in W. Grl., of which the northernmost was here.		

Of these *Woodsia* grew on rocks, *Arctagrostis* in a humid depression on a rocky hill and *Taraxacum* on a small island of gneiss, whereas the remaining were observed on the raised marine beds where there was almost no competition as to space.

Absence of common plants.

During my stay at Tasiussarssuaq I studied the flora of "Sofia"s Harbour and about six other places in the vicinity. In my check-lists from these excursions I have expressly stated the absence of the following plants which are generally common north as well south of this latitude:

Alopecurus alpinus
**Poa alpina*
**Oxyria digyna*
Silene acaulis
Ranunculus pygmæus
Scirpus caespitosus
**Salix herbacea*
**Harrimanella hypnoides*
Loiseleuria procumbens
Phyllodoce coerulea

**Arabis alpina*	**Bartschia alpina*
Saxifraga caespitosa	**Antennaria alpina*
**Sibbaldia procumbens*	**Erigeron unalaschkensis*
Cassiope tetragona	*Taraxacum croceum.*

Already BERGGREN had stated the absence of *Cassiope* in the lowland, only finding it on the northern slope of a hill bordering the inlandice. According to his paper BERLIN evidently endeavoured to enumerate all species seen, even the most common, in every locality visited. He records *Poa alpina* from "Sofia"s Harbour but none of the rest.

One of the localities studied by me was the fresh lateral moraine on the northern side of the glacier-tongue. The absence of mycotrophic plants as the *Ericaceae* and *Sibbaldia* on a soil like this, destitute of humus, is easily intelligible. But in the other places there was humus enough, and plants like *Empetrum*, *Ledum*, *Vaccinium microphyllum* and *Vitis-Idæa* were checked with symbols of the highest grade of abundance.

The absence of most of these species may perhaps be due to some locally "abnormal" climatic factors, e. g. the precipitation and the winds. The species marked with an * seemingly give a hint in this direction as they belong to the very characteristic association of plants met with on the so-called snow-flushes, sheltered places with long-lasting accumulations of snow and with ample humidity and a favourable exposure to radiation during the growing season.

Perhaps the "natural" range of *Alopecurus alpinus* may really be north of this latitude since in the southern parts of its area in Greenland it seems to be confined to village- and camp-sites to which its spikelets travel entangled in the fur garments of people or in the coats of dogs.

April 1934.

XII.

ON SOME HERBARIA FROM GREENLAND AND LABRADOR COLLECTED BY THE MORAVIAN BRETHREN

Recently the Botanical Museum in Copenhagen acquired from Germany a collection of herbarium specimens, gathered by missionaries of the Moravian Brethren in Greenland and Labrador. This collection had been part of the „Naturalien Cabinett" of the princely House of Stolberg-Wernigerode. During the first part of the 18th century Count Christian Ernst, a member of this house and related to the Danish King Christian VI., had founded a large library which became famous for its contents of rare books on the Northern Countries of Europe. He also promoted humanitarian and missionary work.

By the courtesy of the Botanical Museum I have had the privilege of having these herbaria sent to Greenland for study and for revision of the identifications. This task aroused a natural desire to know a little about the life of these men, and I have to thank the gentlemen of the Missions-Verwaltung at Herrnhut, Saxony, for their kindness and readiness to supply biographical data from their excellently kept archives.

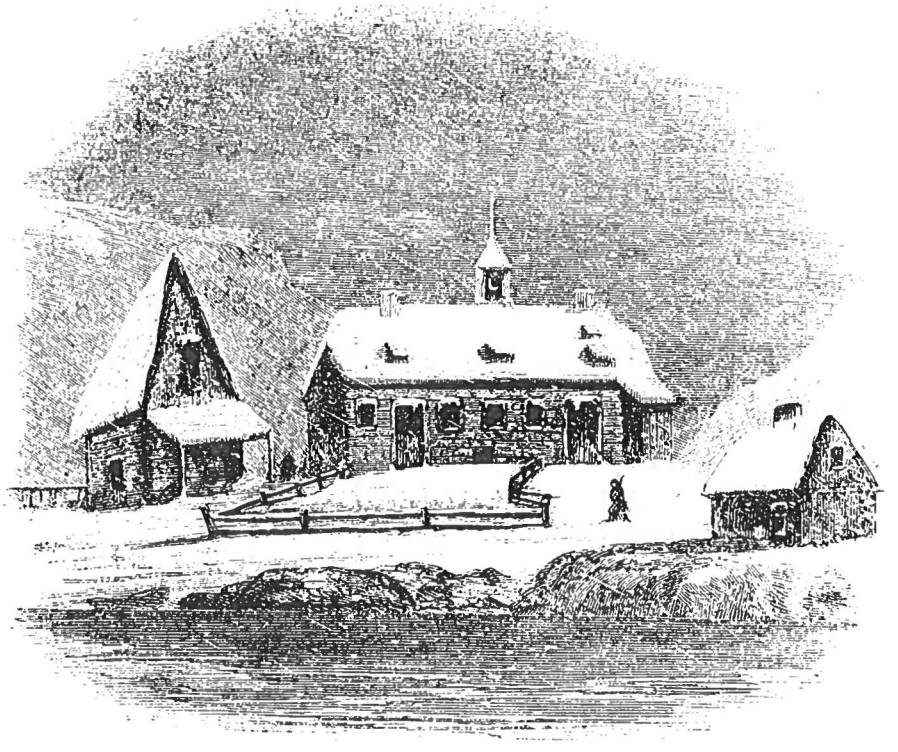


Fig. 20. Moravian settlement of Lichtenfels. From a sketch by E. K. KANE, inserted in his: Arctic Explorations vol. I, p. 26.

The collection is contained in three stout portfolios and the specimens are lying unmounted in covers of folio-sized handmade writing paper, often numerous specimens from different collections with their labels in the same cover. The great bulk of the material has been collected, between 1847 and 1856, by a missionary named TIETZEN[1]) from the environs of the mission station of Lichtenfels, 63°4′ N. in southwest Greenland. Only a small number of specimens came from Umánaq, in the Godthaab

[1]) J. F. D. TIETZEN, born Jan. 24. 1794 at Neuwied a. R., Germany, worked as a missionary at Neu Herrnhut, Greenland 1824—1835 and 1836—1858 at Lichtenfels where he died Sept. 23. 1858.

Fiord, 64°30′ N. taken by the missionary IM. SCHNEIDER[1]). Two of the portfolios are marked "Flora Arctica I and II", the third "Grönländische Pflanzen im Gräflichen Naturalien-Cabinett". The latter set is evidently a selection of duplicates from the former, in most cases it is easy to find from which individual "number" each of its specimens were taken. The collector has given no information whatsoever regarding place, habitat or date, the notes on the labels are due to the identifier who generally only knew from what collector and from which year the specimens were. In some cases it is apparent from the notes that he corresponded with the collector so as to obtain additional information. The first collection is thus the principal one and its labels are the best, often containing quotations of works consulted or descriptive notes in German or Latin, whereas the labels in the second contain the names of the plant, often without the name of the collector, or of the place and the year, only bearing the mark: "Grönland".

The identifications were made by Dr. ERNST HAMPE (1795—1880) who was a well-to-do apothecary in Blankenburg a. H. in Germany. HAMPE wrote a "Flora Hercynica", Halle 1873 and a number of papers on mosses, especially on exotic ones, from Brazil, New Zealand, New Guinea, Borneo etc. Only in a few cases is a "*det. Hpe*" to be found on the labels, but the handwriting is easily recognizable. Moreover, there are some labels, dated 1862, in another handwriting, in which comments are made upon Doctor HAMPE's identifications. With a few exceptions HAMPE's identifications are excellent for the time. From the notes on the labels it may be seen that he has consulted a number of descriptive and illustrated works, as "Flora Danica", REICHENBACH's works, WAHLENBERG's "Flora Lapponica" and probably also HOOKER's "Flora Boreali-Americana", but he had, at that time, no authoritative inventory of the flora of Greenland. HORNEMANN's list in his "Oeconomisk Plantelære" seems to have been unknown to him and LANGE's first list, in RINK's "Grönland" Vol. II was published in 1857. This fact may excuse his suggestion that specimens of *Cystopteris fragilis* were *Woodsia obtusa*, and that he mistook a badly preserved fruiting specimen of *Veronica fruticans* for a *Hypericum* sp. A specimen of *Vaccinium uliginosum* subsp. *microphyllum* with a label "*Arctostaphylos Uva Ursi*" is so preposterous that a confusion of labels by another hand suggests itself.

But how came the bryologist HAMPE to identify arctic vascular plants? Amongst his "bryologic" friends was J. C. BREUTEL who died at Herrnhut, Germany, as a bishop of the "Evangelische Brüdergemeinde" (also called the "Moravian Brethren" or "Unitas Fratrum").

[1]) IMMANUEL SCHNEIDER, born March 6. 1822 at Zaberfeld, Württemberg, worked a as missionary in Greenland, in various places, 1851—1875, died in Görlitz, Germany April 22. 1885.

BREUTEL who was born on Jan. 21. 1788 at Wissenburg am Sand, Bavaria, soon after, with his parents, moved to Ebersdorf, Thuringia, where they joined a congregation of the Brethren. BREUTEL started his career in the commercial line, but he became acquainted with HAMPE, who aroused in him an interest in plants and especially in mosses. BREUTEL was for a long time connected with the central administration of the mission, in his last years as a bishop, at the same time pushing forward his botanical studies. His friend, the great bryologist and palaeophytologist W. PH. SCHIMPER in Strassbourg (1808—1880) has named a genus of mainly tropical mosses for him (*Breutelia* 1851). He died in 1875.

As a bishop BREUTEL travelled extensively. He has, e. g. collected new species of mosses in the Cape Colony of South Africa. For their world-wide mission the Brethren had only the means supplied by the members of their congregations in Germany, Bohemia and Moravia and they endeavoured to obtain some support by collecting ethnographic objects or specimens of natural history in foreign parts of the world and selling them to museums or private collectors, or they gave them as a token of recognition to people who supported their mission work for religious or idealistic reasons.

Herbarium specimens from Greenland and Labrador, originating from the Brethren, have been widely spread, especially in the German speaking countries. Before being issued they had to be identified, and we may conclude that HAMPE undertook the task out of personal friendship for BREUTEL.

In the main collection "Flora Arctica" a number of specimens from Labrador have been put in between the specimens from Greenland and mostly lie in the same covers. But, fortunately, here the labels are attached to the plants, thus preventing confusion. The labels of the Labrador specimens are narrow strips of paper containing merely the plant name in a calligraphic handwriting, without author's name, locality or date. In another handwriting — the receiver's? — is added' in one corner "Labrador", sometimes also the place, and in the other corner "BREUTEL". These specimens are very small, less so owing to natural conditions than by the division of the material into numerous specimens. *Salix vestita* and *Kalmia polifolia* are only small twigs with a couple of leaves and a single flower or catkin. These plants too are identified or revised by HAMPE, and the place names, where given, are added by him. The following places are mentioned.

Hebron, 58°10′ N.
Nain, 56°16′ N.
Hoffenthal, 55°44′ N.

The last place, now called Hopedale, HAMPE curiously, but consistently, writes "Hopfenthal", once even "Hopfenthal in Grönland".

On some of the labels of Labrador is to be found the name "WENCK" or "leg. WENCK". EDUARD WENCK was born at Herrnhut, Sept. 1st 1811 and died there, March 22. 1896. After being educated as a clergyman, he had studied theology and natural history in Geneva and Basel, Switzerland, held appointments for many years as a pastor of the Brethren's congregations and as an agent for the mission in different cities in Germany and Holland, but he never came to Greenland or Labrador. WENCK was a member of learned societies, wrote articles on natural history and has left, in the archives of Herrnhut, a list of all the plants sent by the missionaries from Greenland and Labrador.

In several cases collections issued by BREUTEL and prepared like this have led to confusion. Thus LANGE in his "Conspectus Florae Groenlandicae" 1880 incorporated some plants from a Breutelian collection, owned by Professor TH. M. FRIES at Uppsala, which evidently came from Labrador as they have never before nor since been found in Greenland. Among his sources LANGE mentions "plants in the herbarium Th. M. Fries collected by the missionary BREUTEL somewhere in South Greenland", but, as we have seen, BREUTEL had been neither in Greenland nor in Labrador.

The botanical exploration of the section of West Greenland around Lichtenfels and the neighbouring trade place Fiskernæs has been somewhat neglected. Therefore any list of plants collected there will be of some interest. The collection from Greenland here treated contains 106 species of vascular plants. Actually, from the whole district, reckoned from the Frederikshaab Glacier, in 62°30′, to the Sermilik icefiord, in 63°30′, about 160 species have been found, and when species common north and south of the district are added, the number will be raised to about 210 species. Several of the lacking species are to be found in the TIETZEN collection, but in addition, as will be shown later, there are some unexpected rare plants.

On his outward voyage the American explorer ELISHA K. KANE visited the place on the first of July 1853. Here he took in supplies of fish and engaged the Eskimo hunter HANS HENDRIK who later won a great reputation on numerous arctic expeditions, especially for providing food for the party of the "Polaris" crew drifting on the ice-floe. It is difficult to understand that the commander of the expedition, during the hurried negotiations of a single day, also found time personally to make botanical collections. More likely he obtained a set of herbarium specimens from the Brethren, and one of the specimens of Thymus in TIETZEN's collection may thus be a co-type of *Th. Serpyllum* var. *arcticus* nov. var. DURAND.

It is curious that the picture reproduced here on page 85 and which is said to be "from a sketch by the author" (KANE), gives a winter aspect of

Lichtenfels, whereas KANE in his book praises the dry and sunny summer-climate of the place.

As is generally the case in collections made by amateurs, plants like *Viscaria alpina*, *Cerastium alpinum*, *Polygonum viviparum* etc. will be found in every package sent, whereas there is a deplorable lack of species of *Carex*, *Juncus*, small *Caryophyllaceae* and aquatic plants. Unfortunately there are no specimens of *Betula* at all. As the ranges of *B. nana* and *B. glandulosa* overlap in this district, specimens of them and their probable hybrids would have been especially interesting. Also a corroboration of the alleged occurrence of *Sorbus decora* would have been welcome.

The names in the following list are the present writer's, those in parenthesis are HAMPE's. Where no parenthesis is given HAMPE's naming was identical with the nomenclature of our days. The few plants from Godthaab Fiord, taken by IM. SCHNEIDER are marked by an asterisk, the rest are all from the environs of Lichtenfels, collected by TIETZEN. The figures indicate the years of the collection in which the plant was represented, 18— means that no year was given.

List of Plants from the environs of Lichtenfels in West Greenland, 63°4′ N., collected by TIETZEN missionary of the Unitas Fratrum 1847—1856.

Plants marked * are from Umánaq in Godthaab Fiord, 64°30′ collected by the missionary IM. SCHNEIDER.

Cladonia bellidiflora FL. 3 specimens 1853.
Woodsia ilvensis (L.) R. BR. 2 specimens 1856.
Cystopteris fragilis (L.) BERNH. (*Aspidium obtusum*), Lichtenfels 1849, *Umánaq.
Dryopteris dilatata (HOFFM.) C. CHR. (indet.) 1853, 1855, 1856.
Dryopteris Linnæana C. CHR. (indet.) 18—.
Polystichum Lonchitis (L.) ROTH 1851, 1855.
Equisetum arvense L. sterilis (indet.) 18—.
Lycopodium alpinum L. 18—.
Lycopodium annotinum L. v. *pungens* DESV. (*L. annotinum*) 1855.
Hierochloa alpina (SW.) R. & SCH. 1849.
Phleum alpinum L. 1856.
Calamagrostis Langsdorffii (LINK.) TRIN. (*C. Halleriana*) 1855.
Deschampsia alpina (L.) R. & SCH. (*Aira alpina*) 1853.
Deschampsia flexuosa (L.) TRIN. 1855.
Catabrosa aquatica (L.) BEAUV. var. *laurentiana* FERN. Rhod. 1933, p. 137, pl. 242, fig. 2, 4. (*Glyceria aquatica*) 1853.
Poa alpigena (FR.) LINDM. (*Poa pratensis* oder *distichophylla*) 1853.

Poa glauca VAHL subsp. *glaucantha* (GAUD.) LINDM. (*Poa nemoralis*) 1853.
Poa alpina L. 1848, 1853, 1855, 18—, 18—.
Poa annua L. 1855.
Carex scirpoidea MICHX. (*C. rupestris? C. dioica?*) 1852, 1855.
Carex concolor R. BR. (*C. saxatilis*) 1846, 1852, 18—.
— juv. (*C. dioica*) 1852.
Carex Goodenowii Gay (*C. globularis*) 1855.
Eriophorum Scheuchzeri HOPPE 1855.
Scirpus caespitosus L. 1855.
Juncus trifidus L. 1855.
Luzula spicata LAM. 1853, 1855.
Luzula parviflora (EHRH.) DESV. 1852, 18—, 18—.
Luzula frigida? (BUCH.) SAM. juvenis (*L. campestris*) 1848, 18—.
Tofieldia minima (HILL) DRUCE (*T. borealis*) 1849, 1850, 1855, 1856.
Habenaria straminea FERN. (*Gymnadenia albida*) 1853, 18—.
Salix herbacea L. 1855.
Salix Uva Ursi PURSH (*S. myrsinites* var.) 1850, 1855.
Salix glauca L. (*S. glauca?*) 18—, 18—.
* — (*S. lanata*), Umánaq.
Salix arctophila COCK. (*S. arctica?*) 1855.
— (*S. myrtilloides*, the specific name later cancelled) 1852.
— (*S. arbuscula*) 1852, 1853.
Polygonum viviparum L. 1848, 1852, 1855, 18—.
Oxyria digyna (L) HILL 1856.
Minuartia groenlandica (RETZ.) OSTENF. (*Arenaria biflora*) 1853.
Cerastium alpinum L. 1847, 1850, 1853, 1856, 18—, 18—.
— var. *lanatum* (LAM.) HEG. 1856.
Cerastium trigynum Vill. (*Stellaria cerastioides*) 1855, 1856.
Stellaria longipes (*S. Edwardsii*) 1855, 1856.
Stellaria media (L.) CYR. intermingled with *Cochlearia*.
Viscaria alpina (L.) ROEHL. (*Lychnis alpina*) 1847, 1848, 1849, 1850, 1852, 1853, 1855.
Silene acaulis L. 1855, 18—, 18—.
Coptis groenlandica (OED.) FERN. (*C. trifolia*) 1850, 1855.
Ranunculus hyperboreus ROTTB. 1850, 1852, 1853, 1855 several numbers.
Ranunculus acris L. 1848, 1852, 18—.
Thalictrum alpinum L. 1855, 1856.
Papaver radicatum ROTTB. (*P. nudicaule* v. *arcticum*) 1851, 1855.
Cochlearia officinalis L. var. *groenlandica* (DC) GEL. (*C. anglica* & *C. off. v. groenl.*) 1850, 1853, 1855, 1856.
Draba incana L. (*D. contorta*) 18—.
— var. *confusa* POIR. 1847, 1855, 18—.
— ? a juvenile specimen, 1852.

Draba aurea Vahl 18—.
Arabis alpina L. 1853, 1855, 18—.
Cardamine pratensis L. var. *angustifolia* Hook. (*C. pratensis*) 1855.
Sedum annuum L. 1850, 1856.
Sedum villosum L. 1856.
Saxifraga nivalis L. 1849, 1853, 1855.
Saxifraga tenuis Wahlenb. 1856.
Saxifraga stellaris L. 18—, 18—.
Saxifraga caespitosa L. var. *groenlandica* L. 1850, 1853, 18—.
Saxifraga rivularis L. 1848, 1850, 1853, 1855: several numbers, 18—.
Saxifraga oppositifolia L. 1855.
Alchemilla alpina L. 1852, 1853, 1855.
Alchemilla glomerulans Bus. (*A. vulgaris*) 1847: two numbers, 1855.
Dryas integrifolia Vahl 1856, 18—, 18—.
**Potentilla pacifica* Howell (*P. anserina* v. *groenlandica*) Umámaq.
Potentilla tridentata Sol. 1848, 1849, 1852, 1853, 18—: several.
Potentilla maculata Pourr. (*P. salisburgensis*) 1848, 1849, 1850, 1853.
— (*P. maculata*) 1852, 1853.
Potentilla nivea L. 1856, 18—.
Sibbaldia procumbens L. 1855.
Viola palustris L. 1855.
Viola Selkirkii Pursh (*V. suecica*) 1856.
Chamænerium angustifolium (L) Spach var. *intermedium* Wormskj. (*Epilobium angustifolium*) 1855, 18—.
Chamænerium latifolium (*Epilobium l.*) 1853, 18—.
Epilobium palustre L. 1848.
Epilobium lactiflorum Hausskn. (*E. montanum*) fruiting 18—.
— (*E. origanifolium*), flowering, 1855.
Cornus suecica L. 1848, 1851, 1852, 1853, 18—, 18—
Pirola grandiflora Rad. 1850, 1852.
Pirola minor L. 1850, 1851, 1852.
**Cassiope tetragona* (L) Don, (*Andromeda t.*) no locality, probably Umánaq.
Harrimanella hypnoides (L) Cov. (*Andromeda h.*) 18—.
Ledum groenlandicum Oed. (*L. latifolium*) 1849, 1853, 18—.
Loiseleuria procumbens (L.) Desv. 1855, 18—.
Phyllodoce coerulea (L.) Bab. (*Menziesia c.*) 1850, 1851, 1855, 18—.
Rhododendron lapponicum L. 1850, 1856.
**Vaccinium uliginosum* L. subsp. *microphyllum* Lange (*Arctostaphylos Uva Ursi*), Umánaq.
**Vaccinium Vitis Idæa* L. var. *minus* Lodd. (*V. Vit. Id.*), Umánaq.
Diapensia lapponica L. 1850, 1855, 18—.
Gentiana nivalis L. 1850, 1855, 1856.
Thymus arcticus (Dur.) Ronniger (*Th. Serpyllum*) 1855, 1856, 18—.

Bartschia alpina L. 1850, 1853, 1855.
Euphrasia arctica LANGE (*E. officinalis*) 1853, 1855, 1856, 18—.
Rhinanthus groenlandicus CHAB. (*Rh. minor*) 1851, 1855, 18—.
Veronica Wormskjoldii CH. & SCHL. (*V. alpina*) 1847, 1850, 1852, 1853, 1855, 1856, 18—.
Veronica fruticans JACQ. (*V. saxatilis*) 1850, 1851, 1855, 18—.
— (*Hypericum*) 1855.
Pinguicula vulgaris L. 18—.
— (*P. leptoceras*) 1856.
— (*Pinguicula sp.*) 1856.
Campanula rotundifolia L. v. *linifolia* WAHL. 1852, 1853, 1856.
Achillea Millefolium L. var. *nigrescens* E. MEY. 1855, 18—.
Artemisia borealis PALL. (*A. b. v. Wormskjoldii*) 1853, 1855.
**Antennaria groenlandica* PORSILD (*A. dioica*), Umánaq.
— *Gnaphalium alpinum*) 1851.
Antennaria alpina (L) GÄRTN. (*Gn. alpinum*) 18—.
Gnaphalium norvegicum GUNN. (*Gn. sylvaticum*) 1852, 1856.
Erigeron borealis (VIERH.) SIMM. (*E. alpinum*) 1850.
Hieracium rigorosum ALMQ. (*H. prenanthoides*) 1856.
Hieracium hyparcticum (ALMQ.) DAHLST. (*H. murorum*) 1853, 1856.
— (*Hieracium* sp.) 18—.
Taraxacum croceum DAHLST. (*T. officinale*) 1855.

Remarks on some of the plants listed.

1) *Catabrosa aquatica* is, so far, very rare in Greenland. The earliest record of its occurrence here is by Durand: Appendix XVIII to Kane: Arctic Explorations, 1856 p. 463 as taken at Sukkertoppen, 65°[1]), where it has not been found later. However, on his outward voyage Kane in July 1853 anchored first at Fiskernæs (Lichtenfels) and according to his book, he spent more time here than at Sukkertoppen. Therefore, *Catabrosa* might eventually have been collected at Fiskernæs. Statements like *Arenaria groenlandica* and *Alchemilla vulgaris* from Upernavik 73°, *Epilobium spicatum* from Upernavik 72°, *Potentilla tridentata* from Rensselaer Harbor 79°, *Saxifraga flagellaris* from Disko 70° etc. etc. afford evidence that a most considerable confusion of labels must have taken place in the collection.

The next record is by the Swedish geologist N. O. Holst who in 1880 found *Catabrosa* near the Frederikshaab Glacier in 62°30′.

[1]) Should be 65°20′ N. The latitudes given for the localities visited are rather carelessly compiled: "Fiske Fiord" or "Fiske Fork" (ɔ: Fiskernæs Fiord) 64° instead of 63°4′; Holsteinborg 68° instead of 66°56′; Egedesminde 69° instead of 68°42′; Disko (Godhavn) 70° instead of 69°14′ etc.

The plants of the TIETZEN collection are small, 12—15 cm high and they seem, by their acuminate leaves, deeply furrowed straws and narrow and short panicles to belong to the variety *laurentiana* Fernald.

2) *Poa annua* has not been recorded from Fiskernæs or Lichtenfels before. Its occurrence is easily explained since the German missionaries were ardent gardeners and they could hardly avoid introducing it.

3) *Carex Goodenowii* is an interesting range extension from 61° N. Unfortunately no information is available about the character of its habitat. (Cfr. M. P. PORSILD: "Alien Plants and Apophytes of Greenland" p. 50).

4) *Viola Selkirkii* is also a range extension to the 5 localities hitherto known which are situated between 61°16′ and 62° N. The specimens are taken in the autumnal state, with empty capsules and with the leaf-blades about twice as large as in the flowering state.

5) *Hieracium rigorosum* was heretofore known on the west coast up to 61°25'. The finding of it at Lichtenfels, 63°4′, gives it a similar range on this coast as it has on the eastern coast (see DEVOLD & SCHOLANDER in "Skrifter om Svalbard" etc. Nr. 56, Oslo 1933 p. 102). The specimens are tops of budding inflorescences only.

Plants from Labrador.

Salix vestita Pursh.
Polygonum viviparum L.
Koenigia islandica L., Nain.
?*Moehringia macrophylla* (Hook.) TORR. (*Stellaria alpestris*).
Stellaria longipes Goldie (*St. Edwardsii*).
Viscaria alpina (L.) G. DON (*Lychnis a.*).
Coptis groenlandica (OED.) FERN (*C. trifolia*).
Anemone parviflora MICHX. (*A. borealis*) Hebron, Wenck.
Arabis alpina L.
Draba arabisans MICHX.
Parnassia parviflora DC (*P. calyculata* NOB.).
Saxifraga stellaris L.
Saxifraga cernua L., Hebron, WENCK.
Alchemilla glomerulans BUS. (*A. vulgaris*).
Dryas integrifolia VAHL.
Potentilla pacifica HOWELL (*P. Anserina*).
Potentilla palustris (L.) SCOP.
Potentilla nivea L.
Potentilla maculata POURR. (*P. grandiflora*).
Rubus Chamæmorus L.

Astragalus alpinus L. (*Phaca astragalina*).
Viola labradorica SCHRANK, "Hopfenthal in Grönland" (sic!).
Chamænerium latifolium (L.) SPACH (*Epilobium l.*).
Epilobium ?lactiflorum HAUSSKN. (*E. alpinum* β *nutans*), seeds absent.
Cornus canadensis L.
Pirola grandiflora RAD.
Harrimanella hypnoides (L.) COV. (*Andromeda h.*).
Andromeda glaucophylla LINK. (*A. Polifolia*).
Kalmia polifolia WANG. (*K. glauca*).
Phyllodoce coerulea (L.) BAB. (*Menziesia c.*).
Vaccinium Vitis Idæa L. var. *minus* LODD. (*V. V. Id.*).
Diapensia lapponica L.
Primula stricta HORN. (*P. farinosa*).
Primula stricta HORN. (*P. Hornemanni*).
Trientalis borealis RAF. (*Tr. europæa*).
Bartschia alpina L., Hebron, WENCK.
Castilleja pallida (L.) SPR. v. *septentrionalis* (Lindl.) Gray.
Pedicularis groenlandica RETZ.
Pedicularis flammea L.
Veronica Wormskjoldii CH. & SCHL. (*V. alpina*).
Pinguicula villosa L. (*P. involuta* SCHRANK).
Linnæa borealis L. var. *americana* (FORB.) REHDER (L. b.).
Campanula uniflora L., Hebron, WENCK.
Antennaria sp. not *A. alpina* (L.) GÄRTN., perhaps *A. labradorica* Nutt. (*Gnaphalium alpinum*).
Senecio pauciflorus Pursh, Hebron, WENCK.

All these were previously known from the coast of Labrador.

Dec. 1933.

Færdig fra Trykkeriet den 6. Februar 1935.